MANUAL FOR EVALUATION OF INDUSTRIAL PROJECTS

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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Prepared jointly by the United Nations Industrial Development Organization and the Industrial Development Centre for Arab States

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INDUSTRIAL DEVELOPMENT ORGANIZATION
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The description and classification of countries and territories in this study and the arrangement of the material do not imply the expression of any opinion whatsoever on the part of the secretariats of UNIDO and IDCAS concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries, or regarding its economic system or degree of development.

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Foreword

In the Lima Declaration and Plan of Action on Industrial Development and Co-operation, the international community in 1975 expressed its intention that the developing countries should attain at least 25 per cent of world industrial production by the year 2000. Five years later, that same community, in the New Delhi Declaration and Plan of Action adopted by the Third General Conference of UNIDO, re-emphasized the great socio-economic benefits to the world of achieving that target. All assessments of the cost of achieving the Lima target agree that it would involve thousands of billions of dollars of investments, opinions vary as to just how many thousands.

Because of the vastness of the human and capital resources involved, every industrial investment project should be scrutinized to determine its real contribution to the global target and to the welfare of the country. The proverb "Measure three times before cutting" applies with even greater force to investment projects. The larger the amount of investment, the more important it is to avoid inappropriate decisions, the "price" the community has to pay for errors resulting from bad investment decisions is proportional to the size of the investment.

That is why the secretariats of IDCAS and of UNIDO decided to co-operate in the preparation of this Manual for Evaluation of Industrial Projects, *which represents the culmination of the joint activities of our two organizations in this field. We hope that the operational step-by-step methodology advocated in this Manual, which should be used in conjunction with the* Manual for the Preparation of Industrial Feasibility Studies *produced by UNIDO in 1978, will help project evaluators in developing countries to prepare economically sound industrial investment projects.*

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Director General, IDCAS

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Executive Director, UNIDO

Preface

This Manual represents the culmination of the experience gained by the United Nations Industrial Development Organization (UNIDO) and the Industrial Development Centre for Arab States (IDCAS)* in the field of project evaluation. The idea of drafting a Manual providing an operational step-by-step methodology for industrial project evaluation was put forward by the participants in the Joint UNIDO/IDCAS Regional Workshop on Project Evaluation held in December 1972 at Cairo, Egypt. On the recommendation of this Workshop, UNIDO and IDCAS undertook to develop an operational manual which developing countries could use for evaluating industrial projects as an integral part of their overall industrial planning.

The Manual was prepared by a group of senior experts on the subject, comprising staff members of UNIDO and IDCAS as well as outside consultants.

Throughout the preparation of the Manual, concepts and drafts were presented and tested at national training workshops on project evaluation held in Somalia, Sudan, Democratic Yemen and Yemen, and in regional workshops held at Cairo in January 1976 with participants from Egypt, Iraq, Libyan Arab Jamahiriya, Sudan and the Syrian Arab Republic, at Amman, Jordan in August 1976 with participants from Bahrain, Jordan, Saudi Arabia and Yemen, and at Tunis in October 1977 for participants from Algeria, Morocco and Tunisia. The Manual was published in Arabic in 1977 and has been widely used through the Arab countries. A reprint in Arabic is expected soon.

The authors of the Manual kept in mind that their task was to develop a simple operational step-by-step methodology which could be applied in everyday practice by an average qualified project evaluator, with an average availability of data, taking into account also other limitations existing in developing countries.

The Manual differs from the *Guidelines for Project Evaluation,* published by UNIDO in 1972, and the Manual on *Industrial Project Analysis in Developing Countries,* published by the OECD in 1968, conceptually and in the simplicity of its approach. It is felt that the concept and the operational step-by-step approach advocated here are more realistic as compared with the more theoretical treatment of the above-mentioned publications. Practical experience, however, will be the ultimate test, and the project evaluators from developing countries will be the final judges of its applicability and usefulness.

*The Industrial Development Centre for Arab States (IDCAS) was established by the League of Arab States in 1969, with the objective of promoting and accelerating industrial development in the Arab region. It enjoys the membership of all Arab countries, members of the League of Arab States (22 countries) and has a consultative status with the United Nations Industrial Development Organization (UNIDO) and a number of international organizations. Address: 5, rue Robespierre (Mohamed V), Tunis, Tunisia. Cable address: IDCASAL, telex: 13179 TN; telephone: 891-322.

Any project evaluator, regardless of the methodology he uses, must rely on a certain amount of intuition and judgement accumulated through experience This Manual, as any other manual, cannot serve as a substitute for these requisite qualities It is hoped, however, that as a guide it will help to reduce the scope of subjective judgement in project evaluation

The authors are grateful to all the colleagues who commented on drafts of the Manual

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EXPLANATORY NOTES

A monetary unit, one dinar, has been selected for use throughout this Manual for illustrative purposes. It is an accounting monetary unit only and, except for its name, has nothing in common with the same unit of currency being used in some developing countries.

The following abbreviations are used in the Manual

IBRD	International Bank for Reconstruction and Development (World Bank)
IDCAS	Industrial Development Centre for Arab States
OECD	Organisation for Economic Co-operation and Development
UNCTAD	United Nations Conference on Trade and Development

The following technical abbreviations and symbols are used in the Manual

ACIF	Actual cost insurance and freight price
AFOB	Actual free on board price
BEP	Break-even point
c.i.f.	Cost, insurance, freight
E_{FE}	Relative efficiency under foreign-exchange scarcity situation
E_L	Relative efficiency under skilled-labour scarcity situation
f.o.b.	Free on board
SRD	Social rate of discount

The following forms have been used in tables

Three dots (. . .) indicate that data are not available or are not separately reported
A dash (—) indicates that the amount is nil or negligible
A blank indicates that the item is not applicable
A minus sign before a figure (—2) denotes a deficit or decrease, except as indicated
Parentheses around a figure indicate a minus amount.
t_0, t_1 etc. mean year 0, year 1 etc.

Introduction

1 Objective of the Manual

The quest of developing countries for economic and social progress inevitably involves the basic problem of the most rational use of limited resources, such as labour, managerial and administrative talent, capital, foreign exchange and natural resources, to yield the best economic results Each country has its own development objectives and this in turn requires that the resources be marshalled and judiciously allocated in order to attain these objectives The use of resources which are limited to attain one objective implies their reduced availability for other objectives If resources are used efficiently, the number of objectives that can be pursued simultaneously increases. Development planning therefore requires the fixing and ranking of objectives and the efficient allocation and use of scarce resources Once objectives are established and ranked for a certain period, individual investment proposals should be scrutinized to determine whether and to what extent they can contribute to 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 A main objective of this Manual is to help to improve investment decisions in developing countries in three respects the selection, modification and rejection of investment proposals The criteria presented here are designed first of all to facilitate the choice of projects that will meet the national objectives most effectively Secondly, they should aid in the modification of projects in order to make their contribution more positive And, thirdly, they should assist in the decision to reject projects which, even after modifications, cannot adequately serve the national objectives The application of the criteria should answer not only 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 theory and practice in project evaluation This applies to commercial profitability, but it is particularly marked so far as national profitability is concerned The literature on national cost-benefit 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 great that there is no common language While theory offers more and more elegant, sophisticated techniques, since these techniques are not applied, the gap continues to grow

Another objective in drafting this Manual was to help narrow this gap by suggesting a consistent, relatively simple, easily understandable, operational step-by-step approach for national profitability analysis in developing countries The authors are convinced that it is better to offer an operational methodology for approximate assessment of the soundness of a project with an acceptable degree of

precision than to recommend highly sophisticated procedures which it is claimed can measure comprehensively all the effects of a project but which cannot be put into operation

The problem of the absence or shortage of explicit and workable criteria for project evaluation in most developing countries came into focus at various training workshops for project evaluators from developing countries. The suggestions of the participants have always pointed to the need for an operational manual for project evaluation which could be easily understood and applied in these countries in view of their present technological constraints and difficulties in obtaining data The main concepts presented here have, therefore, been subordinated to the prevailing conditions in the developing countries in terms of skills, availability of data, time pressures etc. The attempt is made, where possible, to synthesize some major approaches, ideas and criteria of project evaluation that would benefit project evaluators in these countries

Simplicity was the aim in preparing the Manual, which is based on the 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 The purpose of this approach is not to measure with great accuracy all direct and indirect effects that a project may have on the economy, but to measure or take into account only those effects that may have an impact on the final investment decision to accept, modify or reject a project. What really matters is to determine if a project is acceptable, not how acceptable it is.

The above-stated objectives can be achieved only if the authorities concerned in a developing country are willing to ensure that the formulation, evaluation and selection of investment projects shall be based on a certain minimum elementary reasoning and not be the result of an arbitrary rubber-stamp exercise carried out on the instruction of a decision maker to the project evaluators to "prove" efficient, by consistent scientific methods, an investment proposal that they want to implement for one reason or another Any project evaluation methodology can be easily discredited and its usefulness negated if there is not the will to apply it properly Project evaluation techniques do not solve problems automatically or easily. They can only aid those who actually wish to take well-founded investment decisions If such reasoning and logic were not used, even the most comprehensive methodology for cost-benefit analysis would be fruitless and the project evaluation exercise would be a waste of time

The Manual is not intended as a textbook It could, if supplemented by appropriate reading material, however, be of value in the education of economists, accountants, financial analysts, engineers and other professionals in the methodology of cost-benefit analysis

2. Scope and applicability of the Manual

Project evaluation touches on a wide range of questions market analysis, appraisal of technical feasibility, adequacy of financial arrangements, management and staffing, legal conditions etc. These aspects come within the scope of the Manual only indirectly, however, to the extent that they affect a project's commercial and national profitability The Manual is mainly concerned with a project's profitability

from the point of view of the enterprise on the one hand and of the country as a whole on the other. It provides a step-by-step approach to an assessment of the financial and economic impact of an investment proposal

The methodology proposed is intended mainly for use in evaluating the economic effects and only some of the social effects of an investment project A project has other aspects, too, such as a wide range of social ramifications, and political, national security, ecological, demographic and other implications All these aspects, along with the economic effects, 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, to whom the Manual is addressed The project evaluators should, however, inform the decision makers about the economic "price", the economic and other implications of political decisions

The Manual is designed to apply to industrial projects No limits are set as regards the kind of industrial branches that can be included It may also be applied to projects in the services sector, in the fields of transport, electricity, communications etc , after appropriate adaptations Basically, the approach to evaluation will be the same irrespective of the industrial branch, there may, however, be some differences in the computation procedures from one branch to another An understanding of the criteria that determine an investment's commercial and national profitability will also permit the evaluator to judge its applicability in border cases

The Manual is by no means intended to be a handbook only for the public sector, as will be stressed again later Although private entrepreneurs tend to make their investment decisions primarily on the basis of simple commercial profitability criteria, they use some national resources and at one point or another they have to approach the Government and its agencies for financing, import licences and assorted permits and to utilize the national utilities such as power and transport As there is need for a better understanding between the government authorities, industrialists, bankers and consultants and a common concern for the plans and development objectives, a Manual of this kind, if widely distributed and easily understood by professionals in government and industry, should contribute towards this end

The Manual is designed to provide developing countries with an operational methodology for industrial project evaluation. These countries differ considerably in terms of their levels of development, socio-economic systems, objectives and priorities, decision-making mechanisms, resource endowments, availability of data and skills of project evaluators For this reason the scope of the Manual obviously has to be fairly broad in comparison with national manuals for project evaluation A country that is sparsely populated but that commands rich natural resources faces different obstacles to development compared with a country having problems of a pressing population and an unfavourable balance of payments Again, alternative approaches to economic advancement will be necessary where neither human nor natural resources are abundant

The Manual does not advocate the use of a single indicator for assessing commercial or national profitability, and does not attempt to combine various aspects of national profitability into one global comprehensive criterion Such an attempt would require weighing different indicators and would imply that both the selection of, and the weights given to, specific indicators would be equally relevant for all developing countries For this reason the Manual provides a set of indicators each of which is associated with a specific national objective It is up to the

evaluating agency to determine, by recourse to national development plans or other sources of information about national priorities, the objectives and their relative importance to be served by an investment proposal The Manual sets out the methods that 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 with other alternatives The evaluating agency can as well rank the different indicators and assign them relative importance consistent with the development objectives to facilitate the decision of whether a project should be undertaken in the light of its evaluated merits and demerits

The Manual contains both 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 The methodologies and techniques prescribed can be applied irrespective of the methods of planning and levels of decision making, whether these are 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 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 provide readily calculated national parameters needed for the evaluation of projects, this would be impossible in dealing with all developing countries The competent national authority should calculate the national parameters on the basis of the specific conditions in each country at a given period To do so they need a methodology The authors cover these aspects and also suggest alternative methods that the national agency can use to select the most appropriate one to suit the actual conditions in the country

The Manual presents 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

Before a definition is given of an investment project as conceived in the Manual, it may be worthwhile to clarify explicitly the use of such terms as "evaluation", "appraisal", "assessment" and "selection" No differentiation is made between evaluation, appraisal and assessment In practice, these terms are used in analysing the soundness of an investment project, i.e in an *ex-ante* analysis of the effects of a determined course of action The analysis is based on projecting, forecasting in the future, on the expected course of events, it 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 clear enough post-investment evaluation, post-mortem evaluation, performance evaluation This analysis relies on actual data characterizing the past and present operation of existing production units The term "selection" is used in the Manual only when referring to a decision to implement, modify or reject a project Selection usually also takes into account factors that are not explicitly considered in the process of evaluation Selection is a prerogative of the decision makers, and it should be based along with other considerations on recommendations submitted by the project evaluators

The Manual can be used as a basis for drafting national manuals for project evaluation in any developing 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 establish the numerical values of the various national parameters, the correction factors needed for adjusting prices and other relevant 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 basis for the national manuals

3 Definition of an investment project

A project is a proposal for an 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 its evaluation should be possible in all these forms If a project is combined with others in 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 the macro-type of assessment of entire sectors or subsectors

The construction of a new warehouse may not qualify as a project because even though it could be distinguished technically from the remainder of the factory, its functions are so closely interrelated with already existing parts of the plant that its commercial and social impact cannot reasonably be separated On the other hand, the replacement of a fleet of delivery lorries by a railway siding with associated loading equipment may be a project because savings in transport costs connected with the measure could 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 a national profitability analysis It may well be, however, that domestic cotton commands high prices in the export market whereas the staple cloth 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 or should be appraised separately

4 Major types of investment projects to which the Manual applies

The Manual focuses on the evaluation of industrial projects in the manufacturing, power-generating and extractive sectors in order to compare and evaluate alternative variants of technology, of raw materials to be used, of production capacity, of location, of local production versus import, of international industrial specialization and of international co-operation from the point of view of one country

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 for which the benefits are predominantly non-quantifiable, although there are certain methods for their measurement when possible Evaluation of projects within these sectors may be handled best by cost-effectiveness techniques Because of the difficulties of valuing the outputs, the analysis may be done on a "least-cost" basis

The Manual is also applicable to projects for modernization and expansion if the aforementioned principles are observed If the expansion can be distinguished technically, commercially and economically from the already existing facilities, its 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 production processes with forward and backward linkages Or the expansion may lead to a broader line of products manufactured by the company The Manual contains a special section on evaluation of modernization and expansion projects

The question of how to evaluate projects that are multinational is an interesting issue Such projects could, of course, be evaluated strictly for their commercial profitability without difficulty These projects could also be easily evaluated from the social viewpoint of one country at a time It would be much more difficult, however, to evaluate such projects from the overall social viewpoint of all participating countries taken together The evaluation of multinational investment projects is beyond the scope of this Manual

5 Public- and private-sector projects

The necessity of evaluating commercial and national profitability of an industrial project applies to both the private and the public sectors Although a manual of this kind would normally be used mainly by government agencies, it should be of help to private investors, too Although private investors cannot be expected to be concerned mainly with a calculation of national profitability, a national profitability analysis would be useful in the case of a private-sector project since it would assist government agencies if they have to approve it or to extend financial assistance to it In such cases indicators of national profitability will be important in making the decision on the project

The need for thorough project evaluation 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 necessary in order to determine the magnitude of such subsidies beforehand so that they can be properly incorporated in the budgeting procedure Some public-sector projects may be undertaken even though they are not judged suitable from the point of view 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

Both commercial and national project evaluation should be carried out in the public sector not only for fiscal reasons. The process of analysing a project's financial and social implications is in 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 To encounter such parameters on a micro-economic 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 reveals more to a decision maker about the conditions for development than the mere acknowledgement of the results of an evaluation Policy makers in the public sector who bear more responsibility for shaping these conditions than anyone else should share the educational experience of such project evaluation

6. Summary of the main contents of the Manual

Chapter I is designed to provide in a highly condensed form a basic justification for the methodology for project evaluation that has been adopted, and enumerates essential features of the Manual. Only a very limited number of explicit references are made to other publications on project evaluation simply because this is an operational manual and not a comparative theoretical analysis of the numerous alternative techniques for project evaluation available in the literature on economics and management

The chapter concludes with a set of model formats which are used throughout the Manual and which indicate the most essential information needed for project evaluation and how it should be organized

Chapter II, the main body of the text, contains the major criteria and indices of commercial and national profitability These are treated first under the condition of certainty The last section of the chapter gives a brief outline of the techniques of project evaluation under uncertainty and their application under various conditions A simple illustrative example is developed throughout the Manual as an aid to understanding the operational methodology.

The annex is a present value table with instructions on its use

I. The concept of project evaluation adopted by the Manual

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 project, and the real value of the projects cannot be properly ascertained without the framework of a plan The national plan sets out 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 on the consequent sectoral programmes Project formulation and evaluation, which is a continuous integrated process, is one of the basic components of economic planning

In the elaboration of pre-feasibility and feasibility studies, the parameters of investment projects, such as output, investment requirements, manpower, material inputs and foreign-exchange requirements, appear

National and sectoral plans also have their parameters output, investment, manpower, material inputs, balance of payments etc These parameters are elaborated on the basis of general coefficients, past experience, comparative analysis, expert appraisal, input-output analysis etc The parameters of the plan are an aggregation at the macro-level of the respective parameters of a number of individual investment projects and of existing production units. The relationship between the parameters at the project, sectoral and national levels is usually traced through the balances, such as simple commodity, investment and manpower balances or input-output balance sheets.

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

Owing 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 are essential for successful planning. The 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 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

(a) 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,

(b) 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

Project development is an integrated process carried out in several consecutive phases which may be condensed into three stages project preparation, its evaluation and implementation It is extremely important to point out that all three are closely interrelated and that the ultimate success of an investment decision depends equally on each of them

Project preparation itself consists of a series of interdependent measures with the aim of translating an idea into an operating project This is done in different stages

Identification
Preliminary selection
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 the 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 etc All ideas for projects are valuable and may 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 decide whether a project idea should be studied in detail and what the scope should be 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 an investment promoter, e.g. a ministry or development agency It is prepared on the basis of data that are available in published form or that can be easily 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 function of the *formulation 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 supporting data in a systematic and logical order This is done through partial (technical, management etc) or complete techno-economic feasibility studies

The complete feasibility study is the final document in the formulation of a project proposal. On the basis of this study a decision to implement and finance the project will be taken

The feasibility study should contain all technical and economic data that 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 cannot complain of the lack of data or imperfect analysis and, on the other, the decision maker cannot find anything hidden or missing. Accumulation and presentation of all technical and economic facts in a true and complete picture should be the main objective of this study

The complete feasibility study is carried out by a consulting engineering firm, by a foreign supplier of equipment or by a potential investor who has 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 suggests a set of model formats for the information most necessary 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 national project evaluation can be limited to checking assumptions, quantities, prices and the parameters of such feasibility studies with very little original work left to be done This would add efficiency and expedition to the usually protracted process of project preparation and evaluation Needless to say, the investors would appreciate such an approach.

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 evaluation is a systematic procedure for weaving the technical and financial information about the project, with relevant data about its economic environment, together into one or a few criteria on the basis of which the project is recommended for selection, modification or rejection This procedure, however, does not mean 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 related. An overall economic evaluation is carried out only on the basis of data provided at the end of the formulation stage

Interest in the technique of project evaluation has expanded significantly in recent years. Countries at various stages of development with different types of economic systems are seeking the 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 indispensable, though sometimes a rather elaborate, task is the existence of alternative economic opportunities for the commitment of resources, since the selection of a project would be considered rational only if that project is superior in some respect to others. Its superiority could be based on commercial profitability, i.e the net financial benefits accruing to

the owners of the project, or on 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

(a) Firstly, the identification of the quantity, quality and timing of physical inputs and outputs,

(b) Secondly, the attachment of appropriate prices to the inputs and outputs in order to compute the respective values of costs and benefits,

(c) Thirdly, the commeasurement of costs and benefits of the project in such a way that facilitates its comparison with alternative projects

Throughout the process of project preparation, evaluation and implementation, many different yet interrelated aspects come into the picture They are generally of a technical, economic, financial and legal nature, but their relationship is so strongly pronounced that they must 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 the team-work of specialists such as engineers, economists, financial analysts and legal experts The participation of legal experts should save time and resources by ensuring at an early stage that everything envisaged shall be consistent with the laws of a country, and such experts 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 is seldom a clear-cut, step-by-step procedure as described above In practice, evaluation may reveal that certain aspects of a project have to be re-prepared Similarly, project implementation may encounter unforeseen difficulties which require both redesigning certain project elements and evaluating the impact of this redesigning on the project's overall merits

3 Approach to project evaluation adopted by the Manual

3.1 The need to accommodate multiple national objectives

The development process is a process with multi-objectives economic, political, social, national security, ecological etc National development objectives are closely interrelated This interrelationship is very complex, its nature 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 more or less explicitly 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 appears obvious and simple at first glance It is commonly accepted that the criteria for project evaluation must be derived from, or with, national objectives and reflect their interrelationship In practice, however, several factors may intervene to prevent national objectives from

being clearly 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 through different measures These very objectives are often expressed in a vague and imprecise manner, creating ambiguities and permitting different interpretations Contributions of a project to various objectives often cannot 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 that can be traced and if possible measured.

Starting on this basis, it is assumed here that if there is a set of national development objectives, the development projects should be evaluated as much as possible by their contribution to the fulfilment of each of these objectives, in other words, the Manual introduces an explicit 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 links between national objectives and the project evaluation criteria may be of a partial or comprehensive nature Partial links usually appear during the identification and formulation stages of a project. In fact, when a government agency identifies and approves a project for further study, it 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 within the context of certain national priorities and objectives such as the utilization of indigenous raw materials, employment and technical advancement. The formulation of the economic aspects of a project—capital investment, production costs, formation and distribution of profit, pricing, financial structure, local and foreign currency components etc —is carried out within the framework of certain explicit or implicit national objectives, and according to instructions given with these objectives in mind to the project planners on the mobilization of local and foreign financial resources, the formation and distribution of income, conditions of foreign participation, balance of payments position etc The variants of location for a project are usually examined within the framework of objectives for better use of resources (the proximity to raw material deposits, to consumption centres, to manpower resources) or for the promotion of the development of backward or politically sensitive regions.

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 is apparent throughout this Manual.

Other methods have been proposed for the evaluation of investment projects by a single aggregate criterion incorporating several multi-objective aspects of the development process.[1] The incorporation of different aspects into a single aggregate

[1] *Guidelines for Project Evaluation* (United Nations publication, Sales No 72.II.B 11), *Guide to Practical Project Appraisal* (United Nations publication, Sales No 78.II.B 3), I. M. D. Little and J A. Mirrlees, *Manual of Industrial Project Analysis in Developing Countries*, vol. II Social Cost-Benefit Analysis (Paris, OECD Development Centre, 1968) and *Project Appraisal and Planning in Developing Countries* (London, Heinemann Educational Books, 1974), *Economic Analysis of Projects*, Staff Working Paper No 194 (Washington, D.C., IBRD, February 1975)

criterion is possible only by assigning numerical weights (directly reflecting political value judgements) to these partial considerations nominal unit of future consumption as compared with a unit of present consumption, nominal unit of present or future consumption of the rich as compared with the poor, nominal unit of present or future income of wage earners and profit earners compared with a unit of income of the Government, nominal unit of income earned by a backward region as compared with that in a more developed region. This approach 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, these weights and other value judgements which produce what might be termed 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. It may be imagined that this exercise requires highly qualified personnel, abundant information and the use of computers. It is also subject to errors and to misuse of the approach.

Even if ideal conditions are assumed in a highly developed country in terms of skill, information and computers, it is hardly possible to apply this approach consistently in evaluating investment projects. It has in fact never been applied on a large scale in any developed country. It could not, therefore, be expected to be valid for the developing countries. Such a high degree of aggregation of the criterion for assessing investment projects in the developing countries is unrealistic at present and within the foreseeable future. Hence, the Manual recommends 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, practical and easy to apply under the conditions prevailing in the developing countries.

It is argued that the incorporation of distributional and other aspects into the methodology for project evaluation by assigning numerical weights to them is justified because of the weakness or unwillingness of the Governments of developing countries to achieve certain distribution or other objectives by other ways and means. It is difficult, however, to comprehend how a Government that is weak or unwilling to implement distributional or other objectives through more direct and efficient ways such as price, tax, monetary and other policies would 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.

The question to be addressed is whether a methodology for project evaluation is an efficient tool for solving income distribution and redistribution problems. The authors of this Manual feel that well-known political, economic, administrative, financial and other instruments provide better methods to achieve this end. The methodology for project evaluation and particularly national cost-benefit analysis is complicated enough without burdening it with additional functions. If national cost-benefit analysis is to be widely applied in developing countries, it should be simplified considerably and not be complicated further by having important additional functions incorporated into it.

Another justification made for a single aggregate criterion (which implicitly means using numerical weights) is that the single criterion characteristic of a project

facilitates its selection or rejection by the decision maker and reduces the scope for subjective or arbitrary decisions. In reality, however, the wide use of numerical weights automatically opens the door for subjective judgements at the level of project evaluators and people associated with them who, although they may act with the best intentions, may commit substantial errors because they have less information on overall economic and non-economic considerations than the decision makers. The attempt to assign weights—as precise as the figures may be—is an ambitious and responsible exercise which is an expression of political value judgements in numerical terms and should be carried out by highly competent and well-informed people. Even the most competent top policy makers, as a rule, in practice refrain from being too explicit in formulating national objectives and particularly in assigning numerical weights to these objectives.

The characterization of an investment project by a single aggregate criterion and its presentation as such to the decision maker may be used wittingly or unwittingly to hide the conflicts between different aspects of the project expressed by conflicting indicators. The complex, multi-dimensional and often controversial character of a project is greatly oversimplified (and probably distorted) when expressed by a single aggregate criterion. On the surface it may appear easy for the decision maker to take the decision, but actually he cannot see what lies behind the single criterion, he may easily overlook hidden conflicts between different aspects and he may thus take a wrong decision.

The set of criteria approach presented here has two practical advantages. Firstly, it indicates as explicitly as possible the link between the parameters of the national plan, which express the specific national objectives, and the parameters of the project as shown by the basic, additional or supplementary indices. In many cases it does not go beyond demonstrating that there is a causal relationship among factors simply because it is not possible to quantify this relationship. In the alternative approach discussed above the links are concealed behind a single figure. Secondly, the set of criteria approach puts on the desk of the decision maker a picture of the project as complex, multi-dimensional and controversial as it is. It provides him with warnings, pros and cons for one decision or another and gives him a summation 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, faced with the complexity of the facts and being better informed than the project evaluator, should be in a better position to take the right decision.

In sum, the approach advocated by this Manual differs from other approaches. Trying to be realistic and practical, the authors do not assign numerical weights to the indices of an investment project for incorporation into a single aggregate criterion. Giving numerical weights is not the only way and, the authors believe, under the present circumstances not the best way of considering the numerous national development objectives and of translating them at the project level. It is felt that weighting at the project evaluator's level cannot substitute for a comprehensive quantitative and qualitative analysis at the decision-making level, which takes into consideration the national development objectives.

Development objectives and the dimensions of welfare are so diffuse and extensive that they militate against the application of a single universal yardstick to obtain an overall socio-economic assessment of the national profitability of an investment project. The assessment of national profitability in practice is to a 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 truth is that in determining national profitability, evaluators and decision makers are faced with innumerable difficulties that cannot be resolved in the same manner (by one single criterion) as in assessing commercial profitability

The developing countries are quite different in resource endowment, in their stages of development and in the roles that the public and private sectors play in economic activity. The variety of features and circumstances of its potential users has conditioned the design of the Manual which, while it provides criteria to determine whether a project meets specific national objectives, cannot specify these objectives. These objectives vary considerably among different countries as do the economic and social conditions which determine such objectives and their ranking

The user of the Manual must obtain policy objectives from national authorities, objectives such as an increase in production and productivity, an increase in employment opportunities, the constitution of a more equal society, the reduction of external vulnerability through an improvement in the balance of payments, an increase in the international competitiveness of exported goods, the upgrading of the skills of manpower, and the development of an appropriate economic and social infrastructure He may then assemble, with the help of the Manual, a set of criteria to fit these objectives. The evaluator and especially the planner should determine the set of indices to be applied for evaluation of investment projects and, subject to their importance, should decide which are basic, additional and supplementary.

3 2 Value added as a proxy for national welfare

A fundamental strategic objective of the national development policy of any country is to raise the present standard of living of its population and to allocate investment to achieve a higher growth rate of the economy and thus to increase the future consumption

As is well known, the national income is the only source for increasing both consumption and savings It 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 for national welfare, reflecting both the resource endowment of a country and the degree to which the basic needs and ambitions of the people are satisfied

Thus, a fundamental ultimate aim of an investment project undertaken by a country is to contribute as much as possible to the national income National income may be translated at the project (factory) level as *net value added* The problem, therefore, may be reduced 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 that may be called social surplus The question arises, why not confine the analysis to the social surplus and abandon the other component of the value added? The Manual provides the 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 viewpoint of society they are part of the national income. More salaries and wages mean higher employment, higher income per person employed or both

Larger wage bills (balanced with appropriate commodities) 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 cash income of the population The society cannot be indifferent to the level of the income of individuals The higher this income, the better A higher wage bill is one of the major prerequisites for higher present consumption

The social surplus is that portion of the value added that has been directed through other channels of the same national distribution mechanisms taxes to the treasury, net profit (dividends) to shareholders, interest on borrowed capital to the financial institutions, rent, allocations for the expansion, reserve and social welfare funds of the firms etc Through the complex network of the distribution and redistribution process part of the social surplus is being used for present private and public consumption taxes in the national budget, the social welfare funds of the firms, the reserve funds, and a small part of the net profits The larger portion of the social surplus is usually saved and invested part of the taxes, the larger part of the dividends, of interest and of rents, and the expansion funds of the firms. Therefore, a larger social surplus is a major pre-condition for higher private present consumption and the normal functioning of the entire state machinery, on the one hand, and is a basic source of savings for accelerated socio-economic development of the country, on the other 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

In adopting this concept the authors of the Manual have taken into account the structure of value added the magnitudes of the two components, salaries and wages, on the one hand, and social surplus on the other To take one of the components and to neglect the other would provide a partial one-sided picture of the overall contribution of a project to national welfare In the Manual equal treatment is accorded to wages and social surplus. Both components of value added enjoy the same weight, both are equally important to the nation. The authors believe, however, that from the point of view of project evaluation it is advisable and realistic to stop here and not to attempt to trace the further flows of the produced value added through the channels of the national distribution/redistribution system, and not to assign numerical weights to components or subcomponents of the value added.

This approach is well justified theoretically Assigning weights to subcomponents of value added—wages, dividends, taxes, interest, undistributed net profits etc —and to their distribution to social groups or regions, and then incorporating the weighted values into the value added by revising its magnitude, is not advisable because the laws governing the national distribution/redistribution process are exogenous factors, independent of the project Introducing these factors would distort the true picture of the project. On practical grounds, the assignment of weighted values is not recommended simply because it is impossible to carry out such a difficult and demanding analysis for the purpose of project evaluation Even if one cycle of this exercise is carried out, it should be repeated and new judgements passed as soon as socio-economic conditions change, which happens often No developing country could itself afford this luxury in the evaluation of investment projects

What really matters is that an investment project should generate more value added comprising wages and social surplus. The link between the soundness of the project and the distribution/redistribution process exists only in the sense that the higher the value added, the higher the social surplus after paying higher salaries and wages The higher the social surplus, the higher are the dividends to shareholders and taxes to the treasury, after interest is paid on borrowed capital, rent and royalties, if any, making allocation for expansion funds of the firm, reserve funds, social welfare funds etc The value added is a criterion for assessing the soundness of a project How value added is distributed and redistributed further in line with the numerous political, economic, financial, legal and administrative regulations is a matter that should not be accountable to an investment project The methodology for evaluating the soundness of an investment project should not be mixed with the complex and extremely important socio-economic problem of distribution and redistribution of value added

The value added of an investment project has special characteristics that must be taken into account

(a) In the case of the evaluation of an investment project, both outputs and inputs are anticipated or expected This implies that they can be estimated only approximately, and special care should first be taken of the most important outputs and inputs,

(b) The thorny problem of whether to include or exclude unfinished or not yet sold products in output value in a given period (one year) fortunately disappears when value added is calculated for the whole economic life of the project,

(c) 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 project evaluation, investment outlays are material inputs and therefore, when considering the whole life of a project, value added should by definition be net of investment, i.e net value added When a project is evaluated on the basis of a normal year, net value added is derived from the gross value added by subtracting the amount of depreciation for the same year,

(d) 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 should be estimated on the basis of including both taxes and subsidies The inclusion of taxes in 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 direct and indirect taxes On the other hand, the argument for the inclusion of subsidies is based on the assumption that subsidies reflect the social preferences ("merit wants") for given products or services

Value added as a criterion has both merits and demerits The most important merits consist of its direct link with the national income growth objective, its relatively simple estimation, and its link with the national accounting system and the predominant use of market prices 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 when national and sectoral targets are also expressed in terms of increments to national income Greater cohesion is achieved between planners and policy makers, on the one hand, and the ultimate

investors and micro-decision makers on the other Decentralization of economic decisions is facilitated as the value added becomes an easily comprehensible criterion of performance and a basis for a motivational system An incentive system is based in this case on the "behaviour" of the value added, instead of on 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 notable 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

In principle the statement that the net value added is a proxy for national welfare is correct, 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 an 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 by 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 surplus 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 the 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 answer is that the net value added is a measure of a project's contribution to the national income only to the extent that it is distributed and consumed in a country and for the benefit of this country. The portion of the value added that is repatriated abroad as wages, interest, dividends, royalties, rents etc does not add to the national income, does not contribute to the national welfare of the country and therefore should be excluded from the net value added when evaluating the soundness of a project from the point of view of the society In other words, only the *national net value added* is a proxy for national welfare This is a fundamental concept adopted by the Manual and is developed in the operational part

3.4 Two steps in evaluation—screening and ranking

Given the range of objectives and the scarcity of resources throughout the developing world, a two-step procedure is recommended for using the value-added criterion for project evaluation Firstly, an *absolute efficiency test* should be used 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. Secondly, a *relative efficiency test* should be used 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 of shortage: shortage of capital, of foreign exchange and of skilled labour. In these instances the value added of a 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.

3.5 Two stages of project analysis—certainty and uncertainty

The two-step approach advocated here is also expressed in the two recommended stages of project analysis, i.e. under deterministic and under indeterministic conditions. Project evaluation under certainty and uncertainty is not regarded as evaluation under two alternative conditions. The two are indispensable, interrelated stages of project evaluation.

In the course of the first stage the complex reality of the project and its environment are simplified by assuming certain magnitudes of the variables. The expected values of the variables are the most probable ones to occur. On the basis of relative certainty the evaluators carry out the analysis and submit recommendations to the decision makers. However, such evaluation ignores the fact that other values may exist for the variables that are also likely to occur. In addition, there are cases in which it is difficult to pinpoint the most probable values for some key variables.

During the second stage the assumptions are relaxed. The key variables and the possible range of variation that may have a sizeable impact on a project are identified. For each variable different probable values with significant chances of occurrence are estimated. And, finally, probabilities of occurrence are assigned to each value. Therefore, deviations upwards and downwards from the adopted values under conditions of certainty are not only stated as possible, but they are expressed in numerical terms and incorporated in the computation. Such an analysis may serve as a basis for modifying the recommendations to be submitted to the investment decision makers, or at least if the assumptions do not materialize, the decision makers, being aware of this possibility well in advance, will be prepared to cope with the new economic reality instead of being taken by surprise.

3.6 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 that is entirely satisfactory. A project may have indirect effects that are not covered by the basic criterion or by the additional indices.

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

No attempt is made here to provide an exhaustive list of conceivable indirect effects, but evaluators are urged to give proper consideration to such effects as environmental implications; the impact of a project on the health and skills of future employees, infrastructure implications, the effect on basic values such as the quality of life, the dignity of the individual, social justice and equality, and the project's contribution to any essential changes in the life, not only of the basic rural and urban community, but also of the individual. Such indirect effects should be taken into account 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 as a means of evaluating indirect effects that are so important that they cannot be overlooked in the evaluation of the project.

3.7 Market versus shadow prices

Shadow prices are considered in theory to reflect more appropriately the scarcities of resources in an economy. It is argued that project evaluation, if carried out on the basis of such prices, should reveal more accurately the social costs and benefits to a country than if it is based on market prices, which are frequently distorted. Noteworthy publications on project evaluation such as those published by OECD and UNIDO as well as some World Bank staff working papers strongly advocate reliance on the use of shadow prices.

The authors of this Manual believe that the application of shadow prices to project evaluation in developing countries, at least at this stage, is impossible both on conceptual and practical grounds. It is impossible on conceptual grounds because the existing socio-economic complex of a country cannot be described properly, our knowledge of the interrelated socio-economic factors is too limited. From the practical standpoint, the complicated interaction of the different socio-economic factors cannot be simulated properly.

It may be imagined that appropriate shadow prices have been set up and that 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 must accordingly be readjusted. In addition, the prices, including shadow prices, are closely interrelated. The changes in the factors that determine one shadow price will affect other shadow prices in a chain reaction and, therefore, they must be readjusted accordingly. It is unrealistic to expect that this continuous readjustment of the whole complex of shadow prices for the purpose of project evaluation could be carried out in a satisfactory manner in a developing country in the foreseeable future. To advocate the setting up of two parallel price systems in a country (be it developed or developing)—one for the purpose of project evaluation only and the other the actual market prices—is also unrealistic. The decision makers usually press the project planners to formulate and submit projects for decision as quickly as possible, no one would think of such an extremely difficult, time-consuming task as establishing shadow prices with the need for their constant review and readjustment.

For the sake of simplicity, this Manual is based largely on actual prices (with some adjustments, if indispensable); shadow or accounting prices placed on inputs and outputs are not considered. Instead, a compromise is advocated between the

ideal shadow prices (which do not exist in reality) and actual market prices, thus making the Manual operational, easily understandable and closer to economic reality Every project evaluator can check the prices that have been used and, if absolutely necessary, add further price corrections

Problems of data associated with the calculation of shadow prices are thus kept to a minimum and so are the disappointments generated by unsuccessful attempts to apply shadow prices in project evaluation Practical experience has confirmed that when the gap between shadow prices and actual prices becomes too wide, the interest of an investing agency in project evaluation may be dampened, prices lose touch with reality and become suspected of being irrelevant in practice

It has not been proved so far that the distortions introduced by inappropriate application of "artificially" constructed shadow prices for inputs and outputs are fewer than those arising from the use of market prices, in addition to the great conceptual and computational difficulties related to derivation and application of shadow prices The inappropriate application of shadow prices may result from subjective judgement, lack of experience, lack of information, lack of computation facilities, or the pressure of time Unfortunately, the project development process in most developing countries is often characterized by such shortcomings.

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

The application of actual market prices may help, at least to a certain degree, to limit the manipulation of prices and the misuse of the price mechanism for the purpose of project evaluation to prove "economically efficient" any project that is wanted irrespective of whether it is actually efficient There is also less of a tendency in practice to override negative appraisal if it is based on market prices as compared with 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 the project level and the increase of national income has always been of great appeal to national planners

3 8 National parameters

National parameters are yardsticks set up outside an investment project They are given by a national agency 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 (minimum acceptable social rate of return), or a quantitative measure of the value the society assigns to certain major factors, which has direct bearing on project evaluation and selection (social rate of discount, shadow rate of foreign exchange) The national parameters are yardsticks passed on by the central planning authorities to the evaluators and micro-investment decision makers

who 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 of all decisions taken on individual projects They not only express national objectives and top-level value judgements but they are also based on systematic information relevant to the examination of all investment projects This information is usually not available to the individual project evaluator The national parameters should, in principle, be uniform for all sectors, regions and projects Only under very specific circumstances might they be diversified

The theory on project evaluation suggests a set of national parameters to be used in national cost-benefit analysis and indicates how these parameters may be derived The authors of the *Guidelines for Project Evaluation,* issued by UNIDO, for instance, are of the opinion that a comprehensive set of national parameters should be used, such as social rate of discount, social value of investment, shadow wage, shadow rate of foreign exchange, and they have proposed a methodology for their derivation

Throughout the comprehensive analysis of the prevailing conditions in the developing countries the authors of this Manual came to the conclusion that a more operational approach is needed with regard to national parameters The prerequisites do not exist for the derivation and application in the developing countries of the national parameters suggested by the *Guidelines.* For this reason this Manual advocates the utilization of only two national parameters considered to be of crucial importance the *social rate of discount* and the *adjusted rate of foreign exchange.* Methods are recommended for their derivation

The term "adjusted" rate of foreign exchange is used to distinguish it from the term "shadow" rate of foreign exchange and to emphasize the operational, practical approach to the derivation of the adjusted rate of foreign exchange as distinct from the sophisticated techniques suggested for the derivation of the shadow rate of foreign exchange. If in certain cases the evaluator believes that in a developing country the prerequisites exist for additional national parameters, and more sophisticated methods for their derivation may be applied, he may set up such parameters in co-ordination with the appropriate national agency and in line with the fundamental concepts presented in this Manual

3.9 Integrated approach in project analysis

The value added concept permits the use of one set of data in both commercial and national profitability analyses Physical quantities of inputs and outputs are identical in both types of analyses To such quantities market prices are applied in commercial analysis Basically, the same set of values, comprising some indispensable price adjustments, is then used in national project evaluation with the national accounts serving as a reference system. Thus, commercial profitability analysis becomes a stepping stone to social evaluation, providing a coherent and easily understandable appraisal process and reducing data problems

A combination of commercial and national profitability analyses is indeed part of the approach of the Manual 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

Commercial profitability is determined by the net profit generated by an investment project Items such as wages and salaries, interest, rent and 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, 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 to the point at which he would need a subsidy

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

3 10 A broader understanding of project evaluation

The process of evaluation of an investment project from the national point of view advocated by this Manual should be understood as a continuous and broad exercise Continuous because the evaluation does not take place after the project has been formulated Project evaluation is often considered (implicitly or explicitly) to be an activity that takes place at a given time and as a fairly mechanical procedure In practice, it starts with the identification of the project and continues throughout all stages of its formulation In the early stages, even the basic information on physical inputs and outputs is very rough Because of the limited information in the early stages, this assessment is usually fragmentary, covering only certain aspects of a project The final overall socio-economic evaluation is far more comprehensive This Manual is designed mainly for overall evaluation, but it also provides an operational methodology of appraisal for the early stages of formulation–the simple annual formula

National project evaluation is a 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 Discussions are held at different levels (macro and micro) throughout the formulation of a project by means of quantitative and qualitative, economic and non-economic analysis. It would be an oversimplification to believe that in practice the national evaluation of a project is a procedure carried out only through a set of indices for final overall appraisal, no matter how comprehensive they are, and to underestimate the importance of other ways, means and procedures of social evaluation.

3.11 The need for simplicity and practicability

The authors of the Manual have kept in view the working conditions that 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 neo-classical economic theory Nor will the indices of national profitability often

produce clear-cut yes or no answers. The attempt is made to guide the evaluator in assessing the financial and social implications of a project, and he will have to adjust any bench-marks 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 that a project must meet if it is to provide a small but noticeable improvement in prevailing conditions

In short, the attempt is made here to be deliberately eclectic, thereby permitting an eclectic use of the Manual by project evaluators from the developing countries for which it is designed The user is also offered a fairly wide range of choice in the degree of sophistication of the analytical tools he might wish to use. A range of techniques is offered for both commercial and national evaluation among which the user may select whichever is appropriate in the light of data, time and resource availability, both financial and human

In the *Guidelines* issued by UNIDO, the criterion of national profitability is "net aggregate consumption" In this approach, the main aspects of the project, i.e the foreign-exchange, employment and redistribution effects, are evaluated through the reflection of their impact on the level of consumption Shadow prices are the basis for pricing inputs and outputs In the OECD approach, the *numéraire* is national savings in terms of foreign exchange, with foreign-exchange shortage the predominant factor in the determination of shadow prices for most inputs and outputs

In both cases the adoption of one global aggregate indicator renders these methods 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 all

Any project evaluator, regardless of the methodology he uses, must rely on his judgement and experience gained in the field This Manual is intended to serve as a guide which would reduce the scope of subjective judgement in project evaluation

For greater ease of use, the following practical features are incorporated. Each criterion of evaluation covers the following aspects definition and significance, methods of calculation, data requirements and problems of application

A simple hypothetical illustrative example is developed throughout the sections on commercial and national profitability.

4. Basic information needed for project evaluation

4.1 A set of model formats

Project evaluation is largely a quantitative exercise 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 The purpose of the various stages of project preparation is in fact to establish the magnitudes, both in physical and monetary terms, surrounding the construction and operation of an investment project. Ultimately, these magnitudes are brought together in a techno-economic feasibility study which is the starting point for an overall project evaluation More often than not, however, it is up to the evaluator to organize the data in a manner to suit the appraisal methods that he intends to apply

A set of model formats is presented here to assist the evaluator in this first step The tables are designed to serve both commercial and national profitability analysis No universal format exists for such tables, they should be viewed only as illustrative Their purpose is to indicate the minimum information needed for evaluation of an investment project under normal conditions, in 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 in which a project is to be evaluated

The first question that is usually raised is how much the investment will cost Table 1 provides a breakdown of the investment outlay into its various elements Since time plays an important part in project evaluation, it will also be necessary to determine the entire construction period and the phasing of the investment during that period. That way the major characteristic of an investment becomes transparent, and it is then feasible to define the lifetime of major investment elements, i.e to work out annual depreciation rates and the expected years when additional investment 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 Table 2 provides a format for such information

The questions that arise next have to do with the manpower requirements of a project (table 3) and with the magnitudes of the annual income which goods are planned for production; how many of each product will be produced in one year, what prices the investor hopes to attain in the local and export markets, what, if any, subsidy is expected etc (table 4) Again time will have to be taken into consideration the length of the running-in period, the quantities that can be produced annually during that period, the economic life of the project (products), the use of the installed capacity Table 5 provides a detailed breakdown of annual operating costs both during the running-in period and at full capacity

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 6 and 7 represents the data needed for the evaluator to undertake this task

Finally, these data may be compiled into one comprehensive table that contains all the information needed for commercial profitability analysis This is table 8, "Integrated financial analysis" Table 9, "Integrated value added analysis", provides a simple format for computing 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 Tables 8 and 9 may be defined as giving an X-ray picture of an investment project The whole complex of diagnostic analysis, called project evaluation, suggested here is based on the information provided by these two integrated tables

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

At first glance, the tables may appear to be fairly exhaustive, and, in the light of data gaps typical for many developing countries, some evaluators may be discouraged from using them It should be noted that the aggregates at the bottom of each table mainly 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 be assured that no major elements of project analysis are missing and that both the coverage of his data base and the definitions underlying

TABLE 1 INVESTMENT

(In thousands of monetary units)

Item	Construction year														
	t_0			t_1			t_2			t_n			Total		
	Imported	Local	Total	Imported	Local	Total	Imported	Local	Total	Imported	Local	Total	Imported	Local	Total
1 *Fixed assets*															
1 1 Equipment															
c.i.f /ex-factory cost															
Duty/taxes on above															
Transport cost to site															
1.2 Installation cost															
1.3 Land acquisition and development															
Land															
Buildings															
Other															
1.4 Other fixed assets															
1 5 Contingencies on fixed assets															
2. *Preliminary expenses*															
2 1 Licences, royalties															
2.2 Planning and other consultancy services															
2.3 Initial advertising															
2.4 Start-up expenses															
2.5 Training of personnel															
2 6 Other preliminary expenses															
2.7 Contingencies on preliminary expenses															
3. *Working capital*															
3 1 Working capital															
3 2 Contingencies on working capital															
4 Initial investment (1 + 2 + 3)															
5 + Interest during construction															
6 = Total investment															

TABLE 2 DEPRECIATION, REPLACEMENTS AND RESIDUAL VALUES

(In thousands of monetary units)

Item	*Investment*	*Expected lifetime (years)*	*Annual depreciation*	*Replacements occurring in years* t_1	t_2	t_3	t_4	t_n	*Residual values in final year*
1 *Fixed assets*									
1 1 Production equipment including installation costs									
1 2 Buildings									
1 3 Land[a]									
1 4 Other fixed assets									
2. *Preliminary expenses*[b]									
3 *Working capital*[a]									
4 Total									

[a] Working capital and land are not written off, instead the entire amount enters the final year of the project's life as residual value

[b] Rules governing when preliminary expenses can or should be capitalized differ from country to country If they must not be capitalized, they should nevertheless be included in investment costs for capital budgeting 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.

TABLE 3 ANNUAL MANPOWER REQUIREMENTS[a]

Category of manpower	*Number of personnel*			*Average annual wages (in thousands of monetary units)*		
	Skilled	*Unskilled*	*Total*	*Skilled*	*Unskilled*	*Total*
1 *Manufacturing personnel*						
1 1 Direct operating personnel						
1 2 Indirect operating personnel						
2 *Marketing personnel*						
3 *Supervisory personnel*						
4 *Administrative personnel*						
5 *Grand total*						
5 1 National personnel						
5 2 Foreign personnel[b]						

[a] For each year of the lifetime of the project. If the number of personnel is smaller during the running-in period, it should be clearly stated. An increase of the manpower related to expansion should also be indicated.

[b] An estimation should be provided, on the basis of past experience or other considerations, concerning the expected portion of their wage bill to be repatriated abroad.

TABLE 4. ANNUAL INCOME

(In thousands of monetary units)

Item	*Year* t_0		*Year* t_1		*Year* t_2		*Year* t_n	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
1 *Annual sales*[a]								
Product (a)								
Local[b]								
Export								
Product (b)								
Local[b]								
Export								
Product (c)								
Local[b]								
Export								
2. *Subsidy*								
3. *Residual value*[c]								
4. *Total income*								

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

[b] If the domestically marketed output is an import substitution (partly or entirely), it should be clearly indicated in the table. If the project is expected to sell infrastructural services (electricity, energy, water, gas, steam), they should be stated as separate items.

[c] Residual value includes land, buildings, working capital, scrap (see table 2).

TABLE 5 ANNUAL OPERATING COSTS

(In thousands of monetary units)

Item	*Year t_0*			*Year t_1*			*Year t_2*			*Year t_n*		
	Variable	*Fixed*	*Total*	*Variable*	*Fixed*	*Total*	*Variable*	*Fixed*	*Total*	*Variable*	*Fixed*	*Total*
1 *Manufacturing cash expenses*												
1.1 Material												
1 1 1 Imported												
1 1 2 Local												
1 2 Wages												
1 2 1 Foreign												
1 2 2 Local												
1 3 Other manufacturing expenses												
2 *Marketing cash expenses*												
2 1 Material												
2 1 1 Imported												
2 1 2 Local												
2 2 Wages												
2 2 1 Foreign												
2 2 2 Local												
2 3 Sales and excise taxes												
2 4 Other marketing expenses												
3. *Administrative cash expenses*												
3 1 Material												
3 2 Wages												
3 2 1 Foreign												
3 2 2 Local												
3 3 Other administrative expenses												
4 *Operating cash expenses* (1 + 2 + 3)												
5 *Depreciation*												
6 *Total costs* (4 + 5)												

TABLE 6 CAPITAL STRUCTURE

(In thousands of monetary units)

Item	*Year* t_0	t_1	t_2	t_n	*Total*
1 *Investment*					
1 1 Initial investment					
1 2 Interest during construction					
2. *Financing*					
2.1 Equity					
2.1 1 Domestic					
2.1 2 Foreign					
2.2 Loans					
2.2.1 Domestic					
2.2.2 Foreign					
2.3 Others (domestic or foreign)					
3. *Additional financing needed* (1–2)					

TABLE 7 FINANCIAL OBLIGATIONS

(In thousands of monetary units)

Item	*Year* t_0	t_1	t_2	t_3	t_n	*Total*
1 *Loans* (repayment instalments) (interest)						
1 1 Domestic loans						
1 1 1 Repayment instalments						
1 1 2 Interest						
1 2 Foreign loans						
1 2.1 Repayment instalments						
1 2.2 Interest						
2. *Dividends*						
2.1 Domestic						
2.2 Foreign						
3. *Others* (royalties, insurance and reinsurance etc.)						
4. *Total* (1 + 2 + 3)						

TABLE 8 INTEGRATED FINANCIAL ANALYSIS[a]

(Thousand dinars)

	Item	Year						
		t_0	t_1	t_2	t_3-t_{10}[b]	t_{11}	t_{12}-t_{19}[b]	t_{20}
Basic information	1 *Investment* (table 1, row 6)	100	100					
	Initial investment	100	100					
	2. *Operating cost*			40	75	70	70	70
	2.1 Cash expenses excluding interest (table 5, row 4)			40	60	60	60	60
	2.2 Depreciation (table 2, row 4)				10	10	10	10
	2.3 Interest (table 7, row 1)				5			
	3. *Income* (table 4)			70	100	100	100	120
	3.1 Sales revenue (row 1)			70	100	100	100	100
	3.2 Subsidies (row 2)							
	3.3 Residual value (row 3)							20
Investment profitability analysis	4. *Net cash earnings*[c]							
	4.1 Taxable profit (3–2)			30	25	30	30	50
	minus taxes (20% on profit)				5	6	6	10
	4.2 Net profit after taxes and interest			30	20	24	24	40
	plus interest (row 2.3 above)				5			
	4.3 Net profit before interest and after taxes			30	25	24	24	40
	plus depreciation (row 2.2 above)				10	10	10	10
	minus replacement (table 2, row 4)							
	Total			30	35	34	34	50
	5 *Net cash flows* (4–1)	(100)	(100)	30	35	34	34	50
Financial analysis	6. *Financial sources* (table 6)	100	100					
	6.1 Equity (row 2.1)	100	15					
	6.2 Loans (row 2.2)		85					
	6.3 Others (row 2.3)							
	7 *Financial obligations* (table 7)				27	12	12	12
	7.1 Repayment instalments (row 1)				10			
	7.2 Interest charges (row 1)				5			
	7.3 Dividends (row 2)				12	12	12	12
	8. *Net cash balance* (5 + 6–7)	–	–	30	8	22	22	38
	9 *Cumulative net cash balance of row 8*	–	–	30	94	116	192	880

[a]The table contains figures from a hypothetical project which is used throughout the Manual for illustrative purposes. Tables 1-7 are designed to contain all the data necessary for the completion of table 8. In this case only the final figures are taken for the completion of table 8, without completing tables 1-7. However, references are made against each item of table 8, indicating which of the preceding tables is the source of the figures.

[b]Annually

[c]The arrangement of the items under row 2 net cash earnings reflect the taxing and other relevant regulations in a country. In other countries it may be much simpler than that. It is up to the project analyst to rearrange the items in a way most suitable to the prevailing conditions in his country, following the basic logic of the table.

TABLE 9 INTEGRATED VALUE ADDED ANALYSIS[a]

(Thousand dinars)

Item	Year										
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8-t_9	t_{11}-t_{19}	t_{20}
1 *Value of output* (table 4, row 4)	–	–	70	100	100	100	100	100	100	100	120
1 1 Exports (table 4, row 1)			5	10	20	20	25	30	30	30	30
1 2 Domestically marketed (import substitution) (table 4, row 1)			60	80	70	70	65	60	60	60	60
1 3 Domestically marketed (table 4, row 1)											
1 4 Infrastructural services (table 4, row 1)			5	10	10	10	10	10	10	10	10
1 5 Residual value (table 4, row 3)											20
1 6 Others (income from subsidiary activities)											
2 *Value of material inputs*	100	100	30	51	51	51	51	51	51	51	51
2 1 Investments (table 1, row 6)	100	100									
2 1 1 Imported (table 1, row 6)	75	85									
2 1 2 Domestically procured (table 1, row 6)	25	15									
2 2 Current material inputs (table 5, rows 1 1, 2 1, 3 1)			30	51	51	51	51	51	51	51	51
2 2 1 Imported (table 5, rows 1 1 1, 2 1 1)			8	12	12	12	12	12	12	12	12
2 2 2 Domestically procured (table 5, rows 1 1 2, 2 1 2, 3 1)			20	36	36	36	36	36	36	36	36
2 2 3 Infrastructural services (table 5, row 1 3)			2	3	3	3	3	3	3	3	3
3 *Net domestic value added* (1–2)	(100)	(100)	40	49	49	49	49	49	49	49	69
4 *Repatriated payments*			15	16	16	16	15	15	14	10	16
4 1 Wages (table 3, footnote)			3	3	3	3	2	2	1		
4 2 Profits (dividends) (table 7, row 2 2)			12	8	8	8	8	8	8	10	16
4 3 Interest (table 7, row 1 2 2)				5	5	5	5	5	5		
4 4 Others (royalties, insurance and reinsurance etc) (table 7, row 3)											
5 *Net national value added* (3–4)	(100)	(100)	25	33	33	33	34	34	35	39	53
5 1 Wages (table 3, row 5 minus repatriated wages)			7	9	9	9	10	10	11	12	12
5 2 Social surplus (5–5 1)			18	24	24	24	24	24	24	27	41

[a]The figures in this table are taken from a hypothetical project used throughout the Manual for illustrative purposes Tables 1-7 are designed to contain all the data necessary for the completion of table 9 References are made against each item of this table indicating the source of the figures from among tables 1-7. All items are expressed in actual market prices for inputs and outputs and in the official rate of foreign exchange

its various elements are in accordance with sound accounting practices. Also, depending on which indicators he 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, or even all the aggregates in tables 1 through 7. Practical experience should guide him in coping with questions of permissible lumping and omitting.

It may be helpful to refer to the duration of time for which data should be collected in completing the model tables, particularly tables 8 and 9.

A project has a technical life as well as an economic life. The economic life is the period in which it will be economically justifiable to operate a plant. The economic life is determined by the technical life, the technological level at which a project has been designed and erected, the rate of technological progress etc. The economic lives of projects from different industrial branches differ significantly—the economic life of a pharmaceutical plant cannot be compared with the economic life of an iron and steel plant. The economic life of a plant operating in a developing country will differ considerably from that of the same plant in a developed country.

Time horizon is the period in which a decision maker is mainly interested. What happens beyond this period does not concern him, or concerns him insignificantly. The time horizon of an investment decision maker depends on many factors, among which are the economic life of a project, the capacity to forecast the future etc.

It is desirable that the model tables contain the necessary data for the whole economic life of an investment project. Sometimes it may be possible to compile these data, but very often it may be extremely difficult to collect reliable information to cover the economic life of a project. There might be many reasons for these limitations. Attention is drawn to two practical reasons. Firstly, to project what will happen 15, 20 or 25 years from now is very difficult and risky, the further away the future, the larger the margin of error. Secondly, the nominal annual values of benefits and costs occurring 20 years from now, discounted in the present, will make an insignificant present value and could hardly affect the evaluation result. For instance, a nominal value of 1 dinar occurring 20 years from now, discounted at 10 per cent, will have a present value of only 0.15 dinars.

As a general rule for practical purposes, a *time horizon of 10-15 years,* including the running-in period, will be sufficient to define whether a project is acceptable.

A monetary unit, one dinar, has been selected for use throughout this Manual for illustrative purposes. The Manual's dinar is only an accounting monetary unit and except for its name has nothing in common with the same unit of currency being used in some developing countries. The dollar, pound, rupee, rial etc. could be used in the same manner.

4.2 Some selected data problems

4.2.1 Working capital requirements

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

Working capital constitutes the current assets (cash, accounts receivable, inventories of both inputs 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, therefore, only guidelines can be given for estimating working capital requirements.

Step 1 Divide annual operating expenditure at full production (table 4) 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 is ready for sale).

Step 4 Estimate expected average number of days for which the final product is 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 the 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 8 depicts the financial forecast of a steel rerolling mill. Average daily operating expenditures from year 3 onwards are then estimated to amount to 164.4 dinars (step 1: 60,000 dinars : 365 days). 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 23,180 dinars (step 6: 164.4 dinars x 141).

It should be emphasized again that such a procedure can only produce a rough indication of working capital requirements, which may be considered sufficient at the pre-investment stage. Sound judgement has to be exercised and the figure adjusted upwards or downwards if indicated. In this process of adjustment the following elements have to be taken into consideration:

(a) If a project's running-in period is very long, i.e. if full capacity utilization can be reached only after a considerable length of time, a downward adjustment may be necessary;

(b) 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,

(c) If access to short- and medium-term bank credit is relatively easy, part of the working capital requirements may be financed by means of such credit facilities instead of looking for additional equity or long-term funds Therefore, net working capital should be financed by long-term funds The net working capital equals total working capital minus the portion financed through short- (medium-) term credits

4.2.2 Residual and salvage values

For the purposes of discounted cash flow analysis, a decision on the lifetime of a project has to be made Since a project consists of numerous elements which may have different periods of life expectancy, e.g lorries, machinery, buildings and land, the concept of a project's lifetime is somewhat abstract Yet all these elements together are needed to produce the desired output and, consequently, either reinvestments have to be earmarked for those assets that must be replaced early, or residual values must be determined for elements that 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 such elements may therefore be called terminal values

Residual values are easily determined by the kind of calculation shown in table 2 Usually the lifetime of major investments, such as the bulk of machinery, is chosen to represent the project's lifetime Assuming that in table 8 machinery accounts for 80 per cent of total investment and that this machinery is expected to be depreciated after 19 years of operation, 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, 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, that entire sum without any depreciation is added to the residual value in year 20 The value of land is taken at its present or expected actual market price

Too much precision is not justified since residual value in 15 or 20 years from now, after discounting, cannot affect considerably the overall soundness of an investment project 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 the lumping together of investment elements with similar lifetimes is both justified and necessary, in view of 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 that are fully depreciated by the end of the project's lifetime, *salvage values* are sometimes taken into consideration, for even a piece of machinery that 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 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
Financial analysis

The two types of analyses are complementary and not substitutable Both must be carried out since they are concerned with different aspects of an investment proposal *Investment profitability analysis* is the measurement of the profitability of the resources put into a project, more directly the return on the capital no matter what the sources of financing Thus, investment profitability analysis is an assessment of the potential earning power of the resources committed to a project without taking into account the financial transactions occurring 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 shall permit the smooth implementation and operation of the project

Different methods may be used as a basis on which 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, the simple rate of return and the 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. 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 time during the project's life.

The net present value and internal rate of return are called discounted or dynamic methods because they take into consideration the entire life of a project and the time factor by discounting the future inflows and outflows to their present values

Hence, the simple methods are somewhat less precise, but in some cases a simple analysis could be sufficient and the only possible alternative while in others it would be 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 the 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 should 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 aims at ensuring the flow of cash through the construction, running-in and operation periods of a project. The capital structure analysis is carried out to make sure that each type of investment (fixed and working capital) is covered by a suitable type of finance.

The framework for the commercial profitability analysis described above is presented in figure I

Investment profitability analysis and financial analysis may be illustrated by the example of a hypothetical project the data of which are quoted in table 8. 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 interrelationship of various data used in commercial profitability analysis

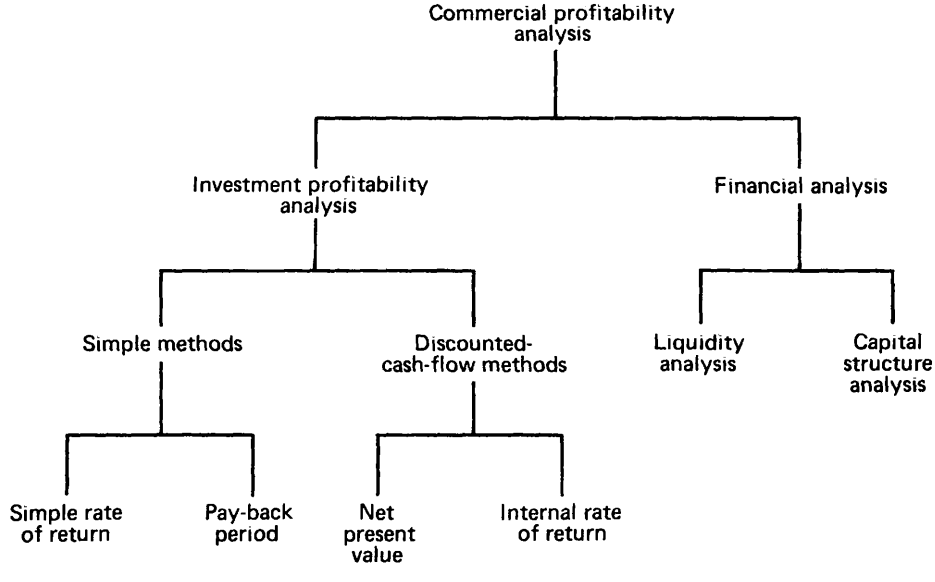

Figure I. Framework for commercial profitability analysis

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 only the profitability of the equity capital. Therefore, the simple rate of return could be presented either as

$$R = \frac{F + Y}{I} \tag{1}$$

or

$$R_e = \frac{F}{Q} \tag{2}$$

where

R = simple rate of return on total investment,
R_e = simple rate of return on equity capital,
F = net profit in a normal year after making provisions for depreciation, interest charges and profit taxes,
Y = annual interest charges on loans in a normal year;
I = total investment 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 attainable capacity and the loan repayment (if any) 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 of 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. Rate R can be computed as follows.

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

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

Step 3: Work out the net profit before interest in the most representative normal year, which is equal to net profit F plus interest charges Y in this year.

Step 4: Divide the sum $F + Y$ by the total investment I 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 Divide the net profit F computed under step 2 above 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 the data for which are derived from table 8 and compiled in table 10. Year 5 has been selected as a normal year

TABLE 10 DATA FOR CALCULATION OF R AND R_e

(Thousand dinars)

Item	*Amount*
1 Total investment I (table 8, row 1)	200
2 Equity capital Q (table 8, row 6.1)	120
3 Net profit after taxes F (table 8, row 4.2)	20
4 Net profit before interest $F + Y$ (table 8, row 4.3)	25

On the basis of data presented in table 10, the rates of return on total capital and equity capital invested are, respectively

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

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

The calculation of the simple rate of return is therefore straightforward since 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's data, neglecting the rest of the project's life Secondly, in real terms it may be difficult to find the normal year adequately representative for the whole life span of a project. Thirdly, the method ignores the timing 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 in which sufficiently detailed information for more comprehensive analysis is not available in the country, or for preliminary evaluation at the 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 cash earnings. Therefore, the pay-back period is the number of years during which a project will accumulate sufficient net cash earnings to cover the amount of its total investment It is given by the expression

$$I = \sum_{t=0}^{p} F_t + D_t \tag{3}$$

where

I = total investment,
p = pay-back period,
F_t = annual net profits in the year t,
D_t = annual depreciation in the year t,
$F_t + D_t$ = annual net cash earnings in year t

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 Projects having the shortest pay-back period are accepted in choosing among several alternatives The pay-back period of a project may be computed in several steps

Step 1 Compute the total investment of the project, I

Step 2 Find out the net cash earnings, $F_t + D_t$, for every year during the project's life

Step 3 Deduct from the total investment the net cash earnings (if any) of the first year of the project's life, which simply means the beginning year of the implementation period. Then 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 cash earnings in order to write off entirely the total investment. This number is the pay-back period p expressed in years. The pay-back period includes the construction period

Step 5. Compare the pay-back period as computed with the cut-off pay-back period set up by the investor If the pay-back period is shorter than the cut-off pay-back period, the project is acceptable and vice versa. Comparisons should also be made with the pay-back periods computed for alternative investment projects (if any) for ranking purposes

The calculation of the pay-back period on the basis of data from table 8 is illustrated in table 11. Year 5 is selected as a normal year. The total investment will be recovered by the net cash earnings just before the end of year 7, or in approximately eight years

The pay-back period arrived at should be compared with the cut-off pay-back period established by the investor as well as with the pay-back periods of alternative investment projects At first glance it would appear that a pay-back period of eight years is marginally acceptable, subject to the industrial branch For a textile project it may be rather too long to be easily accepted, while for an iron and steel project it is acceptable

TABLE 11 CALCULATION OF THE PAY-BACK PERIOD

(Thousand dinars)

Item	*Nominal amount*	*Capital at the end of a year*
1 *Total investment* (table 8, row 1)	200	
Year 0	100	
Year 1	100	
2 *Annual net cash earnings* (table 8, row 4)		
Year 0	–	−100
Year 1	–	−200
Year 2	30	−170
Year 3	35	−135
Year 4	35	−100
Year 5	35	−65
Year 6	35	−30
Year 7	35	+5

The cut-off pay-back period for the public sector should be established, and reviewed periodically, by a relevant central institution. It may be uniform or diversified by industrial sectors, whichever is more advisable on practical grounds. For the private sector the cut-off rate is set up by the investor concerned. Both for the public and private sectors, the levels of the cut-off pay-back periods may be fixed on the basis of relevant past experience They should also reflect, to the extent possible, the development strategy of the public or private investors.

The main merit of the pay-back period method is that it is simple and easy to understand. But it has some shortcomings which limit its use Firstly, it ignores the project's net profits after the pay-back period. Secondly, it may be misleading in case two or more projects are competing for the same resources and do not have a similar time phasing of the net cash earnings Thirdly, with this method much attention is paid to the liquidity of a project, the profitability of investment is not measured and the time phasing of cash inflows and outflows within the pay-back period is not assessed. In spite of these limitations the pay-back period may be a useful criterion in case of risky projects and relative capital scarcity or when 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 annual 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

$$NPV = NCF_0 + (NCF_1 \times a_1) + (NCF_2 \times a_2) + \quad + (NCF_n \times a_n) \qquad (4)$$

where

NPV = net present value of a project,
NCF = net cash flow of a project in years 0, 1, 2, , *n*,
a = discount factor in years 1, 2, . . . , *n*, corresponding to the selected rate of discount. The discount factors are to be found in the present value table in the annex

The same expression could be presented in a more aggregated way in the following formula

$$NPV = \sum_{t=0}^{n} (CI - CO)_t a_t \tag{5}$$

where

$\sum_{t=0}^{n}$ = a sum total for the whole lifetime of the project from year 0 to year *n*,
CI_t = cash inflow in the year *t*,
CO_t = cash outflow in the year *t*,
a_t = discount factor in the year *t* corresponding to the selected rate of discount

The project's net present value, other things being equal, increases with larger CI and number of years, but decreases with a higher discount rate and CO.

The *rate of discount* should be based as far as possible 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 no loans are used for financing a project, 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 This exercise is especially important when 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 further and divide it by the discounted value of the total investment, i.e he may use a sort of discounted rate of return. This ratio is given as·

$$NPVR = \frac{NPV}{P(I)} \tag{6}$$

where

NPVR = net present value ratio (ratio of the project's net present value to the present value of its total investment),
NPV = net present value of a project,
P(I) = 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 factor When the construction period is not more than a year, there will be no need to discount the annual amount of investment, it will be included in the analysis at its nominal value

If the NPVR is used as a criterion when comparing alternative projects, the one with the highest ratio can be selected for implementation The NPV and NPVR 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 year over the entire life of a project, NCF_t, by subtracting CO_t from CI_t

Step 4· Find out the appropriate discount rate to discount the future net cash flows to their present value

Step 5: Find out from the present value table in the annex the respective discount factor for each year corresponding to the selected rate of discount

Step 6: Multiply the nominal net cash flows in each 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 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 12 the calculation of the net present value of a project is demonstrated again using the initial data stated in table 8

To clarify table 12 some additional explanation may be necessary Since at the present stage of the project evaluation the concern is the assessment of the investment profitability of a project, only the real resource flows are taken into account. This means that any flows connected with financial transactions such as loans on the cash inflow side and financial obligations on the cash outflow side are omitted from the analysis. In addition, the cash outflows do not comprise depreciation in order not to account twice for the investment outlays When depreciation is excluded from the cash outflows it means that it is included in the net cash flows.

After the net cash flows are found for each year, one may proceed with the further steps in the calculation The discount factors at a discount rate of 7 per cent are shown in row IV, table 12.

The sum of row V, table 12, gives the net present value of the project at a 7 per cent discount rate, which amounts to 141,200 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, or 193,000 dinars

$$\text{NPVR} = \frac{141{,}200}{193{,}000} = 0.73$$

TABLE 12 CALCULATION OF NET PRESENT VALUE

(Thousand dinars)

Item		Year																					
		t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
I	*Cash inflows (CI)*			70	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	120	
	1 Sales revenue (table 8, row 3 1)			70	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
	2. Residual value (table 8, row 3 3)																						
	3 Subsidies (table 8, row 3.2)																						
II.	*Cash outflows (CO)*	100	100	40	65	65	65	65	65	65	65	65	66	66	66	66	66	66	66	66	66	70	
	4 Investment (table 8, row 1)	100	100																				
	5 Cash expenses (table 8, row 2.1)			40	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	
	6 Taxes (table 8, sub-row of row 4 1)				5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	10	
III	*Net cash flows (NCF)* (I–II)	–100	–100	30	35	35	35	35	35	35	35	35	34	34	34	34	34	34	34	34	34	50	
IV	*Discount factors at 7% discount rate*	1 00	0 93	0 87	0 82	0 76	0 71	0 67	0 62	0 58	0 54	0 51	0 47	0 44	0 41	0 39	0 36	0 34	0 32	0 30	0 28	0 26	
V	*Present values of the net cash flows at 7% discount rate*	(100)	(93)	26 1	28 7	26 6	24 9	23 5	21 7	20 3	18 9	17 9	16 0	15 0	13.9	13 3	12 2	11 6	10 9	10 2	9.5	13.0	141 2

Therefore, a unit of discounted total investment generates 0 73 units of net present value

Finally, it might be mentioned that the main advantage of the net present value method in assessing the investment profitability is that it takes into account the entire 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, 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 in the application of which the discount rate is given outside the project By definition, the *internal rate of return* is the rate of discount that reduces the net present value of a project to zero,

$$0 = \sum_{t=0}^{n} (\mathrm{CI} - \mathrm{CO})_t a_t \qquad (7)$$

where all the symbols have the same meaning as in the case of 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 that will make the present value of the cash inflows of a project equal to the present value of the cash outflows

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

$$i_r \geqslant i_{\min}$$

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, 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 would have been rejected

Step 2 Use a 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

Such a trial-and-error calculation may sometimes be 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 To avoid further calculations, the following formula may be used to arrive at the internal rate of return

$$i_r = i_1 + \frac{PV(i_2 - i_1)}{PV + NV} \tag{8}$$

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 close to each other, say not more than 5 percentage points apart. If this is not respected, the internal rate of return worked out on the basis of the above-mentioned formula may not be accurate enough.

The calculation of the internal rate of return is shown in table 13 Since the investment profitability is to be measured by the internal rate of return, 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 8, but to work further with the net cash flows stated in row III, table 12 These net cash flows are then discounted at different rates in order to find

TABLE 13 CALCULATION OF THE INTERNAL RATE OF RETURN

Discount rate (percentage)	*Net present value of a project (thousand dinars)*
7	141 2
11	52 95
14 5	3 32
14 7	1 014
14 8	−0 121

out the one that will make the net present value of a project equal to zero The first round of calculations has already been worked out in computing the net present value of the project shown in table 12 One needs to apply higher and higher discount rates until the net present value of a project becomes negative Table 13 gives the magnitudes of the net present values of a project at different discount rates.

Table 13 shows that the increase in the discount rate from 7 per cent to 11 per cent brings the net present value of a project from 141,200 dinars down to 52,950 dinars A higher rate of 14 5 per cent reduces the net present value to 3,320 dinars and the rate of 14.7 per cent to 1,014 dinars which is still positive but very close to zero One may proceed to discount at 14 8 per cent, but then the net present value becomes negative, amounting to −121 dinars It may 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 to calculate the exact rate Since the difference between these two rates is rather small and the first yields a positive while the second gives a negative net present value, the following formula may be used for interpolation to determine the internal rate of return

$$i_r = i_1 + \frac{PV(i_2 - i_1)}{PV + NV} = 14.7 + \frac{1{,}014(14.8 - 14.7)}{1{,}014 + 121} = 14.79\%$$

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 explicit discount rate which has to be done in computing the net present value of a project

The method has some features limiting its use, however. Firstly, it cannot be applied safely when there are considerable negative net cash flows during the operating period of the project's life, i.e major replacement investment 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 difficult to decide which is the appropriate one to be used for evaluating purposes Secondly, this method may be misleading when two or more mutually exclusive projects are compared, and reference to the net present value method is desirable Thirdly, it does not reflect directly the time preferences of a decision maker since the discount rate is not given outside of the project but is computed on the basis of the project's data However, as the project's internal rate of return is compared with the cut-off rate, this problem is practically solved Fourthly, the calculation of the internal rate of return is to a certain extent cumbersome work

In view of what has been 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 or when one wants to know at what rate the capital invested is compounded over the project's life But attention must be paid to the circumstances limiting its use

3. Financial analysis

3.1 Liquidity analysis

As has been shown, the investment profitability analysis, as 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 loans have to be repaid. Also, cash flow data as used in investment profitability analysis do not include all outlays and receipts affecting 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, must be taken into consideration in the liquidity analysis, such as

Debt service charges, both principal and interest

Payments of dividends

Payments on insurance and reinsurance

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

(a) Equity and long-term financing are adequate,

(b) Cash deficits are limited to magnitudes that can be covered by recourse to short-term bank credit or eliminated by reshaping some of the cash inflows or outflows,

(c) Terms of long-term financing are adequate,

(d) 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 at their nominal values. The data from table 8 are presented in table 14 as an example of liquidity analysis.

TABLE 14. LIQUIDITY ANALYSIS OF A PROJECT

(Thousand dinars)

Item	*Year*						
	t_0	t_1	t_2	t_3-t_{10}[a]	t_{11}	t_{12}-t_{19}[a]	t_{20}
I. *Cash inflows (CI)*	100	100	70	100	100	100	120
1. Sales revenue (table 8, row 3.1)			70	100	100	100	100
2. Residual value (table 8, row 3.3)							20
3. Financing of investment (table 8, row 6)	100	100					
3.1 Equity (table 8, row 6.1)	100	20					
3.2 Loans (table 8, row 6.2)		80					

TABLE 14 *(continued)*

Item		Year						
		t_0	t_1	t_2	t_3-t_{10}[a]	t_{11}	t_{12}-t_{19}[a]	t_{20}
II	*Cash outflows (CO)*	100	100	40	92	78	78	82
	1 Investment (table 8, row 1)	100	100					
	2. Cash expenses excluding interest (table 8, row 2.1)			40	60	60	60	60
	3. Taxes (table 8, sub-row of row 4.1)				5	6	6	10
	4. Financial obligations (table 8, row 7)				27	12	12	12
	4.1 Repayment instalment (table 8, row 7.1)				10			
	4.2 Interest charges (table 8, row 7.2)				5			
	4.3 Dividends (table 8, row 7.3)				12	12	12	12
III	*Net cash balance (NCB)* (I–II) (table 8, row 8)	–	–	30	8	22	22	38
IV	*Cumulative net cash balance* (table 8, row 9)	–	–	30	94	116	292	330

[a] Annually

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 year, in addition to the equity capital of 20,000 dinars, a long-term loan of 80,000 dinars is needed to finance the project's investment. In year 3 and later 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 also to produce a surplus in all years of its operating period. Therefore, the project being evaluated is considered to have good liquidity of resources.

3.2 Capital structure analysis

Long-term finance must cover a project's cost of fixed investment and the estimated working capital requirements 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 or 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 depend, however, 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 may 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

(a) 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,

(b) By seeking finance through loans, there may be fiscal advantages since interest charges may be deductible from taxable profits.

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

(a) Interest charges are fixed obligations which have to be paid regardless of whether a project earns a profit,

(b) If annual repayments of principal approach the cost of depreciation per year, financial management may become increasingly tight and difficult;

(c) A low debt equity ratio is desirable as 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

$$R_{de} = \frac{L}{Q} \tag{9}$$

where

R_{de} = debt equity ratio,
L = long-term loans (table 8, row 6.2),
Q = equity capital (table 8, row 6.1)

Calculated from the data given in table 8, the debt equity ratio is 0 74 (85 − 115), 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 instalments give cause for short-term borrowing in any period.

It is difficult to formulate general rules on adequate financial structures For instance, the stipulation of a maximum debt equity ratio is not recommended because a very profitable project may be able to bear an unusually high share of debt financing On the other hand, a ratio of 0.74 may not be satisfactory at all if the project is not sound enough and if borrowing is on too short a term If repayments already have to be made during the construction period or before the project generates significant cash earnings, a debt equity ratio of 0 74 may not assure sufficient cash surplus during the running-in period. In addition, anticipated net cash balances must be seen in the light of uncertainties surrounding the length of the construction and running-in periods. Such uncertainties may jeopardize a project's liquidity from the very beginning A low debt equity ratio could be helpful in such cases provided it is judged easier to postpone payment of dividends for a year or so than to ask for debt rescheduling.

B 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 a country Emphasis (up to now) has been 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 national economy, national profitability analysis should be applied

National profitability analysis is similar in form to commercial profitability analysis in that they are both attempts to identify the costs and benefits and, by commeasuring them, to assess the "profitability" of an investment proposal Commercial profitability analysis is a stepping stone to national profitability analysis

Commercial profitability and national profitability, however, differ in many ways The objective of commercial profitability analysis is to assess the net financial result of a project, while the national profitability analysis traces the project's contribution to all fundamental development objectives (economic and non-economic) The former takes into account only the direct monetary effects of a project, the latter, in addition, takes into consideration the indirect (linkage) effects, both measurable and non-measurable Commercial profitability analysis is based on market prices, national profitability is determined with the help of adjusted prices which are deemed to be an approximation of 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 the 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 difference between commercial profitability analysis and national profitability analysis is important The latter is a much more complex exercise than the former, and the techniques used in the former exercise may not be sufficient for the latter Commercial profitability alone is not a solid ground for investment decisions Investment decisions taken on behalf of the society should be justified by a national profitability analysis

An overall development strategy of a country usually requires that several objectives be fulfilled. It is therefore necessary to appraise the social soundness of a project—from the point 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

Accordingly, in addition to the basic criterion recommended here—value added as the device for appraising the main impact of a project on the economy—a set of additional indices is prescribed for measuring certain implications of an investment project, such as the effects on employment, distribution, foreign-exchange earnings and international competitiveness For other implications, which cannot be measured in quantitative terms, qualitative analysis is recommended under supplementary

considerations such as the implications for infrastructure, technical know-how and the environment

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 other considerations that have not been covered, they can be analysed along the same lines as those suggested for additional indices and supplementary considerations

Acknowledging the existence of certain distortions in domestic market prices, a procedure is recommended for price adjustments Three important points are to be noted in this respect Firstly, the existing or expected market prices relevant to the project in question should be analysed and obvious distortions identified that may affect the project heavily If there are no such distortions, further analysis should be carried out on the basis of the actual market prices Secondly, the price adjustments should be made before embarking on national profitability analysis Thirdly, relatively simple practical procedures are recommended for carrying out the adjustments of the actual market prices (adding subsidy, relying on actual f.o b or c.i.f prices etc), instead of constructing sophisticated theoretical models and relying on doubtful assumptions

The use of the net value added and not gross value added is suggested for measuring the project's contribution to national income The use of net national value added (NNVA) and not net domestic value added is advocated, as well as the use of total net national value added, i.e direct plus indirect

The economic evaluation of an investment project should be carried out at each stage of its formulation starting from the early stages It is expected that the results of each consecutive evaluation may 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 This approach stresses the importance of focusing economic analysis on the project when its design is taking shape and choices are still open rather than at a time when it has been formulated and rejection may be difficult.

Two steps should be taken in the application of the value added criterion These are absolute and relative efficiency tests for the overall comprehensive evaluation of investment projects

Operational techniques should be used in applying the value added criterion, not only for evaluating new investment projects, but also for evaluating modernization and expansion projects or a group of technologically and economically interrelated projects forming an industrial complex.

Going a step further than in determining commercial profitability, operational techniques are suggested here for measuring the indirect effects of an investment project occurring in other closely related projects Unfortunately, indirect effects are sometimes difficult to identify and nearly always difficult to measure When 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* to measure in quantitative terms certain preferences from the national point of view, within the framework of an economic policy, setting up certain cut-off levels of efficiency etc As stated earlier, for the sake of practicality only the two most essential national parameters are suggested social rate of discount

and adjusted rate of foreign exchange These parameters should in principle be computed by a competent national agency, such as a national planning agency, ministry of economy, central bank, or central statistical office

As in the case of commercial profitability, several formulae with varying degrees of sophistication are suggested It is up to the users of this Manual to select the appropriate one, subject to the prevailing conditions in the country and the availability of data

Application of a set of criteria to the same project may yield varying, or even conflicting, results The project evaluator should, therefore, provide a comprehensive evaluation summary to the decision maker, drawing his attention particularly to the main economic selective results and at the same time to other expected results of the project This will afford material to the decision maker about the overall impact of the project on the economy and on the branch of the economy in which he is particularly interested or with regard to which he would like to be cautious before making any commitments

The methods suggested for analysing national profitability of investment proposals are described in the following pages

2. Price adjustments

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

However, market prices prevailing in a country at any particular 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 or expected actual prices and the identification of obvious distortions substantially affecting the project analysis. In other words, price adjusting should be done selectively in terms of two criteria *(a)* which items figure most prominently in the inputs and outputs of a project at market prices, and *(b)* for all inputs and outputs which market prices are most out of line with their respective social costs The result would be that adjustments would be recommended only for the most important items and the most apparent price distortions, which might affect the project considerably

The second step would be to segregate these influences and to bring actual market prices to levels that would represent an acceptable approximation of their real social costs The real costs and benefits should be estimated under actual conditions in which the project is to operate and not under any presumed or idealistic conditions

The above-mentioned adjustments should be made before making a final appraisal of the national profitability. For analytical purposes a preliminary appraisal of the national profitability of a project may be made by applying the same market prices and foreign-exchange rate used under commercial profitability This analysis, in addition to the basic one, would indicate the overall impact of the price distortions on the national profitability of an investment project

The following simple techniques for price adjustments may help to achieve the desired approximations to the real social values of outputs and inputs Each project has outputs representing benefits and inputs entailing costs The outputs can be divided broadly into four parts, namely exported, import substituting, domestically marketed and infrastructural services Similarly, the inputs can be divided broadly into imported, domestically produced, infrastructural services, land and labour Table 15 suggests the pricing rules which can be conveniently adopted

Exported outputs should be valued at actual f.o b prices since this value represents the real social price that the country receives The project evaluator should, however, determine whether there are hidden dumping and other distorting elements in this price which may make it misleading For instance, the actual f.o b price may have been set too low for a certain time to conquer a market with the intention of increasing the price later on Such a potential increase in the f.o.b. price would affect the project positively, there might, however, be other distortions that may affect it negatively

Outputs may be domestically marketed at present, but they are actually import substituting The establishment of the new project would lead to the discontinuance of imports of the same product Such outputs should be valued at actual c.i.f prices since this value represents the real cost for the country. Such valuation should be done only when a direct link exists between the establishment of a project and the discontinuance in the import of certain products of the same quantity and quality For the sake of brevity, any further reference made here to c.i.f price should be understood to mean that all import taxes, import duties, internal charges of transport, insurance etc. are also to be taken into consideration Price corrections should be applied to c.i.f prices first, then to internal charges in compliance with the pricing rules

Governments often decide to help in creating and maintaining appropriate economic conditions for the continued production of certain basic domestically marketed goods One of the important economic conditions is the level of prices from the point of view of the producer and of the consumer The producer needs a price that is high enough. At the same time, for essential goods of basic importance the price should be low enough to make such goods easily accessible to the lowest income groups In setting up a low price Governments usually pay subsidies to accommodate the producer, the subsidy is a form of price correction The social value of the output in this case equals the market price plus a subsidy Therefore, domestically marketed basic goods should be valued at the actual domestic market price plus subsidy, if any.

Domestically marketed non-basic goods are valued at actual domestic market prices which may often include indirect taxes. These indirect taxes should not be subtracted from the actual market price since they reflect a certain government policy acceptable to the consumer who is prepared to pay that price

Imported inputs (investment and current material inputs) are valued at actual c.i.f prices plus internal charges for transport, insurance etc This is the real price paid by the country As in the case of exported output, here, too, care should be taken with regard to a possible hidden dumping component or other distorting elements It may well happen that the actual c.i.f price is too low, but as soon as the supplier conquers the market of a country, he may decide to increase the price to a more realistic level, thus affecting the project negatively

TABLE 15 PRICING RULE

Item	*Price*	*Justification*
I. *Outputs*		
1 Exported	AFOB	This is the real social price being realized by the country Care should be taken that there is no hidden dumping as well as other distorting elements in this price
2. Domestically marketed (import substituting)	ACIF	Same as above
3 Domestically marketed		
(a) Basic goods	ADMP plus subsidy (if any)	The subsidy represents additional social costs which are borne by the Government
(b) Non-basic goods	ADMP including indirect taxes (if any)	
4 Domestically marketed infrastructural services–electricity, gas, water, steam, transport etc. (if not exportable)	ADMP or cost, whichever is higher	Since ADMP are sometimes established below production costs and the producer is subsidized
II. *Inputs*		
1 Imported (investment and current material inputs)	ACIF plus internal incidental charges of transport, insurance etc.	This is the real social price being paid by the country, however, one should be careful with regard to possible hidden dumping components in this price
2 Domestically produced (investment and materials)		
(a) Exportable (have been exported before and could be exported now)	ADMP or AFOB, whichever is higher	However, judgement should be exercised in case the internal prices are much lower than f o b., it might be argued that either they are subsidized 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 and could be imported now)	ADMP or ACIF, whichever is lower	Here, too, a judgement might be necessary to adjust ADMP at some suitable level when it is substantially higher than ACIF
(c) Others	ADMP plus subsidy	The subsidy represents additional social cost borne by the Government
3 Domestically procured infrastructural services–electricity, gas, water, steam, transport etc. (if not exportable or importable)	ADMP or cost, whichever is higher	ADMP of these services may sometimes be established below production costs, amounting to a hidden subsidy
4. Land	ADMP (on land for industrial construction)	
5 Labour	Actual salaries and wages plus fringe benefits	

Note ADMP = actual domestic market price, AFOB = actual free on board price, ACIF = actual cost, insurance and freight price For converting the f.o b and c.i.f prices into local currency, adjusted rate of foreign exchange should be utilized

Some material inputs (investment and current materials) are domestically produced, but they are exportable, they have been exported before and could be exported now. For such inputs one should use the actual domestic market price or actual f.o b price, whichever is higher To take the lower price would result in underestimating the real social value of the input There could be three possibilities in practice

(a) The actual f o b price is higher than the actual domestic market price In this case the f.o b price should be used because it expresses the opportunity cost of said input, that is, if the input is not used in the project, it may be exported If this input were to be exported, the country would receive the f.o b. price Thus, a true picture of the real social value is gained For instance, the actual domestic price for cement in a country is 9 dinars per ton, while the export price is 19 dinars per ton The f.o b price of 19 dinars per ton should be used for project evaluation. This would create economic incentives for the better utilization of cement in the country Such an approach might increase the investment cost for the current material inputs of a project, but this would reflect the economic reality. It would provide an indication of the real price for development which a country pays by curtailing the export of a raw material and processing it at home, which may have a number of far-reaching, long-term, positive socio-economic implications for a country Crude oil may be a good example The application of the f.o b price for crude oil used for domestic processing would encourage the use of the huge quantities of associated gas waste The quantity of flared gas in the Arab region alone is enough raw material to produce fertilizers to meet the future demand of the entire world The transportation cost for this gas is 80 per cent of its market price, which makes transportation over long distances unattractive For crude oil this rate is only 10 per cent Therefore, the application of the f.o b price would be a powerful incentive to the petrochemical industry to use associated gas waste while the export of crude oil continues

(b) The actual domestic market price is higher than the f.o b price There might be many reasons for this, however, the country badly needs foreign exchange and is even prepared to subsidize exports This means that the subsidy makes up for the difference between the actual domestic market price and the f.o b price A strong incentive is created for the project to go on exporting In this case the actual domestic market price should be taken because it reflects the true value of the commodity for a country This may be done in two ways which lead to the same result

(i) By taking the actual domestic market price, which is higher than the f.o.b price,

(ii) By taking the f.o.b price and adding the subsidy

(c) The f.o.b price and the actual domestic market price are almost at the same level, but the Government still pays a subsidy to encourage exports. This is a cost that society has decided to make in order to solve certain practical problems In such a case the f.o b price should be taken and the subsidy added

In the above three cases the starting point in the analysis is the price specified in the contract for exports If the contract refers to an f.o b price, it should be used, if the export of a commodity is expected on the basis of a c.i.f price, all adjustments should be based on that price

Other material inputs are being domestically produced, but they are importable, they have been imported before and could be imported now For these inputs the actual domestic market price should be used or the actual c.i.f price, whichever is lower To take the higher price would mean an overestimation of the real social value of the input The real social value is represented by the lower price (i.e c.i.f) because it would be preferable for the society to import the input, as less expensive, than to expand its domestic production In other cases the real value might be represented by the actual domestic market price, which is lower than the c.i.f price, and society would prefer to expand the local production of this input, as cheaper, than to import it

Other inputs should be valued at actual domestic market price plus subsidy since the subsidy is an additional social cost which is borne by the country

Infrastructural services (both inputs and outputs) comprise electricity, gas, water, steam, transport, repair and maintenance services etc If they are importable or exportable, the procedure suggested above is applied If they are not importable or exportable, the valuation is done by using the actual domestic market price or the production cost, whichever is higher Taking the higher value (market price or production cost) would reflect the actual social worth of these services To use the lower one would mean an underestimation of the value of infrastructural services This approach is suggested for the simple reason that the actual domestic price of these services may sometimes be established below production cost, and the result is a hidden subsidy

If there are two prices for electricity—one for the public and another one for industrial purposes—the higher price should be taken as a starting point and then compared with production cost

The land used by the project is valued at actual domestic market price This should be the price of land for industrial construction on the free market

Labour is valued in terms of actual gross salaries and wages plus fringe benefits It is more difficult to value the fringe benefits appropriately This assessment should be done on the basis of the real market price or cost, whichever is higher, of the facilities provided to domestic and expatriate workers and not on the basis of the price they have paid, i.e rent for houses This price is often too low and is supplemented by a considerable hidden subsidy

Project appraisal is carried out in *constant prices* This means that the prices of inputs and outputs as adjusted (as indicated above) should be used throughout the economic life of an investment project

The use of the actual domestic market price, ADMP, does not mean that the price prevailing on the market at the given moment is picked blindly and applied to the future The selection of the prevailing relevant market price at the moment is only the starting point The possibilities for the most likely future fluctuations of this price should be carefully analysed On the basis of this analysis a domestic market price is arrived at which may or may not coincide with the domestic market price prevailing at the moment The domestic market price so derived should then be used for evaluation purposes throughout the lifetime of the project without further adjustments, i.e as a constant price The same logic applies to f.o.b and c.i.f. prices

Any foreseeable future variations that have not been reflected in the selected constant prices owing to inflation or other reasons will be taken care of by sensitivity and probability analysis

3 Basic criterion of national profitability–value added

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 the 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

$$\text{NVA} = O - (\text{MI} + I) \tag{10}$$

where

NVA = expected net value added generated by a project,

O = expected value of the output of a 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

It may be noted that the material inputs of a project include all current materials and services (raw materials, energy, fuel, transport, maintenance etc.) purchased from outside the project

The net value added comprises two major components wages and salaries, W, and social surplus, SS

$$\text{NVA} = W + \text{SS} \tag{11}$$

Wages and salaries express the level of employment and the average wages of the people employed The social surplus expresses the earning capacity of a project It comprises indirect taxes, interest, dividends, insurance and reinsurance charges, rent, royalties, and undistributed profit that is being used by the firm for expansion funds, reserve funds, social welfare funds etc

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

Net value added for a single year

$$\text{NVA} = O - (\text{MI} + D) \text{ (for that year)} \tag{12}$$

where

D = annual depreciation.

Net value added for a project's whole economic life

$$\sum_{t=0}^{n} \text{NVA} = \sum_{t=0}^{n} O_t - \sum_{t=0}^{n} (\text{MI} + I)_t \tag{13}$$

or (which is the same)

$$\sum_{t=0}^{n} \text{NVA} = \text{NVA}_0 + \text{NVA}_1 + \ldots + \text{NVA}_n \tag{14}$$

where

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

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

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

$\text{NVA}_0, \text{NVA}_1, \text{NVA}_n$ = expected annual net values added throughout the project's life from year 0 to year n

As may easily be seen, formulae 13 and 14 provide a more explicit presentation of formula 10, emphasizing the need to take into consideration all benefits and costs throughout the economic life of a project

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

(a) Net national value added that part that is produced and distributed in a country,

(b) Repatriated net value added that part that is produced by a project but repatriated abroad (wages, interest, net profits, dividends, rents, royalties, insurance and reinsurance, or any other foreign payments not included in material inputs)

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

$$\sum_{t=0}^{n} \text{NNVA} = \sum_{t=0}^{n} O - \sum_{t=0}^{n} (\text{MI} + I + \text{RP}) \qquad (15)$$

where RP is equal to all repatriated payments in respect of this project such as royalties, insurance, 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 net national value added unless otherwise stated For the sake of brevity, only value added will be used

The total value added generated by an investment project comprises

(a) Direct value added that produced within a project itself,

(b) Indirect value added additional value added generated by other projects technologically and economically related to a 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 if its magnitude is negligible and therefore not worth the effort, all calculations of efficiency may be based on direct value added only

At this stage the evaluator must take into account the distribution of benefits and costs over time in order 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 section II.B 6 on "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.* For small projects with a uniform stream of value added as well as for larger projects at the early stages of project formulation, it is advisable to compile the value added for a normal year manifesting the normal operational conditions of the project The normal year should be the same as that selected for commercial profitability analysis (see II.A 2 1) This estimate will provide only a preliminary idea of the benefits of a project to the country 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 careful thought has to be given before continuing with the project, with particular emphasis being given to 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 use of the following formula

$$E_s = O - (\mathrm{MI} + D) > W \tag{16}$$

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 normal year,
- O = expected value of normal annual output (usually 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

As can be easily seen, the proposed simple formula is based on net domestic value added This is recommended since at the early stage there may not be sufficient information regarding repatriated payments. If the project evaluator possesses this information and the repatriations are expected to be of crucial importance, they could easily be introduced in formula 16 If the project being formulated shows such a social surplus, it passes the absolute efficiency test at the early stages of formulation, indicating that it will yield a surplus after meeting its wage obligations.

A more detailed analysis of the project may now be undertaken with some confidence Even if there is no such surplus, it may not be necessary to abandon the project at this stage, but how to improve it may be considered

The application of the simple formula for an absolute efficiency test is illustrated by an example of the same hypothetical project considered in the section on commercial profitability (II A) Its data are derived from table 9 and compiled in table 16

TABLE 16 ABSOLUTE EFFICIENCY TEST–SIMPLE FORMULA[a]

(Thousand dinars)

Item	*Amount*
1 Expected value of output in a normal year, O (table 9, row 1)	100
2. Expected value of current material inputs in a normal year, MI	51
3. Expected depreciation of fixed capital in a normal year, D (table 8, row 2.2)[b]	10
4. Expected wages in a normal year, W (table 9, rows 4.1 and 5.1)	12

[a] In accord with the approach under commercial profitability, year 5 is selected as a normal year

[b] As this is the only case in which depreciation is used in national profitability analysis in the Manual, it is not provided in table 9 However, it is readily available in table 8.

The absolute efficiency test on the basis of a normal year's data shows that

$$E_s = 100 - (51 + 10) > 12$$

$$E_s = 39 > 12$$

The project generates in a normal year a social surplus of 27,000 dinars over and above wages and therefore passes the preliminary absolute efficiency test

(b) *Discounting formula.* The application of this formula is recommended for later stages of project formulation as well as when the stream of the annual values added is not uniform The evaluation of the total effects of the project during its lifetime on the national economy is done with the help of the SRD The expected annual values added throughout the project's life are all reduced to one figure by application of the SRD, taking into account the different years of their occurrence This is done in the following manner

Step 1 Model table 9, "Integrated value added analysis", contains data on outputs, current material inputs, investments and repatriated payments of a 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 are already available These may now be carefully reviewed and if obvious distortions are detected, they should be corrected as per price adjustment rules Quantities of outputs and inputs multiplied by adjusted prices give the values of outputs and inputs

Step 3. The figures so computed for each year of the project's life are grouped as follows

Nominal values of output, O_t (basically sales revenues, subsidies and residual value),

Nominal values of investment, I_t,

Nominal values of current material inputs, MI_t,

Nominal values of repatriated payments, RP_t (repatriated wages of expatriates, interest paid on foreign loans, net profits of expatriate shareholders, royalties and other foreign payments which are not included in material inputs)

Step 4 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 (II.B 3 3 2). The annual indirect benefits and costs thus computed are added to the annual direct benefits and costs, respectively. This enables computing the total value added (direct and indirect).

Step 5 The nominal values computed under steps 3 and 4 above are grouped as follows

Value of output (O_t),

Value of all material inputs $(MI + I)_t$

Subtract for each year the nominal values of all material inputs, $(MI + I)_t$, from the nominal values of output, O_t, to arrive at the nominal values of the *net domestic value added,* $NDVA_t$, for the respective years

$$NDVA_t = O_t - (MI + I)_t \tag{17}$$

Step 6 Subtract from the annual values of net domestic value added, computed above, the annual values of repatriated payments, RP_t, to arrive at the expected nominal annual values of net national value added, $NNVA_t$, for the respective years

$$NNVA_t = O_t - (MI + I + RP)_t = NDVA_t - RP_t \tag{18}$$

Step 7 The nominal values of net national value added thus computed for each year of the life of the project should be discounted to the base year by applying the SRD. For this purpose the discount factors should be identified from the present value table in the annex for each year corresponding to the adopted SRD. The nominal annual figures of $NNVA_t$ 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 of the net national value added

$$\sum_{t=0}^{n} VA_t a_t = \sum_{t=0}^{n} [O_t - (MI + I + RP)_t]\, a_t \tag{19}$$

The present worth of the value added thus computed *must be positive*

$$\sum_{t=0}^{n} VA_t a_t > 0 \tag{20}$$

This is an indication of the positive contribution of a project to the national income. Therefore, the project has passed 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, although very important, is still not a sufficient condition for accepting 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 8 The present value added thus computed should usually comprise salaries and wages W and a social surplus SS Table 9 provides a breakdown of the nominal annual values added on wages and social surplus The nominal annual values of net national value added and of wages are discounted by the SRD to arrive at their present values These two present values could be further utilized for applying the absolute efficiency test to the project as follows

$$E = \sum_{t=0}^{n} \mathrm{VA}_t a_t \geqslant \sum_{t=0}^{n} W_t a_t \qquad (21)$$

where

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

$\sum_{t=0}^{n} \mathrm{VA}_t a_t$ = present value of the expected value added for the whole lifetime of a 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 a project from year 0 to year n excluding expatriated wages,

a_t = discounting factor in year t

TABLE 17 ABSOLUTE EFFICIENCY

(Thousand

Item	t_0	t_1	t_2	t_3	t_4	t_5	t_6
1 Value of output (O) (table 9, row 1)	–	–	70	100	100	100	100
2 Value of material inputs (MI + I) (table 9, row 2)	100	100	30	51	51	51	51
3 Net domestic value added (1–3)	(100)	(100)	40	49	49	49	49
4 Repatriated payments (R) (table 9, row 4)			15	16	16	16	15
5 Net national value added (3–4)	(100)	(100)	25	33	33	33	34
5 1 Wages (W) (table 9, row 5 1)			7	9	9	9	10
5 2 Social surplus (SS) (table 9, row 5 2)			18	24	24	24	24
6 Discount factors (a_t) at 9% discount rate	1 00	0 92	0 84	0 77	0 71	0 65	0 60
7 Discounted values of net national value added (5 x 6)	(100)	(92 0)	21 0	25 4	23 4	21 5	20 4
7 1 Discounted values of wages (5 1 x 6)	–	–	5 9	6 9	6 4	5 8	6 0
7 2 Discounted values of social surplus (5 2 x 6)	(100)	(92 0)	15 1	18 5	17 0	15 7	14 4

If the sum total of discounted value added for the whole life of a 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 social surplus 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 produce a social surplus at all 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

In table 17 the application of the absolute efficiency test is demonstrated again using the initial data stated in table 9

It is assumed first that there are no price distortions with regard to prices of inputs and outputs as well as to the rate of foreign exchange The analysis is carried out on the basis of the same market prices, and the official rate of foreign exchange, $US 1 = 5 dinars, applied under commercial profitability Applying the absolute efficiency formula (21), it is found that

$$94{,}900 > 84{,}300$$

TEST AT MARKET PRICES

dinars)

Year														
t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
100	100	100	100	100	100	100	100	100	100	100	100	100	100	
51	51	51	51	51	51	51	51	51	51	51	51	51	51	
49	49	49	49	49	49	49	49	49	49	49	49	49	69	
15	14	14	14	10	10	10	10	10	10	10	10	10	16	
34	35	35	35	39	39	39	39	39	39	39	39	39	53	
10	11	11	11	12	12	12	12	12	12	12	12	12	12	
24	24	24	24	27	27	27	27	27	27	27	27	27	41	
0.55	0.50	0.46	0.42	0 39	0 36	0 33	0 30	0 27	0.25	0 23	0.21	0 19	0 18	
18 7	17.5	16 1	14 7	15.2	14 0	12 9	11 7	10.5	9.8	9 0	8.2	7.4	9.5	94 9
5.5	5.5	5 1	4 6	4 7	4 3	4 0	3 6	3.2	3 0	2.8	2.5	2 3	2.2	84 3
13.2	12.0	11 0	10 1	10.5	9 7	8.9	8 1	7 3	6.8	6.2	5 7	5 1	7 3	10.6

Therefore, should there not be any price distortions, the project would pass the absolute efficiency test, i.e it covers wages of 84,300 dinars and generates a social surplus of 10,600 dinars

However, the project analysts find that this is not the case There are some price distortions and in particular distortions in the foreign-exchange rate. The official rate of exchange overvalues the local currency in comparison with the foreign currency

In these circumstances the same absolute efficiency test is then carried out at corrected prices of inputs, outputs and foreign exchange. The price adjustments are made following the instructions in the pricing rule table (table 15) The adjusted rate of foreign exchange contains 30 per cent premium and $US 1 = 6 5 dinars

Table 18 contains the adjusted figures for the absolute efficiency test

The discounted value added equals 202,300 dinars This is an indication of the positive contribution of the project to the national income Therefore, the project has passed the first part of the absolute efficiency test However, this is still not sufficient for recommending a decision on the project It is very important to find out how much of this value added will be used to pay the wages and salaries of the labourers and how much the social surplus is

By the application of formula 21 it was found that, while the discounted value added is 202,300 dinars, the discounted value of the wages is 84,400 dinars The project generates enough value added to recover the wages paid to the labourers It

TABLE 18 ABSOLUTE EFFICIENCY

(Thousand

Item	t_0	t_1	t_2	t_3	t_4	t_5	t_6
1 Value of output (*O*) (table 9, row 1)	–	–	89.5	127 0	127 0	127 0	127 0
2 Value of material inputs (MI + *I*) (table 9, row 2)	122.5	125.5	32.4	54.6	54 6	54.6	54.6
3 Net domestic value added (1–2)	(122.5)	(125.5)	57 1	72.4	72.4	72.4	72.4
4 Repatriated payments (RP) (table 9, row 4)			19.5	20.8	20 8	20.8	19.5
5 Net national value added (3–4)	(122.5)	(125.5)	37 6	51 6	51 6	51 6	52.9
5 1 Wages (*W*) (table 9, row 5 1)			7 0	9 0	9 0	9 0	10 0
5 2 Social surplus (SS) (table 9, row 5 2)			30 6	42 6	42 6	42 6	42 9
6 Discount factors (a_t) at 9% discount rate	1 00	0 92	0 84	0 77	0 71	0 65	0 60
7 Discounted value of net national value added (5 x 6)	(122.5)	(115.5)	31 6	39 7	36 6	33.5	31 7
7 1 Discounted values of wages (5 1 x 6)			5 9	6 9	6.4	5 9	6 0
7 2 Discounted values of social surplus (5 2 x 6)	(122.5)	(115 5)	25 7	32 8	30 2	27 6	25 7

[a]Exported output, import substitution output, imported investment and current material inputs The adjustments were made on the basis of the data provided in table 9 This table covers only the added (direct and indirect) as it is done in table 22

also produces a substantial social surplus Therefore, from the point of view of contribution to the national income in terms of wages and social surplus, the project is acceptable

If it is determined that the project does not generate a social surplus, the designers should review the project carefully and modify it accordingly to improve its basic parameters Additional domestic resources should be sought for financing the project to minimize the repatriated payments (interest on foreign loans, dividends on foreign equity etc) Special attention should also be paid to the application of the additional indices to measure the project's contribution to other development objectives

A comparison between tables 17 and 18 clearly indicates an improvement in terms of value added In both cases the value added is positive, but at corrected prices it is much higher, i.e it increases from 94,900 dinars to 202,300 dinars This means that the price corrections and in particular the adjustment of the foreign-exchange rate affect the project positively, mainly through the higher prices of output, which compensates for the higher prices of imported inputs (investment and materials) and the higher valuation of repatriated payments

The conclusion is that evaluated at corrected prices the project marks a distinct improvement While at market prices it was expected to produce a social surplus of 10,600 dinars, at corrected prices it generates a considerably larger social surplus of 117,900 dinars

TEST AT CORRECTED PRICES[a]

dinars)

Year														
t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
127 0	127 0	127 0	127 0	127 0	127 0	127 0	127 0	127 0	127 0	127 0	127 0	127 0	147 0	
54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	54 6	
72 4	72 4	72 4	72 4	72 4	72 4	72 4	72 4	72 4	72 4	72 4	72 4	72 4	92 4	
19 5	18 2	18 2	18 2	13 0	13 0	13 0	13 0	13 0	13 0	13 0	13 0	13 0	20 8	
52 9	54 2	54 2	54 2	59 4	59 4	59 4	59 4	59 4	59 4	59 4	59 4	59 4	71 6	
10 0	11 0	11 0	11 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	
42 9	43 2	43 2	43 2	47 4	47 4	47 4	47 4	47 4	47 4	47 4	47 4	47 4	59 6	
0 55	0 50	0 46	0 42	0 39	0 36	0 33	0 30	0 27	0 25	0 23	0 21	0 19	0 18	
29 1	27 1	24 9	22 8	23 2	21 4	19 6	17 8	16 0	14 9	13 7	12 5	11 3	12 9	202 3
5 5	5 5	4 6	4 7	4 7	4 3	4 0	3 6	3 2	3 0	2 8	2 5	2 3	2 2	84 4
23 6	21 6	19 8	18 2	18 5	17 1	15 6	14 2	12 8	11 9	10 9	10 0	9 0	10 7	117 9

as well as repatriated payments are valued at adjusted rate of foreign exchange, $US 1 = 6 5 dinars. direct value added of a project in order to illustrate separately the computation of the total value

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 Ranking cannot 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 into 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 identified

(a) In a case in which there are fewer projects and no production resource constraints, all projects that satisfy the absolute efficiency test can be taken,

(b) If there is no clearly pronounced scarce factor or there are several constraints (all important production factors are scarce), the ranking of alternative projects designed to produce the same products 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 the project is to the economy,

(c) There are, however, some well-known scarcities of basic economic resources which the developing countries generally face, such as scarcity of capital, foreign exchange and skilled labour The occurrence of one scarcity or another, among other things, is closely related to the strategy of socio-economic development and the priorities set up It may therefore be useful to establish which scarcity would vitally affect the setting up and operation of a project and the economy as a whole Ranking should be done then by relating the value added produced by the project to *the scarcest factor* in the country Project ranking under three scarce situations relevant for many countries is illustrated below

Project ranking in a situation of capital scarcity. The objective is to find which projects generate the maximum value added *per unit of capital* invested This can be assessed by dividing the discounted value added $P(\mathrm{VA})$, by the present value of total investment, $P(I)$, both compiled earlier for finding the absolute efficiency of the project

$$E_C = \frac{P(\mathrm{VA})}{P(I)} \tag{22}$$

The larger the ratio, the more beneficial the project is from the capital point of view, it could therefore be selected in a situation of capital scarcity In the hypothetical example the discounted value added is 202,300 dinars and the discounted total investment is 238,000 dinars

$$E_C = \frac{202{,}300}{238{,}000} = 0\ 85$$

Therefore, a dinar of discounted investment generates 0 85 dinars of value added This coefficient seems to be very high, but it has a real meaning only when compared with the same coefficients for alternative projects The higher the ratio, the better the project

Project ranking in a situation of foreign-exchange scarcity The position here is similar to that of capital scarcity, and the object is to find which project produces

the maximum value added *per unit of net foreign-exchange cost* It is obtained by applying the formula

$$E_{FE} = \frac{P(VA)}{P(FE)} \tag{23}$$

P(FE) will be the present value of the net foreign-exchange cost of a project compiled in table 28 of section II B 4 3 , "net foreign-exchange effect" The net foreign-exchange cost is obtained as the difference between foreign-exchange spending and foreign-exchange earnings (savings) during the lifetime of a project This formula is applicable only when the foreign-exchange spending exceeds the foreign-exchange earnings of a project The higher the ratio, the larger is the contribution of value added to the economy per unit of net foreign-exchange cost

The formula does not apply to the hypothetical project because its foreign-exchange earnings and savings exceed the foreign-exchange spending

Project ranking in conditions of the scarcity of skilled labour In conditions of scarcity of skilled labour, it is necessary to find the projects generating a maximum value added *per unit cost of skilled labour* This can be easily determined as follows

$$E_L = \frac{P(VA)}{P(L_s)} \tag{24}$$

$P(L_s)$ 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 table 3, "Manpower requirements" When both skilled and unskilled labour are scarce, the total wage bill along with the fringe benefits should be used in the denominator of the above formula

The larger the ratio, the greater is the contribution of value added per unit cost of skilled labour, therefore the project is preferable in a situation in which labour is scarce

The discounted amount of the wages, salaries and fringe benefits of the local and foreign skilled labour in the hypothetical project was computed as 50,000 dinars It follows that

$$E_L = \frac{202{,}300}{50{,}000} = 4.05$$

Thus, a dinar of discounted wages, salaries and fringe benefits paid to the skilled labour helps to generate 4 05 dinars of value added This coefficient should also be compared with respective coefficients for alternative projects The higher the coefficient, the better the project is

The application of the relative efficiency tests may necessitate certain technical and economic modifications in the project's design If the foreign exchange is too scarce, the designers may be asked to modify the project by looking for domestic material substitutes, alternative lower-priced imports, increasing exports etc This may lead to a certain relief in a situation of foreign-exchange scarcity The same may apply to the scarcity of capital and of skilled labour

3 2 Application of the value added criterion for evaluation of modernization/expansion projects

Modernization and expansion are important aspects of the industrialization programme of any country It is necessary in particular 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 steadily losing industrial unit Modernization is usually accompanied by expansion and vice versa, there is no clear-cut demarcation line between them For the sake of brevity, modernization/expansion projects will be referred to here as modernization projects

There are different types of modernization In one case it may consist of improving or replacing a machine or group of machines which are physically still operational but economically obsolete This may help to resolve a bottle-neck, to increase production, to improve quality, to decrease production cost, to improve working conditions etc At the other extreme, modernization may involve a complete reconstruction of an existing factory, replacing most of the machinery and equipment and retaining only the factory buildings Such reconstruction may lead to a considerable increase in production capacity, lower production costs and capital costs per unit of output, better quality, improved working conditions etc In practice there might be many variations of modernization between these two extremes

Part of the existing fixed capital and certain infrastructural facilities are used by the modernized project However, it is even more important that the modernized factory use basically the same manpower This may be the most essential link between the old and the modernized factory

For very simple and limited-in-scale modernization projects, simple techniques for evaluation may be sufficient. One may conveniently use the simple rate of return (formula 1 or 2), pay-back period (formula 3) or the simple value added formula (formula 16)

Larger modernization projects, such as new projects, should be evaluated in a two-step procedure firstly, by the absolute efficiency test and then by the relative efficiency test

Although throughout this section the terms "before" and "after" are used, what is really advocated here is a comparison between the current level of operation (present or expected in the future without modernization) with the expected parameters of the same production unit being modernized (with modernization)

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 modernization) 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 plus additional value of output owing to modernization,

Value of material inputs = material inputs at the current level of operation plus additional inputs caused by modernization,

Value of capital = market value or book value of the adopted machines, equipment etc , from the existing production unit plus new investment for modernization,

Value of repatriated payments = value of payments going abroad at the current level of operation plus additional repatriations resulting from modernization (if any),

Value of wages = value of wages for employed labour at the current level of operation plus wages for labour newly employed owing 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.

The first question that should be asked in evaluating a modernization project is whether value added after modernization is larger or at least equal to the value added before modernization This could be expressed in the following way

$$\frac{P\,(\text{VA})\text{ after modernization}}{P\,(\text{VA})\text{ before modernization}} \geqslant 1 \tag{25}$$

where

P(VA) after modernization = present worth of the value added expected to be generated by a project after modernization,

P(VA) before modernization = present worth of the value added expected to be generated at the current level of operation

If the project passes this test one can go on applying the following tests, if not, the project should be re-examined and possibly improved

Assuming the project passes the above first step of the absolute efficiency test, the next question should follow is the value added expected to be generated by the modernized project larger or at least equal to the wages to be paid to the labourers?

$$E_m = P\,(\text{VA})_{\text{after}} \geqslant P\,(W)_{\text{after}} \tag{26}$$

where

E_m = absolute efficiency test for modernization project,

$P\,(W)_{\text{after}}$ = present value of the expected wages after modernization

The modernization project passes the absolute efficiency test if the present value added exceeds the present value of wages However, just to pass this test may not be sufficient This type of efficiency test only answers the question whether the modernization proposal is expected to generate a social surplus But how does it compare with the social surplus generated by the production unit prior to modernization? What is the structure of the value added (wages plus social surplus) after modernization as compared with before modernization?

It may be desirable for this type of project that a second efficiency test be carried out by comparing the efficiency in terms of social surplus generated before and after modernization. This can be done in the following steps·

Step 1 Compile the present values of value added and of wages expected to be generated at the current operating level and apply the absolute efficiency formula $E_m = P(\text{VA}) \geqslant P(W)$ 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 in terms of social surplus for the two levels–before and after modernization–and arrive at an absolute efficiency ratio

$$E_m = \frac{P\,(\text{VA}) - P\,(W)\text{ (after modernization)}}{P\,(\text{VA}) - P\,(W)\text{ (before modernization)}} \geqslant 1 \tag{27}$$

A modernization project passes the absolute efficiency test if the ratio is larger than, or at least equal to, one, or in other words, if the expected social surplus from the modernized project is larger than, or at least equal to, the social surplus at the current level of operation If this condition is not met, one may consider how the design for modernization can be improved

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 product

(a) If there is no clearly distinguished scarce factor or if 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,

(b) If the scarce factor is pronounced, the ranking is made by relating the expected value added from the modernized project to the most scarce factor in the country used for this project

$$E_{SF} = \frac{P(VA)}{P(SF)} \tag{28}$$

where

E_{SF} = relative efficiency of a modernization project with regard to respective scarce factor (capital, foreign exchange, skilled labour),

$P(VA)$ = present worth of the expected value added after modernization over the lifetime of a project,

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

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

Table 19 contains the necessary aggregated data for assessment of an investment proposal to expand and at the same time to modernize considerably an existing industrial establishment This table contains two different types of data

(a) Present values of value added, wages, investment and skilled labour which characterize the factory at the current level of operation, i.e before modernization These data combine actual data of the factory's past and present performance with data computed on the basis of its expected performance, should expansion and modernization not be undertaken,

(b) Expected present values of value added, wages, investment and skilled labour after modernization

TABLE 19 EVALUATION OF A MODERNIZATION PROJECT

(Thousand dinars)

Item	*Before expansion/modernization*	*After expansion/modernization*
1. Present values of value added, P (VA)	65	90
2. Present values of wages, $P(W)$	63	64
3. Present values of investment, $P(I)$	250	300
4. Present values of wages and fringe benefits paid to skilled labour, $P(L_S)$	35	45

The first question to be asked is whether the value added after modernization of the factory, $P(\text{VA})_1$, is larger than the value added before modernization, $P(\text{VA})_0$ The available data confirm that it is

$$\frac{P(\text{VA})_1}{P(\text{VA})_0} = \frac{90{,}000}{65{,}000} = 1\ 38 > 1$$

Since this condition is met, the second question follows is the expected value added, $P(\text{VA})_1$, large enough to cover the wages paid to the labourers, $P(W)_1$, and to have a surplus over and above them? The data from table 19 confirm that it is

$$P(\text{VA})_1 \geqslant P(W)_1$$

or

$$90{,}000 > 64{,}000$$

With this condition having been met, the third question follows is the expected social surplus after modernization larger than that at the current level of operation? The answer to this question is also positive·

$$\frac{P(\text{VA})_1 - P(W)_1}{P(\text{VA})_0 - P(W)_0} = \frac{90{,}000 - 64{,}000}{65{,}000 - 63{,}000} = \frac{26{,}000}{2{,}000} = 13 > 1$$

Therefore, the proposed project for modernization of the existing factory is acceptable. The project has passed the absolute efficiency test.

Table 19 also contains the necessary data for carrying out the relative efficiency test. This test is applied with regard to two scarce factors, investment and skilled labour

(a) *Investment.* The present value of the investment of the existing factory is 250,000 dinars. The expected present value of the investment of the modernized project is 300,000 dinars. Part of it is the market value of the adopted equipment of the existing factory. A dinar of investment in the modernized project is expected to generate 0.30 dinars of value added.

$$\frac{P(\text{VA})_1}{P(I)_1} = \frac{90{,}000}{300{,}000} = 0.30 \text{ dinars}$$

This ratio is higher than the same ratio in the existing factory (0.26). This is another indication that the proposed modernization is sound The ratio 0.30 has to

be compared with the same ratio in an alternative project (if any) If the proposed modernization assures a higher productivity of the investment in terms of value added compared with the existing factory, but a lower productivity compared with an alternative proposal for a new investment project, the modernization proposal should be re-examined carefully in order to be improved

(b) *Skilled labour* It may be seen from table 19 that the present value of wages before modernization is 63,000 dinars and the present value of wages and fringe benefits paid to skilled labour is 35,000 dinars After modernization, the output goes up considerably and with it the value added The wages, however, remain practically the same, although the number of manpower employed will have dropped. The share of the skilled labour has increased proportionately to that of unskilled labour, which is reflected in the considerable increase in the present value of wages and fringe benefits paid to skilled labour One dinar of discounted salaries and fringe benefits paid to skilled labour is expected to generate 2 dinars of net national value added

$$\frac{P(\mathrm{VA})_1}{P(L_s)_1} = \frac{90{,}000}{45{,}000} = 2 \text{ dinars}$$

This is higher than the same ratio in the existing factory before modernization (1.86), thus confirming the soundness of the proposed expansion

The coefficient 2 is then compared with the same coefficient in an alternative new project proposal Assume the former coefficient is higher The conclusion is that the proposed expansion and modernization assures a higher productivity of the skilled labour in terms of value added compared with the existing factory and with an alternative proposal for a new investment project. Therefore, it passes the relative efficiency test in terms of productivity of skilled labour

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 self-contained projects that are technologically, economically and geographically closely interrelated. Any substantial change in one of the projects immediately affects the others

The interrelationship between the constituent projects may be based on successive processing of the same raw material (chemical, metallurgical and textile complexes, agro-industrial complexes), on the complex use of different components of the raw material (chemical and petrochemical complexes), on participation in the production of parts that are assembled in a final product (engineering complexes), on utilization of common infrastructure, such as transport facilities, electricity, water, steam and gas supplies

An industrial complex may comprise only industrial projects (mining, power generation and manufacturing) as well as subsidiary projects from other sectors of the economy such as agriculture and transport and communications The constituent projects may or may not be under the same management They may or may not be located in the same area

An industrial complex may comprise three groups of constituent projects

(a) New investment projects,

(b) Existing production units being modernized/expanded;

(c) Existing production units in which some capacities are being underutilized

The industrial complex evaluation technique may be used for two purposes

(a) To measure 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,

(b) To measure the indirect benefits and costs of an investment project occurring in other investment projects and/or existing production units

In addition, the suggested approach may help to "internalize" some external (indirect) effects, which are difficult to measure, by evaluating all individual projects as one unit, i.e the industrial complex The approach may also eliminate the implications of heavily distorted market prices of items exchanged among the constituent projects by valuing internal inputs and outputs at production costs and applying current 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 clarifying 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 economies of scale, better use of planned productive capacities, more efficient marketing etc An estimate of such advantages can be made only by analysing 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, if possible each constituent project has to be appraised separately The rationale for this is that by evaluating first each project separately, information is compiled on what projects of the complex are weaker and where to look for efficiency reserves. The evaluation has to be done by applying the absolute efficiency test suggested for new projects 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 has the purpose only of 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–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 those for individual projects. There are, however, certain implications

in the fact that the whole complex is appraised as one large unit, the individual projects being constituent parts

(a) The value of expected output delivered by the complex (sales revenue) is valued at current or adjusted market prices as per the pricing rules,

(b) The value of expected current material inputs procured from outside the complex are valued at current or adjusted market prices,

(c) The value of expected investments for new projects, their total investment, for modernization/expansion projects, again their total capital (new investments plus the utilized old capital), and for units having idle capacities, their existing capital since they will usually not need any additional investment,

(d) The value of expected repatriation payments for new projects, their total amount, for modernization/expansion on projects, as suggested in the section for evaluation of modernization projects, and for units with idle capacities, foreign payments under normal level of operation plus any additional foreign payments caused by better use of the capacity

Step 3 The nominal annual values computed under step 2 above are to be grouped as follows

(a) $(O)_t^c$ = sum total of the values of output produced by the different constituent units and delivered by the complex,

(b) $(\text{MI} + I)_t^c$ = sum total of the values of all material inputs (investment and current material inputs) used by the constituent units and procured from outside the complex.

Subtract for each year the nominal values of all material inputs $(\text{MI} + I)_t^c$ from the nominal values of output $(O)_t^c$, to arrive at the nominal values of the net domestic value added produced by the complex, $(\text{NDVA})_t^c$, for the respective years

$$(\text{NDVA})_t^c = (O)_t^c - (\text{MI} + I)_t^c \tag{29}$$

Step 4 Subtract from the annual values of net domestic value added computed above the annual values of repatriated payments, $(\text{RP})_t^c$, to arrive at the expected annual values of net national value added, $(\text{NNVA})_t^c$, for the respective years

$$(\text{NNVA})_t^c = (O)_t^c - [(\text{MI} + I)_t^c + (\text{RP})_t^c] \tag{30}$$

Step 5. The nominal values of net national value added so computed for each year of the lifetime of the complex should be discounted to the base year by applying the social rate of discount (SRD) 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 of $(\text{NNVA})_t^c$ are multiplied by the corresponding discount factors, a_t, to obtain its present value The sum total of the individual annual present values gives the present value of the net national value added for the industrial complex,

$$\sum_{j=1}^{m} \sum_{t=0}^{n} (\text{VA})_{j,t}^c a_t = P(\text{VA})^c$$

which can be expressed in the following way

$$\sum_{j=1}^{m} \sum_{t=0}^{n} (\text{VA})_{j,t}^c a_t = \sum_{j=1}^{m} \sum_{t=0}^{n} \left\{ (O)_t^c - [(\text{MI} + I)_t^c + (\text{RP})_t^c] \right\} a_t \tag{31}$$

The present worth of the value added for the whole complex thus computed *must be positive*

$$\sum_{j=1}^{m} \sum_{t=0}^{n} (\mathrm{VA})^{c}_{j,t}\, a_t > 0 \tag{32}$$

This is a clear indication of the positive contribution of the industrial complex to the national income and therefore of its soundness

Step 6· The present worth of the value added for the complex thus computed should usually comprise salaries and wages, $(W)^c$, and a social surplus, $(\mathrm{SS})^c$ It is essential at this stage to compute the expected discounted amounts of wages and of social surplus. The nominal annual values of expected wages for the entire complex comprise for new projects, total wages excluding the repatriated portion; for modernization/expansion projects, as suggested in the section for evaluation of modernization projects, and for units with idle capacities, wages paid at current level of operation plus any wages for additionally appointed personnel to secure better use of the available idle capacity.

The balance of the difference between the nominal annual values added and the nominal annual wages is the nominal annual social surplus The nominal annual wages, $(W)^c_t$, and social surplus, $(\mathrm{SS})^c_t$, thus computed are multiplied by the corresponding discount factors (see step 5 above) to obtain their present values The sum total of the annual present values of wages makes the present value of the wages for the whole complex,

$$\sum_{j=1}^{m} \sum_{t=0}^{n} (W)^{c}_{j,t}\, a_t = P\,(W)^c$$

The same applies to the social surplus.

Step 7: With the major components thus computed the absolute efficiency test for an industrial complex can be applied

$$E^c = P\,(\mathrm{VA})^c \geqslant P\,(W)^c \tag{33}$$

or the same expressed in more elaborate terms

$$E^c = \sum_{j=1}^{m} \sum_{t=0}^{n} (\mathrm{VA})^{c}_{j,t}\, a_t \geqslant \sum_{j=1}^{m} \sum_{t=0}^{n} (W)^{c}_{j,t}\, a_t \tag{34}$$

where

$\sum_{j=1}^{m}$ 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 only be new projects, or new and modernized/expanded projects, or new projects along with modernized/expanded production units and existing units with idle capacities,

$\sum_{j=1}^{m} \sum_{t=0}^{n}$ means the total sum of the value added (wages) for all constituent projects in the complex from j to m for all years of their economic life starting from year $t = 0$ (the beginning of construction) and ending in the year n.

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, attention should be focused on the 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 conditions of capital, foreign-exchange or skilled-labour scarcity by applying the same formulae as have been suggested earlier for individual projects

Table 20 contains the necessary aggregated data for evaluation of a hypothetical investment proposal to set up an industrial complex comprising two new projects which would be closely related with three existing factories, two of them having idle capacities

The values of the output (row 1 of the table) express only the values of output expected to be delivered outside the complex by the constituent production units, and subsidies paid to the existing factories.

The values of the material inputs (row 2 of table 20) comprise investments for fixed capital (domestic and imported) for the new projects as well as the book value of the fixed capital of the existing factories which would become part of the complex. In addition, this row also contains the value of current material inputs (domestic and imported) procured from outside the complex.

Row 4, "Repatriated payments", contains, as explained earlier, the expatriated portion of the salaries of expatriate labourers, interest on foreign loans, dividends to foreign shareholders etc., directly associated with the establishment of the industrial complex.

The engineers and the economists found that the economic life was expected to be 16 years, including the construction and running-in periods.

The evaluation of the proposed industrial complex led the evaluators to conclude that the project was not acceptable in this form. The expected present worth of the value added was only 77,600 dinars, while the wage bill to be paid to the labourers was much higher, namely 130,700 dinars. The project was not in a position to cover the wages and was expected to drain 53,100 dinars from the social surplus produced by other sectors of the economy This was, of course, undesirable The evaluators therefore recommended a modification of the proposed complex

The experts who carefully reviewed the proposed establishment of the industrial complex found

(a) That the two new investment projects, proposed to be part of the complex, were very efficient by themselves and that no considerable improvements in their design were thought to be likely,

(b) That two of the three existing factories had had a very poor performance thus far Part of their capacities had not been utilized for years, the technology was found to be obsolete, part of the equipment was old, and the management was inefficient The Government was supporting them by subsidies. Two years previously there had been a proposal for their modernization, but the action had been postponed in view of the proposal that they be combined with the industrial complex when their position was reviewed preliminary to their joining the complex.

TABLE 20 EVALUATION OF AN INDUSTRIAL COMPLEX[a]

(Thousand dinars)

Item	Year																
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_0-t_{15}
1. Value of output, $(O)^c$	–	–	80	120	150	150	150	150	150	150	150	150	150	150	150	150	
2 Value of material inputs, $(M + I)^c$	100	150	70	70	80	80	80	80	80	80	80	80	80	80	80	80	
3 Net domestic value added (1–2)	(100)	(150)	10	50	70	70	70	70	70	70	70	70	70	70	70	70	
4 Repatriated payments, $(RP)^c$			5	10	15	20	20	20	20	20	20	20	20	20	20	20	
5. Net national value added (3–4)	(100)	(150)	5	40	55	50	50	50	50	50	50	50	50	50	50	50	
5.1 Wages $(W)^c$			10	15	20	20	20	20	20	20	20	20	20	20	20	20	
5 2 Social surplus, $(SS)^c$	(100)	(150)	(15)	25	35	30	30	30	30	30	30	30	30	30	30	30	
6 Discount factors at 9% discount rate, a_t	1 00	0 92	0 84	0 77	0 71	0 65	0 60	0 55	0 50	0 46	0 42	0 39	0 36	0 33	0 30	0 27	
7 Discounted values of NNVA (5 x 6)	(100)		4 2	30 8	39 0	32 6	0 0	27 5	25.0	3 0	1 0	9 5	8 0	6 5	5 0	3 5	77 6
7 1 Discounted values of wages (5 1 x 6)			8 4	11 5	14 2	13 0	2 0	11 0	10 0	9 2	8 4	7 8	7 2	6 6	6 0	5 4	130 7
7 2 Discounted values of social surplus (5 2 x 6)	(100)		4 2	19 3	24 8	19 6	8 0	16 5	15.0	3 8	2 6	1 7	0 8	9 9	9 0	8 1	(53 1)

[a] All foreign components (import substitution or exported output, imported investment and current material inputs, repatriated payments) have been valued at adjusted rate of foreign exchange, i.e $US 1 = 6 5 dinars Outputs and inputs have been valued at actual market prices as well as at adusted prices, when it was found necessary, in compliance with the pricing rules of the Manual (table 15).

TABLE 21 RE-EVALUATION OF AN INDUSTRIAL COMPLEX[a]

(Thousand dinars)

Item	Year																
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_0-t_{15}
1 Value of output $(O)^c$	–	–	80	120	150	200	200	200	200	200	200	200	200	200	200	200	
2 Value of material inputs, $(MI + I)^c$	100	170	90	80	80	90	90	90	90	90	90	90	90	90	90	90	
3 Net domestic value added (1–2)	(100)	(170)	(10)	40	70	110	110	110	110	110	110	110	110	110	110	110	
4 Repatriated payments, $(RP)^c$			5	10	15	20	20	20	20	20	20	20	20	20	20	20	
5 Net national value added (3–4)	(100)	(170)	(15)	30	55	90	90	90	90	90	90	90	90	90	90	90	
5 1 Wages, $(W)^c$			10	15	20	20	20	20	20	20	20	20	20	20	20	20	
5 2 Social surplus, $(SS)^c$	(100)	(170)	(25)	15	35	70	70	70	70	70	70	70	70	70	70	70	
6 Discount factors at 9% discount rate, a_t	1 00	0 92	0 84	0 77	0 71	0 65	0 60	0 55	0 50	0 46	0 42	0 39	0 36	0 33	0 30	0 27	
7 Discounted values of NNVA (5 x 6)	(100)	(156 4)	12 6	23 1	39 0	58 6	54 0	49 5	45 0	41 4	37 8	35 1	32 4	29 7	27 0	24 3	227 9
7 1 Discounted values of wages (5 1 x 6)			8.4	11.5	14 2	13.0	12 0	11 0	10 0	9 2	8 4	7 8	7 2	6 6	6 0	5 4	130 7
7 2 Discounted values of social surplus (5 2 x 6)	(100)	(156 4)	21 0	11 6	24 8	45 6	42 0	38 5	35 0	32 2	29 4	27 3	25 2	23 1	21 0	18 9	97 2

[a] All foreign components, as in table 20, have been valued at adjusted rate of foreign exchange Outputs and inputs have been valued at actual market prices as well as at adjusted prices, when it was found necessary, in compliance with the pricing rules of the Manual (table 15)

The experts then proposed a major reconstruction, modernization and expansion of the two factories to better fit the requirements of the industrial complex

A feasibility study was prepared by an engineering design organization As a result of the proposed expansion and modernization, the annual output of the complex was expected to increase from 150,000 dinars to 200,000 dinars For that purpose an additional 50,000 dinars of investment would be needed, making use of much of the available equipment before the modernization The annual current material inputs were expected to increase from 80,000 dinars before the modernization to 90,000 dinars afterwards. Because of the more up-to-date equipment and technology, and in spite of the increase in output, the number of people employed was expected to drop by 10 per cent, but the average level of skill would increase and along with it, the average annual wage The total annual wage bill, consumed in the country, however, would remain unchanged at 20,000 dinars

The new economic picture of the industrial complex, as it was calculated, is presented in a highly aggregated way in table 21.

Applying formula (34), the evaluation of the redesigned industrial complex led to positive conclusions

$$227{,}900 > 130{,}700$$

The proposed industrial complex was expected to generate 227,900 dinars of present worth of value added This value added was enough to recover the wage bill, i.e 130,700 dinars, and would provide 97,200 dinars of social surplus Therefore, the industrial complex passed the absolute efficiency test.

3 3 2 Measuring the indirect effects of an investment project

The industrial complex technique can be conveniently used for tracing and measuring the indirect benefits and costs of a new investment project These are additional benefits and costs caused by an investment project under examination, occurring 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, modernization/expansion of existing production units and help in the better utilization 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 accounted for only when their occurrence is owing 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 they are therefore not handled in this section. Reference is made to them under section II B 5, "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 of a project being evaluated 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, projects or units requiring modernization or expansion, production units that could make use of existing idle capacities with negligible or no additional investments

Step 3· On the basis of table 9 of the model formats, compute the additional (indirect) value added for each year of economic life that will be produced in linked projects as a result of the establishment of the project under consideration

(a) For other new projects, take the total value added that they are expected to produce,

(b) For modernized/expanded projects take only the incremental value added as the difference between the value added after the modernization/expansion and at the current level of operation,

(c) For production units with idle capacities, take only the incremental value added as a result of the better use of available capacity

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

(a) For other new projects, take total output, material inputs, investments and repatriated payments, if any,

(b) For modernized/expanded projects, take only the incremental (additional) output, material inputs, investments and repatriated payments, if any, actually attributed to the project under consideration,

(c) For production units with idle capacities, take only the incremental output, material inputs, investments, if any, and repatriated payments, if any, related to the better use of available capacity

Step 4 Add the indirect value added thus 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 factor 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

$$P(\mathrm{VA}) = \sum_{j=1}^{m} \sum_{t=0}^{n} \mathrm{VA}_{j,t}\, a_t \tag{35}$$

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

(a) For other new projects, take the total expected amount of wages,

(b) For modernized/expanded projects, take 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 because of modernization, this difference is taken with a minus sign and deducted from the total sum of wages,

(c) For production units with idle capacities, take only the wages of the additionally employed labour to make better use of existing idle capacity

Step 6· Add the indirect wages to the direct ones to obtain the expected total of wages for each year Discount the annual figures, multiplying them by the discount factor, 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

$$P(W) = \sum_{j=1}^{m} \sum_{t=0}^{n} W_{j,t} a_t \tag{36}$$

Step 7· If the discounted value added computed under step 4 above is positive, apply the absolute efficiency formula (34)

If the net result is a positive value added and a surplus of value added over wages, or at least equal to 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 in principle is recommended for large projects with apparent implications for other projects The above suggested approach may be attempted when reliable data are available and can be utilized 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 that may be possible

The application of the suggested approach for measuring the total (direct and indirect) effect of an investment project is illustrated below Table 22 contains the aggregated data on direct and indirect outputs, investments, current material inputs and repatriated payments needed for measuring the total value added (direct and indirect) generated by an investment project

For each of the items in this table separate tables have been compiled, both for the direct and for the indirect effects, using the standard formats provided by the Manual Table 22 contains seven basic items, but for the sake of clarity, each item is broken down into direct and indirect components

The analysis of the data in table 22 provides a clear picture of the total (direct and indirect) effects of the hypothetical project

Evaluated on the grounds of its *direct effects only,* the project is sound enough It is expected to generate a present worth of value added of 201,800 dinars (table 22, row 7 1) while the present value of the wages to be paid is 84,400 dinars (table 22, row 7 1 1) Applying the absolute efficiency formula (21) it is found

$$201{,}800 > 84{,}400 \rightarrow 117{,}400 \text{ dinars of social surplus}$$

The proposed project is expected to cover the wages and to generate a social surplus of 117,400 dinars It is therefore acceptable

The above conclusion applies when the project is being considered by itself, out of the context of its technological and economic relationship with other projects, both on the input and on the output side

With the scope of the project analysis broadened by including *the indirect effects,* the above conclusion is confirmed and amplified The expected present worth of the total value added (direct plus indirect) is as high as 362,400 dinars (table 22, row 7) The expected present value of the direct and indirect wages is 123,000 dinars (table 22, rows 7.1 1 and 7 2 1) Applying formula 37 it is found

$$362{,}400 > 123{,}000 \rightarrow 239{,}400 \text{ dinars of social surplus}$$

Therefore, the total (direct plus indirect) value added expected to be generated by the proposed project covers the expected wages and provides a social surplus of 239,400 dinars With all the uncertainties that may affect the project in the future, one may be more confident that, although the expected social surplus may not be achieved exactly, for unforeseen reasons, a large margin of safety exists Most likely

TABLE 22 MEASURING THE TOTAL

Item	t_0	t_1	t_2	t_3	t_4	t_5	t_6
1 Value of output (O)	–	–	109 5	157 0	177.0	177 0	177 0
1 1 Direct output (table 18, row 1)	–	–	89 5	127 0	127 0	127 0	127 0
1 2 Indirect output, computed	–	–	20 0	30 0	50 0	50 0	50 0
2 Value of material inputs (MI + I)	132 5	145 5	42 4	64 6	74 6	74 6	74 6
2 1 Direct material inputs (table 18, row 2)	122 5	125 5	32 4	54 6	54 6	54 6	54 6
2 2 Indirect material inputs, computed	10 0	20 0	10 0	10 0	20 0	20 0	20 0
3 Net domestic value added (1–2)	(132 5)	(145 5)	67 1	92 4	102 4	102 4	102 4
3 1 Direct NDVA (1 1–2 1)	(122 5)	(125 5)	57 1	72 4	72 4	72 4	72 4
3 2 Indirect NDVA (1 2–2 2)	(10 0)	(20 0)	10 0	20 0	30 0	30 0	30 0
4 Repatriated payments (RP)			19 5	20 8	25 8	25 8	24 5
4 1 Direct repatriated payments (table 18, row 4)			19 5	20 8	20 8	20 8	19 5
4 2 Indirect repatriated payments, computed					5 0	5 0	5 0
5 Net national value added (3–4)	(132 5)	(145 5)	47 6	71 6	76 6	76 6	77 9
5 1 Direct NNVA (3 1–4 1)	(122 5)	(125 5)	37 6	51 6	51 6	51 6	52 9
5 1 1 Direct wages (W_d) (table 18, row 5 1)			7 0	9 0	9 0	9 0	10 0
5 2 Indirect NNVA (3 2–4 2)	(10 0)	(20 0)	10 0	20 0	25 0	25 0	25 0
5 2 1 Indirect wages (W_i) computed			2 0	5 0	5 0	5 0	5 0
6 Discounting factors at 9% discount rate (a_t)	1 00	0 92	0 84	0 77	0 71	0 65	0 60
7 Discounted NNVA (5 x 6)	(132 5)	(133 9)	40 0	55 1	54 3	49 8	46 7
7 1 Discounted direct NNVA (5 1 x 6)	(122 5)	(115 5)	31 6	39 7	36 6	33 5	31 7
7 1 1 Discounted direct wages (5 1 x 6)			5 9	6 9	6 4	5 9	6 0
7 2 Discounted indirect NNVA (5 2 x 6)	(10 0)	(18 4)	8 4	15 4	17 7	16 3	15 0
7 2 1 Discounted indirect wages (5 2 1 x 6)			1 7	3 8	3 6	3 3	3 0

[a] All foreign components, as in preceding tables, have been valued at adjusted rate of foreign when necessary, in compliance with the pricing rules of the Manual (table 15).

the project will still be sound under more difficult economic conditions (higher prices for inputs or lower prices for output, lower capacity use etc.). More precise information on that could be obtained only after the application of sensitivity and probability analysis. On the basis of the above analysis, however, the project could be recommended to the decision maker.

4. Additional indices

Additional indices in project evaluation reflect the fulfilment of development objectives other than those encountered in using the basic criterion and therefore require the appraisal of the project's contribution to such objectives.

VALUE ADDED (DIRECT AND INDIRECT)[a]

Year														
t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
177.0	177.0	177.0	177.0	177.0	177.0	177.0	177.0	177.0	177.0	177.0	177.0	177.0	197.0	
127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	147.0	
50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	
74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	
54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	
20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
102.4	102.4	102.4	102.4	102.4	102.4	102.4	102.4	102.4	102.4	102.4	102.4	102.4	122.4	
72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	92.4	
30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
24.5	23.2	23.2	23.2	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	25.8	
19.5	18.2	18.2	18.2	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	20.8	
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
77.9	79.2	79.2	79.2	84.4	84.4	84.4	84.4	84.4	84.4	84.4	84.4	84.4	96.6	
52.9	54.2	54.2	54.2	59.4	59.4	59.4	59.4	59.4	59.4	59.4	59.4	59.4	71.6	
10.0	11.0	11.0	11.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
0.55	0.50	0.46	0.42	0.39	0.36	0.33	0.30	0.27	0.25	0.23	0.21	0.19	0.18	
42.9	39.6	36.2	33.3	32.9	30.4	27.9	25.3	22.8	21.1	19.4	17.7	16.6	17.4	362.4
29.1	27.1	24.7	22.8	23.2	21.4	19.6	17.8	16.0	14.8	13.6	18.5	11.2	12.9	201.8
5.5	5.5	5.1	4.6	4.7	4.3	4.0	3.6	3.2	3.0	2.8	2.5	2.3	2.2	84.4
13.8	12.5	11.5	10.5	9.7	9.0	8.3	7.5	6.8	6.3	5.8	5.2	4.8	4.5	160.6
2.8	2.5	2.3	2.1	1.9	1.8	1.7	1.5	1.4	1.2	1.1	1.1	0.9	0.9	38.6

exchange. Outputs and inputs have been valued at actual market prices as well as at adjusted prices,

The distinction between basic criterion and additional indices made in this Manual is 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 may be any number of such situations and objectives depending on the strategy of development of a country, but generally four well-known situations exist for which evaluation may be necessary

Four additional indices are, therefore, suggested for inclusion in the analysis, depending on their significance and application in each individual case They are listed below without any order of priority intended Their relative importance will vary from country to country and from time to time within the same country

Employment effect
Distribution effect
Net foreign-exchange effect
International competitiveness

All four indices need not always be applied at the same time 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 will try to create the largest number of new jobs with a given amount of capital In other words, this authority attempts to invest as little capital as possible to provide for 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 Not only direct employment, but also indirect employment should be considered Direct employment refers to the new employment opportunities created within the project, indirect employment concerns 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 the least for one round–projects directly connected with the project on both the input and output sides. This may be 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 that may be available or by applying some standards based on the results of past experience with such projects in the country or abroad In this fashion, the total number of new employment opportunities can be assessed It would seem logical, however, to account for the indirect employment effect only in cases in which it is obviously pronounced

The same logic should be applied to assessing the total capital required to create new jobs. In other words, the total investment of a project comprises the direct investment and the additional investment needed in the projects with backward and forward linkages

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

Thus, the procedure for 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 in a normal year (table 3, "Manpower requirements")

Step 2: Estimate the number of unskilled and skilled workers additionally employed in backward and forward linkage projects in a normal year. The projects directly connected with the project being evaluated should be included, while those involved in further stages of multiplication effect are ignored, 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 projects with backward and forward linkages

These steps are illustrated in table 23

TABLE 23 TOTAL NEW EMPLOYMENT OPPORTUNITIES

Location of effect \ *Effect*	*Number of new job opportunities*			*Capital invested (I) (thousand dinars)*
	Unskilled workers (JO_u)	*Skilled workers (JO_S)*	*Total (JO^T)*	
Within a project	50	150	200	200
Input-supplying projects	20	30	50	30
Output-using projects	10	40	50	40
Total	80	220	300	270

Indirect employment effects depend on the rate of labour utilization in the linked projects. If such projects operate below their full capacity, the employment effects will be less 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 they can be assessed, can be taken into account in finding the overall net employment effects

Further, all foreign personnel should be subtracted from the number of workers for whom employment opportunities will be created. Finally, the total amount of capital invested is derived by adding the nominal values of investment in different years, i.e without discounting.

Table 23 gives the elements for determining the employment effect of a project Three different indicators may be computed for this purpose

(a) JO^T or JO_u indicates the total number of new job opportunities or the number of new jobs for unskilled workers. The new jobs created within the project and those in projects supplying inputs and using outputs are accounted for,

where

Z_e^T = total employment effect (for skilled and unskilled labour) per unit of investment,

(b)
$$Z_e^T = \frac{JO^T}{I} \tag{37}$$

shows 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 or 1,000,000 dinars or any other convenient figure,

where

Z_e^u = employment effect for unskilled labour only per unit of investment,

(c)
$$Z_e^u = \frac{JO_u}{I} \tag{38}$$

gives 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 in which unemployment is present and not too much attention need be paid to the allocation of capital, the first one *(a)* should be chosen If the capital scarcity is pronounced, the second and third indicators 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 *(b)* should be used. The third one *(c)* would be selected if the unskilled workers are unemployed Of course, the evaluator may use all three to observe different aspects of the employment effect, if this should be necessary.

It might be of interest as well to compute the employment/capital ratios for the project under consideration, for projects supplying inputs and for projects using outputs, if reliable information is available

Furthermore, the evaluator may choose to include in the numerator of the above indicators either the number of job opportunities newly created or the number of workers additionally employed The former is relevant in case one wants to find out thenumber of new job opportunities a unit of capital creates, while the latter would 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

Table 23 contains data on new employment opportunities for skilled and unskilled workers, broken down into three groups within a project, in projects supplying inputs and in projects using outputs

(a) *Total employment effect* (direct and indirect)

$$Z_e^T = \frac{JO^T}{I^T} \tag{39}$$

where

Z_e^T = total employment effect,

JO^T = total number of new job opportunities (direct and indirect),

I^T = total investment (direct and indirect).

Thus,

$$Z_e^T = \frac{JO^T}{I^T} = \frac{300}{270{,}000} = 0.0011$$

Hence, 10,000 dinars of total investment (direct and indirect) creates 11 new job opportunities.

(b) *Direct employment effect*

$$Z_e^d = \frac{JO^d}{I^d} \tag{40}$$

where

Z_e^d = direct employment effect,

JO^d = new job opportunities only in the project considered,

I^d = direct investment.

Thus,

$$Z_e^d = \frac{JO^d}{I^d} = \frac{200}{200{,}000} = 0.0010$$

Hence, 10,000 dinars of direct investment creates 10 direct new job opportunities.

(c) *Indirect employment effect*

$$Z_e^i = \frac{JO^i}{I^i} \tag{41}$$

where

Z_e^i = indirect employment effect,

JO^i = new job opportunities in related projects,

I^i = indirect investment.

Thus,

$$Z_e^i = \frac{JO^i}{I^i} = \frac{100}{70{,}000} = 0.00014$$

Hence, 10,000 dinars of indirect investment creates one indirect new job opportunity.

4.2 Distribution effect[2]

The execution of industrial projects can affect the distribution of value added in two ways. Firstly, it can be distributed differently among the social groups, in which case a group distribution effect is relevant. Secondly, the value added may be allocated differently among the regions of a country—the regional distribution effect.

[2] Both distribution and redistribution effects are to be taken into consideration. However, for the sake of brevity, the term "distribution effect" is used in the Manual.

It may be pointed out that distribution objectives could be achieved mainly through the fiscal and price policies of a Government For instance, different taxes and prices levied and charged to different social groups and regions are usually used to reach a socially desirable distribution effect or at least to soften social inequalities In addition, however, it may be of interest to find out how the benefits of an investment project are being distributed among social groups and regions, and whether this distribution pattern is in line with the Government's distribution policy If not, certain modifications may be made in the expected distribution of the benefits to make it consistent with the objectives and priorities of the Government

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

Step 1 Identify 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 the development objective is to achieve equality of distribution for social reasons, two social groups may be identified low-income and high-income groups The latter group may be broken down further The line between the two groups should be determined according to the conditions of a country, but usually it cannot reflect too precisely the differences in welfare because of possible fringe benefits If no other means of identification is possible, unskilled labour may be taken as representative of the low-income group

An analysis is very important 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 not only of 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, on the one hand, and the social surplus 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, with different social and economic implications Because of the difficulties that Governments in developing countries often face in establishing an efficient tax system to generate revenue, income in the hands of the Government may be more desirable than income in the hands of the profit earners

Similarly, the regions within a country may be divided into less developed and more developed, according to a criterion of *per capita* income level, the achieved level of development of infrastructure or of industry If the development of a politically sensitive frontier or other area is a government objective, it should also be treated as a less developed region irrespective of its *per capita* income level or other criteria

If income distribution among rich and poor within a region is of concern, this could be analysed by breaking down each income group into regional subdivisions or the region concerned into income subdivisions

The analysis of the distribution effects of an investment project in a developing country has another very important aspect, namely the distribution of the expected net domestic value added between net national value added and repatriations Net national value added is a crucial aspect of the distribution of the benefits generated by an investment project It is important to find out how much of the value added remains in a country and will be used within its boundaries for its benefit and how much will be repatriated abroad.

Step 2. Determine net distribution benefit flows to a social group or region 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 payments made to other groups or regions The distribution costs are defined as costs caused by a project to a group or region minus any compensating benefits received from another group or region Thus the analysis records 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 the group or region received prior to the establishment of this project Any fringe benefits, if existing, should increase this gain In case of low-income groups and wage-earner groups, the gain would probably amount to their wages and salaries, while for profit earners and the Government, it would be represented by net profits, interest, insurance, rent and indirect taxes It should be pointed out that in case of previously unemployed labour, the total wage bill is considered as a gain, otherwise only the difference between the previous wages and the wages paid by the project is accounted for

The net distribution 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 net distribution benefit, since the vacant jobs are taken by 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 arise with profits and interest, part of which may leave the region Fringe benefits usually take the form of welfare facilities, such as housing, education, health or recreation institutions

The net distribution benefits to a social group or to a region should be identified and computed in expected actual market prices for a normal year of the project's life

As pointed out earlier, the project analysis suggested by this Manual is based on net national 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 24 presents a framework for tracing the net distribution benefits in the case of a social group distribution effect

The items in table 24 could easily be broken down into low-income and high-income groups to get another aspect of the social group distribution effect

In case one wants to trace the regional distribution effect, table 25 is a suggested format which may be used to supply the necessary data It should be pointed out, however, that the items in table 25 represent only a model breakdown of net distribution benefits Other breakdowns may be used as well, depending on the circumstances

Table 26 provides a framework for analysis of the distribution of net domestic value added between net national value added (to be used within a country) and repatriations abroad (to be used in foreign countries)

TABLE 24 NET DISTRIBUTION BENEFITS FOR SOCIAL GROUPS

(Thousand dinars)

Item	*Normal year*[a]
1 Gross domestic value added (table 9, row 3)	49
Annual depreciation	10
2. Net domestic value added	39
Repatriated payments (table 9, row 4)	16
3. Net national value added	23[b]
4. Wage earners (VA^w)	10
4.1 Wages (table 18, row 5 1)[c]	9
4.2 Fringe benefits (computed, table 9, row 1 7)	1
5 Domestic profit earners (VA^p)	3
5 1 Net profits–dividends to domestic shareholders (table 8, row 7 3)	2
5 2 Interest on domestic private capital (table 8, row 7 2)	–
5 3 Rent received by domestic private owners (computed)	1
5 4 Fringe benefits (computed)	–
6. Government (VA^g)	7
6 1 Taxes paid to the treasury (table 8, row 4 1)	5
6 2 Interest on loans from public banks (table 8, row 7 2)	–
6 3 Profits–dividends to state-owned shares (table 8, row 7 3)	2
6 4 Rent and insurance charges received by the state (computed)	–
7 Undistributed (VA^u)	3

[a] Year 5 was selected as a normal year

[b] In case of normal year annual depreciation must be deducted

[c] Excluding repatriated wages.

TABLE 25 NET DISTRIBUTION BENEFITS FOR A REGION OF A COUNTRY

(Thousand dinars)

Item	*Normal year*[a]
1 Wages to workers from the region	8
2. Profits (dividends) to local entrepreneurs	1
3. Interest paid to local banks (local branches of central banks are not accounted for)	–
4. Taxes paid to local Government	1
5 Welfare gains to the region (hospitals, schools etc.)[b]	2
6. Total regional benefits (VA^r)	12

[a] Year 5 was selected as a normal year

[b] Provided that they are already incorporated in the calculation of NVA.

Step 3. Compute 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) must now be related to the total net national value added created by a project in a normal year The distribution index of the wage earners may be determined as

$$DB^w = \frac{VA^w}{VA} \tag{42}$$

TABLE 26 DISTRIBUTION OF THE NET DOMESTIC VALUE ADDED

(Thousand dinars)

Item	*Normal year*[a]		
	Used in a country	*Repatriated*	*Total*
1 Wages (table 9, rows 4.1 and 5 1)	9	3	12
2. Interest on loans (table 8, row 7 2, table 9, row 4 3)	–	5	5
3 Dividends (table 8, row 7 3, table 9, row 4 3)	4	8	12
4. Taxes on profit (table 8, sub-row 4 1)	5	–	5
5 Rent and insurance (table 24, rows 2.3 and 3.4)	1	–	1
6. Fringe benefits (table 24, rows 1 2 and 2.4)	1	–	1
7. Undistributed profit (table 24, row 4)	3	–	3
Total	23[b]	16[c]	39

[a] Year 5 was selected as a normal year

[b] The figure 23 equals net national value added (table 24, row 3)

[c] The figure 16 equals repatriated payments (table 9, row 4).

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 and fringe benefits paid out by a project in a normal year,

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

If the distribution index of profit earners, the Government or the region is to be determined, the nominator in the above expression would contain VA^p, VA^g and VA^r, respectively

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

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

Table 24 provides the necessary data for computation of the distribution indices by social groups in a hypothetical project.

(a) *Distribution index of the wage earners*

$$DB^w = \frac{VA^w}{VA} = \frac{10{,}000}{23{,}000} \times 100 = 43.48\%$$

The wage earners are expected to receive 43.48 per cent of the value added generated by the project in the form of wages and fringe benefits.

(b) *Distribution index of the profit earners*

$$DB^p = \frac{VA^p}{VA} = \frac{3{,}000}{23{,}000} \times 100 = 13\ 04\%$$

The domestic profit earners are expected to receive 13 04 per cent of the value added generated by the project as dividends, rents and fringe benefits The repatriated portions of dividends, interest and rents are not accounted for here since the analysis is based on the net national value added only

(c) *Distribution index of the Government*

$$DB^g = \frac{VA^g}{VA} = \frac{7{,}000}{23{,}000} \times 100 = 30\ 43\%$$

The Government is expected to receive 30 43 per cent of the value added generated by the project as taxes, dividends to state-owned shares, insurance charges and rents

(d) *Undistributed value added*

$$\text{Undistributed} = \frac{VA^u}{VA} = \frac{3{,}000}{23{,}000} \times 100 = 13\ 05\%$$

A portion of the value added (13 05 per cent) is expected to remain in the firm It will most likely be used for expansion funds, reserve funds as well as social welfare funds of the firm The Government will have some control over the use of these funds so that it is done in compliance with the national objectives The wage earners will undoubtedly benefit from it through the social welfare funds as well as through the expansion funds

Therefore, the main beneficiaries of the implementation of the project are expected to be the wage earners and the Government They would capture directly 73 91 per cent of the value added and would also derive the bulk of the benefits through the use of the undistributed value added

Table 25 provides the data for computation of the regional distribution index

$$DB^r = \frac{VA^r}{VA} = \frac{12{,}000}{23{,}000} \times 100 = 52\ 2\%$$

The region where the project will be located is expected to be the main beneficiary It would capture 52 2 per cent of the value added as wages to local workers, profits to local entrepreneurs, taxes to local authorities and welfare gains to the region

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 certain priority 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 usually determines the location of a 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 either to confirm the decision already taken, to modify it if possible, or to show explicitly the "price" paid by the society for achieving certain non-economic objectives

The data from table 26 could be conveniently used to derive the shares of the repatriated payments (RP) and the net national value added (NNVA) within the net domestic value added (NDVA)

$$\frac{RP}{NDVA} = \frac{16,000}{39,000} \times 100 = 41\ 03\%$$

$$\frac{NNVA}{NDVA} = \frac{23,000}{39,000} \times 100 = 58\ 97\%$$

Therefore, a considerable portion (41.03 per cent) of the net domestic value added generated by the project would be repatriated abroad and would lower the net national value added. The project evaluator should bring this fact to the attention of the decision maker, and if the latter finds it too high, special attention should be given to the subject One may explore possible ways and means of lowering the repatriations by mobilizing domestic sources of capital (loans and equity), re-examining the interest rates requested by foreign financial institutions, renegotiating the terms for foreign repatriations etc

4.3 Net foreign-exchange effect

An essential part of the overall economic evaluation of an investment project is the assessment of the effects of its implementation on the foreign-exchange position of a country This assessment is made in two stages

(a) Assessment of the balance of payments effects of a project,

(b) 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 so doing, the present as well as the future balance of payments position should be accounted for since the present balance of payments shortage might be reduced or increased in the years to come Also, the total effects of the project, direct and indirect, should be taken into consideration

The analysis of the foreign-exchange effect of an investment project is important not only for countries facing a shortage of foreign exchange, but also for others that now enjoy a surplus balance of payments. The establishment of sophisticated industrial projects adds considerably to the import requirements of multifarious kinds raw materials, components, replacements, machinery, purchase of know-how, technicians, royalty payments, repatriation of profits and so on 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.

When estimating the future balance of payments situation, some crucial problems should receive attention

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

(b) The trends in basic demand for imports and the supply of exports,

(c) The eventual changes of policy related to the import restrictions,

(d) Strategic significance of a product,

(e) Structure of trends of a product's demand in the world market

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, firstly, 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 sum total of the annual effects will depict the impact of a project on the overall foreign-exchange position of the country for the life span of the project For this purpose it is important to compile a statement of all inflows and outflows of foreign exchange of a project.

Table 27 offers a standard format containing the essential items for calculation of the foreign-exchange inflows and outflows of an investment project It provides a procedure for a liquidity analysis of the project in terms of foreign exchange

It may be seen from table 27 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 to aid in table 27 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 a project contributes to the availability of foreign exchange in the country in the year t, while a 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 the commercial and national profitability of the project Indirect inflows and outflows are the only new items required for this analysis and will have to be compiled if possible and if worth the effort

In actual practice, there may be many factors 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 If any such factors are known with a degree of certainty, they would be reflected in the feasibility study, or in data compiled for earlier evaluation exercises. Since these same figures are being used for ascertaining the effects of the project on the balance of payments position of the country, they will be covered appropriately It would be inconsistent and hazardous to introduce any new elements at this stage of evaluation. All factors that have not been considered thus far should be left to be covered in the sensitivity and probability analysis.

TABLE 27 FOREIGN-EXCHANGE FLOWS OF A PROJECT

(In foreign exchange)

Item	*Year*			
	t_0	t_1	t_2	t_n
I. Foreign-exchange inflows (FI)				
A. *Direct inflow*				
1 Foreign equity capital				
2. Loans in cash				
3. Foreign aid or grant				
4. Goods or equipment on credit or deferred payment[a]				
5 Exports of goods or services				
6. Others				
B. *Indirect inflow* (for linked projects)				
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 (FO)				
A. *Direct outflow*				
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 outflow* (for linked projects)				
23. Import of capital goods, equipment, machinery etc.				
24. Import of raw materials, intermediates, replacements etc.				
25 Imported goods purchased on domestic market				
26. Others				
III. Net foreign-exchange flow (I–II) (positive +, negative –)	FE_0	FE_1	FE_2	FE_n

[a]Not incorporated in cash loans.

If two or more projects are to be compared on the basis of the net foreign-exchange flows, all the $(FI - FO)_t$ should be multiplied by the respective discount factors to arrive at their present value, a single magnitude as a criterion for evaluation Thus,

$$P(FE) = \sum_{t=0}^{n} (FI - FO)_t \, a_t \qquad (43)$$

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,

FI_t = foreign-exchange inflow of a project in the year t,

FO_t = foreign-exchange outflow of a project in the year t,

a_t = discount factor in the year t

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

Step 2. Determine the impact of a set of projects on the national balance of payments For the purpose of balance of payments planning and its relationship with an industrial complex or an investment programme, one further step in the analysis may be desirable It consists of tracing the impact of a set of projects on the balance of payments situation of a country Table 27 provides the foreign-exchange flows for each year of the life of a project and on this basis the total net foreign-exchange flow for each constituent 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 an expected residual (surplus or deficit) in the balance of payments after their implementation. The net impact of a set of projects on the balance of payments is presented in table 28.

The evaluation presented in table 28 should be carried out only at the level of an industrial complex or an investment programme and if the required data are available.

For individual projects, which are not an integral part of an industrial complex, or for an investment programme, step 2 of the analysis is not needed. The net foreign-exchange flow computed under step 1 above is actually the net impact of a project (positive or negative) on the national balance of payments. The project analyst should then proceed directly to the computation of the import substitution effect of a project

Step 3 Compute the import substitution effect of a project The import substitution effect measures the estimated savings in foreign exchange owing to the curtailment of imports of the items the production of which has been taken up by the project This effect is calculated at the c.i.f 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 28 IMPACT OF A SET OF PROJECTS ON THE BALANCE OF PAYMENTS

(In foreign exchange)

Net foreign-exchange flows	*Year*			
	t_0	t_1		t_n
Project 1 = FE_1				
Project 2 = FE_2				
Project m = FE_m				
Net balance of payments effects of a set of projects	$\sum_{i=1}^{m} (FE_i)_0$	$\sum_{i=1}^{m} (FE_i)_1$	.	$\sum_{i=1}^{m} (FE_i)_n$
Balance of payments surplus (deficit) prior to the implementation of a set of projects	S_0	S_1		S_n
Expected residual (surplus or deficit) in the balance of payments after implementation of the set of projects	$S_0 + \sum_{i=1}^{m} (FE_i)_0$	$S_1 + \sum_{i=1}^{m} (FE_i)_1$		$S_n + \sum_{i=1}^{m} (FE_i)_n$

Step 4: Compute the net foreign-exchange effect of a project. The net foreign exchange of a project includes the net foreign-exchange flow computed under step 1 and the import-substitution effect computed under step 3 above. The computation is shown in table 29.

In the case of commodities in large demand in the country, using the analysis in table 29 a negative foreign-exchange flow of a project during its whole economic life may even be converted into a positive figure of net foreign-exchange effects. This would be indicative of the import-substitution effect of the project.

TABLE 29 NET FOREIGN-EXCHANGE EFFECT OF A PROJECT

(In foreign exchange)

Item	*Year*			
	t_0	t_1	t_2	t_n
1 Net foreign-exchange flow (table 27, row III)				
2 Import-substitution effect				
Total net foreign-exchange effect (positive +, negative −)				

If two or more alternative projects are compared on the basis of their net foreign-exchange effects, the annual figures should 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 30 provides the data for the estimation of the net foreign-exchange effect It has been compiled on the basis of the model tables 27 and 29 above All elements are expressed in United States dollars.

Table 30 reflects the direct net foreign-exchange effect because the evaluators failed to obtain reliable data on the indirect foreign-exchange effect for incorporation in this table They found only that there is definitely a positive indirect net foreign-exchange effect, but the inconsistency of the data did not permit an appropriate measurement to this effect Therefore, it is safer to proceed with the analysis of the direct foreign-exchange effects alone with the awareness that the indirect effects will add positively to the direct ones

The analysis of the net foreign-exchange effect could be carried out taking into consideration the whole life of the project, but also on the basis of a normal year [3] The life span of the project is, of course, more indicative

The analysis confirms that the annual nominal net foreign-exchange flow (table 30, row 3) is negative between years 2 and 10 inclusively The annual foreign-exchange outflows for these years exceed the annual foreign-exchange inflows, owing to the import of current material inputs, repayment of foreign loans (principal and interest) and repatriation of wages and dividends However, owing to foreign equity capital and the equipment on credit obtained during the construction period, and the positive annual net foreign-exchange flows from year 11 onwards, the overall discounted net foreign-exchange flow is $US 18,600 (table 30, row 7)

The situation changes considerably when the foreign exchange saved owing to import substitution (table 30, row 4) is taken into consideration In this case the net foreign-exchange effect (table 30, row 5) is positive throughout the project's life By discounting the annual net foreign-exchange effect at the selected social rate of discount of 9 per cent, one arrives at the present value of the net foreign-exchange effect, amounting to $US 123,700 (table 30, row 8) Hence, the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan, using imported material, foreign equity capital and personnel, there would still be a surplus which in terms of present value would amount to $US 123,700

4 4 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 therefore may be exported This assessment is of particular importance also for projects of which the economic scale of production is larger than what can be absorbed in the domestic market.

To determine the international competitiveness of the products of any project, it is necessary to compare the input of domestic resources for the production of the exported items with the benefit (the net foreign-exchange earnings) that would be received from exports

[3] In such a case depreciation referring to this year should also be taken into consideration.

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

Step 1 As indicated in section II.B.2, "Price adjustments", the actual present or expected export prices (f o b), should be taken as a starting point These are the expected actual prices at which certain commodities produced by the project will be exported. If the project produces 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 f.o.b prices, the gross foreign-exchange earnings are attained or, in other words, the expected *output in export prices (f o b)* The f o b price is converted into local currency at the adjusted rate of foreign exchange Add to the expected output in export prices the foreign equity capital, the cash loans and the equipment on credit acquired during the construction period (both in foreign exchange) to arrive at the *foreign-exchange inflow* of an investment project expressed in local currency The foreign exchange is converted into local currency at the adjusted rate of exchange

Step 2: As a next step the foreign component of the capital and current inputs should be computed In the pricing rule table (table 15) the actual c.i.f price may be found for the imported inputs used in the production of the goods to be exported One can 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 c.i.f price is converted into local currency at the adjusted rate of foreign exchange Add to the foreign component of the inputs the repatriated payments such as wages, dividends, interest on foreign loans etc. to arrive at the *foreign-exchange outflow* of an investment project, expressed in local currency The foreign currency is converted into local currency at the adjusted rate of exchange

Step 3 Deduct from the expected foreign-exchange inflow established under step 1 the foreign-exchange outflow computed under step 2 to arrive at the *net foreign-exchange flow* The same figures should be arrived at by converting the net foreign-exchange flow of a project (table 27 above) by the adjusted rate of foreign exchange, provided the entire output goes for export Multiply the nominal annual values of the net foreign-exchange flows thus computed by the respective discount factors to arrive at the present value of the net foreign-exchange flow

Step 4: The input of domestic resources for the production of the exported items should be computed next, such resources as domestically procured investment, current material inputs, infrastructural services and domestic wages. In the pricing rule table (table 15) the prices of all inputs are adjusted to obtain an approximation of their real costs to the country, representing the real value of domestic inputs Multiply the nominal annual values of domestic resource inputs thus computed by the respective discount factors to arrive at the present value of the domestic resource inputs, expressed in local currency

Step 5· Compare the expected present value of the net foreign-exchange flow expressed in local currency as obtained in step 3

$$\sum_{t=0}^{n} (\mathrm{FI} - \mathrm{FO})_t \, a_t$$

with the present value of the domestic resource inputs as obtained in step 4

$$\sum_{t=0}^{n} \mathrm{DR}_t \, a_t$$

TABLE 30 ELEMENTS FOR ESTIMATION OF THE NET FOREIGN-EXCHANGE EFFECT[a]

(Thousand dollars)

Item	*Year*																					
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
1 Foreign-exchange inflow (FI)	150	170	10	20	40	40	50	60	60	60	60	60	60	60	60	60	60	60	60	60	60	
1 1 Foreign equity capital (table 6, row 2 1 2)	150	10																				
1 2 Equipment on foreign credit (table 6, row 2 2 2)		160																				
1 3 Exports (table 9, row 1 1)			10	20	40	40	50	60	60	60	60	60	60	60	60	60	60	60	60	60	60	
2 Foreign-exchange outflow (FO)			46	76	76	76	74	74	72	72	72	44	44	44	44	44	44	44	44	44	56	
2 1 Royalties (table 9, row 4 4)																						
2 2 Imported materials (table 9, row 2 2 1)			16	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	
2 3 Repayment of the foreign loan (table 8, row 7 1)				20	20	20	20	20	20	20	20											

2.4	Repatriated wages by foreign personnel (table 9, row 4 1)			0 6	0 6	0 6	0 6	0.4	0 4	0 2	0 2	0 2												
2.5	Dividends to foreign shareholders (table 9, row 4.2)			2 4	1 6	1 6	1 6	1 6	1 6	1 6	1 6	1 6	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0	3.2		
2 6	Interest on foreign loans (table 9, row 4 3)				1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0												
3	Net foreign-exchange flow (FE) (1−2)	15 0	17 0	(3.6)	(5 6)	(3 6)	(3 6)	(2 4)	(1 4)	(1.2)	(1 2)	(1 2)	1 6	1 6	1 6	1 6	1 6	1 6	1 6	1 6	1 6	0 4		
4.	Import-substitution effect (table 9, row 1.2)			12 0	16 0	14 0	14 0	13.0	12 0	12 0	12 0	12 0	12.0	12 0	12 0	12.0	12 0	12.0	12.0	12 0	12.0	12 0		
5	Net foreign-exchange effect (3+4)	15 0	17 0	8 4	10.4	10 4	10 4	10 6	10 6	10 8	10 8	10 8	13 6	13 6	13 6	13 6	13 6	13.6	13 6	13 6	13 6	12 4		
6	Discount factors at social rate of discount of 9%	1 0	0 92	0 84	0.77	0 71	0 65	0 60	0.55	0.50	0.46	0.42	0 39	0 36	0 33	0 30	0 27	0 25	0 23	0 21	0 19	0 18		
7	Discounted net foreign-exchange flow (3 x 6)	15 0	15 6	(3 0)	(4 3)	(2 6)	(2 3)	(1.4)	(0 8)	(0 6)	(0 6)	(0.5)	0 6	0 6	0.5	0 5	0.4	0 4	0.4	0 3	0 3	0 1	18 6	
8.	Discounted net foreign-exchange effect (5 x 6)	15 0	15 6	7 1	8 0	7 4	6 8	6.4	5 8	5 4	5 0	4.5	5 3	4 9	4.5	4 1	3 7	3.4	3 1	2 9	2 6	2 2	123 7	

[a]The computation of the net foreign-exchange effect expressed in dollars has been made on the basis of the official rate of foreign exchange $US 1 = 5 dinars. This is the rate at which all real foreign-exchange transactions have been made and not the adjusted rate of exchange Therefore, all items from relevant tables in dinars have been divided by 5 to arrive at their equivalent in dollars

to find out whether the net earnings of foreign exchange ensure at least a recovery of domestic resource inputs The formula for such export efficiency test is as follows

$$IC = \frac{\sum_{t=0}^{n} (FI - FO)_t \, a_t}{\sum_{t=0}^{n} DR_t \, a_t} \geqslant 1 \qquad (44)$$

where

IC = indicator of international competitiveness,

FI_t = foreign-exchange inflow of a project in the year t of its life,

FO_t = foreign-exchange outflow of a project in year t of its life,

DR_t = domestic resource inputs (domestic component of investments, current material inputs and wages) of a project's output going for export in the year t of its life,

a_t = discount factor at the selected social rate of discount in the year t

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 f o b /c i f prices calculated at the adjusted and official rates of foreign exchange determines the maximum amount of subsidy that the Government can offer for exports or the amount that it can impose as taxes on imports without leading to any unrewarded transfer of resources from the country

In the analysis of a group of products (the project as a whole), a hidden situation may occur in which the net foreign-exchange earnings from the export of one item entails the non-recovery of domestic inputs, but this loss is more than compensated for by other items and should not be alarming since there is an overall gain Such situations are easy to discover with experience, and gradually more emphasis may be put on items yielding net social gain on exports

Step 6 Compare the result obtained above with the *cut-off criterion* for international competitiveness (if set up by the authorities concerned) 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 can be improved, if possible If a reliable cut-off rate does not exist in a country, this step of the analysis is omitted

Step 7 If there are several competing products or projects, they should be *ranked* on the basis of the strength of their international competitiveness The higher the rate, the more competitive the project is

The cut-off criterion for international competitiveness expresses in numerical terms the *minimum acceptable level* of international competitiveness In principle, it is the level that would ensure at least a recovery of the domestic real social costs, namely, the ratio between net foreign-exchange earnings and domestic resource inputs should equal at least one

No special sophisticated methodology is needed for establishing a cut-off rate of international competitiveness As stated above, in principle, it should be equal to

one Often, however, as a result of the highly competitive conditions on the international market as compared with the low level of national productivity in a developing country, and as an encouragement to exports in a difficult foreign-exchange situation, the competent agency may establish a cut-off rate of less than one In doing so the Government is offering incentives above what would be determined on the basis of real social costs and benefits In other cases, as a result of the dominant position of a country on the international market for certain commodities, the cut-off rate may be established above one Such cases arise in extraordinary circumstances and much depends on the evaluation of the overall current and future economic situation

Subject to the prevailing conditions in a country, the cut-off rate for international competitiveness may be uniform or diversified by industrial sectors and/or foreign markets This rate should be periodically reviewed by the competent agency and, if necessary, readjusted to the new economic reality.

Tables 31 and 32 provide an illustration of the practical application of the approach for calculating international competitiveness

Foreign-exchange inflows and outflows have been computed for the total annual production in dollars in table 30 As the international competitiveness is analysed only for exports, only the foreign-exchange inflows and outflows related to the quantity of exported output have to be accounted for Exports vary from 8 per cent to 33 per cent throughout the project's life On this basis, a respective portion of the foreign-exchange components is computed for each year For foreign equity capital, equipment and royalties, 33 per cent is taken since for most of the project's life the share of exports in total output is 33 per cent Naturally, the entire foreign-exchange inflow from exports should be taken into consideration (table 31, row 1 3)

In order to make the data on net foreign-exchange earnings (expressed in dollars) comparable with the data on domestic resource inputs (expressed in local currency), the former are multiplied by the adjusted rate of foreign exchange, i.e $US 1 = 6 5 dinars

The above procedures could be illustrated with the following simple example the foreign-exchange equity capital in year 0 amounts to $US 15,000 (table 30, row 1 1) Thirty-three per cent of it should be accounted for in this part of the output, which goes for export, namely $US 4,950 This figure is then multiplied by the adjusted rate of foreign exchange, i.e $US 1 = 6 5 dinars, to arrive at this portion of the foreign equity capital expressed in local currency

$US 4,950 x 6 5 = 32,200 dinars (table 31, row 1 1)

Table 32, "Domestic resource inputs", is compiled basically from table 9, but in this table inputs are stated for the total annual production In this case only that part of domestic resource inputs related to exported output needs to be accounted for As explained above, to compute the domestic resource inputs related to exports for respective years, the share of exports in total output should be used

The present value of net foreign-exchange earnings from exports is 230,300 dinars (table 31, row 5) The present value of domestic resource inputs needed to produce the output going for export is 117,400 dinars (table 32, row 7)

When the above figures are introduced in the expression for international competitiveness (45), the following result is obtained

$$\frac{230,300}{117,400} = 1\ 96$$

TABLE 31 NET FOREIGN-EXCHANGE EARNINGS[a]

(for calculation of international competitiveness)

(Thousand dinars)

Item	*Year*																					
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
Share of exports in total output (percentage)			8 0	11 0	22 0	22 0	28 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	
1 Foreign-exchange inflow (FI)	32 2	36 4	6 5	13 0	26 0	26 0	32 5	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	
1 1 Foreign equity capital (table 30, row 1 1)	32 2	2 1																				
1 2 Equipment on credit (table 30, row 1 2)		34 3																				
1 3 Exports (table 30, row 1 3)			6 5	13 0	26 0	26 0	32 5	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	39 0	
2 Foreign-exchange outflow (FO)			2 3	6 7	11 6	11 6	13 7	15 8	15 3	15 3	15 3	9 4	9 4	9 4	9 4	9 4	9 4	9 4	9 4	9 4	12 0	
2 1 Royalties (table 30, row 2 1)																						
2 2 Imported materials (table 30, row 2 2)			0 8	1 7	3 4	3 4	4 4	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	
2 3 Repayment of foreign loan (table 30, row 2 3)				1 4	2 9	2 9	3 6	4 3	4 3	4 3	4 3											
2 4 Repatriated wages (table 30, row 2 4)			0 3	0 4	0 9	0 9	0 7	0 9	0 4	0 4	0 4											
2 5 Repatriated dividends (table 30, row 2 5)			1 2	1 1	2 3	2 3	2 9	3 4	3 4	3 4	3 4	4 3	4 3	4 3	4 3	4 3	4 3	4 3	4 3	4 3	6 9	
2 6 Interest on foreign loan (table 30, row 2 6)				2 1	2 1	2 1	2 1	2 1	2 1	2 1	2 1											
3 Net foreign-exchange flow (1–2)	32 2	36 4	4 2	6 3	14 4	14 4	18 8	23 2	23 7	23 7	23 7	29 6	29 6	29 6	29 6	29 6	29 6	29 6	29 6	29 6	27 0	
4 Discounting factors at social rate of discount of 9%	1 00	0 92	0 84	0 77	0 71	0 65	0 60	0 55	0 50	0 46	0 42	0 39	0 36	0 33	0 30	0 27	0 25	0 23	0 21	0 19	0 18	

5 Present values of the net foreign-exchange flow (3 x 4)	32 2	33 5	3 5	4 9	10 2	9 4	11 3	12 8	11 8	10 9	10 0	11 5	10 7	9 8	8 9	8 0	7 4	6 8	6 2	5 6	4.9	230 3

[a] Foreign-exchange inflows and outflows are computed on the basis of table 30, but only for the exported portion of the output, which varies from 8 per cent in year 2 to 33 per cent in most years They are converted into dinars at the adjusted rate of exchange $US 1 = 6 5 dinars, and then discounted at the social rate of discount of 9 per cent

TABLE 32 DOMESTIC RESOURCE INPUTS[a]

(for calculation of international competitiveness)

(Thousand dinars)

Item	*Year*																					
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
Share of exports in total output (percentage)			8 0	11 0	22 0	22 0	28 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0	33 0
1 Investments domestically procured (table 9, row 2 1 2)	8.3	5.0																				
2 Current material inputs–domestically procured (table 9, row 2 2 2)			1 6	4 0	7 9	7 9	10 1	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	11 9	
3 Infrastructural services (table 9, row 2 2 3)			0 2	0 3	0 7	0 7	0 8	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
4 Domestic wages (table 3, row 5 1)			0 5	0 9	1 8	1 8	2 6	3 0	3.4	3 4	3 4	3 8	3 8	3 8	3 8	3 8	3 8	3 8	3 8	3 8	3 8	3 8
5 Domestic resource inputs (1 + 2 + 3 + 4)	8 3	5 0	2 3	5 2	10 4	10 4	13 5	15 9	16 3	16 3	16 3	16 7	16 7	16 7	16 7	16 7	16 7	16 7	16 7	16 7	16 7	
6 Discounting factors at the social rate of discount of 9%	1 0	0 92	0 84	0 77	0 71	0 65	0 60	0 55	0 50	0 46	0 42	0 39	0 36	0 33	0 30	0 27	0 25	0 23	0 21	0 19	0 18	
7 Present value of the domestic resource inputs (5 x 6)	8 3	4 6	1 9	4 0	7 4	6 8	8 1	8 7	8 1	7 5	6 8	6 5	6 0	5 5	5 0	4 5	4 2	3 8	3 5	3 2	3 0	117 4

[a] Domestic resource inputs are computed on the basis of table 9, but only for the exported portion of the output, which varies from 8 per cent in year 2 to 33 per cent in most years

A unit of domestic resource inputs occurring in the hypothetical project is thus expected to generate 1.96 units of net foreign exchange in terms of present value Therefore, in addition to the recovery of domestic resources used in the project, there would be a considerable surplus of foreign exchange over and above the domestic resource inputs

5 Supplementary considerations

Some effects of a project have not been covered by the basic criterion and by the additional indices suggested earlier These effects are termed *supplementary considerations* and cover an analysis of the implications of an investment project for infrastructure, technical know-how and the environment 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 evaluated, the project analyst may decide to extend or shorten this list.

5 1 Implications for infrastructure

All projects require infrastructural facilities, i.e supply of power, water, transport, postal services, communications, banking, marketing, cultural, housing, educational and social and health care services. Such facilities also supplement the arrangements necessary for maintaining law and order

The new projects may be conceived of in two types of circumstances in which there are idle (or spare) infrastructural facilities available at the proposed locations, or there are scarcities and infrastructural bottle-necks

In the case of idle infrastructural facilities 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 special assessment of the infrastructural implications in project evaluation, the infrastructure may be considered as given to the project

When scarcities and bottle-necks exist in the infrastructural capacities and it is necessary to augment these services for the successful working of the project through additional capital investment, the situation becomes somewhat different Thus far, the variable costs of infrastructural services have been accounted for in the operating costs of the project The main problem arises with 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 an augmentation of the infrastructural facilities to meet the requirements of this project and possibly other projects. In case the facilities are exclusively for this project, they should be calculated as part of the project and their costs and benefits should form part of the basic analysis undertaken earlier An example would be when a power plant is built for the sole purpose of meeting the requirements of an aluminium plant

Greater difficulty, however, arises in cases in which the costs or benefits cannot be so directly estimated, e.g roads have to be widened, the capacities of schools and hospitals have to be increased, the size of post offices and banks must 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 project implemented, the subsequent ones being charged only the variable costs This would obviously not be justified, one project should not be burdened at the beginning stage of the development programme with the total additional investment costs of infrastructure, but should bear only a reasonable proportion of the infrastructural investment costs based on the infrastructural services that it would use

A comparative infrastructural analysis of alternative projects may be unnecessary 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 Implications in terms of technical know-how

The implementation of large and sophisticated projects generally contributes to the development of local skills and capabilities in a country Furthermore, they help to change traditional values, attitudes and the 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 work discipline 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 measure, but this imposes the need to account for this impact at least in qualitative terms. Apart from the size of a project, the effect on the development of technical know-how depends on the technology applied and the location of the project. Technologically more advanced projects are bound to have a more important impact on the formation of the country's technical know-how, but if the technology is too sophisticated, the result may lead to importing foreign personnel to run the factory instead of improving the skills within the country. Also, the project will have a different effect when located in different regions owing to their differing traditions and levels of development. The evaluator can take account of the possible benefits within the context of the overall and regional development plans of the country

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

5.3 Environmental implications

The environmental implications can be related to natural and to socio-cultural conditions. The effect on the natural environment can be detected rather easily and

measured in terms of the costs necessary to prevent the deterioration of the environment The effect on socio-cultural conditions is more difficult to perceive and subject to a value judgement.

In a general sense, damage to the natural environment can be associated with

(a) Inputs used in a project;

(b) Production process within a plant,

(c) Use of the project's output

The production of an input or its transportation to the plant where it is to be used may have potentially polluting effects on the environment. For instance, the transport of bulky raw materials, toxic or explosive inputs, which in addition would add to the noise and congestion of traffic, may cause a considerable worsening of the environmental conditions. In such cases the location of a plant to be built may have to be reconsidered or additional investment in infrastructure may be necessary to avoid the hazards

The operation of the plant itself may result in air, soil and water pollution and a rise in the noise level, and in negative effects in terms of sewage, solid waste disposal and soil erosion In addition, it may spoil the aesthetic aspect of the natural environment, leading to decreased possibilities for the tourist industry, development of recreational facilities etc

The output of a new plant may also have undesirable ecological effects Certain types of fertilizers and pesticides may require strict rules for handling and use, and marketing channels may not be sufficiently controllable to guarantee adherence to these rules Also, in the further processing of products environmental problems may occur if the prescribed production standards are not adhered to in supplying industries or if some products, like fertilizers, are used beyond a specified limit

In all these instances the effects of a project on the socio-cultural environment are relevant Preserving the positive values of tradition, the cultural monuments and the informal links among the people may be helpful to a development process Attention should be paid to them, especially under conditions of rapid urbanization which are likely to introduce a new way of life too suddenly and to provoke social disturbances

The first step in estimating the environmental effects is to identify and classify them into positive and negative. As mentioned earlier, it is easier to assess effects on the natural environment with some degree of success. Determining possible sources of natural environmental deterioration and designing possible solutions to the problem are basically technical matters The solutions are selected and evaluated in financial terms, however What matters is whether the social benefits to be gained by avoiding environmental damage are significant enough to justify the cost of preventing such damage.

The appraisal of environmental implications is thus a matter not of a technical, but of an economic and social concern. This fact is often overlooked If environmental safeguards are inevitable, the least-cost solutions should be found and their effects determined on the commercial and national profitability of a project If safeguards turn out to be too costly relative to investment, it may be worthwhile to calculate commercial and/or national profitability with and without such a cost In some instances, it may well be that a project is commercially sound without such additional costs, but that it would be only marginally sound if the investor had to accept them. The question then arises whether the project can be redesigned or

relocated in order to lessen the negative impact on the environment. If this is not feasible, government grants or subsidies may be sought, provided that a project is socially profitable under such conditions.

A comparative analysis of the effects of competing projects on the environment may be unnecessary if these effects do not differ considerably among the projects However, a self-contained analysis of the environmental impact of each industrial project should always be carried out.

6. National parameters

The methodology for determining national profitability requires that project evaluators 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 made at the national level of the planning process rather than at the project level They are thus called national parameters.

National parameters are yardsticks set up outside of a project and are established by a national planning institution. They reflect an attempt to better allocate 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 in project evaluation The authors of this Manual recommend the use of two national parameters which are considered to be the most essential, namely social rate of discount and adjusted rate of foreign exchange.

6.1 Social rate of discount

Social rate of discount (SRD) is the quantitative estimate of the value society places on future benefits and costs, or in other words, the rate at which the value placed by society on future benefits and costs declines over time The need for such an estimate arises in compiling the present value of the social costs and benefits of a project spread over a long span of time The social rate of discount provides the link between costs and benefits occurring at different times 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 the socially most desirable uses If the SRD is set too low, demand for public investment 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 chosen so that the demand for public investment resources will more or less exhaust the available supply The selection of a social rate of discount for the purposes of project evaluation is a responsible exercise for, all other parameters of a project being given, the soundness of the project may vary considerably with the variation of the social rate of discount

For practical reasons it is assumed that the social rate of discount is constant over time The same rate should be used throughout a project's life. From an

operational point of view it is not advisable to use several social rates of discount throughout the lifetime of a project This is an acceptable approximation for the purposes of project evaluation

The sequence of steps in calculating the social rate of discount may 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 Among the existing interest rates on the relevant world capital market, the rate of interest on long-term loans would be the appropriate basis for estimation of the social rate of discount For each loan there might also be variations subject to who the borrower is and who the lender is, i.e Government to Government, central bank to central bank, bank to bank, interest rates on tied and untied loans and interest rates of the Eurodollar capital market There might be different interest rates on long-term loans to different countries, subject to whether they have a history of nationalizations, of delayed debt payments etc All these various interest rates should be considered carefully by the institution setting up the social rate of discount in order to determine an objective interest rate as a starting point

Step 2: This rate should then be adjusted by taking into account the prevailing domestic conditions of a country One country may be regarded as a *capital lender* and another as a *capital borrower*

(a) When a country is a capital lender, investment in domestic projects has various advantages over investments abroad, particularly from a long-term development point of view 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 others In general, the Government of a 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 lowering the premium rates

Giving a premium for domestic projects means actually promoting 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

$$\text{SRD} = (r_w - p_d)r_w \tag{45}$$

where

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

p_d = "premium" for domestic projects

"Premium" rate for domestic projects p_d can be estimated on the basis of experience and guesswork for the national and the world economy after taking into account factors such as

(i) Expected rate of growth of the national economy,
(ii) Expected rate of inflation in the world market,
(iii) "Steadiness" of a given world capital market;

(iv) World political stability,
(v) Expected long-term returns on domestic projects,
(vi) Expected rate of inflation within the country

If the expected growth rate is high, the expected rate of inflation is also high, or if the long-term forecasts about the world political situation are gloomy, the "premium" should be rather high In such a case, the "premium" p_d could be about 25 per cent of the relevant world capital market rate of interest

$$\text{SRD} = r_w - 0\,25\, r_w$$

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

$$\text{SRD} \geqslant r_w \tag{46}$$

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

There may be a country that is not a clearly pronounced lender or borrower in the international capital market In this case one should also look for an objective starting point, such as the interest rate on long-term loans on the relevant international capital market If the development strategy of a country emphasizes high growth rates, this should be reflected in the social rate of discount To secure a higher rate of growth, other things being equal, more investment projects should be approved by lowering the social rate of discount Therefore, the social rate of discount could be used as an important instrument in the investment decision making

Step 3 It is important that a nation-wide, uniform social rate of discount be established, and it should generally be applied to all projects in a country and particularly to alternative projects There are, however, two circumstances in which a modification in the SRD to achieve some objectives may be necessary One relates to the need for speedy development of some basic strategic industries The other refers to the speedy development of backward regions of a country

(a) Investment projects for some basic strategic industries would hardly pass the absolute efficiency test if their future benefits and costs were 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 industrialization process and for certain industries This means a differentiation in the rates of discount by industrial branches A decision on this should be taken by a national policy-making institution,

(b) Similarly, the second circumstance in which different rates of discount are suggested is 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 prevent the projects for these areas from passing the absolute efficiency test and therefore from promoting 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 additional expected future benefits This means that a differentiation in the SRD for backward regions of a country may be desirable A decision on setting up regional SRDs should be made again by a 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

$$r_i = \text{SRD} - p_i \tag{47}$$

where

r_i = a special promotional SRD for a given industry/region,
SRD = uniform social rate of discount,
p_i = premium for an industry or a region leading to the lowering of SRD

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 SRD can be increased by adding some premium to the normal SRD

$$r_i = \text{SRD} + p_i \tag{48}$$

It should be noted, however, that there are many other ways and means of promoting or retarding the development of an industry or a region The application of differentiated SRDs is only one of them and may not always be the most efficient one It is up to the competent national policy-making institution to decide which one to use under the prevailing socio-economic conditions.

The SRD thus established should be periodically reviewed and, if necessary, adjusted in line with the new domestic and international economic realities, i.e growth rates, interest rates, economic development policies and priorities and inflation rates These periodic reviews should be consistent with the elaboration of the medium-term development plans or with any major changes in the socio-economic development policy of a country

The hypothetical project considered throughout the Manual is located in a developing country which is a capital borrower The actual rate of interest for long-term loans on the international capital market from which this country borrows varies between 6.50 and 7.50 per cent.

The country's absorptive capacity is greater than the possibility of borrowing capital from abroad The national planning agency was aware that under these circumstances the SRD should be somewhat higher than the actual rate of interest on the capital market in order not to allow less efficient projects to pass the efficiency test easily. Taking all this into consideration, the national planning agency established a uniform SRD for the five-year period 1976-1980 equal to 9 per cent, which is approximately 25 per cent higher than the prevailing interest rate on the relevant international capital market (This rate has been used for discounting purposes throughout the section of the Manual on national profitability)

6.2 Adjusted rate of foreign exchange

The *adjusted 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 in such circumstances, the foreign-exchange components should be valued at the adjusted rate of exchange in order to obtain a more realistic picture of the social benefits and costs of a project

In general, the adjusted 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 adjusted 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 adjusted rate of foreign exchange, not only should the present position of balance of payments be taken into account but consideration should be given to the expected changes as a result of the implication of different development programmes and large projects, and the economic and fiscal policies that the country would follow.

By definition the adjusted 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 adjusted rate of foreign exchange to secure the proper results of project evaluation. In doing so, he should act in close co-ordination with the respective national agency—a planning office, development bank or central statistical bureau.

The acute lack of information and experience needed for a comprehensive estimate of adjusted rate of foreign exchange prevailing in developing countries has persuaded the authors of the Manual to recommend at this stage a highly simplified approach for estimating the adjusted rate of foreign exchange within an acceptable range of approximation. It is felt that with the prevailing absence of data and other constraints in developing countries, only a simple approach is possible in practice Two methods are therefore suggested, based on the deficit in the balance of payments ratio and the tourist rate of exchange.

6.2.1 Deficit/receipts ratio

The first step should always be to find out if the official rate of foreign exchange could be used and, if certain corrections are needed, what these might be

The adjusted rate of foreign exchange calculated by this method is based on the ratio of the deficit in the balance of payments to the receipts and is given by the following expression

$$P^F = R^F\left(1 + \frac{M - B}{B}\right) = R^F \frac{M}{B} \tag{49}$$

where

P^F = adjusted rate of foreign exchange,
R^F = official rate of foreign exchange,
M = value of visible and invisible payments expressed in domestic currency,
B = value of visible and invisible receipts expressed in domestic currency.

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 receipts 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 projcts evaluated will operate in the future The adjusted rate of foreign exchange should be worked out using the data for a period of five years and by determining the average value of payments and receipts for this period as defined above Such data should be available from the five-year national development plan of a country It is desirable that the rate be recalculated every year skipping the first and including the sixth year and so on in order to get moving five-year average estimates.

The rationale behind this formula is that if a larger deficit is expected in the balance of payments, there will be a larger demand for foreign exchange, which is no longer reflected in the controlled official rate of exchange Therefore, this official rate should be adjusted, i.e certain premiums should be added to it The expression $\frac{M}{B}$ is the magnitude of this premium

The values of payments and receipts in the balance of payments 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

Table 33 provides data concerning the balance of payments situation in a hypothetical country for the five years from 1973 to 1977 It is obvious from table 33 that there is a chronic balance of payments deficit in the period 1973-1977 It is estimated that the situation will not change substantially in the years to come For this reason the demand for foreign exchange exceeds its supply and the official rate of exchange is less than the true value of the foreign exchange from the national

TABLE 33 HYPOTHETICAL BALANCE OF PAYMENTS, 1973-1977

(Million dinars)

	Receipts			*Payments*			*Surplus deficit of payments over receipts (4–7)*	*Adjusted rate of exchange* $(\frac{7}{4})$
Year	*Exported goods*	*Invisible*	*Total*	*Imported goods*	*Invisible*	*Total*		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1973	1 810	60	1 870	2 410	120	2 530	–600	1 35
1974	1 880	80	1 960	2 280	170	2 450	–490	1 25
1975	1 970	100	2 070	2 310	190	2 500	–430	1 21
1976	2 010	110	2 120	2 590	220	2 810	–690	1 33
1977	2 110	130	2 240	2 790	250	3 040	–800	1 36
1973-1977	9 780	480	10 260	12 380	950	13 330	–3 010	1 30

point of view The balance of payments deficit will continue in the foreseeable future, and therefore an adjusted rate of foreign exchange should be used instead of the official rate of exchange.

On the basis of the available information, the adjusted rate of foreign exchange will be estimated as

$$P^F = R^F \frac{M}{B} = 5 \frac{13,330}{10,260} = 5 \times 1\ 30 = 6\ 50$$

Therefore, the adjusted rate of foreign exchange is $US 1 = 6.50 dinars. This rate has been used throughout the national profitability analysis.

6.2.2 Tourist rate of foreign exchange

If, for any reason whatsoever, the above method is impossible to apply, the evaluator may use the tourist exchange rate as the representative adjusted rate of exchange for evaluating investment projects

The ratio between domestic and foreign currency expresses a certain amount of supply and demand for foreign exchange. Foreigners need domestic currency to buy attractive domestic goods which are usually non-basic commodities The nationals of a developing country need foreign exchange also to buy attractive foreign goods since they may not be available on the domestic market or the quality of the foreign goods may be better etc Such goods are usually non-basic commodities, too The above factors along with considerations of risk determine the black market rate of exchange The main conclusion is that the black market rate of exchange is based on attractive marginal commodities and not on basic essential goods It overestimates the value of the foreign exchange For this reason this rate is not acceptable from the national point of view, it is an extreme rate.

The official rate of exchange may be another extreme Behind this rate there are certain important considerations which ultimately lead to underestimation of the real value of foreign exchange If there were a balance between the supply of and demand for foreign exchange, the official rate would be the right one, but usually this is not the case.

It follows that the actual objective rate of foreign exchange is somewhere between the official and the black market rates As a matter of principle, the true rate should be based on the domestic costs of a unit of foreign currency The theory suggests methods for the assessment of such domestic costs, but unfortunately these methods are not operational. Thus, one is forced to look for an acceptable approximation somewhere between the official and the black-market rates The tourist rate of exchange is such an approximation.

The *tourist rate of foreign exchange* is usually determined by a component national agency at a high decision-making level The purpose is to attract foreign currency, which is valued by and needed in the country. If the originally established tourist rate has not performed its function properly, it will have been adjusted accordingly. Therefore, in the absence of a more comprehensive way of determining the adjusted rate of foreign exchange, the project evaluator may rely on the tourist rate of exchange already established As an approximation, it may be conveniently presumed that this rate reflects the social value of foreign exchange

The use of the tourist rate as the adjusted rate of foreign exchange needs no calculation. It is very often readily available.

C EVALUATION OF COMMERCIAL AND NATIONAL PROFITABILITY UNDER UNCERTAINTY

1 Why uncertainty?

The previous presentation of the methods of commercial and national profitability analysis is based on the assumption that the evaluator has a perfect knowledge of the future in cases in which information about the future is required for making an investment decision Each decision on the volume of production, size of investment, operating costs, prices, discount rate, lifetime of the project etc is a logical outcome of an assumption about a known sequence of future developments As a result, it is 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 very often even of the present, is imperfect Each decision taken now is a product of a set of assumptions concerning the future, about political and social developments, technological developments, the behaviour of prices of inputs and outputs and so on The uncertainty moreover is worsened 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 of some uncertainty When the decision maker assesses the desirability of a project, he evaluates, consciously or unconsciously, 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.

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 account being taken of how uncertain these calculations are for the alternative projects

Countries with comprehensive national planning may largely reduce the degree of uncertainty, but even then the uncertainty cannot be completely eliminated.

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

2. Sources of uncertainty

Each basic variable entering the calculation of commercial or national profitability could be a source of uncertainty of greater or lesser importance Some variables are common sources of uncertainty in evaluating investment projects. These are. size of investment, operating costs and sales revenue Each 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 relating to the project itself and uncertainties relating to the environment in which it operates These two sources of uncertainty usually act together in practice

3. Causes of uncertainty

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 being

(a) Inflation, by which it is understood that the prices of most items, inputs or outputs, increase with time, causing changes in relative prices The exact magnitude of price increases will always be unknown Prices may change upwards or downwards for other reasons, too,

(b) Changes in technology quantities and qualities of inputs and outputs used for project evaluation are estimated according to the present state of knowledge, yet new technologies might be introduced in the future that would alter these estimates,

(c) The rated capacity used in project evaluation may never be attained This in turn will affect operating costs as well as sales revenue,

(d) It often turns out that the needed investment for both fixed and working capital is underestimated and that the construction and running-in periods are considerably longer than expected This affects the size of investment, operating costs and 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 uncertainty or by substituting a less risky alternative for a more 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

Methods for assessing the soundness of a project from both the commercial and national point of view have been outlined in the preceding sections The procedure for applying uncertainty analysis is basically the same for all these methods Simple uncertainty analysis is applied to some selected methods of determining commercial and national profitability in the sections that follow The *break-even analysis* is recommended as a first step A second step proposed is the *sensitivity analysis* whereby instead of using one estimate of each variable several estimates are used under varying conditions Finally, the authors recommend the *probability analysis* in which all the probable values of each variable that have a significant chance of occurrence are used. It is up to the evaluator to decide how far to go in uncertainty analysis in order to verify 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

Probability analysis is applied to the pay-back period as representative of the commercial profitability methods and to value added (absolute efficiency formula) as representative of national profitability analysis

Before embarking on the uncertainty analysis of an investment project the evaluator should examine carefully whether it is indispensable Uncertainty analysis, and particularly probability analysis, requires a great deal of computation which should be avoided if possible An evaluator is advised therefore to carry out probability analysis only under conditions of great uncertainty regarding the future operation of a project

4 1 Break-even analysis

Break-even analysis is carried out to establish the lowest production and/or sales levels at which a project can operate without endangering its financial viability The term break-even 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 break-even point could also be expressed as a minimum selling price for outputs or as the maximum purchasing price for inputs as well as the maximum operating cost per unit of output

The lower the break-even point, the higher the chances of a project are for earning profits and the lower the risk of making losses The difference between the expected use of the installed capacity and the BEP is a safety margin The larger this margin is, the better The BEP expresses the lowest tolerable level of utilization of the production capacity

Break-even analysis may be particularly useful in a situation in which 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 investment, output and operating costs Each comprises quantity and a price Other factors, such as product-mix, input-mix and type of technology, 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 more slowly than production volume (depreciation, administrative expenses etc) Variable costs are directly related to the level of output They increase or decrease with the increase or decrease of the level of production (raw materials, power, fuel, direct labour inputs etc)

The period adopted for the break-even analysis should be clearly specified It is recommended to work with data from a normal year

The break-even point of an investment project may be determined graphically and algebraically on the basis of data in any normal year on level of output, level of

inputs, prices, product-mix etc. To be meaningful 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.

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. A conventional break-even chart (assuming single product, fixed costs remain constant regardless of the sales volume and linear relationship between quantity of output and variable cost) may be expressed as in figure II.

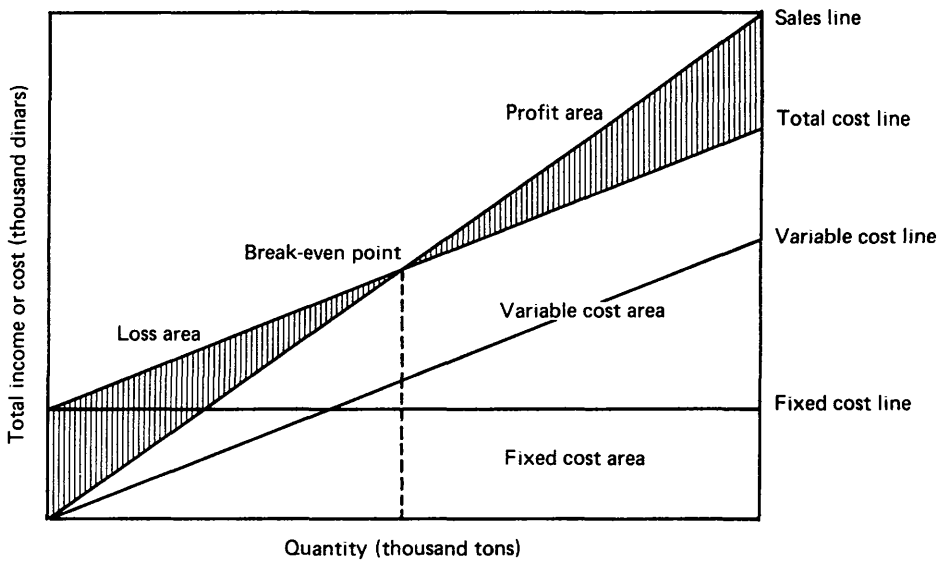

Figure II. Break-even chart

Break-even point can also be determined algebraically either in physical or in value terms. It should be noted that, for practical purposes, 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 that can be converted easily into a basic product. The following formulae are suggested for this purpose:

(a) In terms of physical units

$$BEP = \frac{FC}{SP - VC} \tag{50}$$

(b) In terms of sales revenue

$$BEP = SP\frac{FC}{SP - VC} \tag{51}$$

where

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 above formulae could be used for deriving a formula for a BEP in terms of a selling price This would be the minimum selling price that a project could afford, making neither profit nor loss.

In applying the break-even analysis it is essential to identify the product-mix If the product-mix comprises two products, the expected quantities of each of them should be multiplied by the expected unit price

$$(Q_1 \times SP_1) + (Q_2 \times SP_2) = FC + Q_1(VC)_1 + Q_2(VC)_2 \qquad (52)$$

where

Q_1, Q_2 = quantities in physical terms of products 1 and 2, respectively,
SP_1, SP_2 = selling prices for products 1 and 2, respectively,
VC_1, VC_2 = variable costs per unit for products 1 and 2, respectively,
FC = fixed cost

If one of the products could be converted and measured in terms of the other (say, $Q_2 = \frac{1}{2}Q_1$), this would enable substitution and a fairly easy solution of equation 52 Another possibility might be to take a major product that is a main source of uncertainty and compute a BEP only for that product, considering the others as by-products.

The calculation of BEP involves the following operational steps

(a) *Break-even point in physical units*

Step 1 Estimate total fixed costs for a project (FC)

Step 2 Compute the variable costs (VC) per unit on the basis of the data on capacity in physical terms. Find out from the feasibility study the expected selling price per unit (SP)

Step 3. Divide the total fixed costs by the difference between a selling price per unit and variable costs per unit to arrive at the break-even point in terms of physical units.

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

The relevant information from the hypothetical project for a normal operating year (year 5) is

Selling price per unit (SP)	2 dinars
Total fixed cost (FC)	30,000 dinars
Variable cost per unit (VC)	0 9 dinars
Installed capacity	50,000 units

Hence,

$$BEP = \frac{FC}{SP - VC} = \frac{30{,}000}{2 - 0\,9} = \frac{30{,}000}{1\,1} = 27{,}273 \text{ units}$$

BEP as a rate of utilization of production capacity equals

$$\frac{27,273}{50,000} 100 = 54\ 5\%$$

Therefore, at a production level of 27,273 units (which means 54 5 per cent utilization of the installed capacity), the project is expected to make neither profit nor loss, this is its break-even point

(b) *Break-even point in sales revenue*

$$BEP = SP \frac{FC}{SP - VC} = 2 \frac{30,000}{2 - 0.9} = \frac{30,000}{1\ 1}$$

$$= 2 \times 27,273$$

$$= 54,546 \text{ dinars}$$

Therefore, sales revenue at a production level of 27,273 units equals 54,546 dinars The sales revenue at 100 per cent capacity utilization is 100,000 dinars (table 8, row 3 1) Hence,

$$\frac{54,546 \text{ dinars}}{100,000 \text{ dinars}} 100 = 54\ 5\% \text{ capacity utilization in monetary terms}$$

In other words, the break-even point of the project expressed in sales revenue is 54,546 dinars, or 54 5 per cent of the installed production capacity The project's break-even point is relatively low, which is an indication of a low risk of sustaining losses and a high chance of earning profit

The break-even point is calculated usually on the basis of the following assumptions

(a) Constant per unit selling price, price of material inputs and variable cost, i.e it assumes proportionality,

(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 varies in a given proportion

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

In spite of the above limitations, break-even analysis is a useful tool in defining and describing the relationships between output in physical terms, operating costs in physical units, prices for outputs and inputs, and the benefits from the operation A project's break-even point can be calculated from data usually available in the feasibility study

The break-even point varies widely according to the characteristics of the industry to which the project belongs High fixed-cost operations have relatively high break-even points, while industries operating with a high variable cost rate have relatively low break-even points

4 2 Sensitivity analysis

Sensitivity analysis shows how the value of the efficiency criterion (net present value, net national value added or any other criterion) 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 cutting in half the selling price of the output will make the value added zero If the value added is sensitive to the variables, the project is sensitive to uncertainties and special care should be devoted to making precise estimates, particularly of those variables the estimated values of which may contain significant errors

Sensitivity analysis may be used in early stages of project preparation to identify the variables in the estimation of which special care should be taken In practice it is not necessary to analyse the variations of all possible variables It is sufficient to confine the analysis to the key variables affecting the project the most, either because they are large in value as parameters or they are expected to vary considerably below or above the most likely magnitude 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 into account uncertainty by calculating an efficiency indicator, not only using the best estimates of the variables under conditions of certainty, but also using 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 conditions of certainty 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 the commercial success of a project

One may test the sensitivity of a fictitious project's net present value to alternative investment cost Assume that in the world of certainty investments are estimated to be 200 dinars with 100 dinars spent in the year zero and another 100 dinars spent in the year one When combined with other cash-flow elements, the result is a net present value of 115,000 dinars (table 12, row V)

Assume that owing to the uncertainty of actual needs and prices of equipment, investment could vary in the range of 180,000 to 250,000 dinars Hence, a total investment of 180,000 dinars could be used as an optimistic estimate, and a total investment of 250,000 dinars as a pessimistic estimate The calculations of the net present value would change accordingly as follows

Optimistic Estimate

Year	*Annual investment (thousand dinars)*	*Discount factors at discount rate of 7%*		*Present value (thousand dinars)*
t_0	90	1 00		90 0
t_1	90	0 93		83 7
			Present value of investment	173 7
			Present value of net cash inflow (table 12, years 2-20)	308
			Net present value (NPV)	134 3

Pessimistic Estimate

Year	*Annual investment (thousand dinars)*	*Discount factors at discount rate of 7%*		*Present value (thousand dinars)*
t_0	120	1		120.0
t_1	130	0 93		120 9
			Present value of investment	240 9
			Present value of net cash inflow (table 12, years 2-20)	308
			Net present value (NPV)	67 1

Therefore, the net present value of the project is sensitive to changes in investment requirements It ranges from 67,100 dinars under pessimistic assumptions to 134,300 dinars under optimistic ones Yet the project still has positive NPV under the worst expected circumstances in terms of investment costs

The recalculation of the efficiency criterion on the basis of 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 consultant services or firm assurances on behalf of the Government to safeguard critical areas

Sensitivity analysis may be carried even further by testing profitability on the assumption that the pessimistic alternatives of more than one variable materialize at the same time For instance, in the above example the pessimistic estimate for investment requirements is 250,000 dinars In addition, sales revenue may also be recalculated on the basis of more pessimistic price assumptions with the result that the present value of net earnings may drop from 308,000 dinars to, say, 232,000 dinars As a consequence, the NPV would become negative, i.e −8,900 dinars, which may render the project altogether unacceptable

Sensitivity analysis is a suitable simple tool for checking a project's sensitivity to changes in one variable or another However, the range of estimates for one variable will usually have different probabilities of occurrence Sensitivity analysis does not guide the investor about the possible occurrence of those values It does not tell him which of the pessimistic and optimistic values have a higher chance of occurring 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 unprofitable under the best conditions of all variables or alternatively it may be profitable even in 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 Probability analysis

Probability as used here refers to the frequency of occurrence of an event, measured as a ratio of the number of different ways that the specific event can happen to the total number of possible outcomes The purpose of probability

analysis is to eliminate the need for restricting 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, so that for each variable the sum of all these numbers (probabilities) is equal to one This numerical description of the likelihood of an event's occurrence makes possible an objective measure of many situations that could otherwise be gauged only intuitively Therefore, from a mathematical point of view, probability analysis consists of aggregating probabilities

Assigning probabilities of occurrence to each possible value of each variable is a highly intellectual exercise and its result amounts to a value judgement The outcome of probability analysis depends largely on the quality of this value judgement There is no prescription for it

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 probability analysis works in practice, it is applied in the following sections to two selected criteria the pay-back period (commercial profitability analysis) and the value-added criterion (national profitability analysis) The procedural steps, as outlined in these two examples, may then be applied correspondingly to other indicators

(a) *The pay-back period*

Step 1 Identify the range of variation of the variables that are subject to a high degree of uncertainty The findings of this analysis are

Variables	*Expected range of variation*	
	A	*B*
1 Investment	200 000	250 000
Probability	70%	30%
2 Annual net cash earnings from t_3 to t_{10}	35 000	31 000
Probability from t_{11} to t_{19}	34 000	30 000
Probability	60%	40%

The possible range of variation of investment between 200,000 and 250,000 dinars does not mean that only these two figures are likely to have probabilities of occurrence, in practice any figure between them is possible The two extremes only serve to define the range of variation of the variable The same applies to the other variables as well

Step 2 Narrow down the range of variations of each variable into several values For each of these values assign a probability of occurrence (the sum total of the probabilities always adding up to 1)

Table 34 gives values of investment cost and earnings under uncertainty

It is also expected that the net cash earnings will decrease from t_3 onwards The expected decrease will result from a decrease in sales revenue and an increase in cash operating expenses

TABLE 34 EXPECTED VALUES OF INVESTMENT COST AND ANNUAL NET CASH EARNINGS UNDER CONDITIONS OF UNCERTAINTY

Variable	*Alternative probability*	*Estimated values*	*Expected values*
Investment	200 000 x 0 70 =	140 000	
	250 000 x 0 30 =	75 000	215 000
Annual net cash earnings			
from t_3 to t_{10}	35 000 x 0 60 =	21 000	
	31 000 x 0 40 =	12 400	33 400
from t_{11} to t_{19}	34 000 x 0 60 =	20 400	
	30 000 x 0 40 =	12 000	32 400

Note Investment cost is expected to increase as the result of some pessimistic trends in international prices owing to inflation The cost of machinery and equipment is expected to increase by 50,000 and accordingly the total cost of investment will increase from 200,000 dinars to 250,000 dinars.

Step 3· Estimate alternative values of investment cost and annual net cash earnings along with their respective probabilities of occurrence (This is shown in table 34)

Step 4· Estimate the expected values of investment and annual net cash earnings by summing up their alternatives weighed with their respective chances of occurrence (This is shown in the last column of table 34) Compare the expected annual net cash earnings under conditions of uncertainty (equal to 32,400 dinars from t_3 to t_{10} and equal to 32,400 dinars from t_{11} to t_{19}) with their corresponding cash earnings in the deterministic conditions (equal to 35,000 dinars from t_3 to t_{10} and to 34,000 dinars from t_{11} to t_{19}) The result of using only the most likely alternative of each variable indicates how far one can go wrong in adopting the deterministic approach to evaluate this particular project

The expected annual net cash earnings under conditions of uncertainty is 1,600 dinars less than the expected annual net cash earnings under deterministic conditions This is a substantial difference and deserves the special attention of the evaluator and of the decision maker

Step 5 As stated in section II A, "Commercial profitability", the expected pay-back period *(p)* is the number of years that make

$$I = \sum_{t=0}^{p} F_t + D_t$$

where

I = total investment

$F_t + D_t$ = annual net cash earnings in the year t

Using this formula the expected pay-back period can be computed under conditions of uncertainty, as shown in table 35. The expected pay-back period is, therefore, nine years including two years of the construction period If the pay-back period is the preferred indicator of commercial profitability, an investment decision with due regard given to risk should be based on an expected nine years pay-back period

TABLE 35 EXPECTED PAY-BACK PERIOD UNDER CONDITIONS OF UNCERTAINTY

(Dinars)

Year	*Expected values of investment cost*	*Expected values of net cash earnings*	*Balance*
t_0			
t_1	215 000		
t_2		30 000	185 000
t_3		33 400	151 600
t_4		33 400	118 200
t_5		33 400	84 800
t_6		33 400	51 400
t_7		33 400	18 000
t_8		33 400	–

The simple comparison between the expected pay-back period under deterministic conditions (eight years) and the expected pay-back period under conditions of uncertainty (nine years) indicates that the project will be sound enough in terms of the duration of the pay-back period

(b) *Value added criterion (absolute efficiency test)*

Step 1 The key elements of this criterion should be scrutinized in order to determine the key variables which are subject to pronounced uncertainty and which if they change would greatly affect the value added It is found that output, current material inputs and investments fall into this category

Step 2 The sales revenue from t_7 onwards at market prices is expected to be 100,000 dinars, comprising 60,000 dinars for the local market as import substitution, 30,000 dinars for export and 10,000 dinars for infrastructural services Owing to some uncertainties on the domestic market the probability of selling goods worth 60,000 dinars is 0 60, the probability of selling goods for 55,000 dinars is 0 30, and of 50,000 dinars, 0.10 The export of goods for 30,000 dinars has been assured by long-term commercial agreements

The value of the infrastructural services is considered to be more certain The residual value is very uncertain, but since it is more than 20 years from now, it cannot affect the soundness of the project and is therefore considered not to be a key variable

Step 3 On the basis of the assumptions arrived at above, compute different values of sales revenue together with the respective probabilities of occurrence as shown below The most probable sales revenue in year 7 is equal to

Locally marketed as import substitution	
(60 000 x 0 6 + 55 000 x 0 3 + 50 000 x 0 1)	57 500
Exports	30 000
Infrastructure	10 000
Total expected value of sales at market prices	97 500

This expected value of exports and of output as import substitution converted into local currency at the adjusted rate of foreign exchange is

Adjusted value of exports = 30,000 x 1 3 = 39,000
Expected adjusted value of import substitution = 57,500 x 1 3 = 74,750

Accordingly, the expected value of sales revenue at corrected prices is arrived at, as follows (for $t_4 - t_{19}$, for other years see table 36)

	Dinars
Exports	39 000
Import substitution	74 750
Infrastructure	10 000
	123 750

Step 4. Material inputs in year 7, priced at actual market prices, were estimated to be 51,000 dinars (table 9, row 2.2). There are, however, uncertainties concerning the behaviour of both domestic market prices and c.i.f prices for material inputs. The probability of producing current material inputs worth 36,000 dinars (table 9, row 2.2 2) is 0.60, the probability with the same inputs costing 39,000 dinars is 0 30, and the probability with these inputs at 41,000 dinars is 0.10.

The expected value of domestic current material inputs = 36,000 x 0 6 + 39,000 x 0 3 + 41,000 x 0 1 = 37,400 dinars.

The probability of producing the above output with imported current material inputs for 12,000 dinars is 0.70, and the probability with paying 15,000 dinars for the same quantity of imported materials is 0 30.

On this basis one may compute the expected value of imported current material inputs at actual market prices in year 7 as follows

$$12{,}000 \times 0\ 70 + 15{,}000 \times 0.30 = 12{,}900 \text{ dinars}$$

Step 5. The imported component of the material inputs enters the figure of current material inputs computed under step 4 above at c.i.f prices converted into domestic currency at the official rate of foreign exchange. To correct this and comply with the pricing rules suggested earlier, compute the expected annual value of imported current material inputs at the adjusted rate of foreign exchange.

The expected value of material inputs including the cost of imported current material inputs converted into local currency at the adjusted rate of foreign exchange is

	Dinars
Imported material inputs at the adjusted prices (12 900 x 1 3)	16 770
Domestic material inputs	37 400
Infrastructure	3 000
	57 170

Step 6. Material inputs, as stated earlier, comprise current material inputs and investment. The expected values of the former have been computed, the expected value of the latter should now be computed. The investment is expected to vary from 200,000 dinars (probability 0 70) to 250,000 (probability 0.30). It follows from this that the most probable value of investment at market prices is

$$(200{,}000 \times 0.70) + (250{,}000 \times 0.30) = 215{,}000 \text{ dinars}$$

TABLE 36 EXPECTED VALUE OF OUTPUT AT CORRECTED PRICES

Year	*The expected value of domestic output as import substitution at market prices*	*The expected value of output as import substitution at corrected prices*	*Value of expected output at corrected prices*	*Value of infrastructural services*	*Residual value*	*Total expected value of output*
t_2	60 000 x 0 6 + 55 000 x 0 3 + 50 000 x 0 1 = 57 500	57 500 x 1 3 = 74 750	5 000 x 1 3 = 6 500	5 000	–	86 250
t_3	80 000 x 0 6 + 75 000 x 0 3 + 70 000 x 0 1 = 77 500	77 500 x 1 3 = 100 750	10 000 x 1 3 = 13 000	10 000	–	123 750
t_4-t_5	70 000 x 0 6 + 65 000 x 0 3 + 60 000 x 0 1 = 67 500	67 500 x 1 3 = 87 750	20 000 x 1 3 = 26 000	10 000	–	123 750
t_6	65 000 x 0 6 + 60 000 x 0 3 + 55 000 x 0 1 = 62 500	62 500 x 1 3 = 81 250	25 000 x 1 3 = 32 500	10 000	–	123 750
t_7-t_{19}	60 000 x 0 6 + 55 000 x 0 3 + 50 000 x 0 1 = 57 500	57 500 x 1 3 = 74 750	30 000 x 1 3 = 39 000	10 000	–	123 750
t_{20}	60 000 x 0 6 + 55 000 x 0 3 + 50 000 x 0 1 = 57 500	57 500 x 1 3 = 74 750	30 000 x 1 3 = 39 000	10 000	20 000	143 750

It is assumed that the imported component, converted into local currency at the official rate of foreign exchange, amounts to 160,000 dinars with a probability of 0.70, and 210,000 dinars with a probability of 0.30. Consequently, the most probable value of the imported investment component is

$$(160{,}000 \times 0\ 70) + (210{,}000 \times 0\ 30) = 175{,}000 \text{ dinars}$$

This component, in compliance with the pricing rules of the Manual (table 15), should be converted into local currency at the adjusted rate of foreign exchange. Thus, the expected value of the component of imported investment converted into local currency at the adjusted rate of foreign exchange is

$$175{,}000 \times 1\ 3 = 227{,}500 \text{ dinars}$$

The value should be added to the value of local investment (40,000 dinars) in order to arrive at the expected value of the investment at adjusted prices

$$227{,}500 + 40{,}000 = 267{,}500 \text{ dinars}$$

distributed throughout the construction period as follows

Year t_0 = 130,000 dinars
Year t_1 = 137,500 dinars

Step 7 With all essential data compiled above one may now compute the most probable present value of the value added under conditions of uncertainty For that purpose one may use the format of table 18 and compile the information as demonstrated in table 37

The discounted expected value added under conditions of uncertainty equals 137,200 dinars, as compared with 202,300 dinars under conditions of certainty (table 18, row 7). This is an indication of the expected positive contribution of the project to the national income even under uncertain conditions, i.e. increasing prices for domestically procured and imported current material inputs and the probability of exceeding the investment requirements originally envisaged. Therefore, the project has passed the first part of the absolute efficiency test under conditions of uncertainty.

As stated earlier, although this test is of paramount importance, it is not sufficient for recommending that a decision be taken on the project It is important to find out how much of this considerably reduced value added will be used to pay the wages and salaries of the labourers and how much will remain as a social surplus

By the application of formula 21, one finds

$$137{,}200 > 84{,}300 \rightarrow 52{,}900 \text{ dinars}$$

of social surplus, as compared to 117,900 dinars under conditions of certainty (table 18, row 7 2). Hence, the project generates enough value added to recover the wages and produce a social surplus Therefore, from the national point of view the project is acceptable, under conditions of uncertainty.

The project evaluators should call to the designer's attention the need to carefully re-examine and if possible to improve the basic parameters of the project in view of the expected uncertainties in domestic demand, prices of domestic and imported current material inputs, investments and the rate of foreign exchange. They

TABLE 37 EXPECTED PRESENT VALUE OF

(Thousand

Item	*Year*						
	t_0	t_1	t_2	t_3	t_4	t_5	t_6
1 Expected value of output	–	–	86 3	123 8	123 8	123 8	123 8
2 Expected value of material inputs (see steps 4, 5, 6)	130 0	137 5	33 8	57 2	57 2	57 2	57 2
3 Expected value of net domestic value added (1–2)	(130 0)	(137 5)	52 5	66 6	66 6	66 6	66 6
4 Repatriated payments (table 18, row 4)	–	–	19 5	20 8	20 8	20 8	19 5
5 Expected value of net national value added (3–4)	(130 0)	(137 5)	33 0	45 8	45 8	45 8	47 1
5 1 Wages (table 9, row 5 1)[a]			7 0	9 0	9 0	9 0	10 0
5 2 Social surplus	(130 0)	(137 5)	26 0	36 8	36 8	36 8	37 1
6 Discount factor at 9% discount rate[b]	1 0	0 92	0 84	0 77	0 71	0 65	0 60
7 Discounted expected net national value added (5 x 6)	(130 0)	(126 5)	27 7	35 2	32 5	29 7	28 3
7 1 Discounted wages (5 1 x 6)			5 9	6 9	6 4	5 8	6 0
7 2 Discounted social surplus (5 2 x 6)	(130 0)	(126 5)	21 8	28 3	26 1	23 9	22 3

[a] As uncertainty with regard to wages is considered relatively insignificant, the expected annual

[b] In carrying out the probability analysis it was assumed that the discount rate of 9 per cent was may often happen that the discount rate is uncertain, too. In such cases the discount rate should be

should also bring these matters to the attention of the decision maker to have in mind when he makes a decision and so that he may, if possible, take the necessary action to prevent or at least limit the unfavourable effects of uncertain domestic demand, prices, rate of exchange etc

5. Common operational steps of uncertainty analysis

Uncertainty analysis of any criterion can be facilitated if the following common operational steps are followed

Step 1 Identify the key variables, which are expected to have large magnitudes and show great variations and, therefore, have a sizeable impact on the soundness of a project

Step 2. Identify the possible range of variation of the key variables

Step 3 For each variable, with the established range of variation, estimate the different likely values that have significant chances of occurrence

Step 4 Assign probabilities of occurrence to each value based on experience, expectations and market and financial analysis

Step 5 Combine the alternative values of relevant variables as well as their respective probabilities to get the probability of occurrences of each outcome as outlined above for each measure

THE VALUE ADDED AT CORRECTED PRICES

dinars)

Year															
t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}	t_{16}	t_{17}	t_{18}	t_{19}	t_{20}	t_0-t_{20}
123 8	123 8	123 8	123 8	123 8	123 8	123 8	123 8	123 8	123 8	123 8	123 8	123 8	143 8	
57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	57 2	
66 6	66 6	66 6	66 6	66 6	66 6	66 6	66 6	66 6	66 6	66 6	66 6	66 6	86 6	
19 5	18 2	18 2	18 2	13 0	13 0	13 0	13 0	13 0	13 0	13 0	13 0	13 0	20 8	
47 1	48 4	48 4	48 4	53 6	53 6	53 6	53 6	53 6	53 6	53 6	53 6	53 6	65 8	
10 0	11 0	11 0	11 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	12 0	
37 1	37 4	37 4	37 4	41 6	41 6	41 6	41 6	41 6	41 6	41 6	41 6	41 6	53 8	
0 55	0 50	0 46	0 42	0 39	0 36	0 33	0 30	0 27	0 25	0 23	0 21	0 19	0 18	
25 9	24 3	22 3	20 3	20 9	19 3	17 7	16 1	14 4	13 4	12 4	11 2	10 2	11 9	137 2
5 5	5 5	5 1	4 6	4 7	4 3	4 0	3 6	3 2	3 0	2 8	2 5	2 3	2 2	84 3
20 4	18 8	17 2	15 7	16 2	15 0	13 7	12 5	11 2	10 4	9 6	8 7	7 9	9 7	52 9

wage bills enter the analysis without adjustment

certain and it was decided to apply the same rate used under deterministic conditions. However, it treated as a key variable and the same approach followed as that prescribed above.

6. Data requirements

Project analysis under deterministic and uncertain conditions requires the same type of information The additional information needed for sensitivity and probability analysis centres mainly on estimating several possible values for each relevant variable and assigning probabilities of occurrence to each of these values

7 Scope, limitations and conditions of uncertainty analysis

The crux of including uncertainty in project evaluation is to introduce as much as possible the realities concerning the future behaviour of relevant variables. The recognition that several values are likely, and estimating them and their probabilities of occurrence, using some value judgement, may lead to more accurate evaluation than ignoring them completely and making just one estimate for each variable as in the deterministic analysis

However, uncertainty analysis requires more elaborate computations compared with those necessary for deterministic analysis The work of computation will vastly increase as the number of possible values of each variable increases. The computations could be reduced by concentrating only on the most important variables from the point of view of risk, judging on the basis of their values and probability distributions

The additional effort required for uncertainty analysis should be justified by the additional benefits to be gained by introducing it The greater the uncertainties concerning some variables, and the larger their ranges, the higher the benefits and the more compelling the reason would be for introducing this analysis into the evaluation of an investment project

D EVALUATION SUMMARY

Title of project _____

Output in value terms _____

Output in physical terms _____

Investment _____

Number of people employed _____

Project to start _____

To be completed _____

CRITERIA[a]	EVALUATION RESULTS[b]
I *Commercial profitability*	
1 Simple rate of return	
2 Net present value	
3 Financial aspects	
4	
	General conclusions about commercial profitability
II *National profitability*	
1 Net national value added criterion	
1 1 Absolute efficiency test	
1 2 Relative efficiency test	

[a]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

[b]The evaluator should briefly explain the most essential evaluation results to give the decision maker in a very condensed way an idea of the merits and demerits of the project and a justification for its being recommended for selection, modification or rejection. The "evaluation summary" should be an "identity card" of the project The presentation of the evaluation results should not be written in highly professional terminology It should be easily understandable to those who read it without having to go through the entire feasibility report It is up to the project evaluator to determine how long the evaluation summary should be, it may vary from three to five pages for a small and simple project or 10 to 15 pages for a large, highly complicated one

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 about national profitability

III *Uncertainty analysis*
1. Break-even analysis
2. Sensitivity analysis
3. Risk analysis

General conclusions about uncertainty

The project is recommended for.

☐ because

Selection

☐ if modified as follows

Approval

☐ because

Rejection

Recommended policy, managerial and other measures to secure successful implementation of the project:

Annex

PRESENT VALUE TABLE

As stated earlier, the need to adopt the discounted cash flow technique arises on account of the widely accepted principle that one monetary unit is more valuable if received today, instead of tomorrow, similarly, disutility of expenditure is more if it has to be incurred today than if it could be postponed until next year Since both receipts and expenditures are spread over the entire life of the project, it becomes necessary to eliminate the influence of time differential and this is done through the use of rate of discount

The *rate of discount* reflects the preference for present over future if the rate of discount is 10 per cent, receipt of 100 dinars this year would be valued as equivalent to 110 dinars in the following year The rate of discount may vary over time or be constant The use of different rates of discount over different years is not recommended Usually, the same rate of discount is taken for the whole period The rate of discount is the rate of interest in reverse

Once the rate of discount is known, the next step is to work out the present worth of one unit of receipt (similarly, disbursement) received at different periods of time. The present worth of one unit of receipt (or expenditure) in different periods is known as the *discount factor* If the rate of discount is constant, the discount factor for the year n would be

$$\frac{1}{(1+r)^n}$$

where r is the rate of discount The discount factor is a decreasing function of both r (rate of discount) and n (number of years) Tables giving the values of

$$\frac{1}{(1+r)^n}$$

for different values of r and n have been worked out The table of this annex provides the values of the discount factors at different values of the rate of discount (from 2 per cent to 30 per cent) and different numbers of years (from 1 to 50) The table indicates discount factors corresponding to different rates of discount for a particular year Columns show the discount factors for different years corresponding to different rates of discount For instance, if the rate of discount is 8 per cent, discount factors for years 5 and 6 would be 0 681 and 0 630, respectively, for the year 5 the discount factors corresponding to 8 and 8 5 per cent rate of discount would be 0 681 and 0 665 respectively

If net cash inflows are the same for several years, they need not be discounted separately for each year The sum of discounted net cash inflows during this period can be arrived at by multiplying the yearly net cash inflow by the sum of discount factors for these years For instance, in table 18, row 5, the net national value added is the same between year 11 and year 19 If the annual value added of 62,400 dinars is multiplied by 2 53, which is the sum total of discount factors for these years at 9 per cent discount rate (row 6 of the same table), the result is 157,870 dinars, which is equal to the sum total of discounted values added for this period (row 7 of the table)

PRESENT VALUE OF DISCOUNT FACTOR

(Per

n \ *r*	*2*	*3*	*4*	*5*	*5½*	*6*	*6½*	*7*	*7½*	*8*	*8½*
1	0 980	0 971	0 962	0 952	0 948	0 943	0 939	0 935	0 930	0 926	0 922
2	0 961	0 943	0 925	0 907	0 898	0 820	0 882	0 873	0 865	0 857	0 849
3	0 942	0 915	0 889	0 864	0 852	0 840	0 828	0 816	0 805	0 794	0 783
4	0 924	0 888	0 855	0 823	0 807	0 792	0 777	0 763	0 749	0 735	0 722
5	0 906	0 863	0 822	0 784	0 765	0 747	0 730	0 713	0 697	0 681	0 665
6	0 888	0 837	0 790	0 746	0 725	0 705	0 685	0 666	0 648	0 630	0 613
7	0 871	0 813	0 760	0 711	0 687	0 665	0 644	0 623	0 603	0 583	0 565
8	0 853	0 789	0 731	0 677	0 652	0 627	0 604	0 582	0 561	0 540	0 521
9	0 837	0 766	0 703	0 645	0 618	0 592	0 567	0 544	0 522	0 500	0 480
10	0 820	0 744	0 676	0 614	0 585	0 558	0 533	0 508	0 485	0 463	0 442
11	0 804	0 722	0 650	0 585	0 555	0 527	0 500	0 475	0 451	0 429	0 408
12	0 788	0 701	0 625	0 557	0 526	0 497	0 470	0 444	0 420	0 397	0 376
13	0 773	0 681	0 601	0 530	0 499	0 469	0 441	0 415	0 391	0 368	0 346
14	0 758	0 661	0 577	0 505	0 473	0 442	0 414	0 388	0 363	0 340	0 319
15	0 743	0 642	0 555	0 481	0 448	0 417	0 389	0 362	0 338	0 315	0 294
16	0 728	0 623	0 534	0 458	0 425	0 394	0 365	0 339	0 314	0 292	0 271
17	0 714	0 605	0 513	0 436	0 402	0 371	0 343	0 317	0 292	0 270	0 250
18	0 700	0 587	0 494	0 416	0 381	0 350	0 322	0 296	0 272	0 250	0 230
19	0 686	0 570	0 475	0 396	0 362	0 331	0 302	0 277	0 253	0 232	0 212
20	0 673	0 554	0 456	0 377	0 343	0 312	0 284	0 258	0 235	0 215	0 196
21	0 660	0 538	0 439	0 359	0 325	0 294	0 266	0 242	0 219	0 199	0 180
22	0 647	0 522	0 422	0 342	0 308	0 278	0 250	0 226	0 204	0 184	0 166
23	0 634	0 507	0 406	0 326	0 292	0 262	0 235	0 211	0 189	0 170	0 153
24	0 622	0 492	0 390	0 310	0 277	0 247	0 221	0 197	0 176	0 158	0 141
25	0 610	0 478	0 375	0 295	0 262	0 233	0 207	0 184	0 164	0 146	0 130
26	0 598	0 464	0 361	0 281	0 249	0 220	0 194	0 172	0 153	0 135	0 120
27	0 586	0 450	0 347	0 268	0 236	0 207	0 183	0 161	0 142	0 125	0 111
28	0 574	0 437	0 333	0 255	0 223	0 196	0 171	0 150	0 132	0 116	0 102
29	0 563	0 424	0 321	0 243	0 212	0 185	0 161	0 141	0 132	0 107	0 094
30	0 552	0 412	0 308	0 231	0 201	0 174	0 151	0 131	0 114	0 099	0 087
40	0 453	0 307	0 208	0 142	0 117	0 097	0 081	0 067	0 055	0 046	0 038
50	0 372	0 228	0 141	0 087	0 069	0 054	0 043	0 034	0 027	0 021	0 017

AT RATE r PAYABLE IN n YEARS $\frac{1}{(1+r)^n}$

centage)

9	*9½*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*18*	*20*	*25*	*30*
0 917	0 913	0 909	0 901	0 893	0 885	0 877	0 870	0 862	0 847	0 833	0 800	0 769
0 842	0 834	0 826	0 812	0 797	0 783	0 769	0 756	0 743	0 718	0 694	0 640	0 592
0 772	0 762	0 751	0 731	0 712	0 693	0 675	0 658	0 641	0 609	0 579	0 512	0 455
0 708	0 696	0 683	0 659	0 636	0 613	0 592	0 572	0 552	0 516	0 482	0 410	0 350
0 650	0 635	0 621	0 593	0 567	0 543	0 519	0 497	0 476	0 437	0 402	0 328	0 269
0 596	0 580	0 564	0 535	0 507	0 480	0 456	0 432	0 410	0 370	0 335	0 262	0 207
0 547	0 530	0 513	0 482	0 452	0 425	0 400	0 376	0 354	0 314	0 279	0 210	0 159
0 502	0 484	0 467	0 434	0 404	0 376	0 351	0 327	0 305	0 266	0 233	0 168	0 123
0 460	0 442	0 424	0 391	0 361	0 333	0 308	0 284	0 263	0 225	0 194	0 134	0 094
0 422	0 404	0 386	0 352	0 322	0 295	0 270	0 247	0 227	0 191	0 162	0 107	0 073
0 388	0 369	0 350	0 317	0 287	0 261	0 237	0 215	0 195	0 162	0 135	0 086	0 056
0 356	0 337	0 319	0 286	0 257	0 231	0 208	0 187	0 168	0 137	0 112	0 069	0 043
0 326	0 307	0 290	0 258	0 229	0 204	0 182	0 163	0 145	0 116	0 093	0 055	0 033
0 299	0 281	0 263	0 232	0 205	0 181	0 160	0 141	0 125	0 099	0 078	0 044	0 025
0 275	0 256	0 239	0 209	0 183	0 160	0 140	0 123	0 108	0 084	0 065	0 035	0 020
0 252	0 234	0 218	0 188	0 163	0 141	0 123	0 107	0 093	0 071	0 054	0 028	0 015
0 231	0 214	0 198	0 170	0 146	0 125	0 108	0 093	0 080	0 060	0 045	0 023	0 012
0 212	0 195	0 180	0 153	0 130	0 111	0 095	0 081	0 069	0 051	0 038	0 018	0 009
0 194	0 178	0 164	0 138	0 116	0 098	0 083	0 070	0 060	0 043	0 031	0 014	0 007
0 178	0 163	0 149	0 124	0 104	0 087	0 073	0 061	0 051	0 037	0 026	0 012	0 005
0 164	0 149	0 135	0 112	0 093	0 077	0 064	0 053	0 044	0 031	0 022	0 009	0 004
0 150	0 136	0 123	0 101	0 083	0 068	0 056	0 046	0 038	0 026	0 018	0 007	0 003
0 138	0 124	0 112	0 091	0 074	0 060	0 049	0 040	0 033	0 022	0 015	0 006	0 002
0 126	0 113	0 102	0 082	0 066	0 053	0 043	0 035	0 028	0 019	0 013	0 005	0 002
0 116	0 103	0 092	0 074	0 059	0 047	0 038	0 030	0 024	0 016	0 010	0 004	0 001
0 106	0 094	0 084	0 066	0 053	0 042	0 033	0 026	0 021	0 014	0 009	0 003	0 001
0 098	0 086	0 076	0 060	0 047	0 037	0 029	0 023	0 018	0 011	0 007	0 002	0 001
0 090	0 079	0 069	0 054	0 042	0 033	0 026	0 020	0 016	0 010	0 006	0 002	0 001
0 082	0 072	0 063	0 048	0 037	0 029	0 022	0 017	0 014	0 008	0 005	0 002	0 001
0 075	0 066	0 057	0 044	0 033	0 026	0 020	0 015	0 012	0 007	0 004	0 001	
0 032	0 027	0 022	0 015	0 011	0 008	0 005	0 004	0 003	0 001	0 001		
0 013	0 011	0 009	0 005	0 003	0 002	0 001	0 001	0 001				

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