OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

06868

Distr.
RESTRICTED

UNIDO/ICIS.1 *
1/ January 1976

ORIGINAL: ENGLISH

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INDUSTRIAL DEVELOPMENT CENTRE FOR ARAB STATES

M A N U A L

FOR

EVALUATION OF NATIONAL INDUSTRIAL PROJECTS

IN ARAB COUNTRIES

(Final Draft)

* Documents in this series formerly bore the symbol UNIDO/IPPD.

id.76-230

TABLE OF CONTENTS

INTRODUCTION

1. Objective of the Manual

The quest of Arab countries for economic and social progress inevitably involves the basic problem of allocating limited resources, such as labour, managerial and administrative talent, capital, foreign exchange and natural resources, for example, arable land, water and minerals, to their optimal use so as to yield the best economic results. Each country has its own development objectives and this in turn requires the resources to be marshalled and judiciously allocated in order to attain these objectives. The use of resources which are limited for one objective implies their reduced availability for other objectives. If available resources are applied efficiently, the number of objectives that can be pursued simultaneously increases. Development planning therefore requires fixing and ranking of objectives and efficient allocation and use of scarce resources. Once objectives are established and ranked, individual investment proposals have to be scrutinized in order to determine whether and to what extent they can contribute towards achieving the desired results.

Investment decisions form an essential part of the development process. The more sound the majority of investment decisions are, the more successful a development process will be. It is the objective of this Manual to help improve investment decisions in Arab countries. Improvement in this context has three aspects, i.e. selection, modification and rejection of investment proposals. The criteria in the Manual should first of all facilitate judgement as to which projects meet the national objectives most effectively; secondly they should aid in the modification of projects in order to make their contribution positive and more effective; thirdly they should assist in rejecting those projects which even after modifications cannot adequately serve the national objectives. The application of the criteria in the Manual will not only answer the question whether the limited resources will be used efficiently in a particular project, but also whether alternative investment proposals would contribute more towards national objectives.

It is well known that at present there is a gap between the theory of project evaluation and the practice of project evaluation. This applies to commercial profitability, too; but it is particularly

acute as far as national profitability is concerned. The literature on national benefit-cost analysis suggests a number of comprehensive sophisticated approaches which are not appropriately tailored to the economic reality in developing countries and which are therefore not applied in actual practice. The gap between theory and practice is so large that they cannot find a common language. The theory offers more and more elegant, sophisticated techniques; since one does not use these techniques in practice, the gap between theory and practice becomes even larger.

The objective in drafting this Manual is to contribute to narrowing the above-mentioned gap by suggesting a consistent, relatively simple, easily understandable, operational step-by-step approach for national profitability analysis in developing countries. Our conviction is that it is better to offer an operational methodology for approximate assessment of the soundness of a project with a tolerable degree of precision rather than recommending very sophisticated procedures which claim to measure comprehensively all the effects of a project but which cannot be put into operation in reality.

As stated above, the preparation of this Manual was motivated by the absence or shortage of explicit and workable criteria of project evaluation in most Arab countries. The problem came to focus at the 1972 Regional Training Workshop for Project Evaluators from several Arab countries held in Cairo under the auspices of IDCAS and UNIDO. Their suggestions eventually led to the decision to prepare an operational manual on project evaluation which could be easily understood and applied in the Arab countries in the wake of their present technological and data availability constraints. The main concepts of the Manual as well as its elements have, therefore, been subordinated to the prevailing conditions in the Arab region in terms of skills, availability of data, time pressures, etc.

The Manual seeks to present and, where possible, to synthesize some major approaches, concepts and criteria of project evaluation for the benefit of project evaluators in Arab countries. It is hoped that the Manual would be helpful to project evaluators in acquiring and/or sharpening their tools of analysis. It is also hoped that the evaluators, after becoming acquainted with the techniques outlined in

this Manual, will find it simple with regard to both application and interpretation of results thus leading to better choices and improved investments.

Simplicity was the dominating objective as this Manual was designed and written. This may cause some disappointment to the more academically inclined fraction of professional economists and financial analysts. But if this aids the Manual in being practically applied by those responsible for their investment decisions, viz., the Ministries, banks, assorted development agencies, consulting firms, and public and private entrepreneurs, its lack of sophistication may be balanced out by its practical impact.

This Manual is based on the simple philosophy that the aim of project evaluation is to determine whether a project is acceptable and, if it is, whether it is the best alternative available. The purpose is not to measure with great accuracy absolutely all direct and indirect effects which a project may have on the economy. It is important to measure and/or take into account only those effects which may have an impact on the final investment decision, i.e. to accept, modify or reject a project. This is what really matters: to find out if a project is acceptable, not how acceptable it is.

The above-stated objectives could be achieved only if the authorities concerned in a developing country are willing and act accordingly so that the formulation, evaluation and selection of investment projects is based on certain minimum elementary reasoning and logic and is not an arbitrary rubber-stamp exercise carried out by instruction of a decision-maker to the project evaluators to "prove" efficient, by way of implementing consistent scientific methods, every investment proposal they want to implement for one reason or another. Any project evaluation methodology could be easily discredited and its use reduced to nil if one cannot, or does not want to, apply it properly. The project evaluation techniques are only one of the tools in development planning, though not a magic tool. These techniques do not solve the problems automatically and easily. They can only aid those people who actually wish to take well-founded investment decisions. If the above-mentioned reasoning and logic are not available, even the most comprehensive methodology for benefit-cost analysis is hopeless and the project evaluation exercise is a waste of time.

The Manual is not meant to be a textbook. It could, if supplemented by appropriate reading material, serve the purpose of assisting in the education of economists, accountants, financial analysts, engineers and other professionals in the methodology of benefit-cost analysis.

2. Scope and Applicability of the Manual

Project evaluation covers a wide range of questions: market analysis, appraisal of technical feasibility, adequacy of financial arrangements, management and staffing, legal conditions, etc. All these aspects enter the Manual's scope only indirectly, i.e. to the extent that they affect a project's commercial and national profitability. In other words, the Manual is mainly concerned with a project's profitability from the point of view of the enterprise on the one hand and the nation as a whole on the other. It provides a step-by-step approach to assessing the financial and economic impact of an investment proposal.

The intention in drafting this Manual was to propose a methodology for evaluating mainly the economic effects and only some of the social effects of an investment project. A project has other different aspects too - a wide range of social aspects as well as political, strategic, ecological, demographic and other implications. All these aspects, along with the economic ones, are taken into account at the level of investment decision-making. Thus the appraisal of the non-economic implications of a project is almost exclusively a prerogative of the decision-makers and not of the project evaluators. This Manual is addressed to the latter.

The Manual is applicable by design to industrial projects. No narrow limits should be seen as regards the kind of industrial branches which can be included. It can also be applied to service projects in the fields of transport, electricity, communications, etc. Basically, the evaluation approach will be the same irrespective of the industrial branch; it does not, however, preclude some differences in the computation procedures from one branch to another. An understanding of the criteria which, according to this Manual, determine an investment's commercial and national profitability will also permit the evaluator to judge its applicability in border cases.

This Manual is by no means intended to be a public sector handbook as will be stressed again later. Even though private entrepreneurs will tend to make their investment decisions primarily on the basis of simple commercial profitability criteria, they do utilize some national resources and at one point or another they will have to approach the government and it's agencies for financing, import licenses, assorted permits or to utilize the national utilities, i.e. power, transport, etc. There is need for a better understanding between the Government authorities, industrialists, bankers and consultants regarding the plans and development objectives in order to create a motivational direction that will spur the development process along correct and desired lines. A Manual of this kind, if widely distributed and easily understood by a wide range of professionals in government and industry, should contribute towards this end.

The Manual is supposed to provide operational guidelines for industrial project evaluation to all Arab countries. It is designed for a group of countries which differ considerably in terms of their levels of development, socio-economic systems, objectives and priorities, decision-making mechanisms, resources, availability of data, skills of project evaluators, etc. For such reasons, the Manual's scope obviously has to be fairly broad and different in comparison to national manuals or guidelines for project evaluation. A country which is sparsely populated but commands rich natural resources faces different development obstacles compared to a country having both pressing population and balance of payments problems. Again, alternative approaches to economic advancement will be necessary where neither human nor natural resources are abundantly available.

The Manual, therefore, does not advocate the use of a single indicator for assessing commercial and/or national profitability, nor does it attempt to combine various aspects of national profitability into one global comprehensive criterion. An attempt of this kind would require weighing different indicators and would involve a claim that both the selection of, and the weights given to, specific indicators are equally relevant for all Arab countries. For this reason the Manual provides a set of indicators each associated with a specific national objective. It is up to the evaluating agency to determine,

by reference to national development plans or other manifestations of national priorities, the objectives and their relative importance which are to be achieved through different investment proposals. The Manual provides the methods which can help to measure whether a project does indeed contribute towards individual objectives and whether it does this efficiently, i.e. with a minimum of resource cost compared to other alternatives. The evaluating agency can as well rank the different indicators and assign them relative weights consistent with the development objectives to facilitate decision-making - whether a project should be undertaken in the light of its evaluated merits and demerits.

Keeping in mind the different standards of availability of data and skills of the Arab countries, the Manual contains both the very simple and somewhat more sophisticated methods of project evaluation. It thus provides a choice in selecting methods for economic evaluation of investment projects. It is then up to the evaluating agency to select the appropriate method and apply it to all competitive projects. Moreover, the methodologies and techniques prescribed in the Manual can be applied irrespective of the methods of planning and levels of decision-making, e.g. centralized, semi-centralized or decentralized. This will hold true as long as the development objectives and priorities for investment decisions have been clearly laid down. The only compulsory rule in this respect is that the set of criteria for evaluation of a project must correspond to the set of objectives for socio-economic development.

The Manual does not and cannot provide readily calculated national parameters needed for the evaluation of projects. This is completely impossible for a Manual designed for 20 Arab countries. On the basis of the specific conditions in each country at a given period, the national parameters should be calculated by the competent national authority. To do so they need a methodology. The Manual covers these aspects and also suggests several alternative methods which the national agency can use to select the most appropriate one to suit the actual conditions in the country.

As stated above, the Manual provides operational techniques for pre-investment evaluation of industrial projects. Although certain elements of this methodology could be used for post-investment evaluation, the Manual as a whole is not designed for this type of analysis.

Along this same line of thinking it would be worthwhile to clarify explicitly the use of terms such as "evaluation", "appraisal", "assessment", "selection". The Manual does not differentiate between "evaluation", "appraisal" and "assessment". In practice, these are all used for analysis of the economic merits of an investment project, i.e. for ex-ante analysis of the effects of a predetermined course of action. This analysis is based on projecting, forecasting in the future, on the stated course of events. This analysis is carried out by project evaluators. The same terms are being used in practice to describe the analysis of the achievements of on-going establishments and they are also known as post-investment evaluation, post-project evaluation, performance evaluation. This analysis relies on actual data characterizing the past and present operation of existing productive units. The term 'selection' is used in the Manual only when referring to the decision to implement, modify or reject a project. Selection usually takes into account also factors that are not explicitly considered in the process of evaluation. Selection is a prerogative of the decision-makers, which should be based on recommendations submitted by the project evaluators.

The Manual can be used as a basis for drafting national manuals for project evaluation in any Arab country if national authorities so desire. The national manuals should be more specific in suggesting basic additional and supplementary indices corresponding to the relevant national objectives. They may lay down the numerical values of the various national parameters, the correction-factors needed for adjusting prices, some other details and prescribe the particular methods of evaluation and calculation to be followed. The basic features of the methodology contained in the Manual may, however, be the principal guidelines.

3. Definition of an Investment Project

A project is a proposal for a new investment to create, expand and/or develop certain facilities in order to increase the production of goods and/or services in a community during a certain period of time. Furthermore, for evaluation purposes, a project is a unit of investment which can be distinguished technically, commercially and economically from other investments. A project or an investment proposal may have

different forms and it should be capable of being evaluated in all these forms. If a project is combined with others into an industrial complex in such a way that separate evaluation is difficult or imprudent, the so-called industrial complex technique may be applied for its evaluation. In case a project is part of a much larger investment programme, such as the establishment of agro-industries which may consist of numerous projects, the project can and should be evaluated separately. Conversely, the whole programme may be evaluated in toto on technical, commercial and economic grounds, but it may be preferable to evaluate each unit of investment which is part of that programme as an individual plant. Programme evaluation raises additional questions which are not covered in this manual. The same applies to macro-type appraisals of entire sectors or subsectors.

The construction of a new warehouse may not qualify as a project because even though it can be distinguished technically from the remainder of the factory, its functions are so closely interrelated with already existing parts of the plant that it cannot reasonably be attempted to separate its commercial and social impact. On the other hand, the replacement of a delivery fleet of lorries by a railway siding with associated loading equipment may be a project because savings in transport costs connected with the measure can be made the object of separate commercial and economic appraisal. In many instances it may indeed be worthwhile to break down a proposal presented as a project into smaller units of investment. An integrated textile project, for instance, may be planned to include spinning, weaving and finishing of locally produced cotton. The entire complex may easily pass national profitability analysis. It may well be, however, that domestic cotton commands high prices in the export market whereas staple cloth as demanded by local consumers may be produced with lower grade cotton. Project evaluation then may demonstrate that a finishing complex based on cheap imported grey cloth would be an even more attractive proposition in terms of national profitability. The spinning and weaving parts of the complex, if appraised separately, may be considered uneconomical. Practical experience and good judgement are required to group investment proposals into meaningful projects because obviously not every smallest unit of investment can be appraised separately.

4 Major Types of Investment Projects to which the Manual Applies

The Manual has been written with a focus on the evaluation of industrial projects in the manufacturing and extractive sectors, to compare and evaluate alternative variants of technology, of raw materials to be used, of production capacity, variant of location, variants of local production vs. import, variants of international industrial specialization and co-operation from the point of view of one country and of other socio-economic aspects.

The Manual deals with the projects' commercial profitability, i.e. the benefits that the investor may expect, as well as with their national profitability, i.e. their benefits to the nation as a whole. The Manual is not directly relevant for the evaluation of projects within or between such sectors as services, education, health and national defence where the benefits are predominantly non-quantifiable. Evaluation of projects within these latter sectors may be best handled by cost-effectiveness techniques. Due to the difficulties of valuing the outputs, the analysis must be done on a "least cost" basis.

The Manual is also applicable to modernization and expansion projects if the aforementioned principles are observed. If the expansion can be distinguished technically, commercially and economically from the already existing facilities, its marginal commercial and national merits can easily be evaluated. The expansion may be horizontal, i.e. an increase in capacity for the same output, or vertical, i.e. the addition of forward and backward linkage production processes or the expansion may lead to a broader line of products manufactured by the company. The Manual provides a special section on evaluation of modernization and expansion projects.

The question of how to evaluate projects which are multi-national in character is an interesting issue. Such projects could, of course, be evaluated from the strict commercial profitability viewpoint without difficulty. Such projects could also be easily evaluated from the social viewpoint of one single country at a time. Much more difficult, however, is to evaluate these projects from their overall social (i.e. multi-national) viewpoint of all participating countries simultaneously. The evaluation of multinational investment projects is beyond the scope of this Manual. This will be the subject of a special manual to be worked out in the near future.

5. Public and Private Sector Projects

The objectives governing commercial and national profitability of an industrial project are identical for both the private and the public sector. Though it should be expected that a Manual of this kind will be used mainly by government agencies it is expected to be of help to private investors, too. Even though private investors cannot be expected to be mainly concerned with national profitability calculation, it would be useful to carry out national profitability analysis in the case of a private sector project also as it will assist the government agencies in reviewing the project if they have to accord approval or to extend financial assistance. In these cases indicators of national profitability will play a major role in considerations leading to a decision on the project.

However, the need for thorough project valuation is felt most urgently for public sector projects. This applies equally to commercial and national profitability analysis. Even if it is assumed that a public sector project may not yield commercial profit and subsidies, for whatever reason, are envisaged from the beginning, commercial analysis is a necessity in order to determine the magnitude of such subsidies beforehand so that they can be properly incorporated into the budgeting procedures. Some public sector projects may be undertaken even though they are not judged suitable on grounds of both commercial and national profitability (e.g. defence-oriented projects), but governments should take such decisions in full awareness of the magnitude of the financial and social burden, of the "price" to be paid for solving certain political, social or other problems of crucial importance to the country.

It is not only for fiscal reasons that both commercial and national project evaluation should be carried out in the public sector. The process of analyzing a project's financial and social implications is by itself a highly commendable exercise because it confronts decision-makers with a variety of parameters both favourable and unfavourable to the project. It forces them to think in terms of alternatives and policies conducive to economic development. The encounter with such parameters on a microeconomic level is to face the realities of economic decisions. It is stimulating in commercial analysis as well as in national analysis. The process of evaluating a project tends to be more

revealing about the conditions for development and the more acknowledgement of evaluation results. Policy makers in the public sector who bear more responsibility for shaping these conditions than anyone else should share the educational experience of such overall and thorough project evaluation.

I THE MANUAL'S CONCEPT OF PROJECT EVALUATION

1. National and Sectoral Planning and Individual Projects

It is an accepted principle that plans require projects and projects require plans. Good plans cannot be formulated without proper economic appraisal of the projects and the real value of the projects cannot be properly ascertained without the framework of a plan. It is the national plan which lays down the social objectives and priorities between different sectors and regions. The existence of a national strategy for economic and social advancement is a prerequisite for a meaningful appraisal of a project, especially from the national point of view. Projects are the pivot of a sectoral programme and the sectoral programmes in turn constitute a well-conceived national plan.

The successful formulation and implementation of a national development plan depends on the proper selection of projects and the consequent sectoral programmes. Project formulation and evaluation, which is a continuous integrated process, are one of the basic components of economic planning.

By elaboration of pre-feasibility and of feasibility studies, the parameters of investment projects crystallize more and more: output, investment requirements, manpower, material inputs, foreign exchange requirements, etc.

The national and sectoral plans have also their parameters: output, investment, manpower, material inputs, balance of payments, etc. These parameters are elaborated on the basis of general co-efficients, past experience, comparative analysis, experts' appraisal, input-output analysis, etc. These parameters of the plan are an aggregation at the macro level of the respective parameters of a number of individual investment projects. The relationship between the above parameters

at project, sectoral and national levels is usually traced through the balances, i.e. simple commodity, investment, manpower, etc. balances or input-output balance sheets.

The balances, and particularly the simple ones, answer only the question "how much" to produce and not "how" to make it available in an efficient way. This second question can be answered only at a project (product) level, using the techniques of the benefit-cost analysis. It is in this sense that project preparation and evaluation are an indivisible part of the overall planning process.

Due to this interdependence a constant exchange of information and cross-adjustment of prices and production targets between decision makers at the macro- and micro-levels is essential for successful planning. This exchange of information will facilitate the determination of gaps where new information is needed or studies have to be prepared.

An important feature of a good sectoral plan is the identification of a list of potentially viable projects, almost like "building blocks" for which feasibility reports can be made according to a phased time programme to build a "shelf of projects" which could be drawn upon as circumstances permit without undue delays. A sectoral plan should be elaborated on the basis of well-conceived investment projects.

From the above it follows that:

- Realistic plans can hardly be formulated in the absence of a great deal of project planning and without proper economic evaluation of projects. An overall industrial development plan is of only very limited value unless it is translated into more specific terms, i.e. projects.
- Realistic preparation and evaluation of a project from a national point of view can best be made in the framework of a national development plan.

2. Project Preparation and Evaluation[1/]

Investment decisions are carried out in several consecutive phases

---

1/ Project preparation is examined in great detail in a special Manual being prepared by UNIDO. It is touched on briefly here only as is needed for the purpose of project evaluation.

which may be operationally conducted at three stages: project preparation, its evaluation and implementation. It is extremely important to point out that all three of them are interrelated and that the ultimate success of an investment decision depends equally on each of them.

Project preparation itself consists again of a series of interdependent measures aimed at translating an idea into an operating project. This is done in different stages:

1. Identification
2. Preliminary selection
3. Formulation

Industrial project development starts with the Identification of the project idea, a notion of possibility/desire to produce specific product(s) or to utilize specific resources. Project ideas may arise from studies of product-consumption pattern of the country, market studies, surveys of existing industrial establishments, import schedules, internal resources, geological surveys, industrial linkages, sectoral and industry analyses, development plans, export possibilities, experience of other countries, increasing demand for manufactured inputs for different sectors, studies of technology and development literature or from any other source. All ideas for projects are valuable and can prove to be the beginning of development.

The identification of a project idea is followed by a Preliminary Selection Stage. The objective at this stage is to make a decision whether a project idea should be studied in detail and what should be the scope of further studies. The findings at this stage are embodied in a Pre-feasibility Study (Opportunity Study).

The pre-feasibility study is carried out by an investor himself or by a "shadow investor" (promoter), e.g. a ministry, development agency, etc. It is prepared on the basis of data which are available in published form or can easily be collected or worked out.

Once it is proved that a project idea deserves detailed study, an investor should be found who would be interested in following it up (should the promoter not be identical with the investor). If the pre-feasibility study indicates that the proposed project appears to be a promising one, the decision may be taken to proceed further with the formulation of the project.

The purpose of the Evaluation Stage is to study from the technical, economic, financial and managerial aspects all the alternative ways of accomplishing the objectives of the project idea and to present the findings and recommendations in an systematic and logical order. This is true for partial (technical, management, etc) or complete techno-economic feasibility studies.

The Complete Feasibility Study is the first document in the formulation of a project proposal. It is on the basis of this study that a decision to implement or finance the project will be taken.

The Feasibility Study should contain all technical and economic data which are essential for the overall economic and social evaluation of a project. The Feasibility Study should be so self-contained that on the one hand the evaluator should not complain of the lack of data or imperfect analysis and the decision-maker should not find something hidden or missing. Accumulation and presentation of all technical and economic facts in their true and complete picture should be the main objective of this study.

The Complete Feasibility Study is carried out either by a consulting engineering firm, by a foreign supplier of equipment or by a potential investor, who have the technical competence to accomplish this job.

The complete feasibility study should contain as much of the information needed for project evaluation as possible. This Manual contains a set of model formats for the most essential information needed for project evaluation. Indeed, a project's feasibility in terms of its commercial and national profitability should be established by means of the criteria and parameters which are usually applied by institutions involved in the investment decision. Project evaluation manuals, if widely distributed and adhered to, may serve this useful purpose. Ideally, commercial and social project evaluation can be limited to checking assumptions, quantities, prices and parameters of such feasibility studies with very little original work left to be done. This will add efficiency and expedition to the usually protracted process of project preparation and evaluation. Needless to say, the investors will appreciate this.

The overall economic evaluation is a crucial exercise which is based on the project's feasibility report and precedes its implementation.

More specifically, the overall economic evaluation is a systematic procedure to weave technical and financial information about the project, together with relevant data about its economic environment, into one or few measures by which the project would be recommended for selection, modification or rejection. This, however, is not to say that the evaluation of a project starts only when its preparation ends. Actually, project preparation and partial economic evaluation should be carried out simultaneously and are closely interrelated. Only an overall economic evaluation is carried out on the basis of data provided at the end of the formulation stage.

Interest in the techniques of project evaluation has expanded significantly in recent years. Countries at various stages of development and having different types of economic systems are seeking articulation of, and refinements in, the criteria by which corporations and/or governmental agencies would rationally sift projects competing for relatively limited resources.

What renders project evaluation an interesting, though sometimes a rather elaborate task, is the existence of alternative economic opportunities for the commitment of resources. For the selection of a project would be considered rational only if that project is superior in some respect to others foregone. Such superiority of a project could be based on commercial profitability, i.e. the net financial benefits accruing to the owners of the project, and/or national profitability, i.e. the net overall impact of the project on the nation as a whole.

Whether the interest is in commercial or national profitability, the core of the evaluation process is somewhat similar and consists of three steps. First, the identification of the quantity, quality, and timing of physical inputs and outputs respectively. Second, the attachment of appropriate prices for the inputs and outputs in order to compute the respective values of costs and benefits. Third, the comparison of costs and benefits of the project in such a way that facilitates its comparison with other alternative projects.

Throughout the process of project preparation, evaluation and implementation many different yet interrelated aspects come into the picture. They are generally of technical, economic, financial and

legal nature, but their mutual relationship is strongly pronounced requiring that they all be taken into consideration at any stage of an investment decision. Consequently, the project's preparation, evaluation and finally implementation should be carried out through a team-work of such specialists as engineers, economists, financial analysts and legal experts. The participation of legal experts should save time and resources by making sure at an early stage that everything which is envisaged is consistent with the laws of a country and they should render the future parameters of a technical, financial and economic nature more certain by proper contracts. The presence of legal experts, probably highly specialized, is especially required if a project involves joint ventures. The entire process leading up to a project's implementation in reality will seldom be a clear-cut step-by-step procedure as described above. In practice, evaluation may reveal that certain aspects of a project have to be reprepared. Similarly, project implementation may encounter unforeseen difficulties which require both redesigning of certain project elements and evaluating the impact of this redesigning on the project's overall merits.

4. The Manual's Approach to Project Evaluation

4.1. The need to accommodate multiple national objectives

The development process is a multi-objective process - economic, political, social, strategic, ecological, etc. National development objectives are closely interrelated. This interrelationship is very complex. The nature of the interrelationship differs from country to country and from time to time within the same country. Its characteristic features are dynamism, harmony, conflict and complementarity between different objectives. National objectives are usually expressed in different degrees of explicitness in a national development plan or in another form of official policy statement by the Government.

Investment projects are one of the essential instruments for carrying out the established development policy with its multiple objectives. The link between national objectives and criteria for project evaluation looks obvious and simple at first glance. It is commonly accepted that the criteria for project evaluation must be derived from, or be compatible with, national objectives and reflect their interrelationship. In practice, however, there are a number of obstacles which prevent national objectives from being plainly reflected in project evaluation. It is hardly possible to establish in quantitative or qualitative terms and with sufficient precision the links between a project and the national objectives which are simultaneously pursued by the Government by different measures. The very objectives are often expressed in a vague and imprecise manner, creating ambiguities and permitting different interpretations. Contributions of a project to various objectives can very often not be measured in the same terms, say monetary terms, and are for this reason not directly comparable. Therefore, under these difficult conditions the core of the problem is to identify as much as possible a relationship between the development objectives and the characteristics of an investment project, which could be traced and if possible measured.

Starting on this fundamental basis, the Manual assumes that if there is a set of development objectives at the national level, the development projects should be evaluated as much as possible on the basis of their contribution to the fulfilment of each of these

objectives; in other words, the Manual explicitly introduces a set of criteria. Each objective at the national level is reflected in one or more criteria at the project level and vice versa. The priority assigned to each of these criteria at the project level must correspond to the importance of the respective development objectives at the national level.

The linkages between national objectives and the project evaluation criteria may be of a partial or comprehensive nature. The partial linkages appear usually during the identification and formulation stages of a project. The very act of identifying a project by a Government agency and giving a green light for further studies is a reflection of certain national objectives. The examination of the technical aspects of a project (raw materials, input coefficients, equipment, technology, level of mechanization and automation) is always made under the context of certain national priorities and objectives - utilization of indigenous raw materials, employment, technical advancement, etc. The formulation of the economic aspects of a project - capital investments, production costs, formation and distribution of profit, pricing, financial structure, local and foreign currency components, etc., is clearly carried out in the framework of certain explicit or implicit national objectives and instructions given in this respect to the project planners regarding mobilization of local and foreign financial resources, formation and distribution of income, conditions of foreign participation, balance of payments position, etc. The examination of variants of location for a project is usually done in the framework of objectives for better utilization of resources (proximity to raw material deposits, to consumption centres, to manpower resources) or promoting the development of backward or politically sensitive regions. This listing may go on even further.

The relationship between national objectives and criteria for project evaluation appears in a more comprehensive way in the final overall socio-economic evaluation of a project. This relationship appears throughout the Manual.

Attempts have been made elsewhere to recommend evaluation of investment projects by a single aggregate criterion which incorporates several multi-objective aspects of the development process.[1] The incorporation of different aspects into a single aggregate criterion is possible only by assigning weights in numerical terms (directly reflecting political value judgements) to these partial considerations: a weight to a nominal unit of future consumption as compared to a unit of present consumption; a weight to a nominal unit of present or future consumption in the hands of the rich as compared to the poor class; a weight to a nominal unit of present or future income in the hands of wage earners and profiteers compared to a unit of income in the hands of the Government; a weight to a nominal unit of income earned by a backward region as compared to a unit of income in a more developed region. This approach also requires highly reliable justification of the distribution of the net benefits generated by a project between present consumption and savings (for future consumption); of the marginal propensities of different social groups to save and consume; of the marginal rate of return on investment; of the marginal rate of savings; of the shadow price of investment, etc. Moreover, all these weights and other judgements producing a sort of normatives (national parameters) are true only under certain conditions. As soon as the conditions change, as they often do, this extremely complex set of interrelated weights and normatives should be readjusted accordingly. One can imagine the type of highly qualified personnel, abundant information, computers and time this exercise requires, not to mention possible errors and their implications as well as the room it provides for misuse of the approach and the consequences thereof.

Even if ideal conditions are assumed in a highly developed country in terms of skill, information, computers, etc., it is hardly possible to apply this approach consistently when evaluating investment projects. The best proof of this is that it has never been

---

1/ Marglin, S. A., Dasgupta, P., Sen, A. K., Guidelines for Project Evaluation, UNIDO, 1972; Little, I. M. D. and Mirrlees, J. A., Manual of Industrial Project Analysis in Developing Countries, Vol. II, OECD, Paris, 1969, and a more recent book (1974) by the two authors on the same subject; Economic Analysis of Projects, IBRD Staff Working Paper No. 194, February 1975, etc.

applied in practice on a large scale in any developed country. If this holds true for the developed countries, it should be much more valid for the developing countries to which group the Arab countries belong. Such a high degree of aggregation of the criterion for assessing investment projects in Arab countries is unrealistic at present and in the foreseeable future. This convinced the authors of the Manual to recommend a set of criteria (basic, additional and supplementary) for assessing the contribution of an investment project to the achievement of the different national development objectives. This approach is theoretically well-founded and practically easy to apply under the prevailing conditions in the Arab countries.

The incorporation of distributional and other aspects in the project evaluation methodology by assigning to them numerical weights is often justified by the weakness or unwillingness of the Governments of developing countries to achieve certain distributional or other objectives by other ways and means. It is, however, difficult to understand how a Government, which is weak or unwilling to implement its own distributional or other objectives through more direct and efficient ways such as price, tax, monetary and other policies, will be strong enough and willing enough to achieve the same objectives by an indirect, complicated and less efficient way, such as the methodology for project evaluation.

It is very true that deplorable injustice exists in this world. The question, however, is whether project evaluation methodology is capable of contributing to solving these problems. The authors of this Manual feel that well-known political, economic, administrative, financial and other instruments provide better opportunities to this end. Project evaluation methodology and particularly national benefit-cost analysis are complicated enough without assigning to them such additional functions. If national benefit-cost methodology is to be widely applied in the real life in developing countries, it should be considerably simplified and not further complicated by incorporating into it important additional functions.

Another justification in favour of a single aggregate criterion (which implicitly means using numerical weights) is that the single criterion characteristic of a project facilitates the selection or rejection of an investment project for the decision-maker and reduces the scope for subjective or arbitrary decisions. It appears so on the surface, but actually it does not prevent arbitrariness. The wide use of numerical weights automatically opens the door for subjective judgements on a large scale at the level of project evaluators and people and interests associated with them who even though acting with the best of their knowledge and intentions may commit great errors because they have less information on overall economic and non-economic considerations than at the level of decision-makers. The attempt to assign weights-as precise as the figures are - is an ambitious and responsible exercise, which expresses political value judgements in numerical terms and should be carried out by highly competent and very well informed people. Even the most competent top policy makers, as a rule, in actual practice refrain from being too explicit in formulating national objectives and particularly in assigning numerical weights to these objectives.

The characteristic of an investment project by a single aggregate criterion and its presentation in this way to the decision-maker may be used willingly or unwillingly for hiding the conflicts between different aspects of the project expressed by conflicting indicators. The complex, multi-dimensional and often controversial character of a project is very much oversimplified (and probably distorted) when expressed by a single aggregate criterion. So on the surface it appears easy for the decision maker to take the decision, but actually he can not see what is behind the single criterion, he may easily neglect the hidden conflicts between different aspects and take a wrong decision.

The approach of this Manual in recommending a set of criteria may not be as elegant from a strictly theoretical point of view, but it is more realistic. It has at least two practical advantages: First, the set of criteria approach presents as explicitly as possible the link between the parameters of the national plan which express the specific national objectives and the parameters of a project

expressed by the basic additional or supplementary indices, without claiming to expose all these linkages in quantitative terms. In many cases it does not go beyond stating that there is a causal relationship simply because it is impossible to quantify it. In the alternative approach all these linkages are hidden behind a single figure. Second, the set of criteria approach puts on the desk of the decision-maker the picture of the project - complex, multi-dimensional and controversial as it is. It provides him with warnings, pro's and con's for one decision or another and gives him the final word based on the information available in the feasibility study and on many other actual economic or non-economic facts and considerations on both the micro and macro level as well as expectations for future developments. The decision maker, when faced with the real complexity of the facts and being better informed than the project evaluator should be in a better position to take the right decision.

Therefore, the approach of this Manual differs from some other approaches - not in not taking into account the different aspects of an investment project, but in taking into consideration the multi-dimensional face of a project expressed explicitly by different indices and trying to be realistic and operational, it does not assign numerical weights to the indices for incorporation into a single aggregate criterion. Assigning numerical weights is not the only way and under the present circumstances we believe not the best way for considering the numerous national development objectives and translating them at project level. Weighting can not be a substitute for the comprehensive quantitative and qualitative analysis at the decision making level.

It is clear from the above that the development objectives and the dimensions of welfare are so widespread that they revolt against the application of single universal yardsticks for final overall socio-economic assessment of the national profitability of an investment project. The measurement of the national profitability in practice is to a very great extent subjective. It is based on general and specific implications, on measurable and unmeasurable, direct and indirect effects, on economic and non-economic considerations rather than on any strict mathematical formulae. More and

more often the term "socio-economic efficiency" is being used instead of "economic efficiency". The reality is that in matters of national profitability, evaluators and decision-makers are faced with innumerable difficulties and these cannot be resolved in the same manner (by one single criterion) as in the case of commercial profitability.

The Arab countries which this Manual seeks to serve, are quite different in respect of resource endowment, stage of development and the respective roles of public and private sectors in economic activities. The variety of features and circumstances of the potential users of the Manual has conditioned its design. It cannot be a Manual's approach to determine national objectives, but it provides criteria to determine whether a project meets specific national objectives. These objectives will vary considerably among different Arab countries as is the economic and social conditions which determine these objectives and their ranking.

The user of the Manual, therefore, will have to obtain the policy objectives from national authorities, for instance: increase in production and productivity; increase of employment opportunities; constitution of a more equal society; reduction of external vulnerability through improving the balance of payments position of the country and increasing the international competitiveness of exported goods; upgrading the skill of the national manpower; development of an appropriate economic and social infrastructure for further industrialisation, etc. He can then assemble, with the guidance of the Manual, a set of criteria to fit these objectives.

It will be up to evaluators and especially to planners to determine the set of indices to be applied for evaluation of investment projects and subject to their importance to decide which are basic, additional and supplementary.

3.2. Value added as a proxy of national welfare

The fundamental strategic objective of national development policy of any country is to raise the standard of living of its nationals (social welfare) and to allocate investment to achieve a higher growth rate of the economy (economic welfare). The former is represented by

the net aggregate increase in consumption and the latter by the net aggregate increase in savings and investment.

It is well known that the national income is the only source for increasing both consumption and savings. The national income is a basic quantitative measure of the level and rate of increase in national welfare. The level of national income is regarded as a proxy of national welfare, reflecting both the resource endowment of a country and the degree to which basic needs and ambitions of the people are satisfied.

Thus, a fundamental ultimate aim of an investment project undertaken by the society is to contribute as much as possible to the national income. The translation of national income at project (factory) level is Net Value Added. The problem, therefore, boils down to the assessment of the value added expected to be generated by an investment project on the basis of the real social value of inputs and outputs.

Net value added consists of two major components - salaries and wages and an excess which may be called social profit. The question arises why not confine the analysis to the social profit and abandon the other component of the value added? The Manual provides the following answer to this question:

From the point of view of a project or existing production unit (public or private) the salaries and wages are inputs, but from the view point of the society they are part of the national income. More salaries and wages means higher employment, higher income per person employed or both. Larger wage bills mean higher purchasing power of the population, or in other words higher national welfare. The wages are a component of the national income, already directed through the channels of the national distribution process in the form of personal money income of the population. The society can not be indifferent with regard to the level of this income of the individuals. The higher this income, the better. The higher wage bill is one of the major prerequisites for higher present consumption, i.e. higher social welfare.

The social profit is that portion of the value added which has been directed through other channels of the same national distribution mechanism: taxes to the treasury; net profit (dividends) - to shareholders; interest on borrowed capital; rent, etc. through the complex network of the distribution and redistribution process part of the social profit is used for present private and public consumption - part of the taxes through the national budget as well as a small part of the net profits. The larger portion of the social profit is usually saved and invested - part of the taxes, larger part of the dividends, of interest, of rents. Therefore, a larger social profit is a major precondition for higher private present consumption, normal functioning of the entire state machinery on one hand and on the other, a basic source of savings for accelerated development, i.e. for increasing the economic welfare of the country. This in turn is a prerequisite for higher future consumption.

It follows from the above that net value added is an easily understandable, comprehensive operational criterion for measuring the contribution of an investment project to the national income and therefore to the present consumption as well as to the saving potential of the nation for the sake of increasing future consumption.

By adopting this concept the Manual takes into account the structure of the value added - the magnitudes of the two components, salaries and wages on one hand and social profit on the other. Taking one of the components and neglecting the other provides only partial one-sided picture of the overall contribution of a project to national welfare. The Manual, however, provides equal treatment to wages and social profit. Both components of value added enjoy the same weight, both are equally important to the nation. This concept is developed in more specific terms in the national profitability section of the Manual. We believe, however, that one should stop here and not attempt to trace the further flows of the produced value added throughout the channels of the national distribution/redistribution system, not to pass any value judgements on the pattern of distribution/redistribution and not to assign any numerical weights on components or subcomponents.

This approach is recommended both theoretical and practical grounds. On theoretical grounds assigning weights to subcomponents - dividends, taxes, interest, etc., and their distribution to social groups or regions and then incorporating the weighted values in the value added by revising its magnitude, is not advisable because the laws which govern the national distribution/redistribution process are exogenous factors, independent from the project. Introducing these factors would definitely distort the true picture of the project we are interested in. On practical grounds it is not recommended simply because it is impossible to carry out such difficult and demanding analysis for the purposes of project evaluation. And even if one cycle of this exercise is carried out, it should be repeated and new judgements passed as soon as the socio-economic conditions change, which happens very often. No developing country we know could afford itself this luxury in the evaluation of investment projects.

What really matters for an investment project is to generate more value added comprising wages and social profit. The link between the soundness of the project and the distribution/redistribution process is only in the sense that the higher the value added, the higher the social profit after paying higher salaries and wages. The higher the social profit, the higher the dividends to shareholders and taxes to the treasury after paying interest on borrowed capital, rent, royalties, if any, etc. As stated above, the value added is a criterion for assessing the soundness of a project. How this value added is being further distributed and redistributed in line with numerous political, economic, financial, legal, administrative regulations, has nothing to do with the project and this project should be neither penalised nor given a credit for that. The distribution and redistribution of the value added should not be mixed with the methodology for evaluating the soundness of an investment project.

The value added of an investment project has special characteristics that have to be taken into account:

- In the case of the evaluation of an investment project, both outputs and inputs are <u>anticipated</u> or <u>expected</u>. This implies that they can be estimated only with some degree of accuracy and special care should be taken first of the most important outputs and inputs of the project;

- The theory problem to include or exclude unfinished or not yet sold products into output value when one considers a given time period fortunately disappears when one calculates the value added for the whole economic life of the project;

- Value added can be measured either in terms of gross or net value added. Net value added is equal to gross value added minus investment. In the case of project evaluation, investment outlays including working capital are considered as input, and therefore value added for the purposes of project evaluation should by definition be net of investment, i.e. net value added;

- Value added can be estimated at market prices (including taxes and excluding subsidies) or at factor cost (excluding taxes and including subsidies). But the value added of an investment project for evaluation purposes ought to be estimated on the basis of including both taxes and subsidies. The inclusion of taxes into the value added produced by a project is clearly based on the argument that there exists the "willingness to pay" at actual market prices which include taxes. On the other hand, the argument for the inclusion of subsidies is based on the observation that subsidies reflect the social preferences ("merit wants") for given products or services.

Value added as a criterion reveals both merits and demerits. The most important merit consists in its relatively simple estimation, linkage with the national accounting system as well as the predominant use of market prices throughout the analysis. A project's net value added, i.e. its contribution to national income, becomes the yardstick of its relative benefit to the economy. Such a concept fits easily into common planning practice where national and sectoral targets are also expressed in terms of increments to national income. Cohesion between planners and policy makers on the one hand and the ultimate

investors and micro-decision makers on the other is improved. Decentralization of economic decisions is facilitated as the value added becomes an easily comprehensible performance criterion and a basis for a motivational system. An incentive system is based in this case on the "behaviour" of the value added, instead of profit. Since the basic elements of national accounting are in the realm of rather elementary economics, the evaluation process will be easily understandable to a fairly wide range of professionals with different educational backgrounds.

The most essential limitation of value added as a proxy for national welfare is that it does not reflect adequately the whole range of policy objectives pursued by a Government. This limitation applies to all operational criteria for project evaluation proposed thus far. For this reason, as stated above, the value added criterion should be supplemented by a set of additional indices and considerations.

3.3. National net value added

It was stated above that the net value added is a proxy for national welfare. In principle this is a correct statement, but not precise enough. It may happen and it does happen in practice that an investment project located in a developing country (say in an industrial free zone) generates a very impressive net value added, but the largest portion of this is being automatically transferred abroad. A substantial portion of the wage bill is repatriated abroad by the expatriate labourers, and only a minor portion is being spent in the host country. Only a limited number of local, predominantly unskilled and semi-skilled labour is employed with the project. The bulk of the investment is financed from foreign borrowing and equity from foreign shareholders and consequently a very large portion of the social profit is automatically transferred abroad as interest to foreign banking institutions and dividends to expatriate shareholders. The project has been awarded special tax privileges by the host government and therefore makes only a minor contribution to the treasury of this country. The question arises whether this project is as good from a national viewpoint as it looks from the net value added generated

is the net value added in this case an appropriate measure of the real contribution of the project to the national welfare? The Manual answers "No" to this question. The net value added is a measure of a project's contribution to the national income only up to the extent it is distributed and consumed in a country and for the benefit of this country. The portion of the value added which is repatriated abroad as wages, interest, dividends, rents, etc., does not add to the national income, does not contribute to the national welfare of a country and therefore should be excluded from the net value added when evaluating the soundness of a project from the point of view of society. In other words, only the net national value added is a proxy for national welfare. This is the concept adopted by the Manual and appropriately developed in the operational part.

3.4. Two steps in evaluation - screening and ranking; certainty and uncertainty

Given the range of objectives and resource scarcities throughout the Arab world, the Manual recommends a two-step procedure for using the value added criterion for project evaluation. First, absolute efficiency test for screening purposes, which is a basic measure of efficiency. As a matter of principle, it should be applied as a first step under all circumstances. Second, relative efficiency test for ranking purposes if and when several projects pass the absolute efficiency test. The second step is designed to determine a project's national worth under three different conditions: shortage of capital, of foreign exchange and of skilled labour. In these instances the incremental value added of the project is measured against the efficient use of the scarce production factor. Evaluators may decide to limit national profitability analysis to the absolute efficiency test. They may add a relative efficiency test if conditions warrant it and the data base is sufficient.

The two step approach is also recommended with regard to the degree of certainty. As stated earlier, by definition project analysis is based on the best estimates of the various variables and parameters. These estimates are the most probable ones to occur. The Manual

recommends that the soundness of an investment project should first be evaluated on this basis - under conditions of relative certainty. However, such evaluation ignores the fact that there may exist other values of the variables which are also likely to occur. In addition, there are cases in which it is difficult to pinpoint for some key variables the most probable value. Project evaluators should consider these uncertainties especially when they have a sizeable impact on the soundness of a project.

The Manual recommends the application of break-even analysis as a first step out of the world of relative certainty into the world of uncertainty. Sensitivity analysis is also recommended where, instead of one estimate of each variable, several estimates are used under varying conditions. Finally, probability analysis is suggested where one can use all the probable values of each variable which have a significant chance of occurrence.

3.5. Direct and indirect effects

Even with the application of a basic criterion plus a few additional indices in the evaluation process, a project's overall impact on a society may not be assessed to an extent which is entirely satisfactory. A project may have indirect or "intangible" costs and benefits which are neither covered by the basic criterion nor by the additional indices.

Indirect effects are additional benefits and costs caused by an investment project under consideration, occuring in other technologically and economically related projects. Should the project under examination not have been established, the indirect effects would not have occurred. Such effects of a project may be substantial enough to warrant attention on behalf of evaluators and decision makers alike.

The Manual does not attempt to provide an exhaustive list of conceivable indirect effects, but evaluators are urged to give proper qualitative consideration to such effects as environmental implications, the impact of a project on health and skills of future employees, infrastructure implications, on basic values such as the

quality of life, the dignity of the individual, social justice and equality, on any essential changes in the life, not only of the basic rural and urban community but also of the individual, if possible. In this case, indirect effects should be treated verbally as a third block after the basic criterion and the additional indices.

In certain cases the indirect effects of a project might be traced and even measured. The "industrial complex" technique is suggested in the Manual to evaluate indirect effects which are so important that they should not be severed from the project itself.

3.6. Market versus shadow prices

Shadow prices are considered in theory to reflect more appropriately the resource scarcities that prevail in an economy. It has been said elsewhere that project evaluation, if carried out on the basis of such prices, should reveal more accurately the social costs and benefits to a nation than the frequently distorted market prices. Prominent evaluation books such as those published by OECD and UNIDO as well as some World Bank staff working papers strongly advocate shadow prices.

One may imagine for a moment that appropriate shadow prices have been set up and they reflect the fundamental objectives of a country and the economic environment with all its constraints. But what will happen if the objectives and the constraints change, as they often do in practice? The whole set of shadow prices should be accordingly readjusted. In addition to this, the prices, including shadow prices, are closely interrelated. The changes of the factors which determine one shadow price will affect other shadow prices as a chain reaction and, therefore, they should be readjusted accordingly. To expect that this continued readjustment of the whole complex of shadow prices could be carried out in a satisfactory manner in a developing country in the foreseeable future is unrealistic. To advocate the setting up of two parallel price systems in a country (be it developed or developing) - one for project evaluation purposes only along with the actual market prices is also unrealistic. The decision makers usually press on the project planners to formulate and submit the projects for decision as quickly as possible and

nobody will even think of such extremely difficult, time-consuming setting of shadow prices and their endless review and readjustment.

For the sake of simplicity and added appeal to practitioners, this Manual is largely based on actual prices (with some adjustments, if indispensible) and therefore avoids shadow or accounting prices on inputs and outputs. Data problems associated with the calculation of shadow prices are thus kept to a minimum and so are the disappointments generated by the unsuccessful attempts for application of shadow prices in project evaluation. Practical experience has confirmed that when the gap between shadow and actual prices becomes too wide, the interest of an investing agency in project evaluation may be jeopardized: prices lose touch with reality and turn into something suspected of being imaginary and less relevant in practice.

There is no guarantee and nobody has proved thus far that the distortions introduced by inappropriate application of "artifically" constructed shadow prices for inputs and outputs are less than distortions arising sometimes from market prices, in addition to the great conceptual and computational difficulties related to derivation and application of shadow prices. This inappropriate application of shadow prices may result from unfounded subjective judgements, lack of experience, lack of information, time pressure, etc. Unfortunately, this characterizes very often the project development process in most of the developing countries this Manual is to serve.

Market prices, with all their deficiencies, at least reflect an economic reality, economic environment in which the project is going to operate. The market price may be distorted upwards or downwards, but usually behind such deviations there are many socio-economic reasons, social forces with their particular interests, reflections of the socio-economic policy of the government using the price as a tool for income redistribution (luxury goods), for discouraging or promoting the consumption of certain goods (tobacco, spirits versus bread), etc. All these considerations are reflected in the actual market prices usually in a more objective manner than in the shadow prices.

The application of actual market prices may help, at least to a certain degree, to limit the room for manipulation of prices and misuse of the price mechanism for project evaluation purposes in order to prove "economically efficient" any project one wants to be selected, irrespective of whether it is actually efficient. There is also a tendency in actual practice to override negative appraisal results less reluctantly if based on market prices as compared to shadow prices because it is easier for the decision maker to imagine the consequences, i.e. a net loss of national income. It may be for these reasons that the direct link between an increase in value added at project level and the increase of national income has always been of great appeal to national planners. It may also explain a certain revival of interest in value added concepts.

3.7. National parameters

National parameters are variables set up outside an investment project. They are given by a national planning institution and should reflect the optimal allocation of resources from the point of view of society. National parameters used for the purposes of project evaluation are a numerical expression of limits of acceptability from the point of view of the society (level of international competitiveness, minimum acceptable social rate of return) or quantitative measure of the value the society assigns to certain major factors, having direct bearing on project evaluation and selection (social rate of discount, shadow rate of foreign exchange). The national parameters are yardsticks passed on by central planning authorities to the evaluators and micro-investment decision makers which set targets that have to be achieved or surpassed within the framework of actual prices prevailing on the market.

National parameters are in general independent from all decisions taken with respect to individual projects. They not only express national objectives and top level value judgements but are also concerned with systematic information on facts that are relevant to the examination of all investment projects. The national parameters should, in principle, be uniform for all sectors, regions and projects. Only under very specific circumstances might they be diversified.

3.3 Integrated approach in project analysis

The value added concept permits the use of one set of data in both commercial and national profitability analysis. Physical quantities of inputs and outputs are - externalities apart - identical in both types of analysis. To such quantities market prices are applied in commercial analysis. Basically, the same set of values, comprising some indispensible price adjustments, is then used in national project evaluation with the national accounts serving as a reference system. Thus, commercial profitability analysis serves as a stepping stone towards social evaluation. This provides for a coherent and more easily understandable appraisal process and reduces data problems.

A combination of both commercial and national profitability analysis is indeed part of the Manual's approach to project evaluation. This follows the well established practice that what counts as a profit or loss to a part of the economy, e.g. an enterprise, is not necessarily identical with a profit or loss to the economy as a whole. Commercial profitability analysis deals with the former, national profitability analysis with the latter.

The commercial profitability is determined by the net profit generated by an investment project. Items such as wages and salaries, interest, rent, indirect taxes are part of the costs of the entrepreneur. The commercial benefit comprises only net profit.

A project's value added over its lifetime may be substantial in terms of the sum of wages and salaries, rent, interest, indirect taxes and net profit. A project may be very sound from a national point of view in terms of value added, yet the profit element in this total which determines the net benefit to the investor may be insignificant even up to the point where he would need a subsidy.

The integrated application of both types of analysis permits comparison of individual and national interests and, if industrial activity is predominantly in the public sector, it helps to form judgements on the parameters, e.g. prices, which determine both and may cause them to differ.

3.9. A broader understanding of project evaluation

The process of evaluation of an investment project from the social point of view advocated in this Manual should be understood as a broad and continuing exercise.

Project evaluation is a continuous exercise because the evaluation does not take place at the end, when the formulation of a project has been completed. Project evaluation is often considered (implicitly or explicitly) an activity which takes place at a given point in time and as a fairly mechanical procedure. In practice, it starts in rough terms with the identification of a project and goes on throughout all stages of the formulation. In the early stages, even the basic information on physical inputs and outputs is very rough. Any exceptional accuracy in the procedures would quickly be lost on such rough data. Because of the limited information and the tasks of evaluation in the early stages, this assessment is usually of a fragmentary nature, covering only certain aspects of the project. The final overall socio-economic evaluation is far more comprehensive. This Manual is designed mainly for overall evaluation, but it provides also an operational methodology of appraisal for the early stages of formulation - the simple annual formula.

National project evaluation is a very broad exercise because it comprises not only the application of a certain set of basic, additional and supplementary indices, but also numerous consultations, discussions, clearances, co-ordination among different government institutions in charge of socio-economic planning, financing, balance of payments, manpower training, technological development, territorial location, prevention of pollution, medical and fire regulations, etc. These discussions are held at different levels (macro and micro) throughout the identification and preparation of a project, by means of both quantitative and qualitative, economic and non-economic analysis. It might be too simple to believe that in practice the social evaluation of a project is a procedure carried out only through a set of indices for final overall appraisal and to underestimate the importance of other ways, means and procedures of social evaluation.

3.10. The need for simplicity and practicability

The Manual endeavours to be as practical as possible. It keeps in view the working conditions which potential evaluators are likely to face. Academically oriented people may find it too simple and too operational. It is not rooted in a given theoretical concept such as neoclassical economic theory. Nor will the indices of national profitability often produce clear-cut yes or no answers. The Manual attempts to guide the evaluator to assess the financial and social implications of a project and he will have to adjust any benchmarks to the decision-making situation, which varies widely from country to country. It is hoped that this approach will encourage its application by a wider range of professionals with different backgrounds working under varying conditions. It is of unquestionable merit to define in rigorous terms a project's contribution to the welfare of the people. But it may be at least as important to lay down a few operational conditions which a project must meet if it is to provide a small but noticeable improvement in prevailing conditions.

In short, the Manual attempts to be deliberately eclectic in its exposition and, therefore, permits an eclectic use of its contents by project evaluators from the 20 Arab countries for which it is designed. The user of the Manual is offered also a fairly wide range of choice in the degree of sophistication of the analytical tools he would wish to use. A range of techniques is offered for both commercial and national evaluation amongst which the users may select whichever is appropriate in the light of data, time and resource availability, both financial and human.

* * *

For these and similar considerations the Manual has adopted neither the Marglin, Sen, Dasgupta "Guidelines" (published by UNIDO) nor the Little and Mirrlees approach to social cost-benefit analysis published by OECD. In the "Guidelines", the criterion of national profitability is "net aggregate consumption". In this approach, all the main aspects of evaluating the project, i.e. the foreign exchange,

employment and redistributional effects are evaluated through the reflection of their impact on the level of consumption. The basis for pricing inputs and outputs is shadow prices. In the UNIDO approach, the numeraire is national savings in terms of foreign exchange, with foreign exchange shortage dominating the determination of shadow prices for most inputs and outputs.

In both cases the adoption of one global aggregate indicator renders these methods both rigid and complicated. In addition, the a priori inclusion of foreign exchange constraints may give them a bias towards conditions which may be typical for most developing countries but not necessarily for most Arab countries. Any project evaluator, regardless of the methodology he uses, must always possess an indispensible amount of intuition and judgement, accumulated through experience. This Manual, like any other Manual, cannot claim to furnish a substitute for these requisite qualities. It is hoped, however, that this Manual may serve as a guide which would reduce the scope of subjective judgement in project evaluation to its possible minimum.

Towards added practicability, the following features are incorporated. Each criterion of evaluation is presented successively in terms of (a) definition and significance, (b) methods of calculation, (c) data requirements, and (d) problems of application.

Three case studies (textile mill, urea plant and cement plant) are designed to exemplify the approach, elucidate procedures and/or caution against major pitfalls.

Part I of the Manual is concluded with a set of model formats which will be used throughout the Manual. The model formats indicate the most essential information needed for project evaluation and how it should be "organized". This information should be collected during the project formulation stage and be available from the feasibility study.

Part II is the main body of the manual and expounds the major criteria and indices of commercial and national profitability in succession. The exposition of both is made first within the framework of certainty. The last section of Part II contains a brief outline of the techniques of project evaluation under uncertainty and their application under various conditions.

The annexes contain three case studies which elucidate the application of the various indices, a glossary of basic terms and present value tables with instructions on their use.

4. Basic Information needed for Project Evaluation

4.1. A set of model formats

Project evaluation is a quantitative exercise to a large extent. A solid data base, therefore, is required to form a judgement on a project. In collecting these data the evaluator normally has to rely on information supplied by the investor and his consultants. It is the very purpose of various stages of project preparation to establish the magnitudes, both physical and in money terms, which surround its construction and operation. Ultimately, these magnitudes are pulled together in a Techno-Economic Feasibility Study which is the starting point for project evaluation. More often than not, however, it will be up to the evaluator to organise the data in a manner to suit the appraisal methods which he intends to apply. The Manual recommends a set of model formats to assist the evaluator in this first step. The tables are designed in such a way as to serve both commercial and national profitability analysis. No universal format exists for such tables. This set of tables should be viewed only as illustrative ones. The tables aim at indicating what is the minimum information essential for evaluation of an investment project under normal conditions. This is an attempt to cover comprehensively the major categories of benefits and costs. It is up to the evaluator to modify the model formats subject to the actual conditions under which a project has to be evaluated.

The first question that is usually raised is how much the investment will cost. Table 1 provides a break-down of the investment outlays into its various elements. Since time plays a prominent role in project evaluation, it will also be necessary to determine, usually with the advice of engineers, the entire construction period and the phasing of the investment during that period. That way the major characteristics of an investment become transparent, and it will then be feasible to define the lifetime of major investment elements, i.e., to work out annual depreciation rates and the expected years, when additional investments for major replacements will be called for. By the same analysis any residual values at the end of the project's lifetime will be known (cf. 2b below). Table 2 provides a format for

such information. Next comes the question about the magnitudes of the sales revenue - which goods the project is planned to produce, how much of each product in each year and what prices the investor hopes to attain in the local and export markets (Table 3). Again time will have to be taken into consideration: how long is the running-in period expected to last, what quantities can be produced annually during that period, the economic life of the project (products), the utilisation of the installed capacity, etc. Table 4 provides for a detailed break-down of annual operating costs both during the running-in period and at full capacity utilisation.

Once the feasibility of a project has been established on the basis of these data, the investor will have to secure the financing of the project. The information in Tables 5/ represent the data needed for the evaluator to embark on this task.

Finally, these data may be compiled into one comprehensive table which contains all the information needed for commercial profitability analysis. This is Table 7, Integrated Financial Analysis. Table 8, Integrated Value Added Analysis, provides a simple format on how to compute the value added from the data contained in Tables 1 through 6. This table provides the items needed for computation of the net national value added generated by an investment project, namely outputs, current material inputs purchased from outside the project, investments and repatriated payments. The table illustrates successive steps of calculation:

1. gross domestic value added,
2. net domestic value added,
3. net national value added.

Finally, the table contains data on salaries and wages, to be readily available for the application of the efficiency formulae.

Formats for the calculation of specific indices can then easily be obtained with the same data base along the lines shown in the case studies.

At a first glance, the tables may appear to be of a fairly exhaustive nature and, in the light of data gaps typical for many Arab countries, may discourage some evaluators to use them. It may be emphasised that mainly the aggregates at the bottom of each table determine the economic efficiency. The evaluator, therefore, does not always have to break down all his data in accordance with the model formats, provided the figures comprise the details outlined in the tables. He should therefore consider these tables as a check list to find out that no major elements of project analysis are missing and that both the coverage of his data base and the definitions underlying its various elements are in accordance with sound accounting practices. Also, depending on which indicators the elevator chooses in particular cases and whether he wishes to expand his evaluation to cover, for instance, operational safety analysis, he may not need the entire set of data, not even all the aggregates derived in Tables 1 through 6. Practical experience will quickly yield the understanding necessary to cope with questions of permissable lumping and omitting.

Table 1: Plant Investment and Schedule of Construction

	total costs			year t_0			year t_1			year t_2			year		
	foreign exchange	local currency	total	foreign exchange	local currency	total	foreign exchange	local currency	total	foreign exchange	local currency	total	foreign exchange	local currency	total
1.1 Plant assets															
1.11 Equipment															
- old/up-dating cost															
- duty/taxes on above															
- transport cost to site															
1.12 Installation cost															
1.13 Land acquisition and development															
- land															
- buildings															
- other															
1.14 Other fixed assets															
1.19 Contingencies on fixed assets															
1.2 Preliminary expenses															
1.21 Licenses, royalties															
1.22 Planning and other consultancy services															
1.23 Interest during construction															
1.24 Start-up expenses															
1.25 Training of personnel															
1.26 Other preliminary expenses															
1.29 Contingencies on preliminary expenses															
1.3 Working capital															
1.31 Working capital															
1.39 Contingencies on working capital															
1. Project Investment (1.1 + 1.2 + 1.3) of which: Working capital investment															

Table 2: Depreciation, Replacements and Residual Values

	Expected life-time (economic depreciation) (years)	Annual depreciation	Replacements						Residual value (final year)
			t_1	t_2	t_3	t_4	t_5	t_n	
2.1 Fixed assets									
2.11 - 2.18 Equipment incl. installation costs									
2.19 Buildings									
2.20 Other fixed assets									
2.2 Preliminary expenses[1]									
2.3 Working capital[2]									
2.4 Replacements									
2.5 Residual values									
2.6 Annual depreciation									

1) Rules as to whether preliminary expenses can or should be capitalized differ from country to country. If they should not be capitalized they should nevertheless be included in investment costs for capital budgetic purposes. They are treated in this manner in this set of tables. They must then be written off entirely in the first year of operation. In all other cases depreciation periods will usually be fairly short with no replacements entering the calculations.

2) Working capital is normally not written off. Instead the entire amount enters the final year of the project's life-time as residual value.

Table 3: Annual Sales Revenue

Product	Unit of measurement	year t_0		year t_1		year t_2		----	final year	
		quantity	value [1]	quantity	value [1]	quantity	value [1]		quantity	value
Product (a) local export										
" (b) local export										
" (c) local export										
" (d) local export										
3. Total Sales Revenue										

1) At ex-factory prices. Sales and excise taxes should be included in ex-factory prices provided they are also included in operating expenses

Table 4: Annual Operating Costs

Items	Year t_0			Year t_1			Year t_2			.....	Year n		
	variable	fixed	total cost	variable	fixed	total cost	variable	fixed	total cost		variable	fixed	total cost
4.1 Manufacturing cash expenses													
4.11 Material													
4.111 imported													
4.112 local													
4.12 Wages 4.121 foreign													
4.122 local													
4.19 Other manufacturing expenses													
4.2 Marketing cash expenses													
4.21 Material													
4.211 imported													
4.212 local													
4.22 Wages 4.221 foreign													
4.222 local													
4.23 Sales and excise taxes													
4.29 Other marketing expenses													
4.3 Administrative cash expenses													
4.31 Material 4.321 foreign													
4.32 Wages 4.322 local													
4.39 Other administrative expenses													
4.4 Operating cash expenses													
4.5 Depreciation													
4.6 Total costs (4.4 + 4.5)													
Equal capacity utilization of (in physical terms)			%			%			%				%
Cost per unit of production													

Table 5: Capital Structure

Items	Construction Period					
	t_0	t_1	t_2	t_3	t_4	Total
1. Investment						
1.1 Initial investment						
1.2 Interest during construction						
Total investment (1.1 + 1.2)						
2. Financing						
2.1 Equity						
2.11 Local Currency						
2.12 Foreign Exchange						
2.2 Borrowing						
2.21 Local Currency						
2.22 Foreign Exchange						
Total financing (2.1 + 2.2)						

Table 6: Financial Obligation

Items	Year t_0		Year t_1		Year t_2		. . .	Year t_n	
	Principle	Interest	Principle	Interest	Principle	Interest		Principle	Interest
1. Debt Service Loan A repayment interest 2. Dividends									
Total (1 + 2)									

Table 7

Integrated Financial Analysis

(000 dinars)

	Items	Year 0	1	2	3 - 10	11	12 - 19	20
Basic information economically not dependent	71 Investment (k)							
	711 Initial investment	100	100					
	Total	100	100					
	72 Operating cost (c)							
	721 Cash expenses excluding interest			40	60	60	60	60
	722 Depreciation			-	10	10	10	10
	723 Interest			-	5	-	-	-
	Total			40	75	70	70	70
	73 Income (s)							
	731 Sales revenue			70	100	100	100	100
	732 Subsidies	-	-	-	-	-	-	-
	733 Salvage value			-	-	-	-	20
	Total			70	100	100	100	120
Investment profitability analysis	74 Net cash earnings (E)							
	741 Taxable profit 73 - 72			30	25	30	30	50
	Minus taxes			-	5	6	6	10
	742 Net profit after taxes and interest (simple rate on equity)			30	20	24	24	40
	Plus interest				5	-	-	-
	743 Net profit before interest and after taxes (simple rate on total investment)			30	25	24	24	40
	Plus depreciation, minus replacement			-	10	10	10	10
	Total (pay-off)			30	35	34	34	50
	75 Net cash flows (NPV + IRR)	(100)	(100)	30	35	34	34	50
Financial capability analysis	76 Financial sources							
	761 Equity	100	20					
	762 Loans		80					
	763 Others							
	Total	100	100					
	77 Financial obligations							
	771 Interest charges			-	5	-	-	-
	772 Repayment instalment			-	10	-	-	-
	773 Dividends			-	12	12	12	12
	Total			-	27	12	12	12
	78 Net cash balance (75 + 76 - 77)	0	0	30	8	22	22	38
	79 Cumulative balance of 78	0	0	30		196		330

Table 8: Integrated Value Added Analysis

Items		Year 0	1	2	. . .	n
B.1	Outputs					
B.1.1	Exported					
B.1.2	Domestically marketed					
B.1.3	Infrastructural services					
B.1.4	Subsidies					
B.1.5	Salvage value (working capital, land, non-depreciated fixed capital at the end of the project's life)					
B.2	Material Inputs (purchased from outside the project)					
B.2.1	Imported					
B.2.2	Domestically procured					
B.2.3	Infrastructural and other services					
	Gross Domestic Value Added (B1 - B2)					
B.3	Investments					
B.3.1	Fixed capital					
B.3.2	Land					
B.3.3	Working capital					
	Net Domestic Value Added [B1 - (B2 + B3)]					
B.4	Repatriated Payments					
B.4.1	Wages of expatriated labour					
B.4.2	Profit (dividends on foreign capital					
B.4.3	Interest on foreign capital					
B.4.4	Foreign payments for royalties, know-how, etc.					
B.4.5	Other repatriated payments					
B.5	Salaries and Wages (excluding repatriations)					
B.5.1	Skilled labour					
B.5.2	Unskilled labour					
Net National Value Added [B1 - (B2 + B4)]						

4.2 [illegible]

4.2.1 [illegible] working capital requirements

One of the most frequent reasons for financial difficulties of new projects in early stages of operation is insufficient provision for working capital. Whereas cost of machinery, buildings, consultant services, etc., are usually estimated with considerable diligence, only cursory attention is often given to capital requirements necessary to operate the plant. The results are unrealistic profitability expectations on the one hand (because initial investment entering the calculations is too small) and haphazard financial management on the other once the project is operative.

Working capital is the sum of the current assets (cash, accounts receivable, inventories of both raw materials and final products) required to operate a project under normal circumstances. What is normal differs widely from country to country and from business to business. In general terms, therefore, only very rough guidelines can be given for the estimation of working capital requirements which can help one to make at least a rough estimate.

Step 1: Divide annual operating expenditure at full production (Table A) by 365 to arrive at daily operating expenditure;

Step 2: Estimate expected average number of days for which supplies have to be held in store;

Step 3: Estimate average period of manufacture (i.e., number of days between the day raw materials are taken from store and the day the final product enters the store ready for sale);

Step 4: Estimate expected average number of days for which the final products are stored until delivery;

Step 5: Estimate expected average terms of sale (number of days between delivery of goods and payment dates) and deduct average terms of purchase (average number of days between receipt of supplies and payment of invoices);

Step 6: Add number of days of steps 2 through 5 (if balance of step 5 is negative, deduct from total of steps 2 through 4) and multiply with daily production expenditure (step 1) to arrive at order of magnitude for net working capital requirements.

Example.

Assume Table 1 depicts the financial forecast of a steel rerolling mill. Average daily operating expenditure from year 3 onward are then estimated to amount to [illegible] dinars (60,000 dinars: 365 - step 1). Scrap has to be imported and as arrivals of shipments are difficult to schedule with sufficient reliability, three months supplies are held on average (step 2). The rerolling process takes one day (step 3). An average storage period of 30 days is expected before delivery to the local construction industry (step 4). Terms of purchase cover the shipping period only. Payments, therefore, will have to be effected on arrival of supplies at plant site. No credit terms will be offered to customers but 20 days will have to be allowed for payments to be made against invoices (step 5). Daily operating expenses are then tied down for an average of 141 days (90 + 1 + 30 + 20 - 0 = 141), with working capital requirements totalling 23,265 dinars (step 6: 165 dinars x 141).

It should be emphasised again that such a procedure can only produce a rough indication of working capital requirements. Sound judgement has to be exercised and the figure adjusted upward or downward if indicated. In this process of adjustment the following elements have to be taken into consideration:

- If a project's running-in period is very long, i.e., if full capacity utilisation can be reached only after a considerable length of time a downward adjustment may be necessary,
- If the raw material content of the final product is low, step 2 should be dealt with separately by including the cost of such raw materials only instead of basing step 2 on total daily operating expenditure;
- If access to medium-term bank credit is relatively easy, part of working capital requirements may be financed by means of such credit facilities instead of looking for additional equity or long-term funds.

4.2.2 Residual and salvage values

For the purposes of discounted cash flow analysis, a decision on the life-time of a project has to be made. Since a project consists of numerous elements which may last for different lengths of time, e.g., lorries, machinery, buildings, land, etc., the concept of a project's life-time is a somewhat fictitious one. Yet all these elements together are needed to produce the desired output and consequently either re-investments have to be earmarked for those assets which have to be replaced fairly early, or residual values have to be determined for such elements which are still usable after the lifetime of other major investments has elapsed. Such residual values may then be considered income at the end of the project's terminal year. Instead of residual values, therefore, such elements may also be called terminal values.

With the kind of analysis carried out in Table 2, the determination of residual values is easily carried out. Usually the lifetime of major investments, such as the bulk of machinery, is chosen to represent the project's lifetime. Assuming that in Table 2 machinery accounts for 80 per cent of total investment and that this machinery is expected to be depreciated after 19 years of operation, the, for analytical purposes, the project's life span may be fixed at 19 years including the running-in period, but excluding the construction period. Assuming further that buildings account for another 15 per cent of total investment and their lifetime is estimated at roughly 30 years, then the difference between initial investment for buildings and the sum of annual depreciation for years 1 through 19 enters the calculation as residual value in year 20. This value is equal to the sum of annual depreciation of years 21 through 30. Assuming finally that another 5 per cent of initial investment consists of working capital and the value of land, then that entire sum without any depreciation is added to the residual value in year 20.

Residual values will consist of more than two values if, as is usually the case, the investment is broken down into more than three major elements. The same procedure may then be applied. But lumping together of investment elements with similar lifetimes is both justified and necessary, recognising the fact that after discounting

to the year zero, the present value of this particular income element will usually have only a marginal impact on a project's profitability.

For those assets which are fully depreciated by the end of the project's lifetime, salvage values are sometimes taken into consideration. For even a piece of machinery which is completely worn out may be sold to a scrap dealer and thus produce a modest cash income in the terminal year. Again, not too much time should be devoted to such items in project evaluation, because their value will usually be fairly insignificant relative to the entire cash flow and discounting will reduce their impact to truly minute proportions.

II. EVALUATION OF AN INVESTMENT PROJECT

A. COMMERCIAL PROFITABILITY

1. Introduction

Commercial profitability analysis is the first step in the economic appraisal of a project. It is concerned with assessing the feasibility of a new project from the point of view of its financial results. The project's direct benefits and costs are, therefore, calculated in pecuniary terms at the prevailing (expected) market prices. This analysis is applied to appraise the soundness and acceptability of a single project as well as to rank projects on the basis of their profitability. The commercial profitability analysis comprises:

- investment profitability analysis and
- financial analysis

The two types of analysis mentioned above are complementary and not substitutable. Both need to be carried out as they are concerned with different aspects of a new investment proposal. Investment profitability analysis is to measure the profitability of the resources put into a project, more directly the return on the capital no matter what are the sources of financing. Thus, investment profitability analysis assesses the potential earning power of the resources committed for a project neglecting the financial transactions occuring during the project's life. On the other hand, financial analysis has to take into consideration the financial features of a project to ensure that the disposable finances will permit smooth implementation and operation of the project.

Different methods may be used to assess the investment profitability of a project:

- simple rate of return
- pay-back period
- net present value
- internal rate of return.

The first two methods, simple rate of return and pay-back period, are usually referred to as the simple or static methods since they do not take into consideration the whole life span of the project but rely on one model period (most frequently one year) or at best on a few periods in assessing the investment profitability of a project. Furthermore, their application is based on the project's annual data, meaning that all the inflows and outflows enter the analysis at their nominal non-discounted values as they appear at a given point of time during the project's life.

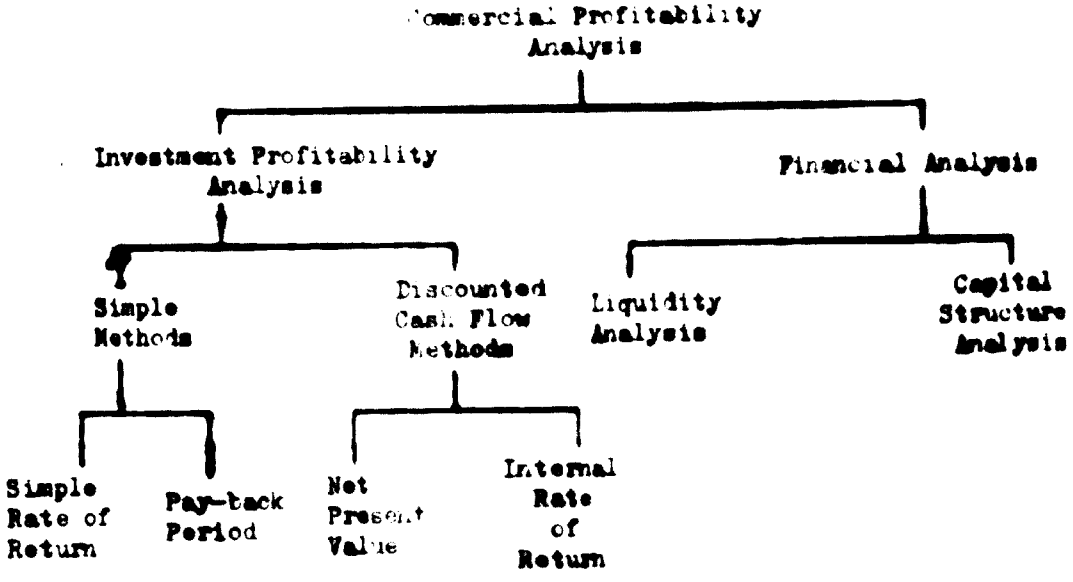
The net present value and internal rate of return are called discounted or dynamic methods as they do appraise the investment profitability of a project taking into consideration its entire life and time preferences by discounting the future inflows and outflows to their present values.

Hence, the simple methods are somewhat less precise and are expected to indicate broad parameters of the operation of a project. In some cases the simple analysis could be sufficient and/or the only possible alternative while in others it is preferable to carry out comprehensive analysis using the net present value and the internal rate of return methods. The choice of method depends on the objectives of the enterprise, the economic environment and availability of data. However, in case two or more projects are being evaluated and compared, the same method consistent with the objectives of the investor has to be used to secure a unified base for adequate comparison, final ranking and rational decision-making.

Financial analysis is carried out on a year-by-year basis. It includes liquidity and capital structure analysis. The first one aims to ensure the flow of cash through the implementation, running-in and operation periods of a project while the latter is related to the sources of investment financing and its repercussions for the flow of cash.

The above exposed framework of the commercial profitability analysis is presented in Chart I.

Chart 1. Framework of Commercial Profitability Analysis



Investment profitability analysis and financial analysis will be illustrated by the example of a hypothetical project whose data are quoted in Table 7 - Integrated Financial Analysis. This table is a major source of information for the project evaluator in carrying out commercial profitability analysis. The table also provides an opportunity to check the interdependence of various data used in commercial profitability analysis.

2. Investment Profitability Analysis

2.1 Simple Rate of Return Method

Simple rate of return is the ratio of the net profit in a normal year to the initial investment (fixed and working capital). This rate could be computed either on total investment or on equity, depending on whether one wants to know the profitability of the total investment (equity plus loans) or the profitability of only the equity capital. Therefore, the simple rate of return could be presented either as

$$R = \frac{P + I}{K} \qquad (A.1)$$

or

$$R_e = \frac{P}{Q} \qquad (A.2)$$

where R = simple rate of return on total investment

R_e = simple rate of return on equity capital

P = net profit in a normal year after making provisions for depreciation, interest charges and corporate taxes

I = annual interest charges on loans in a normal year

K = total capital invested comprising equity and loans

Q = equity capital invested.

It is necessary to point out the importance of the appropriate choice of a normal year in a project's life for assessing accurately the simple rate of return. Normal year is a representative year of the life of a project in which the project has reached its rated capacity and the loan repayment is still continuing. Of course, there can be more than one normal year and the evaluator has to choose the most representative one in terms of the net profit and interest charges commitments.

If the rate R or R_e is higher than the rate of interest prevailing in the capital market, the project can be considered as good from this point of view. In case of a choice between several alternative projects, the one with the highest rate of return can be selected for implementation, other things being equal.

Simple rate of return (whether R or R_e) can be computed as follows (for R):

Step 1: Find out the total investment of a project (K), including fixed and working capital.

Step 2: Work out the net profit before interest in the most representative normal year which is equal to net profit (P) plus interest charges (I) in this year.

Step 3: Divide the sum P + I by the total investment (K) to arrive at the rate R.

If the rate R_e is wanted, the calculation may be carried out as follows:

Step 1: Find out the equity capital invested in a project (Q).

Step 2: Work out the net profit in the most representative normal year after making provisions for depreciation, interest on loans and corporate taxes (F).

Step 3: Divide the net profit (F) by the amount of equity capital (Q) to arrive at the rate R_e.

The application of the simple rate of return in assessing the investment profitability is illustrated by an example of a hypothetical project whose data are derived from Table 7 and compiled in Table 1.1.

Table 1.1. Calculation of R and R_e

(000 dinars)

	Amount
1. Total investment (K) - Row 711 in Table 7	200
2. Equity capital (Q) - Row 761 in Table 7	120
3. Net profit after taxes (F) - Row 742 in Table 7	20
4. Net profit before interest (F+I) - Row 743 in Table 7	25

On the basis of data presented in Table 1.1 the rates of return on total capital and equity capital invested are respectively

$$R = \frac{F + I}{K} 100 = \frac{25}{200} 100 = 12.5\%$$

and

$$R_e = \frac{F}{Q} 100 = \frac{20}{120} 100 = 16.7\%.$$

The calculation of the simple rate of return is therefore straightforward and not complicated as it is calculated on the basis of the expected values of the net profits and costs in a normal year without any adjustments. The simplicity of the method may be regarded as its main merit.

However, the simple rate of return method has some limitations. Firstly, this is a method deriving an approximative criterion since it

is based on one year data, neglecting the rest of the project's life. Secondly, in real terms it may be rather difficult to find the normal year adequately representative for the whole life span of a project. Thirdly, this method ignores the profile and time preferences of the net profits and costs during the life of the project.

Nevertheless, the simple rate of return is a useful tool for the quick appraisal of the investment profitability of a project, particularly one with a relatively short life span. It can also be used in cases where sufficiently detailed information for more comprehensive analysis is not available in the country or for preliminary evaluation at early stages of project formulation..

2.2. Pay-back Period Method

This method measures the time needed for a project to recover its total investment through its net profits. Therefore, the pay-back period is the number of years during which a project will accumulate sufficient net profits to cover the amount of its total investment. It is given by the expression

$$K = \sum_{t=0}^{p} E_t \qquad (A.3)$$

where: K = total investment

p = pay-back period

E = annual net profits in the t^{th} year.

If a single project is being evaluated, it will be accepted for implementation in case

$$p \leqslant p_m,$$

where p_m is a cut-off pay-back period adopted by the decision-maker. If p is greater than p_m, the project in question will be rejected. The period p_m is usually determined on the basis of past experience and other investment opportunities of the investor and therefore varies largely from case to case. When selecting among several alternative projects, those with the shortest pay-back period are accepted.

The pay-back period of a project may be computed in several steps:

Step 1: Compute the total investment of the project (K).

Step 2: Find out the net profits for every year during the project's life (E).

Step 3: Deduct from the total investment the net profits of the first year of the project's life, which simply means the beginning year of the implementation period. Then, if the total investment is not entirely covered, proceed to the second, or further to the third or any of the subsequent years, as long as needed for matching the total investment by adding up the annual net cash earnings.

Step 4: Find out the number of the subtractions which in fact refers to the number of years during which one has to sum up the annual net profits in order to write off entirely the total investment. This number of years is the pay-back period expressed in years (p).

The calculation of the pay-back period on the basis of data from Table 7 is illustrated in Table 1.2.

Table 1.2. Calculation of the Pay-back Period

(000 dinars)

I t e m	Nominal Amount	Uncovered Capital at the end of a year
I. Total investment (K) - Row 711 in Table 7	200	-
II. Annual net cash earnings (E) Row 74 in Table 7		
- Year 0	0	200
- Year 1	0	200
- Year 2	30	170
- Year 3	35	135
- Year 4	35	100
- Year 5	35	65
- Year 6	35	30
- Year 7	35	0

Therefore, the total investment will be recovered just before the end of Year 7, or in approximately eight years. It can be seen that during the years of the implementation period, i.e. Year 0 and Year 1, the project does not yield any net cash earnings and consequently the investment is still entirely uncovered. Starting in Year 2 and in the

later years the project yields the net cash earnings and is able to recover the total investment by the end of the Year 7. It is shown above, when determining the pay-back period, that one has to start computations right from the beginning of the project's life, i.e. the construction period is included in the pay-back period.

The main merit of the pay-back period method is its simplicity and easy understanding. But it has some shortcomings which limit its use. Firstly, it ignores the project's net cash earnings after the pay-back period. Secondly, it may be misleading in case two or more projects are competing for the same resources, and not having a similar time phasing of the net cash earnings. Thirdly, this method pays much attention to the liquidity of a project, not measuring the profitability of investment and not assessing the time phasing of cash inflows and outflows within the pay-back period. In spite of these limitations the pay-back period may be a useful criterion in case of risky projects, relative capital scarcity or where much emphasis is put on the long-term liquidity of the enterprise.

2.3. Net Present Value Method

The net present value of a project is defined as the difference between the present values of its future cash inflows and outflows. This means that all cash flows should be discounted to the zero point of time (the start of the implementation) at a predetermined discount rate. This is given by the expression

$$NPV = \sum_{t=0}^{n} \frac{CI_t - CO_t}{(1+i)^t} \qquad (A.4)$$

where: NPV = net present value of a project
CI_t = cash inflow in the t^{th} period (year)
CO_t = cash outflow in the t^{th} period (year)
i = rate of discount
n = number of periods (years) of the project's life.

The project's net present value, other things being equal, increases with the larger CI and n, but decreases with higher i and CO.

The rate of discount should as far as possible be based on the actual rate of interest in the capital market to reflect the time preference and opportunity cost of the possible alternative use of the capital invested. In case the investment is financed by long-term loans, the actual rate of interest paid should be taken as the discount rate. If for some reason this rate is not available, the rate of interest charged by the Central Bank on long-term loans should be adopted as the rate of discount.

A project is commercially acceptable if its present value is greater than or at least equal to zero. When selecting among alternative projects, the one with the largest net present value is chosen for implementation.

Therefore, the net present value method measures the magnitude of the net cash flows, or more generally of the net benefits, of a specific project, but does not relate this magnitude to the total investment needed to produce these positive effects. The latter is especially important in cases where alternative projects of different magnitudes of investment are compared and it becomes important to relate the absolute amount of the project's net benefits to its total investment. In such instances instead of computing only the net present value of a project, the evaluator may go on dividing it by the discounted value of the total investment, i.e. to use a sort of discounted rate of return. This ratio is given as

$$NPVR = \frac{NPV}{PVI} \qquad (A.5)$$

where: NPVR = ratio of the project's net present value to the present value of its total investment (net present value ratio)

NPV = net present value of a project

PVI = present value of total investment.

This ratio shows how much of the project's net present value is generated by a unit of total investment, which is discounted to its present value in order to account for the time preferences. Needless to say that whenever the implementation period is not more than a year, there will be no need for discounting the annual amount of investment and it will be included into the analysis at its nominal value.

If the NPVR is used as a criterion, a single project will be selected if the ratio is greater than or at least equal to zero. Of course, among alternative projects the one with the highest ratio can be selected for implementation. In cases when all projects show negative NPVR ratios, but one has to be selected, it should be the one having the smallest ratio (closest to zero).

The net present value of a project and NPVR ratio may be calculated as follows:

Step 1: Compute the cash inflows over the entire life of a project (CI_t).

Step 2: Compute the cash outflows over the entire life of a project (CO_t).

Step 3: Work out the net cash flows for every period (year) over the entire life of a project (NCF_t) by subtracting CO_t from CI_t.

Step 4: Find out the appripriate discount rate to discount the future net cash flows to their present value at Year 0.

Step 5: Find out from the present value tables the respective discount factor for each period (year).

Step 6: Multiply the net cash flows in each period (year) by their corresponding discount factors to arrive at their present values.

Step 7: Sum up the present values of the net cash flows of all the periods (years) to get the net present value of the project.

Step 8: In case the NPVR is desired, work out the present value of the total investment using the same discount rate as previously and divide the net present value of a project by the amount of total investment discounted to Year 0.

In Table 1.3. and Table 1.4. the calculation of the net present value of a project is demonstrated again using the initial data stated in Table 7.

Table 1.3. Net Cash Flows of a Project

(000 dinars)

Item				Years			
	[illegible]	[illegible]	[illegible]	[illegible]-10*	11	12-19*	20
I. Cash Inflows (CI) (1+2)	–	–	[illegible]	[illegible]	100	100	120
1. Sales revenue (Row [illegible] in Table [illegible])	–	–	[illegible]	[illegible]	100	100	100
2. Salvage value (Row [illegible] in Table [illegible])	–	–	–	–	–	–	20
II. Cash Outflows (CO) (3+4+5)	[illegible]	[illegible]	[illegible]	[illegible]	66	66	70
3. Investment (Row [illegible] in Table [illegible])	100	100	–	–	–	–	–
4. Operating costs (Row [illegible] in Table [illegible])	–	–	[illegible]	[illegible]	60	60	60
5. Taxes	–	–	–	[illegible]	6	6	10
III. Net Cash Flows (NCF) (I-II)	-100	-100	[illegible]	35	34	34	50

* annually

To clarify Table 1.3, some additional explanation may be necessary. Since at the present stage of the project evaluation one is concerned with assessing the investment profitability of a project, only the real resource flows are taken into account. This means that any flows connected with the financial transactions, such as the loans at the cash inflow side and the financial obligations at the cash outflow side, are omitted from the analysis. In addition to this, the cash outflows do not comprise depreciation in order not to account twice for the investment outlays. Not including depreciation in the cash outflows means that depreciation is transferred to the net cash flows.

Having found the net cash flows in each year, one proceeds with further steps in the calculation. Suppose the discount rate is 10 per cent, the discount factors will be as stated in Table 1.4.

Table ..4. Calculation of NPV and NPVR

Item	Years						
	0	1	2	3–10*	11	12–19*	20
III. Net Cash Flows (NCF)**	– 100	– 100	50	35	34	34	5
IV. Discount Factors at 10% Discount Rate	1.000	0.909	0.826	4.439	0.350	1.870	0.149
V. Present Values of the Net Cash Flows at 10% Discount Rate**	– 100.00	– 90.90	41.30	155.36	11.90	63.58	0.74

* Annually

** in 000 dinars

The sum of Row V in Table 1.4 gives the net present value of the project at 10 per cent discount rate, which amounts to 68,025 thousand dinars. Since the net cash flows in the year 0 and the year 1 encounter only the investment outlays, and therefore are negative, it is easy to find the present value of the total investment by summing up the present values of the net cash flows in those years, which is 190,900 thousand dinars. Therefore, a unit of discounted total investment generates 0.35 units of net present value:

$$NPVR = \frac{68,025}{190,900} = 0.35.$$

Finally, it might be mentioned that the main advantage of the net present value method in assessing the investment profitability is the fact that it takes into account the whole life of the project. Also, it accounts for the time preferences by discounting the future cash flows to their present values. Further, by using a given discount rate it encounters the opportunity costs of the possible alternative uses of capital. Thus, no matter what the time phasing of the future net cash flows is, this method is suitable for making a rational investment decision, particularly by using the NPVR as a reliable yardstick for comparing alternative projects.

2.4. Internal Rate of Return Method

In the internal rate of return method the discount rate is unknown, unlike the net present value method where the discount rate was given outside the project. By definition, the internal rate of return is the rate of discount which reduces the net present value of a project to zero, i.e.

$$0 = \sum_{t=0}^{n} \frac{CI_t - CO_t}{(1+i)^t} \qquad (A.6)$$

where all the symbols have the same meaning as in the case of the net present value.

When applying the internal rate of return, one starts with an assumption that NPV = 0 and tries to find out the discount rate which will make the present value of the receipts from the project equal to the present value of the investment. In other words, the internal rate of return is the rate at which the capital invested will be compounded over the lifetime of a project.

Investment decision is taken comparing the internal rate of return of a specific project (i_r) with a cut-off rate (i_{min}), which states the minimum acceptable rate at which the capital invested should be compounded. Thus, the project being evaluated will be accepted if

$$i_r > i_{min}$$

and vice versa.

The cut-off rate is equal to the actual rate of interest on long-term loans in the capital market or to the interest rate paid by the borrower.

If one has to choose among alternative projects, the one with the highest internal rate of return will be selected, provided this internal rate of return is higher than the cut-off rate.

The internal rate of return of a project has to be determined through trial and error procedure and the steps of its calculation may be as follows:

Step 1: Go back to the net present value calculations and identify the present value of the project and the rate of discount used in these calculations. Of course, the net present value of the project has to be positive, since otherwise the project should have been rejected.

Step 2: Use higher discount rate than that in the net present value calculations to compute the present value of the future net cash flows at this new rate of discount.

Step 3: If the present value of the net cash flows is still positive, keep increasing the rate of discount and computing the corresponding present value of the net cash flows until the latter is reduced to close to zero.

Step 4: Keep increasing the discount rate and compute one or two corresponding present values with a negative sign, one of them being close to zero.

Step 5: Identify the rate of discount at which the present value of the net cash flows is zero, this being the internal rate of return of a project, and compare it with the cut-off rate appropriately set up and if needed with the internal rates of return of other projects.

If such a trial and error calculation may be sometimes too demanding and time consuming, it might be useful to point out a short-cut method (in steps 3 and 4). The two net present values of a project are worked out, one positive close to zero and the other negative close to zero. Then to avoid further rounds of calculations, the following formula may be used to arrive at the internal rate of reuurn:

$$i_r = i_1 + \frac{PV\ (i_2 - i_1)}{PV + NV}, \qquad (A.7)$$

where: i_r = internal rate of return of a project

PV = positive value of NPV at the lower discount rate

NV = negative value of NPV at the higher discount rate in absolute terms, i.e. the minus sign neglected

i_1 = lower discount rate at which NPV is still positive but close to zero

i_2 = higher rate of discount at which NPV is already negative but close to zero.

It is important that PV and NV are very close to zero, meaning that i_1 and i_2 are very close to each other, say not more than one or two per cent. If this is not respected, the internal rate of return worked out on the basis of the mentioned formula may be misleading.

The calculation of the internal rate of return is shown in Table 1.5. Since the internal rate of return is to measure the investment profitability, the financial transactions are omitted from the analysis and depreciation is again not included in cash outflows. Thus, in computing the internal rate of return, one does not need to go back to Table 1.3, but to work further with the net flows stated in Row III of Table 1.4. Then these net cash flows are discounted at different rates in order to find out the one which will make the net present value of a project equal to zero. The first round of calculations has already been worked out when computing the net present value of the project shown in Table 1.4. The only exercise one has to do is to apply higher and higher discount rates until the net present value of a project becomes negative. Table 1.5 states the magnitudes of the net present values of a project at different discount rates.

Table 1.5. Calculation of the Internal Rate of Return

Discount Rate	Net Present Value of a Project in 000 Dinars
10%	68,025
11%	52,951
14.5%	3,319
14.7%	1,014
14.8%	121
15.0%	-2,357

Table 1.5 shows that the increase in the discount rate from 10 per cent to 11 per cent brings the net present value of a project from 68,025 thousand dinars down to 52,951 thousand dinars. Considerably higher rate of 14.5 per cent reduces the net present value to 3,319 thousand dinars, which is still well above zero. This is why one may proceed to discounting at 15 per cent, but then the net

present value of a project becomes negative and amounts to -2,457 thousand dinars. Therefore, lower rates have to be applied. It can be seen that the project's internal rate of return is somewhere between 14.7 per cent and 14.8 per cent. For practical purposes, this approximation would be quite sufficient, but one may go on calculating the exact rate. Since the difference between these two rates is rather small and the first value is positive while the second gives a negative net present value, the formula for interpolation may be used to determine the internal rate of return. Thus:

$$i_r = i_1 + \frac{PV\ (i_2 - i_1)}{PV + |NV|} = 14.7 + \frac{1.214\ (14.8 - 14.7)}{1.214 + 2,121} = 14.79\%$$

Therefore, the internal rate of return of the project is 14.79 per cent. This rate has to be compared with the cut-off rate (the interest rate paid or payable for long-term loans on the capital market) and/or with the internal rates of the other projects in competition.

As shown, the internal rate of return determines the return on the capital invested and therefore signals the maximum rate of interest on loans this project can pay without getting into difficulties. No other method will supply such information, and this is a very important merit of the internal rate of return method.

Also, it may be very convenient to use this method, if for some reason the evaluator wants to escape determining the discount rate explicitly which has to be done in computing the net present value of a project.

But the method has some features limiting its use. Firstly, the internal rate of return method cannot be applied safely whenever there are considerable negative net cash flows during the operating period of the project's life. In this case, it might happen that the net present value of a project changes sign more than once when discounting at different discount rates. In such a case more than one internal rate of return exists and it is not possible to decide which is the appropriate one to be used for evaluating purposes. This seldom happens in practice, but the project evaluator should be aware of it. Secondly, this method may be misleading when two or more mutually

exclusive projects are compared, and reference to the net present value method is necessary. Thirdly, it does not reflect directly the time preferences of a decision-maker, as the discount rate is not given outside of the project but is computed on the basis of the project's data. However, since the project's internal rate of return is compared with the cut-off rate, this problem is somewhat solved. Fourthly, the calculation of the internal rate of return is to a certain extent somewhat cumbersome work.

Taking into consideration what was mentioned above, the internal rate of return may be considered as a useful method to be applied when it is not easy to find out the appropriate discount rate in computing the net present value of a project and/or one wants to know at what rate the capital invested is compounded over the project's life. But due attention has to be paid to the circumstances limiting its use.

3. Financial Analysis

3.1. Liquidity Analysis

As was shown, the investment profitability analysis, being the first phase of the commercial profitability analysis, is carried out on the basis of the project's life taken as a whole. But favourable results of such an analysis may very well coincide with substantial cash deficits in some years of the project's life, especially those in which the loans have to be repaid. Also, cash flow data as used in investment profitability analysis do not include all outlays and receipts which affect a project's cash balance, but only those related to the flows of real resources used in a project.

All this suggests that the additional cash positions, concerned with the financial transactions, have to be taken into consideration in the liquidity analysis, such as:

- debt service charges, both interest and principal;
- payments of dividends;
- other cash outlays and receipts not typically associated with the investment under consideration (sale of excess land, contributions to national fund raising campaigns, etc.).

Having included all the items of the financial transactions in the project appraisal and having estimated the profitability of investment, the evaluator is able to judge whether:

- equity and long-term financing are adequate;
- cash deficits are limited to magnitudes which can be covered by recourse to short-term bank credit or eliminated by reshaping some of the cash inflows or outflows;
- terms of long-term financing are adequate;
- dividends as envisaged by investors will materialize.

Liquidity analysis is done on a year-by-year basis and therefore the annual cash positions are taken into consideration in their nominal values. The data from Table 7 are presented in Table 1.6 as an illustrative example of the liquidity analysis.

It can be seen that equity capital will be sufficient to cover the investment outlays in the first year of the construction period, but in the second one in addition to the equity capital of 20,000 dinars, a long-term loan of 30,000 dinars is needed to finance the project's investment. In years 3 and later on the project's annual cash balance is positive in all years, meaning that the project is able not only to meet all the cash outflows, but to produce a surplus in all years of its operating period. Therefore, the project being evaluated is considered to have good liquidity of resources.

Table 1. . Liquidity Analysis of a Project

(000 dinars)

	Years						
	0	1	2	3-10*	11	12-19*	20
I. Cash Inflows (CI) (1+2+3)	100	100	70	100	100	100	120
1. Sales revenue (Row 731 in Table 7)	-	-	70	100	100	100	100
2. Salvage value (Row 733 in Table 7)	-	-	-	-	-	-	20
3. Financing of Investment (Row 76 in Table 7)	100	100	-	-	-	-	-
3.1. Equity (Row 761 in Table 7)	100	20	-	-	-	-	-
3.2. Loans (Row 762 in Table 7)	-	80	-	-	-	-	-
II. Cash Outflows (CO) (4+5+6+7)	100	100	40	92	78	78	82
4. Investment (Row 71 in Table 7)	100	100	-	-	-	-	-
5. Operating costs (Row 72 in Table 7)	-	-	40	60	60	60	60
6. Taxes (Row 741-a in Table 7)	-	-	-	5	6	6	10
7. Financial obligations (Row 77 in Table 7)	-	-	-	27	12	12	12
7.1. Interest charges (Row 771 in Table 7)	-	-	-	5	-	-	-
7.2. Repayment instalment (Row 772 in Table 7)	-	-	-	10	-	-	-
7.3. Dividends (Row 773 in Table 7)	-	-	-	12	12	12	12
III. Net Cash Balance (NCB) (I-II) (Row 78 in Table 7)	0	0	30	8	22	22	38
IV. Cumulative Net Cash Balance (Row 79 in Table 7)	0	0	30	94	116	292	330

* Annually

3.2. Capital Structure Analysis

Long-term finances must cover a project's cost of fixed investment and at least that part of the working capital requirements which will be needed for normal operation. These finances should be procured in the form of equity and long-term credit. Short-term loans for financing the fixed assets and working capital will burden a project's cash balance with early and heavy principal repayments. The cash inflows generated by these assets during the short period may not be sufficient to meet these commitments since they are spread over the entire life span of the project. Much will, however, depend on the profitability of the project and capital structure should be related to the earning capacity of the project.

Financing of a project's capital requirements should not only determine its future liquidity but also its future balance sheets. Therefore, in the course of project evaluation the capital structure envisaged by the investor should be looked at closely with a view to judging the enterprise's future financial viability. Various aspects have to be considered in this context. In general, the combination of equity capital and loans will determine a project's debt equity ratio. Relatively heavy reliance on credit offers certain advantages:

- The rates of interest on loans may be lower than the expected rate of return of the project. In such circumstances it may be attractive for the investor - taking into account the risk involved - to keep equity low, thus increasing the actual rate of return on equity.
- By seeking finance through loans, there may be fiscal advantages since interest charges may be deductable from taxable profits.

On the other hand, relatively heavy dependence on external sources of finance has also disadvantages:

- Interest charges are fixed obligations which have to be paid regardless of whether a project earns profit or not;
- If annual repayments of principal approach the cost of depreciation per year, financial management will become increasingly tight and difficult;
- A low debt equity ratio is desirable so far as circumstances permit in order to avoid undue interference by lenders.

The most commonly applied indicator of an enterprise's capital structure is the so-called debt-equity ratio, i.e. the ratio of long-term loans to equity capital. In the preceding example (row 762 divided by row 761 in Table 7), this ratio works out to 0.67 (80 : 120) which may be judged satisfactory. Also, in terms of the project's liquidity analysis this capital structure is adequate since neither interest charges nor repayment installments give cause for short-term borrowing in any period.

V. NATIONAL PROFITABILITY

1. Introduction

Commercial profitability as assessed earlier may not give a good idea of the contribution of a project to the economy of the nation since emphasis at that stage was only on finding the profits of a project in monetary terms and not on its real contribution to the welfare of the society. For measuring a project's contribution to the welfare of the society, National Profitability Analysis should be applied.

National profitability analysis is similar in form to commercial profitability analysis in that they both try to identify the costs and benefits and by commeasuring them to assess the 'profitability' of an investment proposal.

Commercial profitability and national profitability, however, differ in many ways. The objective of commercial profitability analysis is assessing the net financial result of a project while the national profitability traces the project's contributions to all fundamental development objectives (economic and non-economic). The former takes into account only the direct effects of a project, but the latter, in addition to this, takes also into consideration the indirect (linkage) effects, both measurable and non-measurable. Commercial profitability analysis is based on market prices, but national profitability is determined with the help of adjusted prices which are deemed to be the social prices. For commercial profitability the time preference problem is tackled by application of the prevailing interest rates on the capital market, while in the case of national profitability, it is solved by using social rate of discount.

These different concepts of profitability are reflected in the different items considered to be costs and benefits and in their valuation. The two types of benefits and costs do not coincide. Some payments which appear, say, in the cost streams of the financial analysis do not represent direct claims on the country's resources but merely reflect a transfer of the control over resource allocation from one member or section of society to another. Social benefits or costs may be larger or smaller than financial ones.

Thus the contrast between commercial profitability analysis and national profitability analysis is simple but important The latter is a much more complex exercise than the former, and the techniques used in the former exercise may not be helpful in the latter. Commercial profitability is commonly rejected nowadays as a basis of planned choice, but this causes a gap that national profitability analysis has to fill.

Besides overall economic development, planning and development strategy of a country usually requires that several other objectives be fulfilled. It is, therefore, necessary to appraise the social soundness of a project - both from the points of view of its effects on the economy as a whole and on the particular aspects of national life in the context of which a project is being considered.

Based on this the Manual recommends along with the basic criterion - value added as the device for appraising the main impact of a project on the economy - a set of additional indices for measuring certain implications of an investment project, i.e. employment effects, distribution effect, foreign exchange effect, idle capacity effect, international competitiveness. For other implications, which cannot be measured in quantitative terms, qualitative analysis is recommended under supplementary considerations - infrastructure implications, technical know-how implications, environmental implications.

An attempt has been made to include in the Manual all important economic and social considerations which generally form the basis for investment proposals, yet the list may not be complete. In the event there are any other considerations which have not been covered, they can be analysed on the same lines as suggested for additional indices and supplementary considerations.

Acknowledging the existence of certain distortions in the domestic market prices, the Manual recommends a procedure for price adjustments. Three important points are to be noted in this respect. First, the existing or expected market prices relevant to the project in question are to be analysed and obvious distortions identified. If there are no such distortions, further analysis should be carried out on the basis of the actual market prices. Second, the price adjustments should be made before embarking on national profitability analysis. Third,

relatively simple practical procedures are recommended for carrying out the adjustments of the actual market prices (adjusting subsidy, relying on actual FOB or CIF prices, etc.), instead of constructing sophisticated theoretical models and relying on doubtful assumptions.

The Manual recommends the utilization of the national value added and not the total value added for measuring the project's contribution to national income. It also advocates the use of net value added, and not gross value added.

This Manual recommends economic evaluation of an investment project to be carried out at each stage of its formulation starting from the early stages. This underscores the importance of focusing economic analysis on the project at the time when its design is taking shape and choices are still open rather than when the project has been formulated and rejection may be difficult. It is expected that the results of each consecutive evaluation might suggest some improvements in the project. In view of the scanty and uncertain information available at these early stages, the so-called "simple formula" is recommended, based on an expected representative normal year of the project's operation.

The Manual also suggests two steps in the application of the value added criterion - absolute and relative efficiency tests - in carrying out overall comprehensive evaluation of investment projects.

The Manual recommends operational techniques for application of the value added criterion not only for new investment projects but also for evaluation of modernization and expansion projects and for a group of technologically and economically interrelated projects forming an industrial complex.

Taking a step further as compared to commercial profitability, this part of the Manual suggests operational techniques for measuring the indirect effects of an investment project occuring in other closely related projects. Unfortunately, indirect effects are sometimes difficult to identify and nearly always difficult to measure. In cases where these effects are measurable, the "industrial complex" technique is suggested. If they are not measurable, the analysis recommended under "supplementary considerations" may be used.

An important feature of national profitability analysis is the application of a set of national parameters measuring in quantitative terms certain preferences from the national point of view, setting up certain cut-off levels of efficiency, etc. For the sake of simplicity and practicality only the three most essential national parameters are suggested - social rate of discount and shadow rate of foreign exchange and international competitiveness. These national parameters should in principle be computed by a competent national agency - national planning agency, Ministry of economy, central bank, central statistical office, etc.

As in the case of commercial profitability, for national profitability analysis too, several methods with varying degrees of sophistication are suggested. It is up to the users of this Manual to select the appropriate method, subject to the prevailing conditions in the country and availability of data.

Application of a set of criteria to the same project may yield varying, sometimes conflicting, results. The project evaluator should, therefore, provide a comprehensive table to the decision-maker, drawing his particular attention to the main economic selective results and at the same time to the other expected results of the project. This will afford material to the decision-maker about the overall impact of the project on the economy as well as on the branch of the economy in which he is particularly interested, or about which he likes to be cautious in undertaking any commitments.

In view of the above, the methods suggested for analyzing national profitability of investment proposals are described in the following pages.

Price Adjustments

In principle the output and inputs of an investment project should be valued at actual market prices. By actual prices are meant current or expected future prices on the domestic and world markets at which the outputs can actually be marketed and the inputs can actually be procured. Those traded at the domestic market are valued at actual market prices. Those traded on the international market at actual "f.o.b." prices are transformed into domestic prices by the shadow rate of foreign exchange.

However, market prices prevailing in a country at any particular point of time may not represent their real social costs since they are vitally affected by the financial, economic, social and administrative policies of the government.

Therefore, the first step should be a review of the existing actual prices and identification of obvious distortions, substantially affecting the project analysis. This is to say that price adjusting should be done selectively in terms of two criteria. First, which items figure most prominently in the inputs and outputs of a project at market prices? Second, for all inputs and outputs, which market prices are farthest out of line with their respective social costs? This means that adjustments are recommended only for the most important items and the most apparent price distortions

The second step would be to segregate these influences and bring domestic market prices to levels which may represent their real social costs. The real social costs and benefits should be assessed under actual conditions in which the project is to operate and not under any presumed or idealistic conditions.

The above-mentioned adjustments have to be made before appraising the national profitability. The following simple techniques may help to achieve the desired social values.

Each project has its outputs which represent the benefits and its inputs which entail costs. The output can broadly be divided into three parts, namely, (i) exported, (ii) domestically marketed, and (iii) infrastructural services. Similarly, the inputs can be divided broadly into (i) imported, (ii) domestically produced, (iii) infrastructural services, (iv) land and (v) labour The following table suggests the pricing rules which can be conveniently adopted

Project appraisal is carried out in constant prices. The prices of inputs and outputs so adjusted should be used throughout the economic life of an investment project. Current prices are used only to establish the project's yearly financial position. Any foreseeable future variations in the selected constant prices will be taken care of by sensitivity and probability analysis.

PRICING RULE

Item	Formula	Remarks
I. Outputs		
1. Exported	AFOB	Since this is real social price being realised by the country. A judgement has to be exercised whether there is no hidden dumping element in this price.
2. Domestically marketed		
a. basic goods	ADMP + subsidy (if any)	Since subsidy represents additional social costs which are borne by the government.
b. non-basic goods	ADMP (including taxes)	
3. Infrastructural services - electricity, gas, water, transport, etc.	ADMP or cost - whichever is higher	Since ADMP are sometimes established below production costs and the producer is subsidised.
II. Inputs		
1. Imported	ACIF + internal incidental charges of transport, insurance, etc.	Since this is real social price being paid by the country. However, one should be careful with regard to possible hidden dumping component in this price.
2. Domestically produced		
a. exportable (have been exported before or could be exported now)	ADMP AFOB (whichever is higher)	However judgement has to be exercised sometimes: in case the internal prices are much lower than FOB, it might be argued that either they are subsidised or the items can be exported and in such a situation an objective adjustment in internal prices may be necessary.
b. importable (have been imported before or could be imported now)	ADMP ACIF (whicher is lower)	Here, too, a judgement might be necessary to adjust ADMP at some suitable level when it is substantially higher than the CIF price.
c. others	ADMP + subsidy	Since subsidy represents additional social cost which is borne by the government.
3. Infrastructural services - electricity, gas, water, transport, etc.	ADMP or cost (whichever is higher)	Since ADMP of these services sometimes may be established below production costs, which is a hidden subsidy.
4. Land	ADMP	
5. Labour	Actual salaries and wages plus fringe benefits	

ADMP = Actual Domestic Market Price
AFOB = Actual Free on Board Price
ACIF = Actual Cost Insurance and Freight Price
For converting the FOB and CIF prices into local currency, shadow rate of foreign exchange should be utilised.

3. Value Added - Basic Criterion of National Profitability

Value added, as stated earlier, is the basic criterion for the overall effects of a project on the economy. It represents in a most general way the difference between the output value and value of inputs purchased from other units.

The evaluation of an investment project is based on net value added. Net value added generated by a project equals value of output, minus value of current material inputs and services purchased from outside the project, minus total investment outlays:

$$NVA = O - (MI + I) \qquad (B.1)$$

Where: NVA = expected net value added generated by a project;

O = expected value of the output of the project which is usually the sales revenue;

MI = expected value of current material inputs and services purchased from outside the project required to obtain the above output;

I = total investment for fixed and working capital.

It say be noted that the material inputs of a project include all current materials and services (raw materials, energy, transport, maintenance, etc.) purchased from outside. Thus, the net value added comprises two major components: wages and salaries (W) and social profit (SP):

$$NVA = W + SP \qquad (B.2)$$

Wages and salaries express the level of employment and the average income of the people employed. The social profit expresses the earning capacity of a project. It is distributed to indirect taxes, interest, net profits, rent, royalties.

Net value added can be measured for any single year or for the whole life of the project.

Net value added for a single year:

$$NVA = O - (MI + D) \text{ (for that year)} \qquad (B.3)$$

where: D = annual depreciation.

Net value added for a project's whole life:

$$\sum_{t=0}^{n} NVA = \sum_{t=0}^{n} O - \sum_{t=0}^{n} (MI + I) \qquad (B.4)$$

or (which is the same):

$$\sum_{t=0}^{n} NVA = NVA_0 + NVA_1 + \ldots\ldots + NVA_n \qquad (B.5)$$

where: $\sum_{t=0}^{n} NVA$ = net value added generated by a project throughout its economic life from year 0 to year n;

$\sum_{t=0}^{n} O$ = expected value of output throughout the project's life from year 0 to year n;

$\sum_{t=0}^{n} (MI + I)$ = expected current material inputs (MI) and investments (I) throughout the project's life from year 0 to year n;

$NVA_0, NVA_1 \ldots NVA_n$ = expected annual net values added throughout the project's life from year 0 to year n.

The total net value added produced by a project consists of two parts:

- national value added -- that part which is produced and distributed in the country;
- repatriated value added -- produced by the project but repatriated abroad (wages, interest, net profits, royalties, or any other foreign payments not included in material inputs).

Investment projects are evaluated in terms of national net value added (NNVA). This value added is the most important index of the social contribution of a project to the national economy. All repatriation payments are to be excluded. The formula for finding the national net value added would therefore be as follows:

$$\sum_{t=o}^{n} \text{NNVA} = \sum_{t=o}^{n} O - \sum_{t=o}^{n} (MI + I + R) \qquad (B.6)$$

where R is equal to all repatriated payments in respect of this project such as royalties, rents, interest and net profits of foreign capital as well as wages of expatriate labour.

Any further mention of value added in this Manual refers to national net value added unless stated otherwise. For the sake of brevity only value added will be used.

The value added generated by an investment project comprises:

- direct value added - produced within the project itself;
- indirect value added - additional value added, generated by other projects technologically and economically related to the project under consideration. This induced value added would not have been produced if the project in question had not been established.

The evaluation of an investment project should in principle be based on the total value added, both direct and indirect. The procedure for measuring the indirect value added is provided in the section on measuring the indirect effects. If it is too difficult to measure the indirect value added or its magnitude is negligible and therefore not worth the effort, all calculations of efficiency may be based on the direct value added only.

At this stage the evaluator is confronted with taking into account the social time preferences to find the total value added in present terms. This problem is solved by applying the discounting technique. But in place of applying the usual interest rate, it is necessary to apply the social rate of discount (SRD). The detailed description and method of calculation of SRD is contained in the section "National Parameters".

3.1 Application of the Value Added Criterion for Evaluation of New Investment Projects

Two stages are suggested for the application of the value added criterion: absolute efficiency test for screening purposes and relative efficiency test for ranking purposes.

3.1.1 Absolute Efficiency Test

a) Simple formula: At the initial stage of project formulation it is advisable to compile the value added for a single typical year which manifests the normal operational conditions of the project. This estimate will provide only a preliminary idea of the benefits of the project to the nation. If the result shows positive value added, it is a good sign for proceeding further with the project. On the other hand, if the result is negative, it sounds an early warning and very careful thought has to be given before proceeding further with the project, with particular emphasis on those aspects of the economy in the context of which the project is being initiated.

At the same time it might be useful to discern whether the value added estimated for a single year also yields some surplus over the wages for that year. This can be assessed by the following formula:

$$E_s = O - (MI + D) - W \qquad (B.7)$$

where: E_s = absolute efficiency test of the project in terms of value added surplus over the wages on the basis of data for a single normal year;

O = expected value of normal annual output (annual sales revenue)

MI = expected value of normal annual current material inputs and services purchased from outside the project;

D = expected depreciation of fixed capital in a normal year;

W = expected wages in a normal year (domestic and those of foreigners which are not repatriated). Repatriated wages are excluded.

If the project being formulated shows such a surplus (social profit), it passes the absolute efficiency test at the early stages of formulation. This indicates that the project will yield a surplus after meeting its wages obligations. One can now undertake with some confidence a more detailed analysis of the project. Even if there is no such surplus, it may not be necessary to abandon the project at this stage but one may consider now it can be improved.

b) **Discounting formula:** The evaluation of the total effects of the project on the nation during its lifetime is done with the help of the social rate of discount (SRD). The output, material inputs, investments and wages are all reduced to on figure by application of SRD, taking into account the different years of their occurance. This is done in the following manner:

Step 1: Model table No. 6, Integrated Value added Analysis, contains data on outputs, current material inputs, investments, repatriated payments and wages of the project. The analysis should begin with the completion of this table.

Step 2: The market prices for all these items as assessed for commercial profitability analysis are already available. These may now be carefully reviewed and if obvious distortions are detected, adjusted to their real social prices as per price adjustment rules

Step 3: An attempt should then be made, if possible, to measure the indirect effects of the project - benefits and costs occurring in other linked up projects (existing production units) as indicated in the section on measuring the indirect effects. This will enable computing the total value added (direct and indirect).

Step 4: The figures so computed for each year of the project's life are grouped as follows:

- nominal values of output (sales revenue) (O_t);
- nominal values of current material inputs (MI_t);
- nominal values of investment (I_t);
- nominal value of payments going abroad (repatriated wages of expatirates, interest paid on foreign loans, net profits on expatriate shareholders, royalties and other foreign payments which are not included in material inputs;
- nominal values of wages (W_t).

Step 5: The above five items for each year of the life of the project should be discounted to the base year by applying the Social rate of discount. For this purpose the discount factors should be identified from the present value tables for each year corresponding to the adopted SRD. The nominal annual figures for each item are multiplied by the corresponding discount factor (a_t) to obtain its present value. The sum total of the individual annual present values gives the present value for each of the above items

- present value of outputs (sales revenue) =

$$\sum_{t=0}^{n} O_t \quad a_t$$

- present value of current material inputs =

$$\sum_{t=0}^{n} MI_t \quad a_t$$

- present value of investment = $\sum_{t=0}^{n} I_t \quad a_t$

- present value of repatriated payments = $\sum_{t=0}^{n} R_t \; a_t$

- present value of wages = $\sum_{t=0}^{n} W_t \quad a_t$

Step 6: It should now be possible to compute the present worth of the value added by deducting from the discounted value of outputs the discounted values of current material inputs of investments and of repatriated payments:

$$\sum_{t=0}^{n} (VA)_t a_t = \sum_{t=0}^{n} O_t a_t - \sum_{t=0}^{n} (MI + I + R)_t a_t \quad (B.8)$$

The present worth of the value added so computed must be positive:

$$\sum_{t=0}^{n} (VA)_t a_t > 0 \qquad (B.9)$$

This is an indication of the positive contribution of a project to the national income. Therefore, the project passes the first part of the absolute efficiency test. If this condition is not met, the project should be carefully re-examined and modified.

However, merely passing this test - though very important - is still not a sufficient condition for acceptance of a project. For this purpose, the project should go through the second stage of the absolute efficiency test, which is examined under the following step:

Step 7: The present value added so computed should comprise salaries and wages (W) and a surplus over it which is social profit (SP). This value added could now be further utilized for applying the absolute efficiency test to the project as follows:

$$E \quad \sum_{t=0}^{n} (VA)_t a_t \quad \sum_{t=0}^{n} W_t a_t \qquad (B.10)$$

Actually this formula makes sense only if value added is positive. Any further utilization of this formula implies that the value added is positive.

E = absolute efficiency test of a project on the basis of the discounted values of net national value added and of wages;

$\sum_{t=0}^{n} (VA)_t a_t$ = present value of the expected net national value added for the whole life of the project from year 0 to year n;

$\sum_{t=0}^{n} W_t a_t$ = present value of the expected wages for the whole lifetime of the project from year 0 to year n excluding expatriated wages;

n = economic life of a project starting from the year 0;

a_t = discounting factor in year t.

If the sum total of discounted value added for the whole life of the project is larger than the sum total of discounted wages, the project is efficient from the national point of view. The value added produced by this project not only recovers the wages needed for its operation but also generates a surplus (social profit), which is a source for increasing present consumption and for further expansion of the economy - payment of taxes to the treasury, interest on loans, net profits, etc.

If the value added produced by a project equals wages, the project is marginally acceptable. It only recovers the wages paid to the labourers and generates no surplus over and above that.

If the value added is less than wages, there is an indication that the project will not make a net contribution. It is not even able to recover the wages paid to the labourers. Therefore, from the point of view of contribution to the national income in terms of value added, the project is not acceptable. However, there may be other aspects measured by the additional indices or other considerations such as infant industry, strategic industry or others in view of which the project may need further examination and modification to improve its efficiency.

If the project passes the above efficiency tests, there are sufficient grounds to conclude that it is acceptable since it contributes positively to the national income of the country. However, as in the case of the net present value method in commercial profitability, one may need to know the social "price" of this contribution. This requires deriving a ratio between the discounted net surplus - social profit (P(SP)), generated by a project and the discounted total investment committed to this project:

$$SRR = \frac{P(SP)}{P(I)} \quad 100 \qquad (B.11)$$

where: SRR = social rate of return

P(SP) = present value of the net surplus-social profit, which equals P(VA) - P(W)

P(I) = present value of the project's total investment.

3.1.2 Relative Efficiency Test

If several competing projects pass the absolute efficiency test, the project evaluator is faced with the problem of ranking. This ranking can not be done on the basis of the absolute amount of the value added generated since there are usually limitations with regard to production resources which have to be taken in to account.

The ranking of investment projects is possible by applying the relative efficiency test to the analysis of the value added accomplished earlier. For this purpose several decision situations may be identffied:

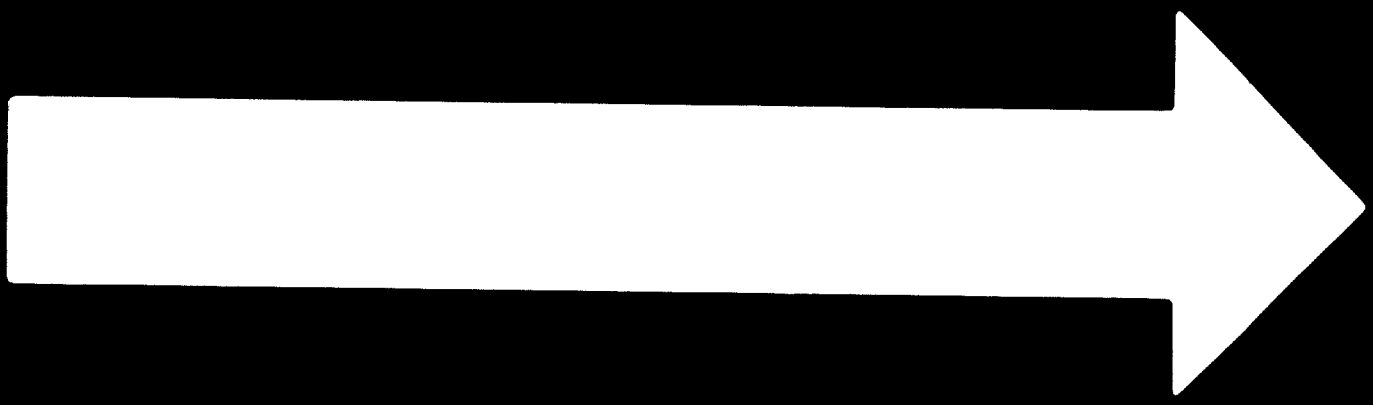
i. In the case where there are fewer projects and no production resource constraints, all projects which satisfy the absolute efficiency test can be taken.

ii. If there is no clearly pronounced scarce factor or there are a number of constraints (all important production factors are scarce) and there are no particular objectives earmarked to be fulfilled, the ranking of the projects should be done by using the absolute efficiency formula. The higher the value added and the surplus of value added over wages, the more useful is the project to the economy.

iii. There are, however, some well-known scarcities which the developing countries generally face such as scarcity of capital, foreign exchange, skilled labour. It may therefore be useful to establish which scarcity would vitally effect the setting up and operation of the project and the economy as a whole. Ranking should be done then by relating the value added produced by the project to the most scarce factor in the country. Project ranking under three scarce situations relevant for many countries is illustrated below:

a. Project ranking in the capital scarcity situation

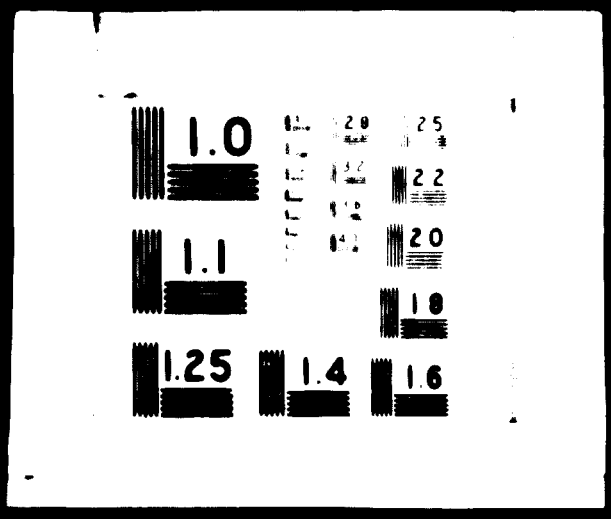
The objective is to find which projects generate the maximum value added per unit of capital invested. This can be assessed by



76.05.04

2 OF 2

06868



dividing the discounted value added by the present value of total investment (both compiled earlier for finding the absolute efficiency of the project):

$$E_{} = \frac{P(VA)}{P(I)} \qquad (B.12)$$

The larger the ratio, the more beneficial is the project from the capital point of view, enabling it therefore to be selected in a capital scarcity situation.

b. Project ranking in a foreign exchange scarcity situation

The position here is similar to that under capital scarcity, and the object is to find which projects produce the maximum value added per unit of foreign exchange used. It is obtained by applying the formula:

$$E_{FE} = \frac{P(VA)}{P(FE)} \qquad (B.13)$$

P(FE) will be the present value of the net foreign exchange cost of a project compiled in Table 6 of the section "Net Foreign Exchange Effect". The net foreign exchange cost is obtained as the difference between foreign exchange earnings (savings) and the foreign exchange spendings during the lifetime of the project. This formula is applicable provided the foreign exchange spendings exceed the foreign exchange earnings (savings) of the project. The higher the ratio, the larger is the value added contribution to the economy per unit of net foreign exchange cost.

c. Project ranking in skilled labour scarcity conditions

Under skilled labour scarcity conditions, it is necessary to find the projects generating a maximum value added per unit of cost of skilled labour. It can be easily found as follows:

$$E_L = \frac{P(VA)}{P(L_s)} \qquad (B.14)$$

$P(L_s)$ is the present value of all wages, salaries and fringe benefits given to the local and foreign skilled employees, including the portion repatriated abroad. This figure is readily available in the table "Integrated Value Added Analysis".

The larger the ratio, the greater is the value added contribution per unit cost of skilled labour and therefore the project is preferable under a skilled labour scarcity situation.

3.2. Application of the Value Added Criterion for Evaluation of Modernisation/Expansion Projects

Modernization and expansion are two important aspects of the industrialization programme of any country. It is particularly necessary to assess whether modernization/expansion of an existing production unit, which enjoys many infrastructural facilities, is not a more economical alternative than setting up a new project. Sometimes it may be necessary to undertake such a step for the survival of a continuously losing industrial unit. For the sake of brevity, modernisation/expansion projects will be referred to as modernization projects.

Modernisation projects, like new projects, should be evaluated in a two-step procedure: first, absolute efficiency test and second, relative efficiency test.

The general sequence of operational steps is the same as described above for new projects. There are, however, peculiarities in the computation of the different inputs and outputs used for the calculation of the value added. The inputs and outputs at the current level of operation (before modernisation) serve as a starting point. The additional inputs and outputs should be added to them to arrive at the total magnitudes of each input and output after modernization is completed:

- value of output = value of output at the current level of operation + additional value of output due to modernization;
- value of material inputs = material inputs at the current level of operation + additional inputs caused by modernization.
- value of capital = market value of the adopted machines, equipment, etc., from the existing production unit + new investment for modernisation;

- value of repatriated payments = value of payments going abroad at the current level of operation + additional repatriations due to modernization. If foreign capital and expatriate labour is not required for modernization, there will be no additional repatriation.
- value of wages = value of wages for employed labour at the current level of operation + wages for labour newly employed due to modernization. It may however happen that modernization will cut down the labour employed and although the average wage may increase, the total magnitude of wages might decrease. This new (reduced) amount should be taken for the calculation of the value added generated by the modernization project.

In applying the discounted absolute efficiency formula it should be asked whether a project (plant) after modernization passes the absolute efficiency test, namely the present worth of the value added is positive, and if so, whether:

$$E_m = P(VA) > P(W) \qquad (B.15)$$

where: E_m = absolute efficiency test for modernization project;
$P(VA)$ = expected present value added after modernization;
$P(W)$ = present value of the expected wages after modernisation.

The modernization project passes the absolute efficiency test if the present value added exceeds the present value of wages. However, only passing this test may not be sufficient. This type of efficiency test only answers the question whether the modernization proposal is efficient. But how does it stand compared with the efficiency of the production unit prior to modernisation? Is it worth undertaking this modernisation?

It may be desirable for this type of projects that a second efficiency test be carried out by comparing the efficiency before and after modernisation. This can be done in the following steps:

Step 1: Compile the present values of expected value added and expected wages at the current operating level and apply the absolute efficiency formula: $E_a = P(VA) \geq P(W)$. This measures the level of efficiency before modernization;

Step 2: Use the above formula to compute the efficiency at the new levels of inputs and outputs expected after modernization;

Step 3: Compare the efficiency for the two levels -- before and after modernization - and derive an absolute efficiency ratio:

$$E_a = \frac{P(VA) \geq P(W) \text{ (after modernization)}}{P(VA) \geq P(W) \text{ (at the current level of operation)}} \quad (1.16)$$

The modernization of a project passes the absolute efficiency test if the ratio is larger than one, or in other words if the expected efficiency of the modernized project is larger than the efficiency at the current level of operation. If this condition is not met, one may consider how the design for modernization can be improved or the proposal should be rejected.

Therefore, the modernization proposal of a project should not only pass the absolute efficiency test valid for new investment projects, but should also prove to be superior compared to the current level of operation.

For ranking purposes the same relative efficiency test applies as for new investment projects. The analysis for the likely scarcity situations will also be the same.

Modernization projects may compete among themselves as well as with alternate new investment projects producing the same effect:

- if there is no clearly distinguished scarce factor or all are scarce, the ranking is done by using the absolute efficiency formula. The higher the value added and the surplus over wages, the better the project is for the economy;
- if the scarce factor is pronounced, the ranking is made by relating the expected incremental value added from the modernization of the project to the most scarce factor in the country used for this project:

$$E_{SF} = \frac{P(\Delta VA)}{P(SF)} \qquad (B.17)$$

where: E_{SF} = relative efficiency of a modernization project with regard to respective scarce factor;

$P(\Delta VA)$ = present value of the expected increment of value added after modernization over the lifetime of the project. This increment is computed as the difference between the value added expected after modernization and the value added expected at the current level of operation;

$P(SF)$ = present value of the expected scarce factor (capital, foreign exchange or skilled labour) committed to the project due to its modernization. This value is computed as the sum total of the expected magnitude of the scarce factor committed after modernization and its actual value at the current level of operation.

The higher the ratio, the larger is the incremental value added contribution to the economy per unit cost of the scarce factor.

3.3 Application of the Value Added Criterion for Evaluation of Industrial Complexes

There are circumstances in which it is necessary to evaluate investment projects as a complex and not separately. An industrial complex may be defined as a group of projects which are technologically and economically inter-related. The projects may be at one site or located in different places/regions.

An industrial complex may comprise three groups of constituent projects:

- "A" - new investment projects;
- "B" - existing production units being modernised/expanded;
- "C" - existing production units where some capacities are being under-utilised.

The industrial complex evaluation technique may be used for two purposes:

- Measuring the total benefits and costs of a group of interrelated projects constituting an industrial complex in order to improve the efficiency of the complex as a whole;
- Measuring the indirect benefits and costs of an investment project occuring in other investment projects/existing production units.

In addition to this, the suggested approach may help to "internalize" some external (indirect) effects, which are difficult to measure, and to eliminate the implications of heavily distorted market prices of items exchanged among the constituent projects. The former is achieved by evaluating all individual projects as one unit - industrial complex, and the latter by valuing the inputs and outputs at production costs and applying actual or adjusted market prices only to items delivered to or procured from outside the industrial complex.

3.3.1 Evaluation of an Industrial Complex

The purpose of grouping projects in the process of project evaluation into industrial "complexes" is twofold:

a) To take a broader view of the efficiency of a group of interrelated projects by bringing to the surface their technical, economic and social links;

b) To provide an opportunity for "techno-economic redesigning" of the constituent projects if the evaluation results suggest. This redesigning may lead to considerable benefits through the economy of scale, better utilization of planned productive capacities, more efficient marketing, etc. An estimate of such advantages can be done only by analyzing the individual projects as one complex.

The evaluation of an industrial complex is carried out in the following manner:

Step 1: For evaluation of a complex, each constituent project has to be appraised separately. The rationale for this is that by evaluating first each project separately, information is compiled as to which constituent projects of the complex are weaker, and where to look for efficiency reserves. The evaluation has to be done by applying the discounted absolute efficiency test suggested for new projects. This individual evaluation of each

constituent project should not imply that each project should pass the absolute efficiency test on its own. As stated above, the application of this test only aims at identifying the weak links of the complex.

Step 2: Compute the values of outputs and inputs for the complex as a whole: output value, material inputs, investment, repatriated payments, wages, by compiling an Integrated Value Added Analysis table for the entire complex. The general rules for computing the values of inputs and outputs of an industrial complex are the same as for individual projects. There are, however, certain implications of the fact that the whole complex is appraised as one large unit, the individual projects being constituent parts of it:

- the value of expected output (sales revenue): output sold outside of the complex is valued at actual or adjusted market prices as per the pricing rules; output sold within the complex is valued at production costs;
- the value of expected current material inputs: following the same logic as above, inputs procured from within the industrial complex are valued at production costs; inputs procured from outside the complex are valued at actual or adjusted market prices;
- the value of expected investments: a) for new projects - their total investment; b) for modernisation/expansion projects, again their total capital (new investments plus the utilised old capital), and c)for units having idle capacities - their existing capital since they will usually not need any additional investment.

- the value of expected repatriation payments: a) for new projects - their total amount; b) for modernization/expansion projects - as suggested in the section for evaluation of modernization projects, and c) for units with idle capacities - foreign payments under normal level of operation plus any additional foreign payments caused by the better utilization of the capacity;
- the value of expected wages: a) for new projects - total wages, excluding the repatriated portion; b) for modernization/expansion projects as suggested in the section for evaluation of modernization projects, and c) for units with idle capacities - wages paid under current level of operation plus any wages for additionally appointed personnel to secure better utilization of the available idle capacity.

Step 3: On the basis of the above computations calculate the total expected present value added of the complex by summing up the respective values added of the new projects, the group "B" projects after their modernization and of the group "C" projects consequent to better utilization of their idle capacities. This sum total is one of the components of the absolute efficiency formula for an industrial complex, namely:

$$P(VA)^C = \sum_{j}^{m} \sum_{t=o}^{n} (VA)_{j,\,t}\, a_t$$

Step 4: On the basis of the calculations carried out under step 2 above, compute the sum total of the present values of the expected wages for the new projects, the modernized/expanded projects and those whose idle capacities will be better utilized. This is the second component of the absolute efficiency formula, namely:

$$P(W)^C = \sum_{j}^{m} \sum_{t=o}^{n} (W)_{j,\,t}\, a_t$$

Step 5: With the major components so computed the absolute efficiency test for an industrial complex can be applied:

$$E^C = P(VA) \geq P(W) \qquad (B.18)$$

or the same expressed in more elaborate terms:

$$E^C = \sum_{j}^{m} \sum_{t=o}^{n} (VA)_{j,t} a_t \geq \sum_{j}^{m} \sum_{t=o}^{n} (W)_{j,t} a_t \qquad (B.19)$$

where: $\sum_{j}^{m}$ means the sum total of the value added (wages) for all constituent projects in the complex - starting with project j and ending with project m. These projects from j to m could be only new projects, or new and modernized/expanded projects, or new projects along with modernized/expanded production units and existing units with idle capacities.

$\sum_{j}^{m} \sum_{t=o}^{n}$ means the total sum of the value added (wages) for all constituent projects in the complex from j to m $\left(\sum_{j}^{m}\right)$ for all years of their economic life starting from year zero (the beginning of construction) and ending in year n $\left(\sum_{t=o}^{n}\right)$

If the present worth of the value added is positive and larger than the present worth of wages, the complex as a whole is efficient. If this condition is not met, the attention should be focussed on review and redesigning of certain weak constituent projects as identified under Step 1. above, so that the overall efficiency of the complex is improved.

If the ranking of industrial complexes is required, it will also be possible to find the efficiency of the complex as a whole under capital,

foreign exchange or skilled labour scarcity conditions by applying the same formulae as have been earlier suggested for individual projects.

3.3.2 Measuring the Indirect Effects of an Investment Project

The industrial complex approach can be conveniently used for tracing and/or measuring the indirect benefits and costs of a new investment project. These are additional benefits and costs caused by the investment project under examination, occuring in other technologically and economically related projects. Should the project under consideration not have been established, the indirect effects would not have occurred.

An investment project may provoke the establishment of other new projects, modernisation/expansion of existing production units and/or help the better utilisation of existing idle capacities in other establishments. It is justified to trace the indirect effects in the above mentioned projects (existing establishments) only if the causal relationship between them and the project considered is clearly and indisputably established. These indirect effects should be counted for only as long as their occurrence is due to the project under consideration.

An investment project may also induce other indirect benefits (benefits to the whole area provided by the project's infrastructure, benefits to other enterprises using a manpower which has acquired its skill on the project under examination, etc.) or indirect costs (pollution of air or water, noise, destruction of traditional human values, etc.). However, these indirect effects are not measurable and therefore not handled in this section. Reference is made to them under "Supplementary Considerations". This section suggests an approach only for identifying some measurable indirect effects.

The procedure for measuring the total effects (direct and indirect) of a project is as follows:

Step 1: Compute the direct value added and direct wages as suggested before.

Step 2: Identify other projects or existing production units on which the project in question will have a direct bearing - establishment of new projects supplying the inputs or receiving its output for further processing; requiring modernization or expansion; better utilization of existing idle capacities with negligible or no additional investments;

Step 3: On the basis of Table 8 of the model formats, compute the additional (indirect) value added for each year of the economic life which will be produced in the linked projects due to the establishment of the project under consideration:

- for other new projects, take the total value added they are expected to produce;
- for modernized/expanded projects only the incremental value added as a difference between the value added after the modernization/expansion and at the current level of operation;
- for production units with idle capacities - only the incremental value added as a result of the better utilization of the available capacities.

For the proper computation of the indirect value added, several items should be carefully identified:

- for other new projects: total output, material inputs, investments and repatriated payments (if any) should be taken;
- for modernized/expanded projects: only the incremental (additional) output, material inputs, investments and repatriated payments (if any) actually provoked by the project under consideration;
- for production units with idle capacities: only the incremental output, material inputs, investments (if any) and repatriated payments (if any) related to the better utilisation of the available capacities.

Step 4: Add up the indirect value added so computed to the direct value added computed under Step 1. above to obtain the expected total value added for each year. Discount the annual figures, multiplying them by the discount factors (a_t) corresponding to the selected social rate of discount to arrive at the present value of the total (direct and indirect) value added. This will be the first component of the absolute efficiency formula:

$$(P(VA) = \sum_{j}^{m} \sum_{t=o}^{n} (VA)_{j,t}) \, a_t$$

Step 5: Compute the additional (indirect) wages for each year of the economic life which will be paid in the linked-up projects due to the establishment of the project under consideration:

- for other new projects take the total expected amount of wages;
- for modernised/expanded projects - only the additional amount of wages as a difference between the wages paid after and before the modernization/expansion. If the amount of wages decreases due to modernisation, this difference is taken with a minus sign and deducted from the total sum of wages;
- for production units with idle capacities - only the wages of the additionally employed labour to secure the better utilisation of the existing idle capacities.

Step 6: Add the indirect wages to the direct ones to obtain the expected total sum of wages for each year. Discount the annual figures, multiplying them by the discount factors (a_t) corresponding to the selected social rate of discount - to arrive at the present value of the total wages (direct and indirect) committed in a project. This will give the second component of the absolute efficiency formula:

$$P(W) = \sum_{j}^{m} \sum_{t=o}^{n} (W)_{j,t}\, a_t \qquad (B.20)$$

Step 7: If the discounted value added computed under Step 4. above is positive, apply the absolute efficiency formula:

$$E = P(VA) > P(W)$$

or expressed in more elaborate terms:

$$E = \sum_{j}^{m} \sum_{t=o}^{n} (VA)_{j,t}\, a_t > \sum_{j}^{m} \sum_{t=o}^{n} (W)_{j,t}\, a_t \qquad (B.21)$$

where: $\sum_{j}^{m} \sum_{t=o}^{n}$ stands for the total value added or wages (direct and indirect) occuring in a project under consideration and in all linked-up projects from j to m $(\sum_{j}^{m})$

for their entire economic life from the year o to the year n $(\sum_{t=o}^{n})$

If the net result is a positive value added and a surplus of value added over wages, the project is efficient. If this condition is not met, the project with all its linkages should be carefully reviewed and if necessary redesigned to improve its overall efficiency. It may, however, be difficult to make such an analysis in all cases in quantitative terms. This is in principle recommended for large projects with apparent implications for other projects. It may be attempted when reliable data are available and can be utilised for this purpose. If this is not the case, the absolute efficiency test may be carried out on the basis of the direct benefits and costs only. With regard to the indirect benefits and costs, qualitative analysis may be applied, based only on tracing the effects in linked projects so far as possible by the application of the approach suggested above or any other manner as may be found possible.

4. Additional Indices

Additional indices in project evaluation reflect the fulfilling of development objectives other than those encountered by the basic criterion and therefore require the appraisal of the project's contribution to the said objective(s).

The distinction between basic criterion and additional indices made in this Manual is only optional. Under certain conditions in line with the national objectives, some of the so-called additional indices may become as important as the basic criterion. There can be any number of such situations and objectives depending on the strategy of development of a country, but generally there are five well-known situations for which evaluation may be necessary.

Five additional indices are, therefore, suggested to be included in the analysis, depending on their significance and application in each individual case. The order of listing the indices below does not reflect any order of priority assigned to them. Their relative importance will vary from country to country and from time to time within the same country. These indices are:

- Employment effect;
- Distribution effect;
- Net foreign exchange effect;
- Idle capacity effect; and
- International competitiveness.

Suggesting a set of indices does not mean that all the five need to always be simultaneously applied in the evaluation of every project. It is up to the evaluator to select the relevant additional indices, subject to the socio-economic framework in which an investment project is being evaluated.

4.1 Employment effect

If the creation of new employment opportunities is one of the principal development objectives, the planning authority tries to create the largest number of new jobs with a given capital. In other words, it attempts to invest as little capital as possible to open each single new job.

The labour force is usually composed of unskilled and skilled workers. The first are those who did not undergo any kind of training or education, while the latter have done so in order to master their job.

When evaluating an investment project from an employment point of view, its impact on both unskilled and skilled labour should be taken into account. Furthermore, not only direct employment, but also the indirect employment should be considered. Whereas the direct employment relates to the new employment opportunities created within the project, the indirect ones cover the job opportunities created in other projects linked with the project which is being evaluated.

It is worthwhile to try to estimate the indirect employment effects at least for the one round - projects directly connected with the project on both the input and output sides. This is done by analysing each project in question individually. For large projects, it may be preferable to estimate the new employment effects even for further rounds of linkages on the basis of information which can be available or by applying some standards based on the past employment results from such projects in the country or abroad. In such a way, the total number of new employment opportunities can be assessed. Nevertheless, it seems rational to account for the indirect employment effect only in cases where it is obviously pronounced.

The same logic should be applied to assessing the total capital required to open the new jobs. In other words, the total direct investment of the project, the additional investment needed in the backward and forward linkage projects, should be accounted for.

For estimation of indirect investment and indirect employment when possible, the industrial complex technique is recommended.

Thus, the procedure of estimating the new employment opportunities created by a project can be divided into three steps:

Step 1: Calculate the number of unskilled and skilled workers employed directly in the project;

Step 2: Estimate the number of unskilled and skilled workers additionally employed in backward and forward linkage projects. The projects directly connected with the project being evaluated should be included, while those involved in further stages of multiplication effect are neglected, except in cases of large projects;

Step 3: Compute the amount of capital invested in the project and estimate the capital needed to be invested additionally in backward and forward linkage projects.

These can be illustrated as follows:

Table 1. Total New Employment Opportunities

Location of effect \ Effect	Number of workers employed: Unskilled workers	Skilled workers	Total	Capital invested
1. Within a project				
2. Input supplying projects				
3. Output using projects				
TOTAL	W_u	W_s	W	TI

Indirect employment effects depend in real life on the rate of labour utilization in the linked projects. If they operate below their full capacity, the labour employment effects will be smaller and the estimates of indirect employment will have to be lowered. Similarly, a reduction would be needed if the implementation of a project leads to some unemployment in competing industries. It is also possible that the project may attract some labour from existing projects who will not be replaced. Such factors, if assessable, can as well be taken into account in finding the overall net employment effects.

Further, all foreign personnel should be subtracted from the number of workers to whom the employment opportunities are going to be opened if there is a pronounced unemployment in a country. In cases where manpower is scarce, the foreign personnel should not be subtracted. Finally, the total amount of capital invested is derived by adding up the nominal values of investments in different years, i.e. without discounting.

Table 1 gives the elements to determine the employment effect of a project. Three different indicators may be computed for this purpose:

(a) W or W_u indicating the total number of new job opportunities or the number of new jobs for unskilled workers. Both the new jobs opened within the project as well as those in the inputs supplying and outputs using projects are accounted for;

(b) $\frac{N}{M}$ showing the number of new job opportunities created by a unit of investment, both within the project and in the linked projects, if possible. A unit of investment could be 100,000, 1,000, ordinary or any other convenient figure;

(c) $\frac{N_u}{M}$ giving the number of new job opportunities for unskilled workers created by a unit of investment.

The choice of indicator for assessing the employment effect will be made according to the development situation of the country. In cases where unemployment is present and not too much attention need be paid to the allocation of capital, the first one is to be chosen. If the capital scarcity is pronounced, the second and third indices are the appropriate ones, depending on the kind of labour that is unemployed. When there is unemployment of all types of workers, the second one should be used. The third one will be selected if the unskilled workers are unemployed. Of course, the evaluator may use all three of them to see different aspects of the employment effect if this is necessary.

Furthermore, the evaluator has a possibility of choice to put into the numerator in the above indicators the number of job opportunities newly created or the number of workers additionally employed. The first is relevant in case one wants to find out the number of new job opportunities a unit of capital creates, while the latter is to be used to find out the number of additionally employed workers per unit of capital invested. If the factory operates on one shift there will be no difference between the two indicators and vice versa. Comparing the number of workers additionally employed to the capital invested is more relevant for measuring the actual employment effect.

4.2 Distribution effect[1/]

The execution of industrial projects can affect the distribution of value added in two ways. First, it can be distributed differently among the social groups, in which case a group distribution effect is relevant. Second, the value added may be allocated differently among the regions in a country, and one speaks about the regional distribution effect.

1/ Both distribution and redistribution effects are to be taken into consideration. However, for the sake of brievity the term Distribution effect is used in the Manual.

It may be pointed out that distributional objectives could be achieved through fiscal and price policies of the government. For instance, different taxes and prices levied and charged to different social groups and regions are often used to reach a socially desired distribution effect. But it may happen that political, institutional and administrative obstacles make such policies impossible or inefficient, and then project selection could be used as one of the tools to reach the same objective. In such cases project evaluation has to account for the project's distribution effect.

The procedure of estimating the distribution effect of a project may be carried out in four steps:

Step 1: Identifying the target social groups or regions

Identification of social groups affected by distribution of the project's value added depends on the purpose of assessing the distribution effect. If development objective is to improve equality of distribution for social reasons, two social groups may be identified: low income and high income groups, which does not eliminate the possibility of breaking down the latter further. The line between the two groups should be set up according to the conditions of a country, but usually it cannot reflect too precisely the differences in welfare due to the possible existence of fringe benefits. Any other identification being impossible, the unskilled labour may be taken as a representative of the low income group.

Very important is the analysis of the distribution of the value added among the different production agents - wage earners, profit earners and the government. The pattern of distribution of the value added is of not only economic but also of great social significance. It is economically significant because two projects with the same value added will be appraised differently in accordance with the share of wages from one side and the social profit on the other. It is socially significant because the same amount of value added could be distributed in different proportions among wage earners, profit earners and the state treasury, having different social and economic implications. Due to the difficulties which governments in developing countries often face in establishing an efficient tax system to generate revenues, income in the hands of the government may be more desirable than income in the hands of the profit earners.

Similarly, the regions may be divided into less developed and developed ones. This can be done according to a criterion of per capita income level, achieved level of development of infrastructure or industry. If the development of a politically sensitive frontier or other area is a government objective, it should also be treated as less developed region irrespective of per capita income level or other criteria of this sort.

If income distribution among rich and poor within the region is also of concern, this could be analysed by adding regional subdivisions under each of the income groups or income subdivisions in the regions concerned.

Step 2: Determination of a social group's or regional net benefits flows

The net distribution benefits are by definition equal to the difference between the social benefits and social costs brought about by a project. The benefits of a group or region are the benefits received minus any offsetting payments made to other groups or regions. The distribution costs are defined as costs provoked by a project to a group or region minus any compensating benefits received from another group or region. So the analysis proceeds to record the changes in the gains and losses of different social groups or regions.

The net distribution benefits or gains of a group or region may be identified with the value added of a project above the level they used to receive prior to the establishment of this project. Any fringe benefits, if existing, should increase this gain. In case of low income group and wage earners group, this would probably amount to their wages and salaries, while the net profits, interest, rent and indirect taxes will be relevant to profit earners and to the government. It should be pointed out that in case of previously unemployed labour, the total wage bill is considered as a gain, but otherwise only the difference between the previous wages and the wages paid by the project is accounted for.

The distribution net benefits accruing to a region may include additional wages and salaries, profits, interest and fringe benefits for workers. If the project causes no reduction in the labour force engaged elsewhere in the region, the total wage bill should be considered as a regional distribution net benefit, since the vacant jobs are taken

by the immigrants from other regions. In case the project reduces the number of workers employed elsewhere in the region, only the net increase of wages should be accounted for. Often foreign (normally only skilled) labour is employed by a new project, and only the part of wages and salaries spent in the region concerned should be included in the net distribution benefits. A similar case may be with profits and interest, part of which may leave the region. Fringe benefits usually take the form of welfare facilities, such as housing, education or health institutions.

The net distribution benefits to a social group or to a region have to be identified and computed in actual market prices for a normal year of the project's life. As stated on previous occasions, if CIF or FOB prices are used, they are transferred into domestic values by the shadow rate of foreign exchange.

As pointed out earlier, the project analysis suggested by this Manual is based on national net value added, i.e. all repatriations abroad are excluded. This applies to the analysis of the distribution effect too. The benefits obtained by wage earners do not include the repatriated portion of the wages of expatriate labour. The benefits captured by profit earners exclude the repatriated portion of profits, interest, and rent on foreign capital.

Table 2 presents a framework of tracing the net distribution benefits in the case of the social group distribution effect.

The items in Table 2 could easily be broken down into low income and high income groups to get another aspect of the social groups distribution effect.

In case one wants to trace the regional distribution effect, Table 3 may be used as a suggested format to supply the necessary data.

Table 2. Net Distribution Benefits for Social Groups

(in dinars for a normal year)

Net distribution benefits per groups	Normal year
1. Wage earners	VA^W
1.1 Wages	
1.2 Fringe benefits	
2. Profit earners	VA^P
2.1 Net profits (dividends to shareholders)	
2.2 Interest on private capital	
2.3 Rent received by private owners	
2.4 Fringe benefits	
3. Government	VA^S
3.1 Taxes paid to the treasury	
3.2 Interest on loans	
3.3 Profits (dividends to state-owned shares)	
3.4 Rent received by the state	
4. Total value added of the project	VA

Table 3. Net Distribution Benefits for a Region

(in dinars for a normal year)

I t e m	Normal year
1. Wages to workers from the region	
2. Profits (dividends) to local entrepreneurs	
3. Interest paid to local banks (local branches of central banks are not counted for)	
4. Taxes paid to local government	
5. Welfare gains to the region (hospitals, kindergardens, schools, transport network, etc.)	
6. T o t a l	VA

It has to be pointed out that the items in Table 3 represent only a model breakdown of the net distribution benefits. Other breakdowns may be used as well, depending on the circumstances of each case.

Step 3: Computing the distribution index

The amount of the net distribution benefits accruing to a social group or region (VA^W, VA^P, VA^G, VA^r) have to be related now to the total net value added created by the project in a normal year. Assuming the distribution index of the wage earners is to be found out, it is determined as

$$DB^W = \frac{VA^W}{VA} \quad , \qquad (B.22)$$

where: DB^W = the distribution index of the wage earners (the share of the wage earners in the distribution of the value added);

VA^W = the expected nominal value of wages paid out by the project in a normal year;

VA = the expected nominal value added created by the project in the same normal year.

Of course, if the distribution index of profit earners, government or region is to be determined, the nominator in the above expression will contain VA^P, VA^G and VA^r, respectively.

Therefore, the distribution index shows how much of the project's value added unit is distributed to the wage earners, profit earners and government or generally to the social group under consideration. The sum total of the distribution shares of wage earners, profit earners and government should equal one.

The regional distribution index shows how much of the value added generated by a project is distributed to the region considered. The sum total of the distribution shares of the regions concerned should also equal one.

If the government's objective is to distribute more benefits to the wage earners (to favour a labour-intensive technology), the project with a higher DB^W may be given a priority, all other things being equal. If the objective is to promote the development of backward or politically sensitive regions, the project with a higher DB^r may be preferred.

The decision-making institution in a developing country often determines the location of the project prior to its formulation and overall economic evaluation, on certain political, social or other grounds. Nevertheless, the above analysis is useful in supplying arguments to

either confirm the decision already taken, to modify it if possible, or to show explicitly the "price" paid for achieving certain non-economic objectives.

4.3 Net foreign exchange effect

One of the essential aspects of the overall economic evaluation of an investment project is to assess the effects of its implementation on the foreign exchange position of the country. This consists of two stages:

- Assessment of the Balance of Payments Effects of a project;
- Assessment of the Import Substitution Effect of a project.

In countries where the shortage of foreign exchange is a key obstacle to economic development, the project's effect on the balance of payments has to be estimated first. In doing so, the present as well as the future balance of payments situation has to be accounted for since the present balance of payments surplus might be reduced or even eliminated in the years to come. Also, the total effects of the project, direct and indirect, have to be taken into consideration.

The analysis of the foreign exchange effect of an investment project is important not only to countries facing a shortage of foreign exchange. It is equally essential for others which are presently enjoying a surplus balance of payments. The establishment of sophisticated industrial projects adds considerably to the import requirements in multifarious directions: raw materials, components, replacements, machinery, purchase of know-how, technicians, royalty payments, repatriation of profits and on many other accounts. A project may help the country in manufacturing an important item or provide a substitute for an imported commodity, but at the same time it may add new items to the import schedule and impose many payment/repatriation obligations. It is, therefore, useful to make a comprehensive analysis of the effects of an investment project on the balance of payments of any country.

When estimating the future balance of payments situations, some crucial problems should receive due attention:

- The forces shaping the future balance of payments, such as unusually high or low prices for key exports and/or imports, large capital movements in terms of loans and/or foreign aid, temporary profitable exports and others;

- The trends in basic demand for imports and the supply of exports;
- The eventual changes of policy related to the import restrictions.

The procedure of estimating the net foreign exchange effect of a project could be carried out in four steps:

Step 1: Find the net foreign exchange flows of a project

The assessment of the Balance of Payments Effects of a project entails a systematic and careful analysis of the total inflows and outflows of the project in foreign currency, first of all for each year of its construction and operation and, secondly, for its total economic life. The effects for each year will be important for the annual Balance of Payments Statement of the country and the summation of the annual effects will depict the impact of the project on the overall foreign exchange position of the country for the lifespan of the project. For this purpose it is important to compile a statement of all the inflows and outflows of foreign exchange of the project. Table 4 offers a standard format containing the specimen of essential items for calculation of the foreign exchange inflows and outflows of an investment project.

It can be seen from Table 4 that the foreign exchange inflows and outflows include both direct and indirect flows, taking into account not only the flows directly connected with the project but also those in the linked projects. The presence of items related to foreign borrowing and aid in Table 4 indicates that, in fact, the liquidity analysis of a project in terms of foreign exchange is carried out on a yearly basis. The totals of the inflows and outflows for each year need not balance. Since all the inflows and outflows are expressed in foreign exchange, any positive FE^t will indicate that the project contributes to the availability of foreign exchange in the country in the t^{th} year, while the negative sign represents the amount by which the country's foreign exchange availability is reduced by this project.

It should be possible to compile the above table from the data contained in the feasibility study or compiled earlier for ascertaining

Table 4 Foreign Exchange Flows of a Project

(in foreign exchange)

Inflows and Outflows	Years: t_0	t_1 ..... t_n
I. FOREIGN EXCHANGE INFLOWS (A+B)		
A. Direct Inflows (1+2+3+4+5+6)		
1. Capital		
2. Loans in cash		
3. Foreign aid or grant		
4. Goods or equipment on credit or deferred payment		
5. Exports of goods or services		
6. Others		
B. Indirect Inflows (for linked projects) (7+8+9+10+11)		
7. Capital		
8. Loans in cash and in kind		
9. Foreign aid or grant		
10. Export of goods or services		
11. Others		
II. FOREIGN EXCHANGE OUTFLOWS (A+B)		
A. Direct Outflows (12+13+14+15+16+17+18+19+20+21+22)		
12. Survey, technical consultancy, engineering fees		
13. Import of capital goods, equipment, machinery, replacements, etc.		
14. Import of raw materials, components, parts and semi-finished goods		
15. Imported goods purchased from domestic market		
16. Construction and installation charges		
17. Direct charges on imports of raw materials, intermediates, replacements, etc. (payable in foreign currency)		
18. Salaries payable in foreign exchange		
19. Repayment of foreign borrowing		
20. Royalty, know-how and patent rights		
21. Repatriation of profits and capital		
22. Others		
B. Indirect Outflows (for linked projects) (23+24+25+26)		
23. Import of capital goods, equipment, machinery, etc.		
24. Import of raw materials, intermediates, replacement, etc.		
25. Imported goods purchased on domestic market		
26. Others		
III. NET FOREIGN EXCHANGE FLOW (I-II) (positive +; negative -)	FE^{t_0}	FE^{t_1} ..... FE^{t_n}

the commercial and national profitability of the project. Only the indirect inflows and outflows are new items required for this analysis and will have to be compiled.

In actual practice there may be many events during the economic life of the project which may substantially affect its foreign exchange inflows and outflows. Bilateral or multilateral trade agreements, devaluation or re-evaluation of currencies, interplay of some abnormal forces of supply and demand of certain important items in particular years either on the domestic or international markets, changes in the import and export policies of the country, inflation and many other factors may have perceptible influence on the foreign exchange inflows and outflows of the project in question. If there are any such known factors with a certain degree of certainty, they would be reflected in the Feasibility Study, or in data compiled for earlier evaluation exercises. Since these very figures are being used for ascertaining the effects of the project on the balance of payment position of the country, these factors will be covered appropriately. It will be hazardous and inconsistent to introduce any new elements at this stage of evaluation. All such factors which have not been considered thus far should be left to be covered in the Uncertainty Analysis.

If two or more projects are to be compared on the basis of the net foreign exchange flows, all the FE^t have to be discounted by the social rate of discount to their present value to get a single magnitude as a criterion for selection. Thus,

$$P(FE) = \sum_{t=0}^{n} \frac{FE^t}{(1+i)^t} \qquad (B.23)$$

where: $P(FE)$ = present value of the total net foreign exchange flow over the whole life of a project from year 0 to year n;

FE^t = net foreign exchange flow of a project in the t^{th} year;

i = social rate of discount;

n = number of years of the project's life.

The present value of the net foreign exchange flow over the whole economic life of a project could be a very significant figure. It measures the project's net contribution to, or usurpation of, the foreign exchange

of the country over this period. Other things being equal, the project with the largest net foreign exchange flow will be considered as the best and selected for implementation.

Step 2: Determine the project's impact on the national balance of payments

In the case of large projects or industrial complexes, one further step in the analysis may be desirable. It consists of tracing the project's effect on the balance of payments situation of a country over its economic life. Table 4 provides the foreign exchange flows for each year of the lifespan of the project and on this basis the total net foreign exchange flow for each project is computed. The annual figures for each project are summed up to obtain the annual net balance of payments effects of a set of projects. These figures are added to (deducted from) the National Balance of Payments surplus (deficit) prior to implementing this set of projects, to come to a Residual (surplus or deficit) in the Balance of Payments after their implementation. This is presented in Table 5.

The evaluation presented in Table 5 should be carried out only if the size of the project or complex makes it necessary and the required data are available. This analysis would generally be necessary in the case of large-size projects requiring plenty of foreign exchange.

For small and medium size projects, or projects which are not part of a larger industrial complex, Step 2 of the analysis is not needed. The net foreign exchange flow computed under Step 1 above is actually the net impact of the project (positive or negative) on the national balance of payments. The project analyst should then proceed directly to computation of the import substitution effect of the project.

Step 3: Compute the import substitution effect of a project

The import substitution effect measures the estimated savings in foreign exchange due to the curtailment of imports of the items whose production has been taken up by the project. This effect is calculated at the CIF value of the quantity of previously imported (or would-be imported) items, which will now be produced by this project and supplied to the domestic market.

Table 5. Balance of Payments Situation
(in foreign exchange)

Net foreign exchange flow of i^{th} project	Years: t_0	t_1	.....	t_n
Project $-FE_1$				
Project $-FE_2$				
⋮				
Project $-FE_p$				
Net balance of payments effects of a set of projects	$\sum_{i=1}^{p} FE_i^{t_0}$	$\sum_{i=1}^{p} FE_i^{t_1}$	.....	$\sum_{i=1}^{p} FE_i^{t_n}$
Balance of payments surplus (deficit) prior to the implementation of a set of projects	S_0	S_1	.....	S_n
Residual (surplus or deficit) in the balance of payments after implementation of the set of projects	$S_0 + \sum_{i=1}^{p} FE_i^{t_0}$	$S_1 + \sum_{i=1}^{p} FE_i^{t_1}$	.....	$S_n + \sum_{i=1}^{p} FE_i^{t_n}$

Step 4: Compute the net foreign exchange effect of a project

The net foreign exchange effect of a project includes the net foreign exchange flow computed under Step 1 and the import substitution effect computed under Step 3. above. This is shown in Table 6.

In the cases of commodities in large demand in the country, the analysis in Table 6 may even convert a negative effect of the project on the balance of payments during its whole economic life into a positive figure of Net Foreign Exchange Effects. This would be indicative of the import substitution effect of the project.

If two or more projects are compared on the basis of the net foreign exchange effects, the annual figures have to be discounted by the social discount rate to their present value. The project with the largest present value of net foreign exchange effects is to be preferred, other things being equal.

Table 8. Net Foreign Exchange Effect of a Project
(i.e. foreign exchange)

Items	Years: t_0	t_1	.....	t_n
1. Net foreign exchange flow (Row III, Table 4)				
2. Import substitution effect				
Total net foreign exchange effect (positive +; negative -)				

4.4 Idle Capacity Effect

In many developing countries, some industrial capacities remain under-utilised due to lack of demand or shortage of raw materials. If the establishment of a new industrial project creates demand for industries suffering from the lack of demand or produces scarce raw material which these industries need, it brings some additional advantages to the economy. Therefore, while evaluating a project, its effects on idle capacity in other existing enterprises should also be taken into account.

If the project under consideration creates demand for existing under-utilised capacity, the value added in the economy increases not only within the project evaluated, but also in the linked production units. Thus, there is one more criterion for the selection of the proposed project, the idle capacity effect. This criterion will be different depending on the scarcity situation.

In a capital-scarcity situation this criterion can be expressed as a ratio between the present value of the total value added generated (direct plus indirect) and the present value of the investment, namely:

$$\frac{P(VA)^d + P(VA)^i}{P(I)} \qquad (P.24)$$

where: $P(VA)^d$ = present value added in the project being evaluated (direct value added). The technique for computation of this value added is suggested under 3.1 of the National Profitability section of the Manual.

$(PVA)^1$ = additional present value added created in the linked under-utilized capacity due to setting up the proposed project (indirect value added). The method of computation of this value added is presented under 3.3 of the National Profitability section.

P(I) = present value of investment requirement in the project being evaluated.

It can be seen that under capital-scarcity situation the idle capacity effect will increase the chances for selection of the project because no additional investment is needed in the linked projects having under-utilised capacities. In labour scarcity this is also likely, depending on the magnitude of the additional employment of skilled workers.

The implicit assumption in the above expressions is that the unutilised capacity would exist in the linked production units throughout the lifetime of the project being evaluated. However, this may not always be true since the demand for output of the under-utilized capacity may grow with time even if the proposed project is not set up. In this case, after some time there will be no unutilised capacity in those existing factories and the evaluator should add only the value added during the years in which the under-utilisation of capacity is actually expected to exist.

It should, however, be noted that the idle capacity effect need not be taken into consideration when raw materials from the under-utilised capacity are not a major input in the proposed project. The evaluator may take this effect into account only if the under-utilisation of capacity is due to lack of demand. If this is not certain, including the idle capacity effect may be misleading. Finally, if the evaluation of a project is mostly concerned with the choice of alternative techniques of production and all these techniques consume the same quantity of raw material produced by the under-utilised capacity, this effect need not be accounted for.

As has already been mentioned, the idle capacity may exist due to shortage of raw material supply, which will be reduced or eliminated after the setting up of the proposed project. Theoretically, the idle capacity effect in this case should be taken into consideration as well. This is particularly true when the new project supplies a material which

is a major input for the limited under-utilized capacity. However, in practice it would be very difficult, and at times impossible, to quantify it. It is, therefore, suggested that in such cases, instead of quantifying the idle capacity effect, the evaluator should only bring this fact to the attention of the decision-maker.

(c) International competitiveness

It is of vital importance for an evaluator to find out whether the products of an export-oriented project under consideration will be internationally competitive and as such have a chance of being exported. This assessment is of particular importance also for projects the economic scale of production of which is larger than what can be absorbed in the domestic market.

For finding the international competitiveness for the products of any project, it is necessary to compare the real domestic social cost of production with the benefit (the FOB price) that one will get from exports.

The analysis of the international competitiveness of an investment project is carried out in the following sequence:

Step 1. As indicated under Price Adjustments, the actual present or expected export prices (FOB) have to be taken as a starting point. These are the actual prices at which certain commodities produced by the project will be exported. If the project produces only several products this analysis should be done for each product separately and then for the project as a whole. By multiplying the quantities to be exported by the expected FOB prices, the gross foreign exchange earnings are attained or, in other words, the expected output in export prices (FOB). The FOB price is converted into local currency at the shadow rate of foreign exchange.

Step 2. The input of domestic resources for the production of the exported items have to be computed next. In the Pricing Rule Table the prices of all inputs are adjusted to represent their real social costs to the country. These represent the real value of domestic inputs. One can find easily the per unit cost of production. In case the project produces many

products in a composite manner, firstly if data permit, this analysis should be done for each product separately. In case this is not possible, the products can be taken as a group.

Step 3. As a next step the foreign component of the inputs should be computed. In the Pricing Rule Table the actual CIF price is to be provided for the imported inputs used in the production of the goods to be exported. One can easily find the per unit foreign component of the inputs for each product separately or if this is not possible, for a group of products. The CIF price is converted into local currency at the shadow rate of foreign exchange.

Step 4. Deduct from the expected output in export prices (FOB), or in other words, from the gross foreign exchange earnings, established under Step 1, the foreign component of the inputs in CIF prices, established under Step 3, to arrive at the net earnings of foreign exchange by exporting these commodities. The same figures should be arrived at by coverting the Net Foreign Exchange Flow of a project (Table 4 above) by the shadow rate of foreign exchange.

Step 5. Compare the expected net earnings of foreign exchange expressed in local currency as obtained under Step 4. with the input of domestic resources as obtained under Step 2, to find out whether the net earnings of foreign exchange ensure at least a recovery of domestic real social costs. The formula for such export efficiency test is as follows:

$$\frac{\text{NFE (Net Foreign Exchange Earnings)}}{\text{DC (Domestic Real Social Cost)}} \geq 1 \qquad (B.25)$$

In the event that the above test is satisfactory the evaluator can be sure that it will be socially gainful to export the product(s) irrespective of prices expressed in monetary terms based on controlled rates of foreign exchange. In fact, the difference between the FOB/CIF prices calculated at the shadow and official rates of foreign exchange determines the maximum amount of subsidy that the government can offer for exports without leading to any unrewarded transfer of resources from the country.

While analyzing a group of products (or a project as a whole), there may be a hidden situation in which the net foreign exchange earnings from the export of an item entails non-recovery of domestic inputs, but this is more than covered by other items. This should not be considered since there is an overall gain. Such situations are likely to discover by experience and gradually more emphasis can be put on items yielding net social gain on exports.

Step 6. Compare the result obtained above with the cut-off social criterion for international competitiveness. If the ratio is higher than the cut-off rate, the project (product) is competitive and can be exported. If this condition is not met, the project (product) should be re-examined so that its export efficiency be improved, if possible.

Step 7. If there are several competing products or projects, they should be ranked on the basis of their strength of international competitiveness. The higher the rate, the more competitive the project is, provided it exceeds the social cut-off rate.

The cut-off social criterion for international competitiveness is a national parameter. It expresses in numerical terms the minimum socially acceptable level of international competitiveness. In principle, it is set at a level ensuring at least a recovery of the domestic real social costs, namely:

$$\frac{\text{Net Foreign Exchange Earnings}}{\text{Domestic Real Social Cost}} \geq 1 \qquad \text{(B 26)}$$

where both the numerator and the denominator are expressed in local currency. The shadow rate of foreign exchange is used to transfer the foreign exchange units into local currency units.

No special sophisticated methodology is needed for establishing the social cut-off rate of international competitiveness. As stated above, in principle, it should be equal to one. Very often, however, as a result of the severe conditions on the international market as compared to the national productivity

in a developing country, and as an encouragement to exports under very difficult foreign exchange situations, the competent national agency may establish a cut-off rate less than one. In doing so the government offers incentives over and above what is determined on the basis of real social costs and benefits. In other cases, as a result of the dominant position of a country or the international market of certain commodities, the cut-off rate may be established above one. These are cases to meet extraordinary situations and much depends on evaluation of the overall current and future economic situations.

Subject to the prevailing conditions in a country, the social cut-off rate for international competitiveness may be uniform or diversified by industrial sectors and/or foreign markets.

The social cut-off rates of international competitiveness should be periodically reviewed by the competent national agency and if necessary, readjusted to the new economic reality.

5. Supplementary Considerations

There are some effects of a project which have not been covered by the basic criterion and by the additional indices suggested earlier. These effects are termed Supplementary Considerations and cover the analysis of infrastructural, technical know-how, and environmental implications of an investment project. These supplementary considerations are usually assessed in qualitative terms.

The above list of supplementary considerations is only a model. Subject to the conditions under which a project is being evaluated, the project analyst may decide to extend or shorten this list.

5.1 Infrastructural implications

All projects require infrastructural facilities - supply of power, water, transport, postal, communication, banking, marketing, cultural, and other facilities, housing, educational, social and health care, etc. They also add to the arrangements necessary for maintaining law and order.

The new projects can be conceived under two situations, namely, (a) there are idle (or spare) infrastructural facilities available at the proposed locations, or (b) there are already scarcities and infrastructural bottlenecks.

In the situations of the infrastructural idle capacities the project in question should be charged only the variable costs of infrastructural services, which are usually already included in the project's operating costs through the prices paid for these services and/or taxes paid. Therefore, in this case there is no need for any kind of special assessment of the infrastructural implications in project evaluation; the infrastructure may be considered as given to the project.

When scarcities and bottlenecks exist in the infrastructural capacities and it is necessary to augment these services for the successful working of the project by additional capital investment, the situation becomes somewhat different. Thus far, as the variable costs of infrastructural services are concerned, they are accounted for in the operating costs of the project. The main problem arises with respect to the additional capital costs involved. It is obvious that the investment costs of local infrastructural services exclusively built for the project are included in its investment costs. For example, the investment cost of the road to connect the plant site with the main road or that of the electricity line between the factory and the main line.

The problem becomes quite different when there has to be a wholesale augmentation of the infrastructural facilities to meet the requirements of this project and may probably be available for other projects. In case the facilities are exclusively for this project, e.g. a power plant is set up to meet wholly the requirements of an aluminium plant, the power plant is to be reckoned as a part of the aluminium plant and its costs and benefits will totally form part of the basic analysis undertaken earlier.

In the event it is decided to set up the electricity plant with a much larger capacity, and it will supply electricity to the projects too, it becomes a separate unit and its costs and benefits should be evaluated, either separately as an individual investment project, or as a constituant part of an industrial complex. Techniques of evaluation for both cases were suggested earlier.

Greater difficulty, however, arises in cases where the costs or benefits cannot be so directly estimated, e.g. the roads have to be widened, the capacities of schools, and hospitals have to be increased, the size of post offices, banks, etc., has to be increased. In such

cases, the whole problem of allocating the infrastructural costs to various projects should be viewed within the context of a development programme or an industrial complex composed of a given or envisaged number of projects. In such cases the total investment costs of general or regional infrastructure should not be charged to the first implemented project (the subsequent ones being charged only the variable costs) This is obviously not justified, and one project should not be burdened at the beginning stage of the development programme with the total additional investment costs of infrastructure. It should be only a reasonable proportion of the infrastructural investment costs, based on the infrastructural services to be utilized by the project under consideration.

The comparative infrastructural analysis of alternative projects may be neglected in project evaluation if these projects have similar infrastructural implications. However, a self-contained analysis of the infrastructural aspects of industrial projects should always be carried out.

5.2 Technical know-how implications

The implementation of large and sophisticated projects generally contributes to the development of local skills and capabilities in a country. Furthermore, they also help to change the traditional values, attitudes and behaviour of the society, to build up an enterprising spirit among the people, to develop a desire for changing and improving the existing conditions of life, to introduce better discipline for work and thus to change the very pattern and basis of economic development.

The fact is that the project's contribution to raising the industrial status and improving skills in a country is impossible to be measured, but this imposes the need to account for this impact at least in qualitative terms. Furthermore, apart from the size of a project, the technical know-how impact depends on the technology applied and location of the project. Technologically more advanced projects are bound to have more important an impact on formation of the country's technical know-how, but if this is pushed too far, it may end up by importing foreign personnel for running the factory instead of improving the skills in the country. Also, the project will have different impacts when located in different regions due to differing levels of traditionalism and development. The evaluator can take account of all

these benefits in the context of the overall and regional development plans of the country.

The comparative analysis of the technical know-how impact of alternative project could be neglected if the projects concerned are of similar size and technology, located in similar regions, etc., or in other words, do not differ in terms of technical know-how implications. However, a self-contained analysis of the technical know-how implications of a new project may be useful for decision making.

5.3 Environmental implications

The environmental implications can be related to the natural as well as to the socio-cultural conditions. The first can be somewhat easily detected and measured in terms of the costs necessary to prevent the deterioration of natural environments while the latter are vague and subject to a value judgement.

In a more general sense, damages of natural environment can be associated with:

- The inputs used in a project;
- The production process within a plant itself; and
- The use of the project's output.

Production of an input or its transportation to the plant to be used may have potentially pollution effects on the environment. For instance, transporting the bulky raw materials, toxic or explosive inputs, together with noise and traffic congestion may be an environmental worsening of considerable proportion. In such cases the location of a plant to be built may have to be reconsidered or additional infrastructure investment may be necessary to avoid the hazards

Environmental implications associated with the operation of the plant itself may broadly result in air, soil and water pollution and expected noise levels, negative effects in terms of sewage, solid waste disposal, soil erosion, etc. Additionally, the operation of a plant may hinder the aesthetic aspects of the natural environment leading to decreased possibilities for, let us assume, tourist industry, development of recreational facilities for the population in the vicinity, etc.

The output of a new plant may also have undesirable aspects from the point of view of ecological effects. Certain types of fertilizers and pesticides may require strict application rules in handling and using them, and marketing channels may be insufficiently controllable to guarantee adherence to these rules. Also, products being further processed in forward linkages sectors may cause environmental problems there if the prescribed production standards are not adhered to in the supplying industries or if some products, like the fertilizers, are used beyond a certain limit.

In all these instances the socio-cultural environment implications are also relevant. Preserving the positive values of tradition, the cultural monuments, the informal links among the people and things of this kind may be helpful to a development process. This has to be paid attention to, especially under conditions of rapid urbanization, which is likely to emerge and proceed along the process of industrialization, bringing the new way of life sometimes too suddenly and provoking social disturbances.

The first step in estimating the environmental implications is to identify and classify them into positive and negative ones. As already mentioned, the socio-cultural implications are hard to identify and impossible to measure. The natural environmental effects offer better chances of assessment. Determination of all possible sources of the natural environmental deterioration is basically of a technical nature, as well as designing the possible solutions to these problems, but the solutions to be implemented are selected and evaluated in financial terms. Technologically, the problems of natural environmental deterioration can be solved relatively easily. What matters is the fact whether the social benefits of avoided environmental losses are significant enough to justify the costs accrued to prevent them.

The appraisal of environmental implications thus turns out to be a matter not of a technical, but of economic and social concern, which is rather often overlooked. If environmental safeguards are inevitable, the least-costs solutions have to be found and their impact on both the commercial and national profitability of a project has to be determined. If these safeguards turn out to be too costly relative to investment, it may be worthwhile to calculate commercial and/or national profitability

indicators with and without the cost elements related to the environmental implications. In some instances, it may well be that a project is commercially sound without such additional costs, but only marginally if the investor has no other choice than to accept them. The question then arises whether the project can be redesigned or relocated in order to make the ecology less sensitive to the project concerned. If those alternatives are not feasible, government grants or subsidies may be sought, provided that a project is socially profitable under these conditions.

The comparative environmental analysis of competing projects may be neglected if these projects do not differ considerably in terms of environmental implications. However, a self-contained analysis of the environmental impact of industrial projects should be carried out always.

6. National Parameters

The methodology for determining national profitability requires project evaluators to compute social benefits and costs using - along with the actual or corrected market prices - parameters which, though formally resembling market prices, are not to be found in any currently published list of prices. These parameters are in general independent of decisions taken with respect to individual projects. Their calculation is assigned to the national level of the planning process rather than to the project level. They are thus called national parameters.

The national parameters are variables set up outside of a project and are given by a national planning institution, reflecting an attempt towards better allocation of resources from the point of view of the society. Subject to the prevailing conditions in a developing country, a set of national parameters could be used. This Manual recommends the utilisation of three national parameters which are considered to be the most essential, namely: social rate of discount, shadow rate of foreign exchange and social cut-off rate of international competitiveness.*

6.1 Social Rate of Discount

Social rate of discount (SRD) is the quantitative estimate in value terms of the weight the society assigns to future benefits and costs, or in other words, the rate at which the society's weight on future benefits and costs declines over time. The need for such an estimate arises for the compilation of the present value of the social costs and benefits of the project spread over a long span of time. The social rate of discount provides the link between costs and benefits occuring in different time periods. The social rate of discount should, in principle, be uniform for the country.

The essential economic role of the social rate of discount is to help allocate public investment funds to their socially most desirable uses. If the SRD is set too low, demand for public investment

---

* The social cut-off rate of international competitiveness was suggested earlier in the respective section of the Manual. A simple methodology for computing this national parameter was also recommended in the same section. Therefore it will not be discussed here.

resources will exceed supply, since too many projects will have a positive present value added. If it is set too high, too few projects will pass the absolute efficiency test of a positive present value added and there will be an excess supply of public investment funds. In principle, the SRD should be so chosen that the demand for public investment resources will more or less exhaust the available supply.

For practical reasons, it is assumed that the social rate of discount is constant over time. This is an acceptable approximation for the purposes of project evaluation.

The sequence of steps in calculating the social rate of discount can be the following:

Step 1: The interest rate at which a country can actually lend, invest or borrow capital from a relevant international capital market should be taken as an objective basis and reference point for the estimation of the social rate of discount to be used in the evaluation of investment projects.

In applying the international rate of interest as the basis for determining the SRD, some other aspects also need to be gone into, e.g., out of the whole spectrum of relevant world capital market rates, the rate of interest most applicable to the life span of the project(s) under consideration should be taken into account. For instance, if the majority of investment projects are expected to be of "long economic life", the interest rate on long-term loans would be the appropriate basis for estimation of the social rate of discount.

Step 2: This rate should then be adjusted by taking into account the prevailing domestic conditions of the country. There may be a situation where a country can be regarded as a capital lender and another situation in which the country is a capital borrower:

a. When a country is a capital lender, it should be taken into account that investment in domestic projects has various advantages, particularly from a long-term development point of view over investments abroad.

On the one hand, there are national economic and political considerations. On the other, investments abroad are subject to various uncertainties as regards repayments, inflationary factors and there. In general, the government of a given country has a better control over economic conditions at home than abroad and for this reason a certain "premium" should be given to domestic investment projects by lowering the rate at which their future benefits and costs are discounted. The formation of regional economic communities may, among other things, help to reduce some international uncertainties and this leads to lower the premium rates.

Giving a premium for domestic projects means actually a promotion of such projects, since the social discount rate used in their evaluation is lower than the rate based on the relevant world capital market. This can be expressed in the following way:

$$SRD = r_w - p_d \qquad (B.27)$$

where: SRD = social rate of discount

r_w = actual rate of interest of the relevant world capital market

p_d = "premium" for domestic projects

"Premium" interest rate for domestic projects (p_d) can be estimated on the basis of experience and overall guessing for the world economy after taking into account factors such as:

(i) expected rate of inflation in the world market;
(ii) "steadiness" of a given world capital market;
(iii) world political stability;
(iv) expected long-term returns on domestic projects;
(v) expected rate of inflation within the country.

If, e.g., the expected rate of inflation is high and/or the long-term forecasts as to world political situations are gloomy, the "premium" should be rather high. In such a case, "premium" (p_d) could be near about 25 per cent

of the relevant world capital market rate of interest:

$$SRD \quad r_w + (0.2) r_w \qquad (B.2c)$$

It is obvious that the "premium" is to a considerable extent an intelligent guess based on expectations and as such it can always be used in rounded figures.

b. When a country is a capital borrower, the social rate of discount should be no less than the actual rate of interest on the capital market from which the capital is borrowed:

$$SRD \geq r_b \qquad (B.2d)$$

It ought to be even higher than r_w if the country's absorptive capacity is higher than possibility to borrow capital from abroad. In such a situation establishing SRD on r_w level would mean opening the door for less efficient projects.

Step 3: It is important that a nationwide uniform social rate of discount is established and should generally be applied to all projects. There are, however, two situations in which a modification in this SRD to achieve some objectives may be necessary. The first set of such circumstances relates to the need for speedy development of some basic/strategic industries. The second refers to the speedy development of backward regions of a country:

a. Investment projects from some basic/strategic industries would hardly pass the absolute efficiency test if their future benefits and costs are discounted at the uniform SRD. In order to avoid such a situation, well-justified lower discount rates may be applied, at least for a certain period of the industrialisation process for certain industries.

Wages and salaries in some industries are, as a result of government policy or other reasons considerably higher/lower. The use of a uniform rate of discount as per the formulae recommended in this Manual would

lead, *in fact*, to higher (lower) efficiency requirements in those industries. In order to avoid such a situation an appropriate increase (in case) in the uniform rate of discount is necessary. This means a differentiation in the rates of discount by industrial branches. A decision on this is to be taken by the national policy-making institution.

b. Similarly, the second category of circumstances in which different rates of discount are suggested concern the speedy development of less developed regions. The speeding up of their development may be justified on social, economic and political grounds, e.g., better income distribution, employment, politically sensitive areas, etc. Strict application of a uniform rate of discount may not allow the projects for these areas to pass the absolute efficiency test and therefore to promote the development of such backward regions.

The rationale behind the suggested approach is that it is more expedient to lower the rate of discount instead of trying to estimate the project's impact on distributional policy objectives and/or additional expected future benefits. This means that a differentiation in the social rate of discount for backward regions of a country may be desirable. A decision on setting up regional social rates of discount is to be made again by the national policy-making institution consistent with the regional development policy of the government.

The special (lower) SRD for a given industry/region could be estimated as follows:

$$r_i = SRD - p_i \qquad (B.29)$$

where: r_i = a special promotional SRD for a given industry/region

SRD = uniform social rate of discount

p_i = premiums for a given industry or region which lead to lowering the special SRD compared with the uniform one.

Where the object is to retard the speedy development of a region and the evaluator wants to use the SRD as an additional tool for this purpose, the social rate of discount can be increased by adding some premium to the normal SRD:

$$r_i = SRD + p_i \qquad (B.30)$$

It should be noted, however, that there are many other ways and means of promoting or retarding the development of an industry or region. The application of differentiated social rates of discount is only one of them. It is up to the competent national policy-making institution to decide which one to use under the prevailing socio-economic conditions in a country.

6.2 Shadow Rate of Foreign Exchange

The shadow rate of foreign exchange is recommended as an appropriate measure of the true value of foreign exchange to the society if and when the official rate is obviously distorted and does not reflect this real value. Therefore, when evaluating investment projects under such circumstances, the foreign exchange components have to be valued at the shadow rate of exchange in order to obtain a more realistic picture about the social benefits and costs of a project.

Generally speaking, the shadow rate of foreign exchange for project evaluation is associated with the existing and forecast balance of payments position of a country. In countries having balance of payments difficulties it is appropriate to estimate the shadow rate of foreign exchange and apply it, while in countries with no deficit balance of payments, the official rate of exchange would more or less indicate its true social value. In estimating the shadow rate of foreign exchange, not only the present position of balance of payments should be taken into account but consideration would need to be given to the expected changes as a result of the implementation of different development programmes and large projects, and the economic and fiscal policies which the country would follow.

By definition the shadow rate of foreign exchange, being a national parameter, should be given to the evaluator by a competent national agency. If not, the evaluator should make an effort to estimate the shadow rate of foreign exchange to secure the appropriate results of project evaluation. In doing so, he should act in close co-ordination with the respective national agency - planning office, development bank, central statistical bureau, etc. The acute lack of information and experience needed for a comprehensive estimate of shadow rate of foreign exchange prevailing in developing countries compels the Manual to recommend at this stage only a very simplified approach for estimating the shadow rate of foreign exchange with certain tolerable approximations. It is felt that under the prevailing data and other constraints only this simple approach is possible in practice. Two simple methods are therefore suggested: a) deficit-exports ratio and b) tourist rate of exchange.

6.2.1 Deficit-Exports Ratio Method

The shadow rate of foreign exchange calculated by this method is based on the ratio of the deficit in foreign trade to the exports and is given by the following expression:

$$P^F = R^F \left(1 + \frac{M - E}{E}\right) \qquad (B.31)$$

where: P^F = shadow rate of foreign exchange

R^F = official rate of foreign exchange

M = value of imports in current accounts expressed in domestic currency

E = value of exports in current accounts expressed in domestic currency.

It must be noted that both imports and exports include visible and invisible receipts and payments in current accounts but not in capital accounts, except for soft loans. Furthermore, only the imports and exports recorded are taken into consideration.

Some corrections may be introduced to account for the actual demand and supply rate, namely the amount of foreign grants and soft loans should be added to the exports in the nominator, thus reducing

the deficit, but not in the denominator, illustrating in such a way the real national availability of foreign exchange.

The above calculation can be carried out on the basis of the past years' data, but an effort should be made to try to anticipate the future changes in demand and supply of foreign exchange, since the projects evaluated will operate in the future. The shadow rate of foreign exchange has to be worked out using the data for a period of five years and finding out the average value of imports and exports for this period. Such data should be available from the five-year national development plan of a country. It is desirable if the rate could be recalculated every year skipping the first and including the sixth year and so on into the calculations in order to get moving-five-year-average estimates.

The values of imports and exports are the main data required for this calculation. Additional data, which might help in identifying the real demand and supply of foreign exchange, may also be called for. The principal sources of data are trade statistics, the balance of payments statistics and national development plans.

6.2.2 Tourist Exchange Rate

If, for any reason whatsoever, the above method is impossible to apply, the evaluator can take recourse to using the tourist exchange rate as the representative shadow rate of exchange for evaluating the projects. The tourist rate of foreign exchange is generally determined by the government on the basis of the prevailing black-market rate of exchange, which reflects to a certain extent the real foreign exchange value of domestic currency.

Use of the tourist exchange rate as shadow rate of exchange will need no calculation. It can be presumed to independently reflect the social value of foreign exchange. The tourist exchange rate is generally higher than the official one and lower than the black-market rate of the foreign exchange.

3. EVALUATION [illegible] AND ANALYSIS WITH UNCERTAINTY

1. Why Uncertainty

The above presentation of the principles of commercial project profitability analysis has been made under the assumption that one has a perfect knowledge of the future whenever information about the future is required for making an investment decision. Facts such as volume of production, size of investment, operating costs, prices, discount rate, life time of the project, to name a few, are all of them of an assumption about a known sequence of future developments. As a result, it was possible to recommend that a project be accepted, modified or rejected.

But in practice there is always uncertainty about the future. It will rarely, if ever, turn out that events occur exactly as forecast. The project evaluator and the decision maker must be realistic. Usually, their knowledge of the future, and sometimes even of the present, is imperfect. Each decision taker now is a product of a set of assumptions concerning the future political and social developments, technological developments, the behaviour of prices of inputs and outputs, and so on. The uncertainty is moreover aggravated by the fact that forecasts are often based on an imperfect knowledge of economic conditions. Even the most modern techniques of economic forecasting cannot eliminate the uncertainty of many factors affecting investment projects.

Virtually all investment decisions are made under conditions which involve some uncertainty. When the decision maker assesses the desirability of a project, he - consciously or unconsciously - evaluates the element of uncertainty inherent in the project, converts this into known risks and decides whether the probability of these risks renders the project acceptable or not.

As stated above, the future is always uncertain. A good choice between projects cannot be made simply on the basis of net present value or net national value added figures without also taking into account how uncertain these calculations are for the alternative projects.

Having made allowance for these uncertainties, especially those having a sizeable impact on the project's profitability, and for other factors outside the scope of economic analysis, project evaluators will have to see that they possibly can to ensure that they recommend the best possible solution. In section 4 below several simple operational methods for making allowance for uncertainty are recommended.

2. Sources of Uncertainty

Each basic variable which enters into the calculation of commercial or national profitability could be a source of uncertainty, even though uncertainty of some variables could have a greater impact than others. Some variables are usually common sources of uncertainty while evaluating investment projects. These variables are: size of investment, operating costs and sales revenue. Each of them is composed of a quantity and a price. In addition, since time is a key element in investment planning, the phasing of a project may prove to be critical to its evaluation. Uncertainties concerning discount rates may also be of crucial importance in project evaluation. A major task of the evaluator is to identify the key variables to which he should apply uncertainty analysis.

It is important to distinguish between uncertainties about the project itself and uncertainties about the environment in which it operates. These two sources of uncertainty usually act together in practice.

3. Causes of Uncertainty

As stated above, uncertainty usually arises because it is impossible to predict the different variables and consequently the magnitudes of benefits and costs exactly as they will occur. One hundred per cent predictability in project analysis is not feasible for many reasons. The most important of these reasons are:

- Inflation, where it is understood that prices of most items, be they inputs or outputs, do move up with time causing changes in relative prices. The exact magnitude of price increases will always be unknown. Prices may change up and down for other reasons, too.

- Changes in technology - both quantities and qualities of inputs and outputs used for project evaluation - are estimated according to the present state of knowledge, yet new technologies might come up in the future to alter these estimates.

- The rated capacity used in project evaluation may never be attained. This in turn will affect operating costs as well as sales revenue.

- It often turns out that the needed investment for both fixed and working capital is underestimated and the construction and running-in periods are considerably longer than expected. This affects the size of investment, operating costs, sales revenue.

Some uncertainties are outside the control of planners; others can be influenced by their policies. The extent of risk associated with an investment project may be reduced either by making advance arrangements for dealing with adversity or by substituting a more risky alternative by a less risky one. However, such a decision is not easy to make because the more risky project may prove to be a more attractive one.

4. Uncertainty Analysis

Several methods for assessing the soundness of a project from both commercial and national points of view were outlined in the preceding sections. The procedure for applying uncertainty analysis is basically the same for all these methods. The application of simple uncertainty analysis to some selected methods of both commercial and national profitability is shown below. The breakeven analysis is recommended as a first step out of the world of certainty and into the world of uncertainty. As a second step, the Manual proposes

sensitivity analysis where instead of one estimate of each variable several estimates are used under varying conditions. Finally, the Manual recommends risk analysis where one can use all the probable values of each variable which have a significant chance of occurrance. It is up to the evaluator to decide how far to go in uncertainty analysis for verifying the calculations obtained under deterministic conditions.

The application of sensitivity analysis is illustrated on the basis of the net present value method. The same procedure would apply to the net value added. Risk analysis is applied to pay-back period as a representative of the commercial profitability methods and to value added absolute efficiency formula.

4.1. Breakeven analysis

Introduction

Breakeven analysis is carried out to establish the lowest production and price levels at which a project can operate without endangering its financial viability. The term breakeven point (BEP) is used to indicate a level of operation at which a project yields neither profit nor loss. This level can be expressed either as a percentage of capacity utilization in physical units or as a volume of sales revenue. The lower the breakeven point, the higher the chances of the project for earning profits and the lower the risk of making losses.

Sometimes there is a choice between two alternatives where one of them may be more economical under one set of conditions and the other more economical under another set of conditions. By altering the value of some of the variables in a given situation and holding constant all the other points of difference between the two alternatives, it is possible to find a value for the variable that makes the two alternatives equally sound. This value may also be described as a break-even point.

Break-even analysis may be particularly useful in a situation where a decision is very sensitive to a certain variable. If the break-even point for that variable (level of capacity utilization, volume of sales) can be calculated, it may be possible to estimate on which side of the break-even point the operations may fall even though there may

be considerable uncertainty regarding the exact value of the variable. Even in this case, however, it is desirable to investigate the range of values of the variable which would permit that alternative to be attractive and to estimate the consequences of its occurring outside that range.

The magnitude of the break-even point depends on three basic aggregated variables: output in physical units, operating costs in physical units, level of prices for output and inputs. Other factors, such as product-mix, input-mix, type of technology, etc., may also affect the break-even point directly or indirectly.

Operating costs can be broken down conditionally into two main groups: fixed costs and variable costs. Fixed costs are independent of actual production. They usually remain constant, regardless of the volume of production, or they increase, but much slower than production volume (depreciation, administrative expenses, etc.). Variable costs are directly related to the level of output. They increase or decrease in proportion to the level of production (raw materials, power, fuel, direct labour inputs, etc.).

The period adopted for the break-even analysis should be clearly specified, i.e. short or long-term, since certain cost items which may be fixed in one case may become variable in the other.

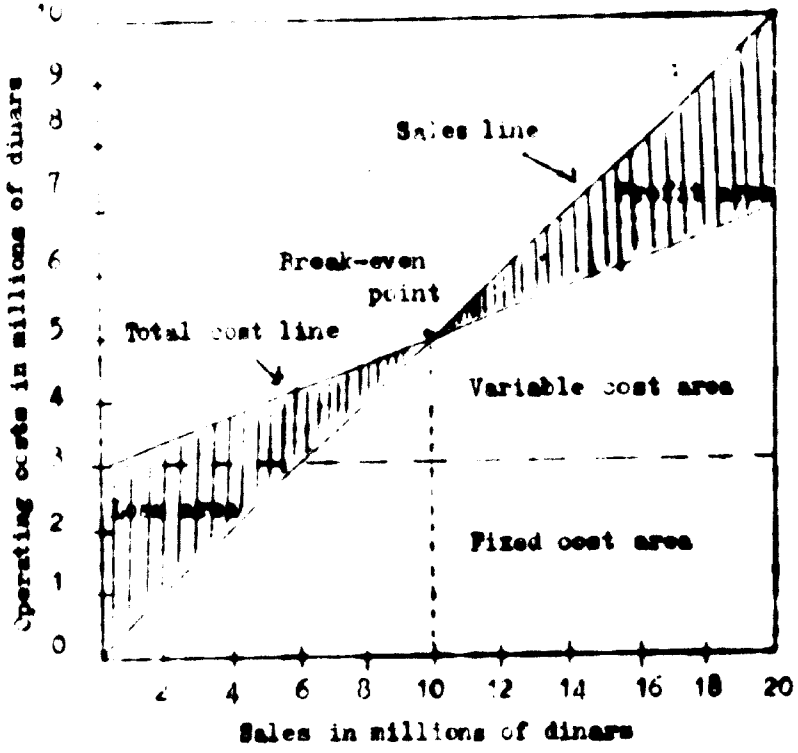
In case there are some saleable by-products, the estimated amount of their sales should be deducted from the total variable cost before starting the calculation of the BEP either graphically or algebraically.

The break-even point of an investment project may be determined graphically and algebraically on the basis of data in any normal year - level of output, of inputs, prices, product-mix, etc. To be meaningful for any extended period, a break-even analysis should be limited to an individual project (plant), with an appropriate grouping of costs and sales records. Output should be measured in some kind of physical units for a product mix that is similar to the current and future mix. Perhaps the best measure of output for a multiproduct project is production valued at a set of constant sales prices for the various products. For instance, an output series from 1980 to 1995 could be

measured by valuing all products through the entire period at their 1980 prices. Of course, if output is in constant dinars, the total cost line must also be in constant dinars. It must be adjusted to eliminate variations caused only by changes in wages and material prices.

The break-even chart indicates the point at which total cost is equal to total revenue. Above this point the project produces profits and below it, losses:

Figure C.1. Break-even Chart



Break-even point can also be determined algebraically either in physical or in value terms. It should be noted that, for practical purposes, the BEP in physical terms can only be applied when the project produces one product. It could also be applied for projects producing several similar products which can be easily converted into a basic product. The following formulae are suggested for this purpose:

a. In terms of physical units:

$$BEP = \frac{FC}{SP - VC} \qquad (C.1)$$

b. In terms of sales revenue:

$$BEP = \frac{FC}{1 - VC/SP} \qquad (C.2)$$

where: BEP - the break-even point in terms of physical units or of sales revenue;

FC - annual total fixed costs including interest charges in a normal operating year;

SP - Selling price per unit of output;

VC - variable costs per unit of output estimated at production level of 100 per cent of installed capacity.

The calculation of BEP involves the following operational steps:

a. Break-even point (in physical units)

Step 1. Estimate total fixed costs for the project (FC).

Step 2. Compute the contribution per unit, which is the difference between the selling price per unit (SP) minus variable costs per unit (VC).

Step 3. Divide the total fixed costs by the contribution per unit computed under step 2 above to arrive at the break-even point in terms of physical units.

Step 4. Divide the figure computed under step 3. above by total installed capacity defined in physical units to arrive at a BEP expressed as a rate of utilisation of production capacity in physical terms.

Assume the pertinent information for a normal operating year to be:

Selling price per unit	2.0 D
Total fixed cost	4,000 D
Variable cost per unit	1.2 D
Installed capacity	10,000 units

Hence:

$$\text{Contribution per unit} = 2 - 1.2 = 0.8 \text{ D}$$

$$\text{BEP} = \frac{4000}{.8} = 5000 \text{ units}$$

BEP as a rate of utilisation of production capacity = $\frac{5,000}{10,000} = 50\%$

b. Break-even point in sales revenue

Step 1. Work out the ratio of variable cost per unit (VC) to selling price per unit (SP) and then find out its residual (1-VC/SP).

Step 2. Divide total fixed cost (FC) by this residual to arrive at the BEP in terms of sales revenue.

Step 3. Divide the figure so computed by the total sales revenue under fully utilised capacity to express the break-even point as a rate of utilisation of the capacity in value terms

In the above example, the ratio of variable cost per unit to selling price per unit is:

$$\frac{VC}{SP} = \frac{1.2}{2} = .60. \quad \text{Then } 1 - \frac{VC}{SP} = 1 - .60 = .40.$$

On these grounds:

$$\text{BEP} = \frac{FC}{1 - \frac{VC}{SP}} = \frac{4000}{.40} = 10,000 \text{ D}$$

Sales revenue at 100 per cent capacity = 10,000 x 2 D = 20,000 D.

BEP as a percentage of maximum possible annual sales is $\frac{10,000}{20,000} = 50\%$.

The break-even point is calculated under the following assumptions:

a. Constant per unit selling price, price of material inputs and variable cost, i.e. it assumes linear functions;

b. Distinction between variable cost and fixed cost is feasible and could easily be made;

c. The project produces a single product, or if it produces several products, the mix could easily be converted into a basic product;

d. The product mix remains constant, or the group of products vary in a given proportion.

In practice, these preconditions seldom hold true and this affects negatively the outcome of the break-even analysis.

4.2. Sensitivity analysis

Sensitivity analysis shows how the value of the efficiency criterion (net present value or net national value added) changes with variations in the value of any variable (sales volume, selling price per unit, cost per unit, etc.). It may be expressed as the absolute change in the efficiency criterion divided by a given percentage or absolute change in a variable or set of variables. Thus, one may say: halving the selling price of the output will make the value added zero. If the value added is sensitive with regard to the variables, the project is sensitive to uncertainties and special care should be devoted to making precise estimates, particularly on those variables whose estimated values may contain significant errors. Sensitivity analysis may be used in early stages of project preparation to identify those variables to the estimation of which special care should be devoted. If value added is insensitive to the value of a particular input or output, the project is said to be insensitive to uncertainties and there is little point in trying to estimate this variable with great precision.

It follows from the above that sensitivity analysis takes account of uncertainty by calculating an efficiency indicator not only using the best estimates of the variables made under conditions of certainty, but also other possible values. For instance, any efficiency indicator may be recalculated using pessimistic or optimistic alternatives to the "normal" or "realistic" estimate(s) applied in the first round under deterministic conditions. Sensitivity analysis provides a better understanding of which variable is in fact crucial to the project's appraisal. Such analysis will also be helpful for those in charge of managing the project later. It will indicate critical areas requiring close managerial attention in order to ensure commercial success of a project.

Let us test the sensitivity of a fictitious project's net present value to alternative investment cost. Assume that in the world of certainty investments were estimated to be 200 D with 100 D spent in

the year zero and another 100 D spent in the year one. This resulted, when combined with other cash flow elements, in a net present value of 83.0.

Assume that due to uncertainty of actual needs and prices of equipment, investment could vary in the range of 180 to 230 dinars. Hence, a total investment of 180 D could be used as an optimistic estimate, and total investment of 230 D as a pessimistic estimate. The calculations of the net present value would change accordingly as follows:

Optimistic estimate:

Year	Annual Investment	Discount Factor	Present Value at 10%
Y_0	(90)	1.00	90.0
Y_1	(90)	.909	81.8
		Present value of total investment	171.8
		Present value of net cash inflow	258.9
		Net present value (NPV)	87.1

Pessimistic estimate:

Year	Annual Investment	Discount Factor	Present Value at 10%
Y_0	(120)	1.00	120.0
Y_1	(110)	.909	108.9
		Present value of total investment	228.9
		Present value of net cash inflow	258.9
		Net present value (NPV)	30.0

Therefore, the net present value of the project is sensitive to changes of investment requirements. It ranges from 30 D under pessimistic assumptions to 87 D under optimistic ones. Yet the project still has positive NPV's under the worst expected circumstances.

The recalculation of the efficiency criterion under alternate assumptions thus demonstrates a project's pronounced sensitivity with regard to uncertainties of estimates. This project may well be

considered risky. Stiff conditions may be attached to the approval of the project such as additional consultants' services or firm assurances on behalf of the government to safeguard critical areas.

Sensitivity analysis may be carried even further by testing profitability under the assumption that the pessimistic alternatives of more than one variable materialise at the same time. For instance, in the above example the pessimistic estimate for investment requirements is 230 D. In addition, sales revenue may also be recalculated under more pessimistic price assumptions with the result that the present value of net earnings may drop from 258.9 D to, say, 210 D. As a consequence, the NPV would turn negative (i.e., -18.9 D) which may render the project altogether unacceptable.

Sensitivity analysis is a suitable simple tool for checking a project's sensitivity with respect to changes in one variable or another. However, the range of estimates for one variable will usually have different probabilities of occurrence. But sensitivity analysis does not guide the investor about the likelihood of those possible values to occur. It does not tell him which of the pessimistic and optimistic values have a higher chance of happening and does not help him sufficiently to evaluate the risk he is taking with the investment. In some situations, sensitivity analysis gives evidence conclusive enough to take a decision: a project may be non-profitable under the best conditions of all variables or alternatively, it may be profitable even under the worst circumstances. However, this will not often be the case. Moreover, some variables are likely to move simultaneously together or in opposite directions. Sensitivity then cannot be analysed by subjecting each variable to one separate recalculation.

4.3. Risk analysis

The purpose of risk analysis is to eliminate the need for restricting one's judgement to a single optimistic, pessimistic or realistic estimation by identifying the possible range of each variable and attaching a probability of occurrence to each possible value of the variables within this range. These judgements take the form of probability distribution - each possible value of each variable is associated with a number between 0 and 1, such that for each

variable the sum of all these numbers (probabilities) is equal to 1. Therefore, from a mathematical point of view, risk analysis consists of aggregating probabilities.

The calculations for each indicator are still carried out in the same manner as before. The only difference is that several values of each indicator are to be calculated along with an estimate of the probability of occurrence for each value. Towards that end, different values of the basic variables and their probabilities are needed in the first place.

In order to demonstrate how risk analysis works in practice, it will be applied to two selected criteria: the payback period (commercial profitability analysis) and the basic national profitability criterion (the absolute efficiency formula). Procedural steps, as outlined in these two examples, may then be applied correspondingly to other indicators.

a. The payback period

Step 1. Assume for a certain project that the following variables are subject to a high degree of uncertainty:

Variable	Expected range of variations
Investment	10,000 - 12,000 D
Fixed cost per annum	3,000 - 5,000 D
Variable cost per unit	1 - 1.25 D
Selling price per unit	2 - 2.2 D
Sales volume per annum	5,000 - 8,000 Units
Economic life of the project	10 - 15 Years

Step 2. Assume next that the investor would narrow down the range of variation of each variable into several likely values. For each of these values he could assign a probability of occurrence as follows (the sum total of the probabilities always adding up to 1):

	Alternatives		
Variable	**A**	**B**	**C**
Investment	10,000	12,000	
Probability	.90	.10	
Fixed cost	3,000	4,000	5,000
Probability	.10	.70	.20
Variable cost	1.00	1.25	
Probability	.75	.25	
Selling price	2.0	2.2	
Probability	.80	.20	
Sales volume	5,000	6,000	8,000
Probability	.30	.60	.10
Economic life	10	15	
Probability	.80	.20	

In addition, the investor has enough evidence that the highest sales volume could only be associated with lowest selling prices. With this information, risk analysis of the project's payback period may be carried out as follows:

Step 3. **For each possible sales volume compile possibilities of total cost along with their chances of occurrence.**

a. **for sales volume 5,000 units (probability .30)**

Total cost alternatives	**Probability**
3000 + 5000 x 1.00 = 8,000	.20 x .75 = .075
3000 + 5000 x 1.25 = 9,250	.10 x .25 = .025
4000 + 5000 x 1.00 = 9,000	.10 x .75 = .525
4000 + 5000 x 1.25 = 10,250	.70 x .25 = .175
5000 + 5000 x 1.00 = 10,000	.20 x .75 = .15
5000 + 5000 x 1.25 = 11,250	.20 x .25 = .05
Total probability of alternative costs when sales 5000	1.00

b. **for sales volume 6000 units (probability .60)**

Total cost alternatives	**Probability**
3000 + 6000 x 1.00 = 9,000	.10 x .75 = .075
3000 + 6000 x 1.25 = 10,500	.10 x .25 = .025
4000 + 6000 x 1.00 = 10,000	.70 x .75 = .525
4000 + 6000 x 1.25 = 11,500	.70 x .25 = .175
5000 + 6000 x 1.00 = 11,000	.20 x .75 = .15
5000 + 6000 x 1.25 = 12,500	.20 x .25 = .05
Total probability	1.00

c. for sales volume 8000 units (probability .10)

Total cost alternatives	Probability
3000 + 8000 x 1.00 = 11,000	.10 x .75 = .075
3000 + 8000 x 1.25 = 13,000	.10 x .25 = .025
4000 + 8000 x 1.00 = 12,000	.70 x .75 = .525
4000 + 8000 x 1.25 = 14,000	.70 x .25 = .175
5000 + 8000 x 1.00 = 13,000	.20 x .75 = .15
5000 + 8000 x 1.25 = 15,000	.20 x .25 = .05
Total probability	1.00

Step 4. Estimate alternative sales revenue along with their respective probabilities:

Sales volume	Prob.	Selling price	Prob.	Sales revenue	Prob.
5000	.30	2	.80	10,000	.24
5000	.30	2.2	.20	11,000	.06
6000	.60	2	.80	12,000	.48
6000	.60	2.2	.20	13,200	.12
8000	.10	2	1.00	16,000	.10
Total probability of all possible sales revenue					1.00

Notice that sales volume 8000 is only associated with selling price of 2 D per unit whose probability will be 1, as presumed.

Step 5. Combine total cost and sales revenue relevant to each case to get alternative profits along with their probabilities. This is shown in Table C.1

Step 6. Estimate the expected profit ty totalling profit alternatives weighed with their respective chances of occurrence. This is shown in the last column of Table C.1.

Comparison of this expected profit with profit in the deterministic case, i.e. by using the most likely alternative of each variable, indicates how far one is off track when one adopts the deterministic approach for this particular project. In the example it is:

Most likely sales revenue 6000 x 2 = 12,000 D
its probability .60 x .80 = .48

most likely fixed cost 4000 D
its probability .70

most likely variable cost 6000 x 1 = 6000 D
its probability .75

profit 12,000 - 4,000 - 6,000 = 2,000 D
its probability .48 x .70 x .75 = .252.

Table C.1

Sales volume	Sales revenue	Prob.	Total cost	Prob.	Profit	Prob.	Profit and probability
5,000	10,000	.24	8,000	.075	2,000	.018	36
			9,250	.025	750	.006	4.5
			9,000	.525	1,000	.126	126
			10,250	.175	- 250	.042	- 10.5
			10,000	.15	0	.036	-
			11,250	.05	-1,250	.012	- 15
5,000	11,000	.06	8,000	.075	3,000	.0045	13.5
			9,250	.025	1,750	.0015	2.625
			9,000	.525	2,000	.0525	63
			10,250	.175	750	.0105	7.875
			10,000	.15	1,000	.0090	9
			11,250	.05	- 250	.0030	- .75
6,000	12,000	.48	9,000	.075	3,000	.0360	108
			10,500	.025	1,500	.0120	18
			10,000	.525	2,000	.2520	504
			11,500	.175	500	.0840	42
			11,000	.15	1,000	.072	72
			12,500	.05	- 500	.024	- 12
6,000	13,200	.12	9,000	.075	4,200	.009	37.8
			10,500	.025	2,700	.003	8.1
			10,000	.525	3,200	.063	201.6
			11,500	.175	1,700	.021	35.7
			11,000	.15	2,200	.018	39.6
			12,500	.05	700	.006	4.2
8,000	16,000	.10	11,000	.075	5,000	.0075	30
			13,000	.025	3,000	.0025	6
			12,000	.525	4,000	.0525	168
			14,000	.175	2,000	.0175	42
			13,000	.15	3,000	.015	36
			15,000	.05	1,000	.005	4
Total probability of all possible profit alternatives						1.00	
Expected value of profits							1602.25

Note that this profit which results from the combination of the most likely values of each variable has only a 25.2 per cent chance of occurrence.

Step 7. As stated in Section A. Commercial Profitability, the expected payback period (P) is the number of years which makes:

$$K = \sum_{t=0}^{P} E_t$$

where: K = total investment

E_t = annual net profits in the t^{th} year

The expected payback periods when K=10,000 D and when K=12,000 are:

10,000 = 1,602.25 x 6.24 years
its probability = .90

12,000 = 1,602.25 x 7.48 years
its probability = .10

Therefore, the expected payback period considering the uncertainties about the investment K is:

P = 6.24 x .90 + 7.48 x .10 = 6.36 years.

The same result could be obtained by dividing expected investment by average expected annual profits, where expected investment is:

K = 10,000 x .90 + 12,000 x .10 = 10,200 D

$$P = \frac{10,200}{1602.25} = 6.36 \text{ years}$$

The most probable payback period is, therefore, 6.36 years. If the payback period is the preferred indicator of commercial profitability, an investment decision with due regard to risk should be based on expected 6.36 years.

b. Basic value added criterion (absolute efficiency test)

Step 1: The key elements which enter this criterion have to be scrutinized in order to determine those variables which (a) are subject to pronounced uncertainty and (b) whose change would greatly affect the value of E. In the following example it was assumed that

- domestic sales prices
- prices of imported inputs and
- the shadow rate of foreign exchange

fall into this category with the latter affecting foreign components of both inputs and outputs.

Step 2: Assume that sales revenue during the first year of operation priced according to the rules given above in the national profitability section is 11,000 D. Assume further that due to great uncertainties in the local market this sales revenue is expected to be 11,000 D in only 60 cases out of 100, 10,000 in 30 cases out of 100 and 10,500 in 10 cases out of 100. Assume further that the foreign component of sales revenue is about 2,000 D. The shadow rate of foreign exchange is estimated to be 1.5 in 80 per cent of the cases and 1.3 in the remaining 20 per cent.

Step 3: Compute different values of output (= sales revenue) together with the respective probabilities of occurance, making sure that the sum total of probabilities equals one:

Sales Revenue			Foreign Exchange		Adjusted Sales Revenue	
Local	Prob.	Foreign	Price	Prob.	Value	Prob.
8000	0.30	2000	1.3	0.20	8,000 + 2,000 x 1.3 = 10,600	0.30 x 0.20 = 0.06
8500	0.10	2000			8,500 + 2,000 x 1.3 = 11,100	0.10 x 0.20 = 0.02
9000	0.60	2000			9,000 + 2,000 x 1.3 = 11,600	0.60 x 0.20 = 0.12
8000	0.30	2000	1.5	0.80	8,000 + 2,000 x 1.5 = 11,000	0.30 x 0.80 = 0.24
8500	0.10	2000			8,500 + 2,000 x 1.5 = 11,500	0.10 x 0.80 = 0.08
9000	0.60	2000			9,000 + 2,000 x 1.5 = 12,000	0.60 x 0.80 = 0.48
						1.00

Hence, the least risky expectation as regards sales revenue (output) is equal to:

Output = 10,600 x 0.06 + 11,100 x 0.02 + 11,600 x 0.12 + 11,000 x 0.24 + 11,500 x 0.08 + 12,000 x 0.48

= 11,570

Step 4: Assume also that the lifetime of the project is five years and compute probable outputs for the other four years in the same manner as above. This may yield 12,000, 12,000, 12,600 and 12,800 D respectively.

Step 5: Assume further that material inputs priced properly as outlined above were estimated for the first year of operation to be 4,000 D. Due to uncertainties concerning the C.I.F. prices the imported portion of the inputs was estimated to be 500 D in 20 per cent, and 600 D in 80 per cent of the cases.

Applying the shadow rate of foreign exchange, one gets the following alternatives on inputs value:

Inputs			Foreign Exchange		Adjusted Inputs	
Local	Foreign	Prob.	Shadow Rate	Prob.	Value	Prob.
3,400	500	0.20	1.3	0.20	4,050	0.04
3,400	600	0.80			4,180	0.16
3,400	500	0.20	1.5	0.80	4,150	0.16
3,400	600	0.80			4,300	0.64
						1.00

Therefore, the expected value of material inputs (MI) during the first year of operation is:

$$MI = 4050 \times 0.04 + 4180 \times 0.16 + 4150 \times 0.16 + 4300 \times 0.64$$

$$= 4246.8 \text{ D}$$

Expected material inputs for the following four years were computed in the same manner, resulting in the following estimates: 4500, 4700, 4800 and 5000 D.

Step 6: By further introducing investment cost into the analysis and assuming a construction period of two years (year 0: 2,000 D; year 1: 1,000 D), the present worth of the net value added most likely to be attained with the project can now be worked out as follows:

Year	Value of Output (O_t)	Value of Material Inputs (MI_t)	Value of Investment (I_t)	Net Value Added (VA_t)	Discount Factor at 10 per cent (a_t)	Present Worth of Net Value Added ($VA_t \cdot a_t$)
0	-	-	2,000	-2,000	1.000	-2,000
1	-	-	1,000	-1,000	0.909	- 909
2	11,570	4,247	-	7,323	0.826	6,049
3	12,000	4,500	-	7,500	0.751	5,633
4	12,500	4,700	-	7,800	0.683	5,327
5	12,600	4,800	-	7,800	0.621	4,844
6	12,800	5,000	-	7,800	0.564	4,399

$$\sum_{t=0}^{6} VA_t \cdot a_t = 23\,343\,D$$

Step 7: Since uncertainty with regard to wages is considered relatively insignificant, the expected annual wage will enter the analysis without further adjustments.

Year	Annual Wages (W_t)	Discount Factor at 10 per cent (a_t)	Present Worth of Total Wages ($W_t \cdot a_t$)
0	-	1.000	-
1	-	0.909	-
2	1,000	0.826	3,304
3	4,500	0.751	2,380
4	4,500	0.683	3,074
5	5,000	0.621	3,105
6	5,000	0.564	2,820

$$\sum_{t=0}^{6} W_t \cdot a_t = 15,683 \text{ D}$$

Step 8: Applying the absolute efficiency test (formula B.10), one gets:

$$\text{E} = 23,343 \text{ D} - 15,683 \text{ D} = 7,660 \text{ L}$$

Since E is positive, the project is expected to yield a social profit even if risks involved in its implementation are taken into account.

4.4 Common Operational Steps of Uncertainty Analysis

Uncertainty analysis of any criterion could be facilitated if the following common operational steps are followed:

1. Identify the key variables, which are expected to have large magnitudes and high variabilities and therefore a sizeable impact on profitability.
2. For each variable estimate the different likely values which have significant chances of occurance.
3. Assign probabilities of occurance to each value based on experience, expectations as well as market and financial analysis.

4. Combine the alternative values of relevant variables as well as their respective probabilities to get the probability of occurance of each outcome as outlined above for each measure.

5. Data Requirements

Project analysis under deterministic and uncertainty situations requires the same type of information. The additional information required for sensitivity and risk analysis centres mainly around estimating several possible values for each relevant variable and assigning probabilities of occurance to each of these values

6. Scope, Limitations and Conditions of Uncertainty Analysis

The essence of introducing uncertainty to project evaluation is to introduce into project analysis as much as possible the realities of life concerning future behaviour of relevant variables Realizing that several values are likely and estimating them and their probabilities of occurance using some value judgement, may be more accurate than completely ignoring them and imposing just one estimate for each variable as in the deterministic analysis.

However, uncertainty analysis requires more elaborate computations as compared to the deterministic case The computational work will vastly increase as the number of possible values of each variable increases. One could cut down the volume of computations by concentrating only on the most important variables, risk-wise, judging from their values and their probability distributions

The additional effort required for uncertainty analysis has to be justified by the additional benefits of introducing it. The higher the uncertainties concerning some variables, and the larger their ranges are, the higher the benefits and the more urgent it is to introduce this analysis to the evaluation of an investment project.

D. EVALUATION SUMMARY

Criteria[1]	Evaluation Results[2]
I. Commercial Profitability	
1. Simple rate of return	.....
2. Net present value	.....
3.	.....
4.	.....
	General Conclusions on Commercial Profitability:
	.....
	.....
II. National Profitability	
1. Net national value added formation:	
1.1. Absolute efficiency test	.....
1.2. Relative efficiency test	.....

1/ Under criteria the evaluator should list the criteria actually used for evaluating an investment project's commercial and national profitability under conditions of both certainty and uncertainty. The listing of the criteria here is for illustrative purposes only.

2/ The evaluator should briefly explain the most essential evaluation results to give to the decision maker in a very condensed way an idea about the merits and demerits of the project and a justification for its being recommended for selection, modification or rejection.

2. Additional indices:

2.1. Employment effect .....

2.2. Distribution effect .....

2.3. Foreign exchange effect .....

2.4. ....

3. Supplementary considerations

3.1. Infrastructure implications .....

3.2. Environmental implications .....

3.3. ....

General Conclusions on National Profitability:

.....

.....

III. Uncertainty Analysis

1. Break-even analysis .....

2. Sensitivity analysis .....

3. Risk analysis .....

General Conclusions on Uncertainty:

.....

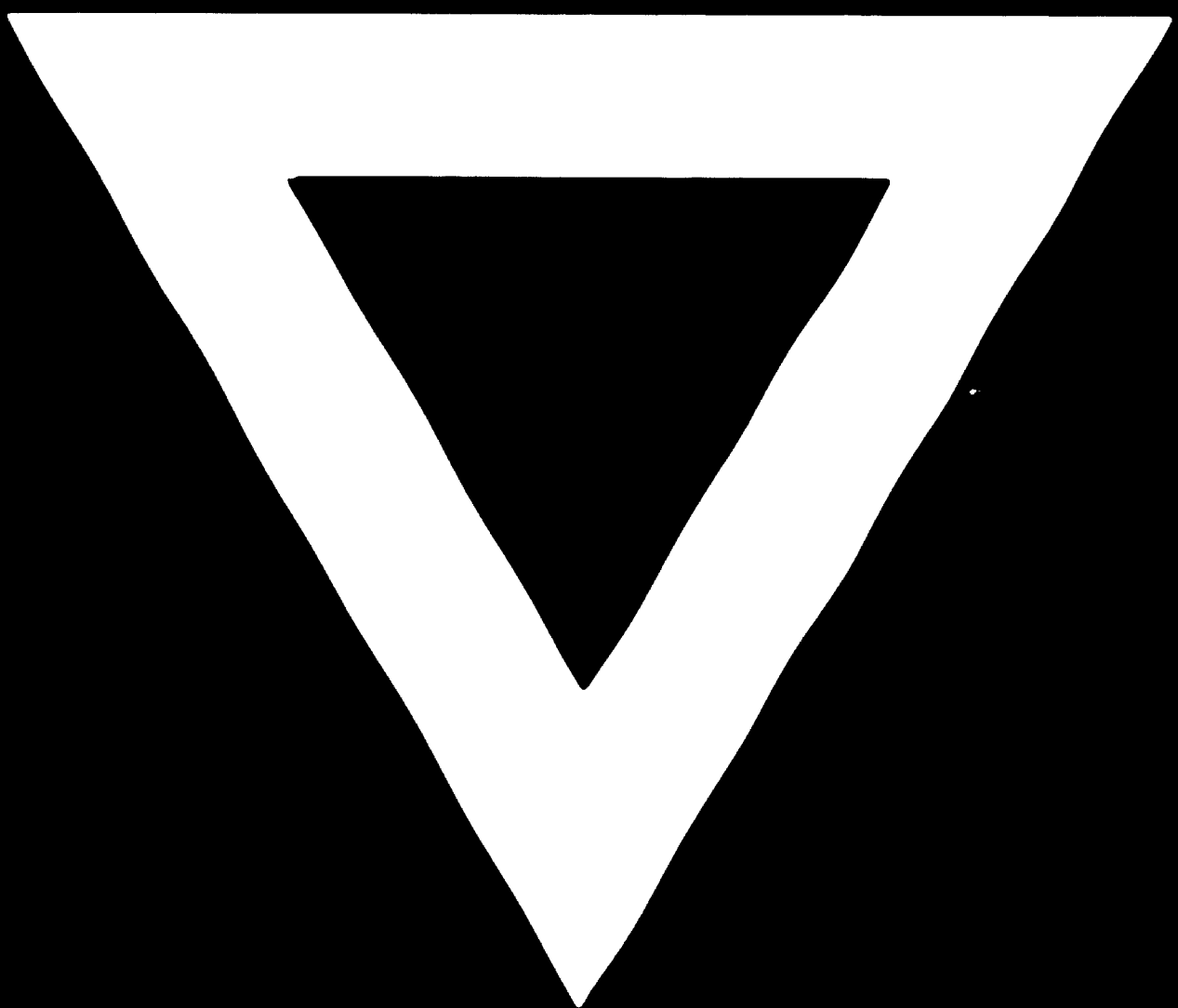
.....

The project is recommended for:

☐ selection because .....
.....

☐ approval if modified as follows: .....
.....

☐ rejection because .....
.....



76.05.04