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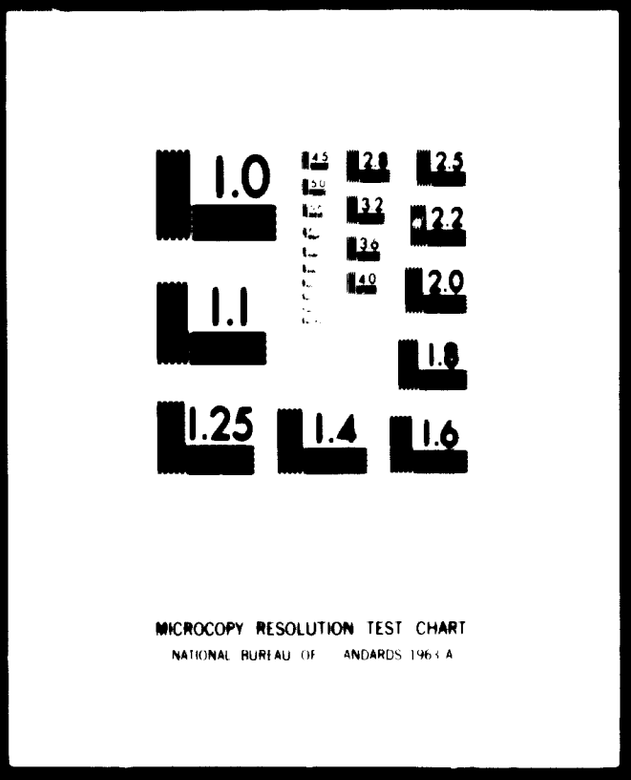

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UNITED NATIONS INDUSTRIAL
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INDUSTRIAL DEVELOPMENT CENTRE
FOR ARAB STATES

# MANUAL FOR EVALUATION OF INDUSTRIAL PROJECTS IN ARAB COUNTRIES[1/]

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## PREFACE

This Manual represents the culmination of 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 to draft 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 in Cairo, Egypt On the basis of this recommendation UNIDO and IDCAS undertook to develop an operational manual which the Arab countries, as well as other developing countries, could use for evaluating industrial projects as an integral part of their overall industrial planning mechanism.

The work on the Manual, which started in early 1974 has gone through several stages. A final draft was prepared and submitted to the two organizing agencies by a group of UNIDO/IDCAS consultants. The following experts were members of this group:

1. Mr. Ivan Angelov, International Centre for Industrial Studies, UNIDO, Chairman of the Working Group
2. Mr. Marian Ostrowski, Deputy Director, Institute of Planning, Warsaw, Poland
3. Mr. Jadranko Bendekovic, Head of Department for Microeconomics, Ekonomski Institute, Zagreb, Yugoslavia
4. Mr. Werner Hammel, Director, Economic Department, Kreditanstalt für Wiederaufbau, Frankfurt, Federal Republic of Germany
5. Mr. N.N. Agrawala, United Nations Expert stationed in Baghdad, Iraq
6. Mr. Hassan Hosny, Central Auditing Organization, Cairo, Egypt
7. Mr. Mohamed Said Ali, Director General, Spinning and Weaving Corporation, Khartoum, Sudan (then staff member of IDCAS)
8. Mr. Jaafar Abdul Ghani, Deputy Director, Industrial Department, Ministry of Planning, Baghdad, Iraq
9. Miss Saadia Montasser, Faculty of Commerce, Ain Shams University, Cairo, Egypt

10. Mr. M. El Arawady, Vice-President, Price Planning Agency, Cairo, Egypt
11. Mr. A.S Khalil, Head of Sector of Production, Central Auditing Organization, Cairo, Egypt
12. Mr. P.C. Sah, Ministry of Planning, New Delhi, India (then UNIDO Expert stationed at IDCAS)

Throughout the preparation of the Manual the drafts were presented and tested at training workshops on project evaluation held in the People's Democratic Republic of Yemen, Sudan and Somalia as well as to a regional workshop held in Cairo in early 1976 with participants from Egypt, Sudan, Libya, Syria and Iraq.

The final draft was thoroughly discussed and endorsed by an Expert Group Meeting of Senior Experts on Project Evaluation from different Arab countries, held in Cairo, 26 January - 1 February 1976. The following experts took part in this meeting:

1. Mr. Rafik Ahmed Sowelem, Senior Economist, Programming Division, Arab Fund for Economic and Social Development, Kuwait
2. Mr. Moheiddin El Ghareeb, Director of Projects, Abu Dhabi Fund for Arab Economic Development, Abu Dhabi
3. Mr. Abdel Kerim Hilmi, Director, Technology Division, IDCAS, Cairo
4. Mr Mohamed Helal, Director, Economic Division, IDCAS, Cairo
5. Mr. Fawzi Riad Fahmy, Director of Industrial Sector, Institute of National Planning, Cairo, Egypt
6. Mr. Ali Ismail El Embabi, General Manager, Research and Project Evaluation Department, U.A.E. Development Bank, Abu Dhabi
7. Mr. Ahmed Amin Ibrahim, Ministry of Planning, Cairo, Egypt
8. Mr. Raafat Shafit Bessada, Arab Planning Institute, Kuwait
9. Mr. Mostafa El Said Ibrahim, Associate Professor, Faculty of Economics, Cairo University, Egypt
10. Mr. M.A. Loutfi, UNCTAD Expert, Geneva

as well as the members of the Expert Group who contributed to drafting the Manual.

On the basis of the final draft submitted by the group of consultants and of the recommendations of the Cairo Expert Group Meeting, the final consolidated version of the Manual was prepared by Mr. Ivan Angelov, UNIDO.

The authors of the Manual always bore in mind that their task was to develop a simple operational step-by-step methodology which could be applied in the everyday practice by an average qualified project evaluator, with an average availability of data, taking into account as well the other limitations existing in the Arab countries as well as in the rest of the developing world. This is what the authors offer to the potential user, the project evaluator, hoping that the objective has been achieved. The final judgement on this will naturally belong to the project evaluators from the developing countries.

This Manual differs from the Guidelines for Project Evaluation published by UNIDO in 1972, and the Guide to Practical Project Appraisal: Benefit-Cost Analysis in Developing Countries by John R. Hansen, which is currently under preparation, both conceptually and in terms of simplicity. It goes without saying that the authors find both the concept and the operational step-by-step approach advocated by this Manual more realistic, more operational, and preferable as compared to the above-mentioned publications. Practical experience, however, will be the ultimate judge. We leave it to the project evaluators from the Arab and other developing countries to have a final say on the applicability and the usefulness of this Manual.

The authors are aware that the Manual is not free of shortcomings; however this is just natural for a publication which claims to be one of the first comprehensive operational step-by-step manuals for evaluation of industrial projects ever produced within the United Nations system. The authors exerted much effort to develop the Manual; the best way to improve it further is through practical application. Any constructive comments and observations aiming at improving the Manual will be highly appreciated.

The authors are grateful to all their colleagues who contributed to the preparation of the Manual by commenting on earlier drafts - staff members from the International Centre for Industrial Studies, UNIDO, and other UNIDO staff members, UNIDO experts stationed at IDCAS (in particular Mr. T. Janakievski, the UNIDO Project Manager), as well as UNIDO experts in other developing countries.

The authors are particularly grateful to the Secretariats of UNIDO and IDCAS for entrusting them with the highly responsible task of drafting this Manual as well as for providing appropriate working conditions and facilities.

A special word of thanks is due to the International Centre for Industrial Studies, UNIDO, for the secretarial assistance it provided during the preparation of the Manual. The authors thank in particular Arne Lugmayr, Sheryl Cupps and Diana Rhind for their contribution in typing and even editing the various drafts of the Manual.

The views and opinions expressed in the Manual are those of the authors and do not necessarily reflect the views of the Secretariats of UNIDO and IDCAS. The authors assume full responsibility for the methodology developed in the Manual.

# INTRODUCTION

## 1. Objective of the Manual

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

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

It is well known that at present there is a gap between the theory and the practice of project evaluation. This applies to commercial profitability also; but it is particularly acute as far as national profitability is concerned. The literature on national benefit-cost analysis suggests a number of comprehensive sophisticated approaches which are not appropriately tailored to the economic reality in developing countries and which are, therefore, not applied in actual practice. The gap between theory and practice is so large that they cannot find a common language. The theory offers more and more elegant, sophisticated techniques; however, since one does not use these techniques in practice, the gap between theory and practice grows even larger.

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

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

The Manual seeks to present and, where possible, to synthesize some major approaches, concepts and criteria of project evaluation for the benefit of project evaluators in Arab countries. It is hoped that the Manual would be helpful to project evaluators in acquiring and/or sharpening their tools of analysis. It is also hoped that the evaluators, after becoming acquainted with the techniques outlined in this Manual, will find it simple with regard to both application and interpretation of results thus leading to better choices and improved investments.

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

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

The above-stated objectives could be achieved only if the authorities concerned in a developing country are willing and act accordingly so that the formulation, evaluation and selection of investment projects is based on certain minimum elementary reasoning and logic and is not an arbitrary rubber-stamp exercise carried out by instruction of a decision-maker to the project evaluators to "prove" efficient, by way of implementing consistent scientific methods, every investment proposal they want to implement for one reason or another. Any project evaluation

methodology could be easily discredited and its use reduced to nil if one cannot, or does not want to, apply it properly. The project evaluation techniques are only one of the tools in development planning, though not a magic tool. These techniques do not solve the problems automatically and easily. They can only aid those people who actually wish to take well-founded investment decisions. If the above-mentioned reasoning and logic are not available, even the most comprehensive methodology for benefit-cost analysis is hopeless and the project evaluation exercise is a waste of time.

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

## 2. Scope and Applicability of the Manual

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

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

inform the decision-makers about the economic "price", the economic and other implications of political decisions. This Manual is addressed to the project evaluators.

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

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

The Manual is supposed to provide operational methodology for industrial project evaluation to all Arab countries. It is designed for a group of countries which differ considerably in terms of their levels of development, socio-economic systems, objectives and priorities, decision-making mechanisms, resources endowment, availability of data, skills of project evaluators, etc. For such reasons, the Manual's

scope obviously has to be fairly broad in comparison to national manuals for project evaluation. A country which is sparsely populated but commands rich natural resources faces different development obstacles compared to a country having both pressing population and balance of payments problems. Again, alternative approaches to economic advancement will be necessary where neither human nor natural resources are abundantly available.

Though it may seem strange at first glance, the very fact that the Manual was carefully designed for a group of twenty Arab countries, which differ so much in many respects, makes it applicable to all developing countries as a standard Manual. It is difficult indeed to find an essential aspect of the socio-economic development of the Arab countries which is not relevant to the rest of the developing countries. Therefore, in spite of the title, the Manual is easily applicable to all developing countries, which have very many common problems and features, no matter whether they are Arab or non-Arab countries. Throughout the Manual references are made only to the Arab countries; this, however, does not diminish the relevancy of the operational step-by-step methodology to other developing countries outside the Arab region.

The Manual, therefore, does not advocate the use of a single indicator for assessing commercial and/or national profitability, nor does it attempt to combine various aspects of national profitability into one global comprehensive criterion. An attempt of this kind would require weighing different indicators and would involve a claim that both the selection of, and the weights given to, specific indicators are equally relevant for all Arab countries. For this reason the Manual provides a set of indicators each associated with a specific national objective. It is up to the evaluating agency to determine, by recourse to national development plans or other manifestations of national priorities, the objectives and their relative importance which are to be achieved through different investment proposals. The Manual provides the methods which can help to measure whether a project does indeed contribute towards individual objectives and whether it does this

efficiently, i.e. with a minimum of resource cost compared to other alternatives. The evaluating agency can as well rank the different indicators and assign them relative importance consistent with the development objectives to facilitate decision-making - whether a project should be undertaken in the light of its evaluated merits and demerits.

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

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

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

Along this same line of thinking, it may be worthwhile to clarify explicitly the use of terms such as "evaluation", "appraisal", "assessment", "selection". The Manual does not differentiate between "evaluation", "appraisal" and "assessment". In practice they are all used for analysis of the soundness of an investment project, i.e. an ex-ante analysis of the effects of a determined course of action. This analysis is based on projecting, forecasting in the future, on the expected course of events. This analysis is carried out by project evaluators. The same terms are being used in practice to describe the analysis of the achievements of on-going establishments and they are clear enough: post-investment evaluation, post-mortem evaluation, performance evaluation. This analysis relies on actual data characterising 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 takes into account also factors that are not explicitly considered in the process of evaluation. Selection is a prerogative of the decision-makers, which should be based, 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 Arab country if national authorities so desire. The national manuals should be more specific in suggesting basic additional and supplementary indices corresponding to the relevant national objectives. They may lay down the numerical values of the various national parameters, the correction-factors needed for adjusting prices, 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 fundamental 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 it should be capable of being evaluated in all these forms. If a project is combined with others into an industrial complex in such a way that separate evaluation is difficult or imprudent, the so-called industrial complex technique may be applied for its evaluation. In case a project is part of a much larger investment programme, such as the establishment of agro-industries which may consist of numerous projects, the project can and should be evaluated separately. Conversely, the whole programme may be evaluated in toto on technical, commercial and economic grounds, but it may be preferable to evaluate each unit of investment which is part of that programme as an individual plant. Programme evaluation raises additional questions which are not covered in this Manual. The same applies to macro-type appraisals of entire sectors or subsectors.

The construction of a new warehouse may not qualify as a project because even though it can be distinguished technically from the remainder of the factory, its functions are so closely interrelated with already existing parts of the plant that it cannot reasonably be attempted to separate its commercial and social impact. On the other hand, the replacement of a delivery fleet of lorries by a railway siding with associated loading equipment may be a project because savings in transport costs connected with the measure can be made the object of separate commercial and economic appraisal. In many instances it may indeed be worthwhile to break down a proposal presented as a project into smaller units of investment. An integrated textile project, for instance, may be planned to include spinning, weaving and finishing of locally-produced cotton. The entire complex may easily pass national profitability analysis. It may well be, however, that domestic cotton commands high prices in the export market whereas staple cloth as demanded by local consumers may be produced with lower grade cotton.

Project evaluation then may demonstrate that a finishing complex based on cheap imported grey cloth would be an even more attractive proposition in terms of national profitability. The spinning and weaving parts of the complex, if appraised separately, may be considered uneconomical. Practical experience and good judgement are required to group investment proposals into meaningful projects because obviously not every smallest unit of investment can and should be appraised separately.

## 4. Major Types of Investment Projects to which the Manual Applies

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

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

The Manual is also applicable to modernization and expansion projects if the aforementioned principles are observed. If the expansion can be distinguished technically, commercially and economically from the already existing facilities, its commercial and national merits can easily be evaluated. The expansion may be horizontal, i.e. an increase in capacity for the same output, or vertical, i.e. the addition

of forward and backward linkage production processes or the expansion may lead to a broader line of products manufactured by the company. The Manual provides a special section on evaluation of modernization and expansion projects.

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

## 5. Public and Private Sector Projects

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

However, the need for thorough project 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 a necessity in order to determine the magnitude of such subsidies

beforehand so that they can be properly incorporated into the budgeting procedures. Some public sector projects may be undertaken even though they are not judged suitable on grounds of both commercial and national profitability (e.g. defence-oriented projects), but governments should take such decisions in full awareness of the magnitude of the financial and social burden, of the "price" to be paid for solving certain political, social or other problems of crucial importance to the country.

It is not only for fiscal reasons that both commercial and national project evaluation should be carried out in the public sector. The process of analyzing a project's financial and social implications is by itself a highly commendable exercise because it confronts decision-makers with a variety of parameters both favourable and unfavourable to the project. It forces them to think in terms of alternatives and policies conducive to economic development. The encounter with such parameters on a microeconomic level is to face the realities of economic decisions. It is stimulating in commercial analysis as well as in national analysis. The process of evaluating a project tends to be more revealing about the conditions for development than the mere acknowledgement of evaluation results. Policy makers in the public sector who bear more responsibility for shaping these conditions than anyone else should share the educational experience of such overall and thorough project evaluation.

# I. THE MANUAL'S CONCEPT OF PROJECT EVALUATION

## 1. National and Sectoral Planning and Individual Projects

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

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

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

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

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

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

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

From the above it follows that:

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

## 2. Project Preparation and Evaluation[1/]

Project development is an integrated process carried out in several consecutive phases which may be operationally condensed into

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

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

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

1. Identification
2. Preliminary selection
3. Formulation.

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

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

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

Once it is proved that a project idea deserves detailed study, an investor should be found who would be interested in following it up (should the promoter not be identical with the investor). If the

pre-feasibility study indicates that the proposed project appears to be a promising one, the decision may be taken to proceed further with the formulation of the project.

The 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. It is on the basis of this study that a decision to implement and finance the project will be taken.

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

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

The complete feasibility study should contain as much of the information needed for project evaluation as possible. This Manual suggests a set of model formats for the most essential information needed for project evaluation. Indeed, a project's feasibility in terms of its commercial and national profitability should be established by means of the criteria and parameters which are usually applied by institutions involved in the investment decision. Project evaluation manuals, if widely distributed and adhered to, may serve this useful purpose. Ideally, commercial and national project evaluation can be limited to

checking assumptions, quantities, prices and parameters of such feasibility studies with very little original work left to be done. This will add efficiency and expedition to the usually protracted process of project preparation and evaluation. Needless to say, the investors will appreciate this.

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

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

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

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

Throughout the process of project preparation, evaluation and implementation many different yet interrelated aspects come into the picture. They are generally of technical, economic, financial and legal nature, but their mutual relationship is strongly pronounced requiring that they all be taken into consideration at any stage of an investment decision. Consequently, the project's preparation, evaluation and finally implementation should be carried out through a team-work of such specialists as engineers, economists, financial analysts and legal experts. The participation of legal experts should save time and resources by making sure at an early stage that everything which is envisaged is consistent with the laws of a country and they should render the future parameters of a technical, financial and economic nature more certain by proper contracts. The presence of legal experts, probably highly specialized, is especially required if a project involves joint ventures.

The entire process leading up to a project's implementation in reality will seldom be a clear-cut, step-by-step procedure as described above. In practice, evaluation may reveal that certain aspects of a project have to be reprepared. Similarly, project implementation may encounter unforeseen difficulties which require both redesigning of certain project elements and evaluating the impact of this redesigning on the project's overall merits.

## 3. The Manual's Approach to Project Evaluation

### 3.1 The need to accommodate multiple national objectives

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

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

Starting on this fundamental basis, the Manual assumes that if there is a set of development objectives at the national level, the development projects should be evaluated as much as possible on the basis of their contribution to the fulfilment of each of these objectives; in other words, the Manual explicitly introduces a set of criteria. Each objective at the national level is reflected in one or more criteria at the project level and vice-versa. The priority assigned to each of these criteria at the project level must correspond to the importance of the respective development objectives at the national level.

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

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

Attempts have been made elsewhere to recommend evaluation of investment projects by a single aggregate criterion which incorporates several multi-objective aspects of the development process.[1/] The incorporation of different aspects into a single aggregate criterion is possible only by assigning weights in numerical terms (directly reflecting political value judgements) to these partial considerations: a weight to a nominal unit of future consumption as compared to a unit of present consumption; a weight to a nominal unit of present or future consumption in the hands of the rich as compared to the poor class; a weight to a nominal unit of present or future income in the hands of wage earners and profit earners compared to a unit of income in the hands of the government; a weight to a nominal unit of income earned by a backward region as compared to a unit of income in a more developed region. This approach also requires highly reliable justification of the distribution of the net benefits generated by a project between present consumption and savings (for future consumption); of the marginal propensities of different social groups to save and consume; of the marginal rate of return on investment; of the marginal rate of savings; of the shadow price of investment, etc. Moreover, all these weights and other value judgements producing a sort of normatives (national parameters) are true only under certain conditions. As soon as the conditions change, as they often do, this extremely complex set of interrelated weights and normatives should be readjusted accordingly. One can imagine the type of highly qualified

1/ Marglin, S.A., Dasgupta, P., Sen, A.K., Guidelines for Project Evaluation, UNIDO, 1972; A Guide to the UNIDO Guidelines: Social Benefit-Cost Analysis in Developing Countries by John R. Hansen, 1976; Little, I.M.D. and Mirrlees, J.A., Manual of Industrial Project Analysis in Developing Countries, Vol. II, OECD, Paris, 1969, and a more recent book (1974) by the two authors on the same subject; Economic Analysis of Projects, IBRD Staff Working Paper No. 194, February 1975, etc.

personnel, abundant information, computers and time this exercise requires, not to mention possible errors and their implications as well as the room it provides for misuse of the approach and the consequences thereof.

Even if ideal conditions are assumed in a highly developed country in terms of skill, information, computers, etc., it is hardly possible to apply this approach consistently when evaluating investment projects. The best proof of this is that it has never been applied in practice on a large scale in any developed country. If this holds true for the developed countries, it should be much more valid for the developing countries to which group the Arab countries belong. Such a high degree of aggregation of the criterion for assessing investment projects in Arab countries is unrealistic at present and in the foreseeable future. This convinced the authors of the Manual to recommend a set of criteria (basic, additional and supplementary) for assessing the contribution of an investment project to the achievement of the different national development objectives. This approach is theoretically well-founded and practically easy to apply under the prevailing conditions in the Arab countries.

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

It is very true that deplorable injustice exists in this world; the question, however, is whether project evaluation methodology is 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 opportunities to this end. Project evaluation methodology and particularly national benefit-cost analysis are complicated enough without assigning to them such additional functions. If national benefit-cost methodology is to be widely applied in real life in developing countries, it should be considerably simplified and not further complicated by incorporating into it important additional functions.

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

The characteristic of an investment project by a single aggregate criterion and its presentation in this way to the decision-maker may be used willingly or unwillingly for hiding the conflicts between different aspects of the project expressed by conflicting indicators. The complex, multi-dimensional and often controversial character of a

project is very much oversimplified (and probably distroted) when expressed by a single aggregate criterion. So on the surface it appears easy for the decision-maker to take the decision, but actually he cannot see what is behind the single criterion, he may easily neglect the hidden conflicts between different aspects and take a wrong decision.

The approach of this Manual in recommending a set of criteria may not be as elegant from a strictly formal point of view, but it is more realistic. It has at least two practical advantages: First, the set of criteria approach presents as explicitly as possible the link between the parameters of the national plan which express the specific national objectives and the parameters of a project expressed by the basic, additional or supplementary indices, without claiming to expose all these linkages in quantitative terms. In many cases it does not go beyond stating that there is a causal relationship simply because it is impossible to quantify it. In the alternative approach all these linkages are hidden behind a single figure. Second, the set of criteria approach puts on the desk of the decision-maker the picture of the project - complex, multi-dimensional and controversial as it is. It provides him with warnings, pro's and con's for one decision or another and gives him the final word based on the information available in the feasibility study and on many other actual economic or non-economic facts and considerations on both the micro and macro level as well as expectations for future developments. The decision-maker, when faced with the real complexity of the facts and being better informed than the project evaluator should be in a better position to take the right decision.

Therefore, the approach of this Manual differs from some other approaches - not in not taking into account the different aspects of an investment project, but in doing it explicitly by a set of indices. Trying to be realistic and operational, the Manual does not assign numerical weights to the indices for incorporation into a single aggregate criterion. Assigning numerical weights is not the only

way and under the present circumstances we believe not the best way for considering the numerous national development objectives and translating them at the project level. Weighting at the project evaluator's level cannot be a substitute for the comprehensive quantitative and qualitative analysis at the decision-making level.

It is clear from the above that the development objectives and the dimensions of welfare are so widespread that they revolt against the application of single universal yardsticks for final overall socio-economic assessment of the national profitability of an investment project. The assessment of the national profitability in practice is to a very great extent subjective. It is based on general and specific implications, on measurable and unmeasurable, direct and indirect effects, on economic and non-economic considerations rather than on any strict mathematical formulae. More and more often the term "socio-economic efficiency" is being used instead of "economic efficiency". The reality is that in matters of national profitability, evaluators and decision-makers are faced with innumerable difficulties and these cannot be resolved in the same manner (by one single criterion) as in the case of commercial profitability.

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

The user of the Manual, therefore, will have to obtain the policy objectives from national authorities, for instance: increase in production and productivity; increase of employment opportunities; constitution of a more equal society; reduction of external

vulnerability through improving the balance of payments position of the country and increasing the international competitiveness of exported goods; upgrading the skill of the national manpower development of an appropriate economic a d social infrastructure for further industrialization, etc. He can then assemble, with the guidance of the Manual, a set of criteria to fit these objectives.

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

3.2 Value added as a proxy of national welfare

A fundamental strategic objective of 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 to increase the future consumption.

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

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

Net value added consists of two major components - salaries and wages and an excess which may be called social 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 following answer to this question: From the point of view of a project or existing production unit (public or private) the salaries and wages are inputs, but from the viewpoint of the society they are part of the national income. More salaries and wages means higher employment, higher income per person employed or both. Larger wage bills (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 with regard to the level of this income of the individuals. The higher this income, the better. The higher wage bill is one of the major pre-requisites for higher present consumption.

The social surplus is that portion of the value added which has been directed through other channels of the same national distribution mechanism: taxes - to the treasury; net profit (dividends) - to shareholders; interest on borrowed capital - 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 - part of the taxes through the national budget, the social welfare funds of the firms, part of the reserve funds, as well as a small part of the net profits. The larger portion of the social surplus is being usually saved and invested - part of the taxes, the larger part of the dividends, of interest, of rents, the expansion funds of the firms. Therefore, a larger social surplus is a major pre-condition for higher private present consumption, normal functioning of the entire state machinery, on the one hand, and on the other, a basic source of savings for accelerated socio-economic development of the country. This in turn is a pre-requisite for higher future consumption.

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

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

This approach is recommended on both theoretical and practical grounds. On theoretical grounds, assigning weights to subcomponents of the value added - wages, dividends, taxes, interest, undistributed net profits, etc., and their distribution to social groups or regions and then incorporating the weighted values in the value added by revising its magnitude, is not advisable because the laws which govern the national distribution/redistribution process are exogenous factors, independent of the project. Introducing these factors would definitely distort the true picture of the project in which we are interested. On practical grounds, it is not recommended simply because it is impossible to carry out such difficult and demanding analysis for the purposes of project evaluation. And even if one cycle of this exercise is carried

out, it should be repeated and new judgements passed as soon as the socio-economic conditions change, which happens very often. No developing country we know could afford itself this luxury in the evaluation of investment projects.

What really matters for an investment project is to generate more value added comprising wages and social surplus. The link between the soundness of the project and the distribution/redistribution process is only in the sense that the higher the value added, the higher the social surplus after paying higher salaries and wages. The higher the social surplus, the higher the dividends to shareholders and taxes to the treasury after paying interest on borrowed capital, rent, royalties, if any, making allocation for expansion funds of the firm, reserve funds, social welfare funds, etc. As stated above, the value added is a criterion for assessing the soundness of a project. How this value added is being further distributed and redistributed in line with numerous political, economic, financial, legal, administrative regulations, is a different matter and an investment project should be neither penalized nor given credit for that. The complex socio-economic problem of distribution and redistribution of the value added should not be mixed with the methodology for evaluating the soundness of an investment project.

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

- In the case of the evaluation of an investment project, both outputs and inputs are <u>anticipated</u> or <u>expected</u>. This implies that they can be estimated only with certain approximation, and special care should be taken first of the most important outputs and inputs of a project;
- The thorny problem to include or exclude unfinished or not yet sold products into output value when one considers a given time period (one year) fortunately disappears when one calculates the value added for the <u>whole</u> economic life of the project;

- Value added can be measured either in terms of gross or net value added. Net value added is equal to gross value added minus investment. In the case of project evaluation, investment outlays 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.
- Value added can be estimated at market prices (including taxes and excluding subsidies) or at factor cost (excluding taxes and including subsidies). But the value added of an investment project for evaluation purposes ought to be estimated on the basis of including both taxes and subsidies. The inclusion of taxes into the value added produced by a project is clearly based on the argument that there exists the "willingness to pay" at actual market prices which include 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 reveals both merits and demerits. The most important merits consist in its relatively simple estimation, linkage with the national accounting system as well as the predominant use of market prices throughout the analysis. A project's net value added, i.e. its contribution to national income, becomes the yardstick of its relative benefit to the economy. Such a concept fits easily into common planning practice where national and sectoral targets are also expressed in terms of increments to national income. Cohesion between planners and policy makers on the one hand, and the ultimate investors and micro-decision-makers on the other is improved. Decentralisation of economic decisions is facilitated as the value added

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

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

3.3 National net value added

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

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

### 3.4 Two steps in evaluation - Screening and ranking; Certainty and uncertainty

Given the range of objectives and resource scarcities throughout the Arab world, the Manual recommends a two-step procedure for using the value added criterion for project evaluation. First, absolute efficiency test for screening purposes, which is a basic measure of efficiency. As a matter of principle, it should be applied as a first step under all circumstances. Second, relative efficiency test for ranking purposes if and when several projects pass the absolute efficiency test. The second step is designed to determine a project's national worth under three different conditions: shortage of capital, of foreign exchange and of skilled labour. In these instances the 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.

The two-step approach advocated by the Manual is also expressed in the two recommended stages of project analysis, i.e. under deterministic and under indeterministic conditions. The Manual does not consider project evaluation under certainty and under uncertainty

as two alternatives. They are two indispensable, interrelated stages of project evaluation.

In the course of the first stage the complex reality of the project and its environment are oversimplified 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 there may exist other values for the variables which 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 - key variables and possible range of variation which may have a sizeable impact on a project are identified; for each variable different probable values with significant chances of occurence are estimated; and finally, probabilities of occurence 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 deterministic 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.

### 3.5 Direct and indirect effects

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

Indirect effects are additional benefits and costs caused by an investment project under consideration, occuring in other technologically and economically related projects. Should the project under

examination not have been established, the indirect effects would not have occurred. Such effects of a project may be substantial enough to warrant attention on behalf of evaluators and decision-makers alike.

The Manual does not attempt to provide an exhaustive list of conceivable indirect effects, but evaluators are urged to give proper qualitative consideration to such effects as environmental implications, the impact of a project on health and skills of future employees, infrastructure implications, on basic values such as the quality of life, the dignity of the individual, social justice and equality, on any essential changes in the life, not only of the basic rural and urban community but also of the individual, if possible. In this case, indirect effects should be treated verbally as a third block after the basic criterion and the additional indices.

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

3.6 Market versus shadow prices

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

The authors of this Manual believe that the application of shadow prices for project evaluation in developing countries, at least at this stage, is impossible both on conceptual and on practical grounds. It is impossible on conceptual grounds because one cannot describe appropriately the existing socio-economic complex of a country; our knowledge concerning the interrelated socio-economic factors is very limited. It is impossible on practical grounds since one cannot simulate properly the complicated interaction of the different interrelated socio-economic factors.

One may imagine for a moment that appropriate shadow prices have been set up and they reflect the fundamental objectives of a country and the economic environment with all its constraints. But what will happen if the objectives and the constraints change, as they often do in practice? The whole set of shadow prices should be accordingly readjusted. In addition to this, the prices, including shadow prices, are closely interrelated. The changes of the factors which determine one shadow price will affect other shadow prices as a chain reaction and, therefore, they should be readjusted accordingly. It is unrealistic to expect that this continuous readjustment of the whole complex of shadow prices for the purposes 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 project evaluation purposes only along with the actual market prices - is also unrealistic. The decision-makers usually press the project planners to formulate and submit the projects for decision as quickly as possible and no one even thinks of such extremely difficult, time-consuming setting of shadow prices and their endless review and readjustment.

For the sake of simplicity and added appeal to practitioners, this Manual is largely based on actual prices (with some adjustments, if indispensable) and therefore avoids shadow or accounting prices on inputs and outputs. As a result the Manual advocates a compromise between the ideal shadow prices (which do not exist in reality) and actual market prices. This makes it operational, easily understandable and closer to economic reality. Every project evaluator can check the prices which have been used and, if absolutely necessary, add further price corrections.

Data problems associated with the calculation of shadow prices are thus kept to a minimum and so are the disappointments generated by the unsuccessful attempts for application of shadow prices in project evaluation. Practical experience has confirmed that when the gap between shadow and actual prices becomes too wide, the interest

of an investing agency in project evaluation may be jeopardized: prices lose touch with reality and turn into something suspected of being imaginary and less relevant in practice.

There is no guarantee and no one has proved thus far that the distortions introduced by inappropriate application of "artificially" constructed shadow prices for inputs and outputs are less than distortions arising sometimes from market prices, in addition to the great conceptual and computational difficulties related to derivation and application of shadow prices. This inappropriate application of shadow prices may result from unfounded subjective judgements, lack of experience, lack of information, lack of computation facilities, time pressure, etc. Unfortunately, this characterizes very often the project development process in most of the developing countries which this Manual is to serve.

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

The application of actual market prices may help, at least to a certain degree, to limit the room for manipulation of prices and misuse of the price mechanism for project evaluation purposes in order to prove "economically efficient" any project one wants to be selected, irrespective of whether it is actually efficient. There is also a tendency in actual practice to override negative appraisal results less reluctantly if based on market prices as compared to shadow prices because it is easier for the decision-maker to imagine the

consequences, i.e. a net loss of national income. It may be for these reasons that the direct link between an increase in value added at project level and the increase of national income has always been of great appeal to national planners.

3.7 National parameters

National parameters are variables 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 quantitative measure of the value the society assigns to certain major factors, having direct bearing on project evaluation and selection (social rate of discount, shadow rate of foreign exchange). The national parameters are yardsticks passed on by central planning authorities to the evaluators and micro-investment decision-makers which set targets that have to be achieved or surpassed within the framework of actual prices prevailing on the market.

National parameters are in general independent from all decisions taken with respect to individual projects They not only express national objectives and top level value judgements but are also concerned with systematic information on facts that are relevant to the examination of all investment projects. This systematic information is usually not available to the individual project evaluators. 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 number of ideas concerning the list of national parameters to be used in national benefit-cost analysis as well as the derivation of these parameters. The authors of the Guidelines for Project Evaluation published by UNIDO, for instance, are of the opinion that a comprehensive set of national parameters should be used: social rate of discount, social

value of investment, shadow wage, shadow rate of foreign exchange and have proposed a methodology for their derivation.

Throughout the comprehensive analysis of the prevailing conditions in the Arab countries (and other developing countries as well) which this Manual is designed to serve, the authors came to the conclusion that a more operational approach is needed with regard to the national parameters. The pre-requisites for derivation and application in the developing countries of the above list of national parameters suggested by the authors of the Guidelines are not available at present and are not expected to be available in the foreseeable future. On these grounds the Manual advocates the utilization of only two national parameters which are considered to be of crucial importance: social rate of discount and adjusted rate of foreign exchange. The Manual also recommends operational methods for their derivation.

The term "adjusted" rate of foreign exchange is used on purpose to distinguish it from the term "shadow" rate of foreign exchange and to make explicit the emphasis on the operational, practical approach suggested for the derivation of the adjusted rate of foreign exchange unlike the sophisticated techniques suggested for derivation of the shadow rate of foreign exchange.

If in certain cases the evaluator believes that in a developing country pre-requisites are available for more national parameters, and more sophisticated methods for their derivation may be applied, he is free to set up such parameters in co-ordination with the appropriate national agency and in line with the fundamental concepts of this Manual.

### 3.8 Integrated approach in project analysis

The value added concept permits the use of one set of data in both commercial and national profitability analysis. Physical quantities of inputs and outputs are - externalities apart - identical in both types of analysis. To such quantities market prices are applied in commercial analysis. Basically, the same set of values, comprising some indispensable price adjustments, is then used in

national project evaluation with the national accounts serving as a reference system. Thus, commercial profitability analysis serves as a stepping stone towards social evaluation. This provides for a coherent and more easily understandable appraisal process and reduces data problems.

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

The commercial profitability is determined by the net profit generated by an investment project. Items such as wages and salaries, interest, rent, 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 up to the point where he would need a subsidy.

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

### 3.9 A broader understanding of project evaluation

The process of evaluation of an investment project from national point of view advocated by this Manual should be understood as a continuous and broad exercise.

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

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

3.10 The need for simplicity and practicability

As stated above, the Manual endeavours to be as practical as possible. It keeps in view the working conditions which potential

evaluators are likely to face. Academically oriented people may find it too simple and too operational. It is not rooted in a given theoretical concept such as neoclassical economic theory. Nor will the indices of national profitability often produce clear-cut yes or no answers. The Manual attempts to guide the evaluator to 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 which a project must meet if it is to provide a small but noticeable improvement in prevailing conditions.

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

For these and similar considerations the Manual has adopted neither the Marglin, Sen, Dasgupta Guidelines (published by UNIDO) nor the Little and Mirrlees approach to social cost-benefit analysis published by OECD. In the Guidelines, the criterion of national profitability is "net aggregate consumption". In this approach, all the main aspects of evaluating the project, i.e. the foreign exchange, employment and 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 numeraire is national savings in terms of foreign exchange, with foreign exchange shortage dominating the determination of shadow prices for most inputs and outputs.

In both cases the adoption of one global aggregate indicator renders these methods both rigid and complicated. In addition, the a priori inclusion of foreign exchange constraints may give them a bias towards conditions which may be typical for most developing countries but not necessarily for all Arab countries.

Any project evaluator, regardless of the methodology he uses, must always possess an indispensable amount of intuition and judgement, accumulated through experience. This Manual, like any other Manual, cannot claim to furnish a substitute for these requisite qualities. It is hoped, however, that this Manual may serve as a guide which would reduce the scope of subjective judgement in project evaluation to its possible minimum.

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

A simple hypothetical illustrative example is developed throughout the commercial and national profitability sections of the Manual. It is hoped that such a numerical example will contribute towards better and easier understanding of the operational methodology advocated by the Manual.

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

* * *

Part I of the Manual is designed to provide in a very condensed manner a basic justification for why this methodology for project evaluation has been adopted. The most essential features of this Manual are enumerated. Only a very limited number of explicit references are made to other publications on project evaluation simply because the authors were aware that 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.

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

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

Part III contains annexes comprising a list of symbols used in the Manual and a present value table with instructions on its utilisation.

## 4. Basic Information Needed for Project Evaluation

### 4.1 A set of model formats

Project evaluation is a quantitative exercise to a large extent. A solid data base, therefore, is required to form a judgement on a project. In collecting these data the evaluator normally has to rely on information supplied by the investor and his consultants. It is the very purpose of various stages of project preparation to establish the magnitudes, both physical and in monetary terms, which surround the construction and the operation of an investment project. Ultimately,

these magnitudes are pulled together in a Techno-Economic Feasibility Study which is the starting point for an overall project evaluation. More often than not, however, it will be up to the evaluator to organise the data in a manner to suit the appraisal methods which he intends to apply.

The Manual recommends a set of model formats to assist the evaluator in this first step. The tables are designed in such a way as to serve both commercial and national profitability analysis. No universal format exists for such tables. This set of tables should be viewed only as illustrative ones. The tables aim at indicating what is the minimum information essential for evaluation of an investment project under normal conditions. This is an attempt to cover comprehensively the major categories of benefits and costs. It is up to the evaluator to modify the model formats subject to the actual conditions under which a project has to be evaluated.

The first question that is usually raised is how much the investment will cost. Table 1 provides a breakdown of the investment outlays into its various elements. Since time plays a prominent role 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 characteristics of an investment become transparent, and it will then be feasible to define the lifetime of major investment elements, i.e. to work out annual depreciation rates and the expected years, when additional investments for major replacements will be called for. By the same analysis any residual values at the end of the project's lifetime will be known. Table 2 provides a format for such information. Next come the questions about the manpower requirements of a project (Table 3) and the magnitudes of the annual income - which goods a project is planned to produce, how much of each product in one year and what prices the investor hopes to attain in the local and export markets, is any subsidy expected, etc. (Table 4). Again time will have to be taken into consideration: how long is the running-in period expected to last, what quantities can be produced

annually during that period, the economic life of the project (products), the utilization of the installed capacity, etc. Table 5 provides for a detailed breakdown of annual operating costs both during the running-in period and at full capacity utilization.

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 represent the data needed for the evaluator to embark on this task.

Finally, these data may be compiled into one comprehensive table which contains all the information needed for commercial profitability analysis. This is Table 8, Integrated Financial Analysis. Table 9, Integrated Value Added Analysis, provides a simple format on how to compute the value added from the data contained in Tables 1 through 6. This table provides the items needed for computation of the net national value added generated by an investment project, namely outputs, current material inputs purchased from outside the project, investments and repatriated payments. Tables 8 and 9 may be defined as an X-ray picture of an investment project. The whole complex of diagnostic analysis, called project evaluation, suggested by this Manual 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 of a fairly exhaustive nature and, in the light of data gaps typical for many Arab countries, may discourage some evaluators from using them. It may be emphasized that mainly the aggregates at the bottom of each table determine the economic efficiency. The evaluator, therefore, does not always have to break down all his data in accordance with the model formats, provided the figures comprise the details outlined in the tables. He should, therefore, consider these tables as a check-list to find out that no major elements of project analysis are missing and that both the coverage of his data base and the definitions underlying its various elements are in accordance with sound accounting

practices. Also, depending on which indicators the evaluator chooses in particular cases and whether he wishes to expand his evaluation to cover, for instance, operational safety analysis, he may not need the entire set of data, not even all the aggregates derived in Tables 1 through 7. Practical experience will quickly yield the understanding necessary to cope with questions of permissible lumping and omitting.

Along the same line of thinking it may be helpful to refer to the duration of time for which data should be collected in completing the model tables and particularly Table 8, Integrated Financial Analysis, and Table 9, Integrated Value Added Analysis.

It is well known that a project has a technical life as well as an economic life. The economic life of a project is the period over 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 the economic life 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 in 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 this data, but very often it may be extremely difficult to collect reliable information throughout the economic life of a project. There might be many reasons for these limitations. We will draw attention to only two of them, mainly from a practical point of view. First, to project what will happen 15-20 or 25 years from

now is very difficult and risky. The further one goes in the future, the larger the margin of error. Second, the nominal annual values of benefits and costs occurring 20 years from now, discounted at the present moment will make an insignificant present value and could hardly affect the evaluation result. For instance, a nominal value of 1.00 dinar occurring 20 years from now, discounted at 10 per cent, will have a present value of only 0.15 dinars.

In compliance with the above, the Manual recommends that the project analysts be flexible, subject to the prevailing conditions - countrywise and branchwise. As a general rule for practical purposes, a time horizon of 10-12 years, including the running-in period, will be sufficient to define whether a project is acceptable.

Throughout this Manual a time horizon of twenty years is used, which is not in conflict with the above statement. It has been purposely done to illustrate the technique of discounting and, what is even more important, to convince the user of the Manual that the nominal annual values of benefits and costs occurring 15-20 years from now do not affect the project significantly. What really matters are the benefits and costs occurring in the course of the 10-12 years' period.

A monetary unit, one dinar, has been used throughout this Manual. The selection of this monetary unit has been done only for illustrative purposes. The Manual's dinar is only an accounting monetary unit and except for the name has nothing in common with the same unit of currency being used in some Arab or non-Arab countries. On the same grounds one can use the dollar, pound, rupee, rial, etc.

**Table 1. Plant Investment and Schedule of Construction**

**(in thousands)**

| Items | Construction period | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Year $t_0$ | | | Year $t_1$ | | | Year $t_2$ | | | Year ... | | | Total | | |
| | imported | local | total | imported | local | total | imported | local | total | imported | local | total | imported | local | total |
| 1. Fixed assets | | | | | | | | | | | | | | | |
| 1.1 Equipment | | | | | | | | | | | | | | | |
| - cif/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 Licenses, royalties | | | | | | | | | | | | | | | |
| 2.2 Planning and all 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)

| Items | Investment | Expected lifetime (years) | Annual depreciation | Replacements | | | | | | Residual values in final year |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $t_1$ | $t_2$ | $t_3$ | $t_4$ | ... | $t_n$ | |
| 1. Fixed assets | | | | | | | | | | |
| 1.1 Production equipment incl. installation costs | | | | | | | | | | |
| 1.2 Buildings | | | | | | | | | | |
| 1.3 Land 1/ | | | | | | | | | | |
| 1.4 Other fixed assets | | | | | | | | | | |
| 2. Preliminary expenses 2/ | | | | | | | | | | |
| 3. Working capital 1/ | | | | | | | | | | |
| 4. Total | | | | | | | | | | |

1/ Working capital and land are not written off. Instead the entire amount enters the final year of the project's life as residual value.

2/ Rules as to whether 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. Manpower Requirements[1]

| Category of manpower | Number of personnel | | | Average annual wages | Amount (000) |
|---|---|---|---|---|---|
| | Unskilled | Skilled | Total | | |
| 1. Direct operating personnel | | | | | |
| 1.1 Department A | | | | | |
| 1.2 Department B | | | | | |
| 1.3 Department C | | | | | |
| 1.4 . . . . . | | | | | |
| 2. Indirect operating personnel | | | | | |
| 2.1 Service operators | | | | | |
| 2.2 Maintenance operators | | | | | |
| 2.3 . . . . . | | | | | |
| 3. Supervisory personnel | | | | | |
| 3.1 Plant superintendant | | | | | |
| 3.2 Engineers | | | | | |
| 3.3 Technical assistants | | | | | |
| 3.4 . . . . . | | | | | |
| 4. Administrative personnel | | | | | |
| 4.1 President | | | | | |
| 4.2 Financial and sales manager | | | | | |
| 4.3 Accountant and clerks | | | | | |
| 4.4 Servicemen | | | | | |
| 4.5 . . . . . | | | | | |
| 5. Grand total | | | | | |
| 5.1 Domestic personnel | | | | | |
| 5.2 Foreign personnel[2] | | | | | |

1/ For the whole 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.

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

Table 4. Annual Income
(in thousands)

| Items | Year $t_0$ | | Year $t_1$ | | Year $t_2$ | | .... | Year $t_n$ | |
|---|---|---|---|---|---|---|---|---|---|
| | quantity | value | quantity | value | quantity | value | | quantity | value |
| 1. Annual sales[1] | | | | | | | | | |
| Product (a) - local[2] | | | | | | | | | |
| - export | | | | | | | | | |
| Product (b) - local[2] | | | | | | | | | |
| - export | | | | | | | | | |
| Product (c) - local[2] | | | | | | | | | |
| - export | | | | | | | | | |
| 2. Subsidy | | | | | | | | | |
| 3. Residual value[3] | | | | | | | | | |
| 4. Total income | - | | - | | - | | | - | |

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

2/ If the domestically marketed output is an import substitution (partly or entirely), it should be clearly indicated in the table, for instance, locally marketed goods may be broken down into two sub-items: domestically marketed and domestically marketed (import substitution). If the project is expected to sell infrastructural services (electricity, energy, water, gas, steam), they should be stated as separate items.

3/ Residual value encounters land, buildings, working capital, scrap (see Table 2).

Table 5. Annual Operating Costs

| Items | 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) | | | | | | | | | | | | | |
| Equal capacity utilization of (in physical terms) | X | X | % | X | X | % | X | X | % | | X | X | % |

Table 6. **Capital Structure**
(in thousands)

| Items | Construction period | | | | |
|---|---|---|---|---|---|
| | Year $t_0$ | Year $t_1$ | Year $t_2$ | Year ... | 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 . Financial Obligations

(in thousands)

| Items | Years | | | | | | |
|---|---|---|---|---|---|---|---|
| | $t_0$ | $t_1$ | $t_2$ | $t_3$ | ..... | $t_n$ | Total |
| 1. Loans - repayment instalments<br>- 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[1]

(thousand dinars)

| | Items | Years | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3-10[2] | 11 | 12-19[2] | 20 |
| Basic information | 1. Investment (Table 1, Row 6) | 100 | 100 | - | - | - | - | - |
| | 1.1 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[3] | | | | | | | |
| | 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 2,2.3 above) | | | | 5 | - | - | - |
| | 4.3 Net profit before interest and after taxes | | | 30 | 25 | 24 | 24 | 40 |
| | plus depreciation (Row 2,2.2 above) | | | - | 10 | 10 | 10 | 10 |
| | minus replacement (Table 2, Row 4) | | | - | - | - | - | - |
| | Total | | | 30 | 35 | 34 | 34 | 50 |
| | 5. Net cash flow (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 | 20 | - | - | - | - | - |
| | 6.2 Loans (Row 2.2) | | 80 | - | - | - | - | - |
| | 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) | 0 | 0 | 30 | 8 | 22 | 22 | 38 |
| | 9. Cumulative net cash balance of Row 8 | 0 | 0 | 30 | 94 | 116 | 292 | 330 |

1/ The table contains figures from a hypothetical project which will be used throughout the Manual for illustrative purposes. Tables 1-7 are so 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.

2/ Annually.

3/ 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 1/

(thousand dinars)

| Items | Years | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8-10 | 11-19 | 20 |
| 1. Value of output (Table 4, Row 4) | 0 | 0 | 80 | 110 | 108 | 105 | 102 | 100 | 100 | 100 | 115 |
| 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 Subsidies (Table 4, Row 2) | - | - | 10 | 10 | 8 | 5 | 2 | - | - | - | - |
| 1.6 Residual value (Table 4, Row 3) | - | - | - | - | - | - | - | - | - | - | 15 |
| 2. Value of material inputs | 100 | 100 | 30 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| 2.1 Investments (Table 1, Row 6) | 100 | 100 | - | - | - | - | - | - | - | - | - |
| 2.1.1 Imported (Table 1, Row 6) | 75 | 75 | - | - | - | - | - | - | - | - | - |
| 2.1.2 Domestically procured (Table 1, Row 6) | 25 | 25 | - | - | - | - | - | - | - | - | - |
| 2.2 Current material inputs (Table 5, Rows 1.1, 2.1, 3.1) | - | - | 30 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| 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) | 50 | 62 | 60 | 57 | 54 | 52 | 52 | 52 | 67 |
| 4. Repatriated Payments | - | 5 | 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 | - | - | - | - | - | - | - | - | - |
| 5. Net National Value Added (3 - 4) | (100) | (105) | 35 | 46 | 44 | 41 | 39 | 37 | 38 | 42 | 51 |
| 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) | - | - | 28 | 37 | 35 | 32 | 29 | 27 | 27 | 30 | 39 |

1/ The figures in this table taken from a hypothetical project will be used throughout the Manual for illustrative purposes. Tables 1-7 are so 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 the tables 1-7. All items in this table are expressed in actual market prices for inputs and outputs and official rate of foreign exchange.

## 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 early stages of operation is insufficient provision for working capital. Whereas cost of machinery, buildings, consultant services, etc., are usually estimated with considerable diligence, only cursory attention is often given to capital requirements necessary to operate a plant. The results are unrealistic profitability expectations on the one hand (because initial investment entering the calculations is too small), and haphazard financial management on the other hand 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 terms, therefore, only very rough guidelines can be given for the estimation of working capital requirements which can help one to make at least a rough estimate:

**Step 1:** Divide annual operating expenditure at full production (Table 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 enters the store ready for sale);

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

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

**Step 6:** Add number of days of steps 2 through 5 (if balance of step 5 is negative, deduct from 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 re-rolling mill. Average daily operating expenditures from year 3 onward are then estimated to amount to 164.4 dinars (60,000 dinars: 365 - Step 1). Scrap has to be imported and as arrivals of shipments are difficult to schedule with sufficient reliability, three months supplies are held on average (Step 2). The rerolling process takes one day (Step 3). An average storage period of 30 days is expected before delivery to the local construction industry (Step 4). Terms of purchase cover the shipping period only. Payments, therefore, will have to be effected on arrival of supplies at plant site. No credit terms will be offered to customers but 20 days will have to be allowed for payments to be made against invoices (Step 5). Daily operating expenses are then tied down for an average of 141 days (90 + 1 + 30 + 20 - 0 = 141) with working capital requirements totalling 23,180 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 upward or downward if indicated. In this process of adjustment the following elements have to be taken into consideration:

- If a project's running-in period is very long, i.e. if full capacity utilization can be reached only after a considerable length of time, a downward adjustment may be necessary;
- If the raw material content of the final product is low, Step 2 should be dealt with separately by including the cost of such raw materials only instead of basing Step 2 on total daily operating expenditure;
- If access to 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 last for different lengths of time, e.g. lorries, machinery, buildings, land, etc., the concept of a project's lifetime is a somewhat fictitious one. Yet all these elements together are needed to produce the desired output and consequently either re-investments have to be earmarked for those assets which have to be replaced fairly early, or residual values have to be determined for such elements which are still usable after the lifetime of other major investments has elapsed. Such residual values may then be considered income at the end of the project's terminal year. Instead of residual values, therefore, such elements may also be called terminal values.

With the kind of analysis carried out in Table 2, the determination of residual values is easily carried out. Usually the lifetime of major investments, such as the bulk of machinery, is chosen to represent the project's lifetime. Assuming that in Table 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, then the difference between initial investment for buildings and the sum of annual depreciation for years 1 through 19 enters the calculation as residual value in year 20. This value is equal to the sum of annual depreciation of years 21 through 30. Assuming finally that another 5 per cent of initial investment consists of working capital

and the value of land, then that entire sum without any depreciation is added to the residual value in year 20. The value of land is taken at its present or expected actual market price.

Too much precision is not justified since residual value 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 lumping together of investment elements with similar lifetimes is both justified and necessary, recognising the fact stated above that after discounting to the year zero, the present value of this particular income element will usually have only a marginal impact on a project's profitability.

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

# II. EVALUATION OF AN INVESTMENT PROJECT

## A. Commercial Profitability

### 1. Introduction

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

- Investment profitability analysis and
- Financial analysis.

The two types of analysis mentioned above are complementary and not substitutable. Both need to be carried out as they are concerned with different aspects of an investment proposal. Investment profitability analysis is to measure the profitability of the resources put into a project, more directly the return on the capital no matter what are the sources of financing. Thus, investment profitability analysis assesses the potential earning power of the resources committed for a project neglecting the financial transactions 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 will permit smooth implementation and operation of the project.

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

- Simple rate of return;
- Pay-back period;
- Net present value;
- Internal rate of return.

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

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

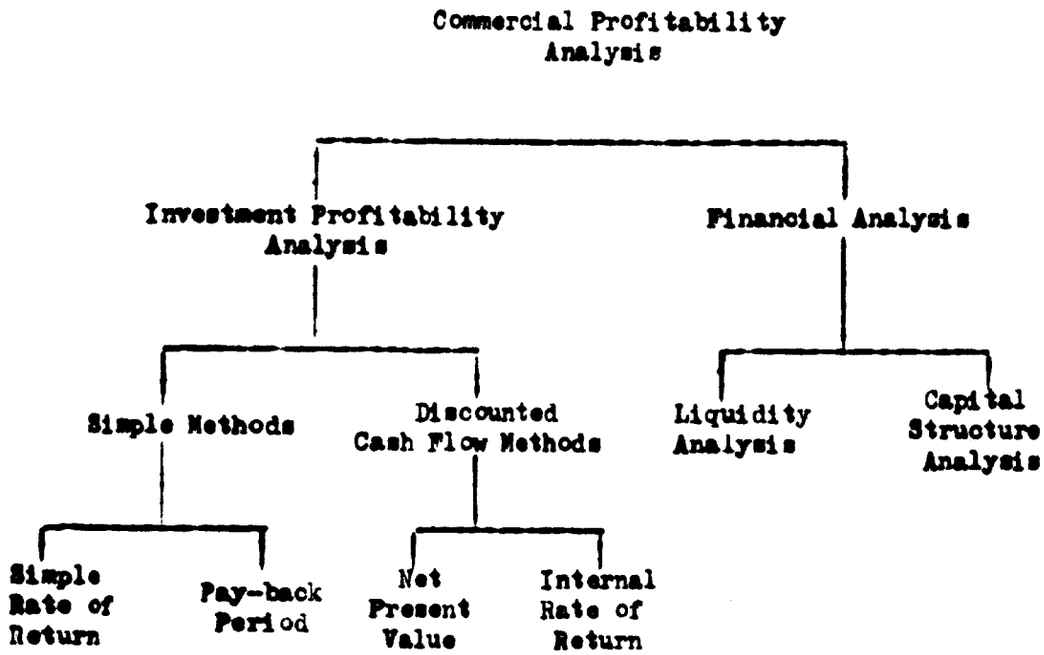
Hence, the simple methods are somewhat less precise but in some cases the simple analysis could be sufficient and/or the only possible alternative while in others it is preferable to carry out comprehensive analysis using the net present value and the internal rate of return methods.

The choice of method depends on the objectives of the enterprise, the economic environment and availability of data. However, in case two or more projects are being evaluated and compared, the same method, consistent with the objectives of the investor, has to be used to secure a unified base for adequate comparison, final ranking and rational decision-making.

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

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

Chart I. Framework of Commercial Profitability Analysis




Investment profitability analysis and financial analysis will be illustrated by the example of a hypothetical project the data of which are quoted in Table 8 - Integrated Financial Analysis. This table is a major source of information for the project evaluator in carrying out commercial profitability analysis. The table also provides an opportunity to check the interdependence of various data used in commercial profitability analysis.

## 2. Investment Profitability Analysis

### 2.1 Simple rate of return method

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

(equity plus loans) or the profitability of only the equity capital. Therefore, the simple rate of return could be presented either as

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

or

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

where R = simple rate of return on total investment

$R_e$ = simple rate of return on equity capital

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

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

Simple rate of return (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 before interest in the most representative normal year which is equal to net profit (F) plus interest charges (Y) in this year.

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

The application of the simple rate of return in assessing the investment profitability is illustrated by an example of a hypothetical project whose data are derived from Table 8 and compiled in Table A.1. Year 5 has been selected as a normal year.

Table A.1 Calculation of R and $R_e$

(000 dinars)

| Items | Amount |
|---|---|
| 1. Total investment (I) - Row 1 in Table 8 | 200 |
| 2. Equity capital (Q) - Row 6.1 in Table 8 | 120 |
| 3. Net profit after taxes (F) - Row 4.2 in Table 8 | 20 |
| 4. Net profit before interest (F+Y) - Row 4.3 in Table 8 | 25 |

On the basis of data presented in Table A.1, the rates of return on total capital and equity capital invested are, respectively:

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

and

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

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

However, the simple rate of return method has some limitations. First, 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. Second, in real terms it may be rather difficult to find the normal year adequately representative for the whole life span of a project. Third, this 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 where sufficiently detailed information for more comprehensive analysis is not available in the country or for preliminary evaluation at early stages of project formulation.

2.2 Pay-back period method

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

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

where: I = total investment;

p = pay-back period;

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

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

$$p \leq p_m,$$

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

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

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

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

Step 3: Deduct from the total investment the net profits (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 profits.

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

Step 5: Compare the pay-back period so computed with the cut-off pay-back period set up by the investor. If the pay-back period is shorter than the cut-off rate, 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 A.2. Year 5 is selected as a normal year.

Table A.2 Calculation of the Pay-back Period

(000 dinars)

| Items | Nominal amount | Uncovered investment at the end of a year |
|---|---|---|
| 1. Total investment (Table 8, Row 1) | 200 | - |
| - year 0 | 100 | - |
| - year 1 | 100 | - |
| 2. Annual net profits (Table 8, Row 4.2) | | |
| - year 0 | 0 | 100 |
| - year 1 | 0 | 200 |
| - year 2 | 30 | 170 |
| - year 3 | 20 | 150 |
| - year 4 | 20 | 130 |
| - year 5 | 20 | 110 |
| - year 6 | 20 | 90 |
| - year 7 | 20 | 70 |
| - year 8 | 20 | 50 |
| - year 9 | 20 | 30 |
| - year 10 | 20 | 10 |
| - year 11 | 24 | + 14 |

Therefore, the total investment will be recovered by the net profits just before the middle of Year 11, or in approximately 11½ years. It can be seen that during the years of the implementation period, i.e. Year 0 and Year 1, the project does not yield any net profits and consequently the investment is still entirely uncovered. Starting in Year 2 and in the later years the project yields net profits and is able to recover the total investment by the middle of the Year 11. It is shown above, when determining the pay-back period, that one has to start computations right from the beginning of the project's life, i.e. the construction period is included in the pay-back period.

Assuming that in Year 2 instead of a net profit of 30, the project generates a net loss of 30, this amount would have to be added to the uncovered capital of the previous year (Year 1 = 200). Subsequent net profits will then have to be deducted from this total (230). The pay-back period will be correspondingly longer.

The pay-back period so 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 a first glance one may say that a pay-back period of over 11 years is rather long for a project to be easily accepted.

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, which is more advisable on practical grounds, diversified by industrial sectors. 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.

Sometimes in practice the pay-back period is computed on the basis of the annual net cash earnings (Table 8, Row 4) instead of annual net profits (Table 8, Row 4.2). Such an approach may also have its raison d'être, but it is <u>less precise</u> conceptually and <u>less rigid</u> in practice than the approach advocated above.

It is less precise conceptually for the simple reason that net cash earnings along with net profits (Table 8, Row 4.2) and interest (sub-row to 4.2) contain also depreciation (sub-row to 4.3). It was stated above that the pay-back period measures the time needed for a project to recover its total investment through the <u>net benefits</u> it generates. No one can dispute that the profit is a measure of benefits. The same does not, however, apply to depreciation. Depreciation is not a benefit generated by a project, but rather a way to recuperate, recover the initially invested fixed capital. Therefore, one wrong step, i.e.

lumping together profit and depreciation, which have different economic meanings, inevitably leads to a second wrong step, i.e. lumping together the pay-back period and depreciation period which are totally different economic terms.

It is less rigid in practice because everything being the same, through annual cash earnings one comes to a shorter pay-back period (less than 8 years in the above example) as compared to net profits (11½ years). The main reason for this is the counting of depreciation as a benefit (which it is not) and adding it to the net profit.

What actually matters to the investor is how long it will take to regain his investment through the net profit the project is expected to generate. A project may generate (one may assume) a zero profit throughout its lifetime but, nevertheless, the initial investment for fixed capital will be recovered through the annual depreciation allowances by the end of the depreciation period.

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

### 2.3 Net present value method

The net present value of a project is defined as the difference between the present values of its future cash inflows and outflows. This means that all 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:

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

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 readily available in the present value tables.

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

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

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 $t^{th}$ year;

$CO_t$ = cash outflow in the $t^{th}$ year;

$a_t$ = discount factor in year t corresponding to the selected rate of discount.

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

The <u>rate of discount</u> should as far as possible be based on the actual rate of interest in the capital market to reflect the time preference and opportunity cost of the possible alternative use of the capital invested. In case the investment is financed by long-term loans, the actual rate of interest paid should be taken as the discount rate. If 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. The latter is especially important in cases where alternative projects of different magnitudes of investment are compared and it becomes important to relate the absolute amount of the project's net benefits to its total investment. In such instances instead of computing only the net present value of a project, the evaluator may go on dividing it by the discounted value of the total investment, i.e. to use a sort of discounted rate of return. This ratio is given as:

$$NPVR = \frac{NPV}{P(I)} \qquad (A.6)$$

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

NPV = net present value of a project;

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. Needless to say that whenever the implementation period is not more than a year, there will be no need for discounting the annual amount of investment and it will be included into the analysis at its nominal value.

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

The net present value of a project and NPVR 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 tables enclosed with the Manual 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 A.3 the calculation of the net present value of a project is demonstrated again using the initial data stated in Table 8.

To clarify Table A.3 some additional explanation may be necessary. Since at the present stage of the project evaluation one is concerned with assessing the investment profitability of a project, only the real resource flows are taken into account. This means that any flows connected with the financial transactions, such as the loans at the cash inflow side and the financial obligations at the cash outflow side, are omitted from the analysis. In addition to this, the cash outflows do not comprise depreciation in order not to account twice for the investment outlays. Not including depreciation in the cash outflows means that depreciation is transferred to the net cash flows.

Having found the net cash flows in each year, one proceeds with further steps in the calculation. Suppose the discount rate is 7 per cent, the discount factors are stated in Row IV of Table A.3.

Table A.3 Calculation of Net Present Value

(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| 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) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 20 | - |
| 3. Subsidies (Table 8, Row 3.2) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| II. Cash Outflows (CO) | 100 | 100 | 40 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 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 | - |
| 7. Interest (Table 8, Row 2.3) | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | 10 | - |
| III. Net Cash Flows (NCF) (I - II) | -100 | -100 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 50 | - |
| IV. Discount Factors at 15 Percent 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 15 Percent Rate | 100 | (93) | 26.1 | 24.6 | 22.8 | 21.3 | 20.1 | 18.6 | 17.4 | 16.2 | 15.3 | 16.0 | 15.0 | 13.9 | 13.3 | 12.2 | 11.6 | 10.9 | 10.2 | 9.5 | 13.0 | 115 |

The sum of Row V in Table A.3 gives the net present value of the project at 7 per cent discount rate, which amounts to 115,000 dinars. Since the net cash flows in the Year 0 and the Year 1 encounter only the investment outlays, and therefore are negative, it is easy to find the present value of the total investment by summing up the present values of the net cash flows in those years, which is 193,000 dinars:

$$NPVR = \frac{115,000}{193,000} = 0.60.$$

Therefore, a unit of discounted total investment generates 0.60 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 the fact that it takes into account the whole life of the project. Also, it accounts for the time preferences by discounting the future cash flows to their present values. Further, by using a given discount rate it encounters the opportunity costs of the possible alternative uses of capital. Thus, no matter what the time phasing of the future net cash flows is, this method is suitable for making a rational investment decision, particularly by using the NPVR as a reliable yardstick for comparing alternative projects.

2.4 Internal rate of return method

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

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

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

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

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

$$i_r > i_{min}$$

and vice versa.

The cut-off rate is equal to the actual rate of interest on long-term loans in the capital market or to the interest rate paid by the borrower. If one has to choose among alternative projects, the one with the highest internal rate of return will be selected, provided this internal rate of return is higher than the cut-off rate. The internal rate of return of a project has to be determined through trial and error procedure and the steps of its calculation may be as follows:

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

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

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

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

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

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. Then to avoid further rounds of calculations, the following formula may be used to arrive at the internal rate of return:

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

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 per cent apart. If this is not respected, the internal rate of return worked out on the basis of the mentioned formula may not be accurate enough.

The calculation of the internal rate of return is shown in Table A.4. Since the internal rate of return is to measure the investment profitability, the financial transactions are omitted from the analysis and depreciation is again not included in cash outflows. Thus, in computing the internal rate of return, one does not need to go back to Table 6, but to work further with the net cash flows stated in Row III of Table A.3. Then these net cash flows are discounted at different rates in

order to find out the one which will make the net present value of a project equal to zero. The first round of calculations has already been worked out when computing the net present value of the project shown in Table A.3. The only exercise one has to do is to apply higher and higher discount rates until the net present value of a project becomes negative. Table A.4 states the magnitudes of the net present values of a project at different discount rates.

Table A.4 Calculation of the Internal Rate of Return

| Discount rate | Net present value of a project in 000 dinars |
|---|---|
| 7% | 115.0 |
| 11% | 32.1 |
| 13% | 3.9 |
| 14% | - 8.8 |

Table A.4 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 115,000 dinars down to 32,100 dinars. A higher rate of 13 per cent reduces the net present value to 3,900 dinars, which is still positive but very close to zero. This is why one may proceed to discount at 14 per cent, but then the net present value becomes negative and amounts to -8,800 dinars. Therefore, lower rates have to be applied. It can be seen that the project's internal rate of return is somewhere between 13 per cent and 14 per cent. For practical purposes, this approximation would be quite sufficient, but one may go on calculating the exact rate. Since the difference between these two rates is rather small and the first yields the positive while the second gives a negative net present value, the formula for interpolation may be used to determine the internal rate of return as follows:

$$i_r = i_1 + \frac{PV(i_2 - i_1)}{PV + NV} = 13.0 + \frac{3900(14.0 - 13.0)}{3900 + 8800} = 13.0 + 0.31 =$$

$$= 13.31\%$$

Therefore, the internal rate of return of the project is 13.31 per cent. This rate has to be compared with the cut-off rate (the interest rate paid or payable for long-term loans on the capital market) and/or with the internal rates of the other projects in competition.

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

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

But the method has some features limiting its use. First, the internal rate of return method cannot be applied safely whenever there are considerable negative net cash flows during the operating period of the project's life, 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. Second, this method may be misleading when two or more mutually exclusive projects are compared, and reference to the net present value method is desirable. Third, it does not reflect directly the time preferences of a decision-maker, as the discount rate is not given outside of the project but is computed on the basis of the project's data. However, since the project's internal rate of return is compared with the cut-off rate, this problem is somewhat solved. Fourth, the calculation of the internal rate of return is to a certain extent somewhat cumbersome work.

Taking into consideration what was mentioned above, the internal rate of return may be considered as a useful method to be applied when it is not easy to find out the appropriate discount rate in

computing the net present value of a project and/or one wants to know at what rate the capital invested is compounded over the project's life. But due attention has to be paid to the circumstances limiting its use.

## 3. Financial Analysis

### 3.1 Liquidity analysis

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

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

- Debt service charges, both 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:

- Equity and long-term financing are adequate;
- Cash deficits are limited to magnitudes which can be covered by recourse to short-term bank credit or eliminated by reshaping some of the cash inflows or outflows;

- Terms of long-term financing are adequate;
- Dividends as envisaged by investors will materialise.

Liquidity analysis is done on a year-by-year basis and therefore the annual cash positions are taken into consideration in their nominal values. The data from Table 8 are presented in Table A.5 as an illustrative example of the liquidity analysis.

It can be seen that equity capital will be sufficient to cover the investment outlays in the first year of the construction period, but in the second one in addition to the equity capital of 20,000 dinars, a long-term loan of 80,000 dinars is needed to finance the project's investment. In Year 3 and later on the project's annual cash balance is positive in all years, meaning that the project is able not only to meet all the cash outflows, but to produce a surplus in all years of its operating period. Therefore, the project being evaluated is considered to have good liquidity of resources.

3.2 Capital structure analysis

Long-term finance must cover a project's cost of fixed investment and at least that part of the working capital requirements which will be needed for normal operation. These finances should be procured in the form of equity and long-term credit. Short-term loans for financing the fixed assets 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, however, depend on the profitability of the project and capital structure should be related to the earning capacity of the project.

Financing of a project's capital requirements should not only determine its future liquidity but also its future balance sheets. Therefore, in the course of project evaluation the capital structure envisaged by the investor should be looked at closely with a view to judging the enterprise's future financial viability. Various aspects have to be considered in this context. In general, the combination of

Table A.5 Liquidity Analysis of a Project

(000 dinars)

| Items | Years | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3-10 1/ | 11 | 12-19 1/ | 20 |
| I. Cash Inflows (CI) | 100 | 100 | 70 | 100 | 100 | 100 | 120 |
| 1. Sales revenue (Table 3, 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 | - | - | - | - | - |
| 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) | 0 | 0 | 30 | 8 | 22 | 22 | 38 |
| IV. Cumulative Net Cash Balance (Table 8, Row 9) | 0 | 0 | 30 | 94 | 116 | 292 | 330 |

1/ Annually.

equity capital and loans will determine a project's debt equity ratio. Relatively heavy reliance on credit offers certain advantages:

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

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

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

The most commonly applied indicator of an enterprise's capital structure is the so-called debt-equity ratio, i.e. the ratio of long-term loans to equity capital:

$$R_{de} = \frac{L}{Q} \qquad (A.9)$$

where: $R_{de}$ = debt-equity ratio;

$L$ = long-term loans;

$Q$ = equity capital.

In the preceding example (Table 8, Row 6 2 divided by Row 6.1), this ratio works out to 0.67 (80 : 120) which may be judged satisfactory. Also, in terms of the project's liquidity analysis this capital structure is adequate since neither interest charges nor repayment 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 recommendable because a very profitable project may be able to bear an unusually high share of debt financing. On the other hand, a ratio of 0.67, as in the above example, may not be satisfactory at all if the project is not sound enough and if borrowing is on too short terms. If repayments have to be made already during the construction period or before the project generates significant cash earnings, a debt-equity ratio of 0.67 may not assure sufficient cash surplus during the running-in period. In addition, anticipated net cash balances have to be seen in the light of uncertainties surrounding the length of the construction and running-in periods. Such uncertainties may jeopardise 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 nation. Emphasis at that stage was only on finding the profits of a project in monetary terms and not on its real contribution to the welfare of the society. For measuring a project's contribution to the national income formation, National Profitability Analysis should be applied.

National profitability analysis is similar in form to commercial profitability analysis in that they both try to identify the costs and benefits and by commeasuring them to assess the "profitability" of an investment proposal Commercial profitability 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 assessing the net financial result of a project while the national profitability 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; but the latter, in addition to this, takes also into consideration the indirect (linkage) effects, both measurable and non-measurable. Commercial profitability analysis is based on market prices, but national profitability is determined with the help of adjusted prices which are deemed to be an approximation of the social prices. For commercial profitability the time preference problem is tackled by application of the prevailing interest rates on the capital market, while in the case of national profitability, it is solved by using 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 in 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 - both from the points of view of its effects on the economy as a whole and on the particular aspects of national life in the context of which a project is being considered.

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

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

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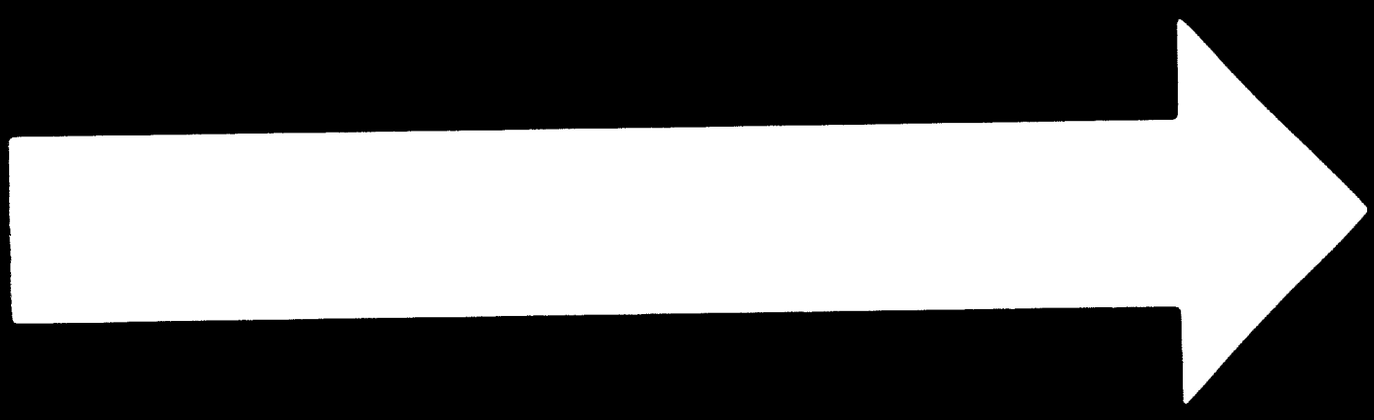

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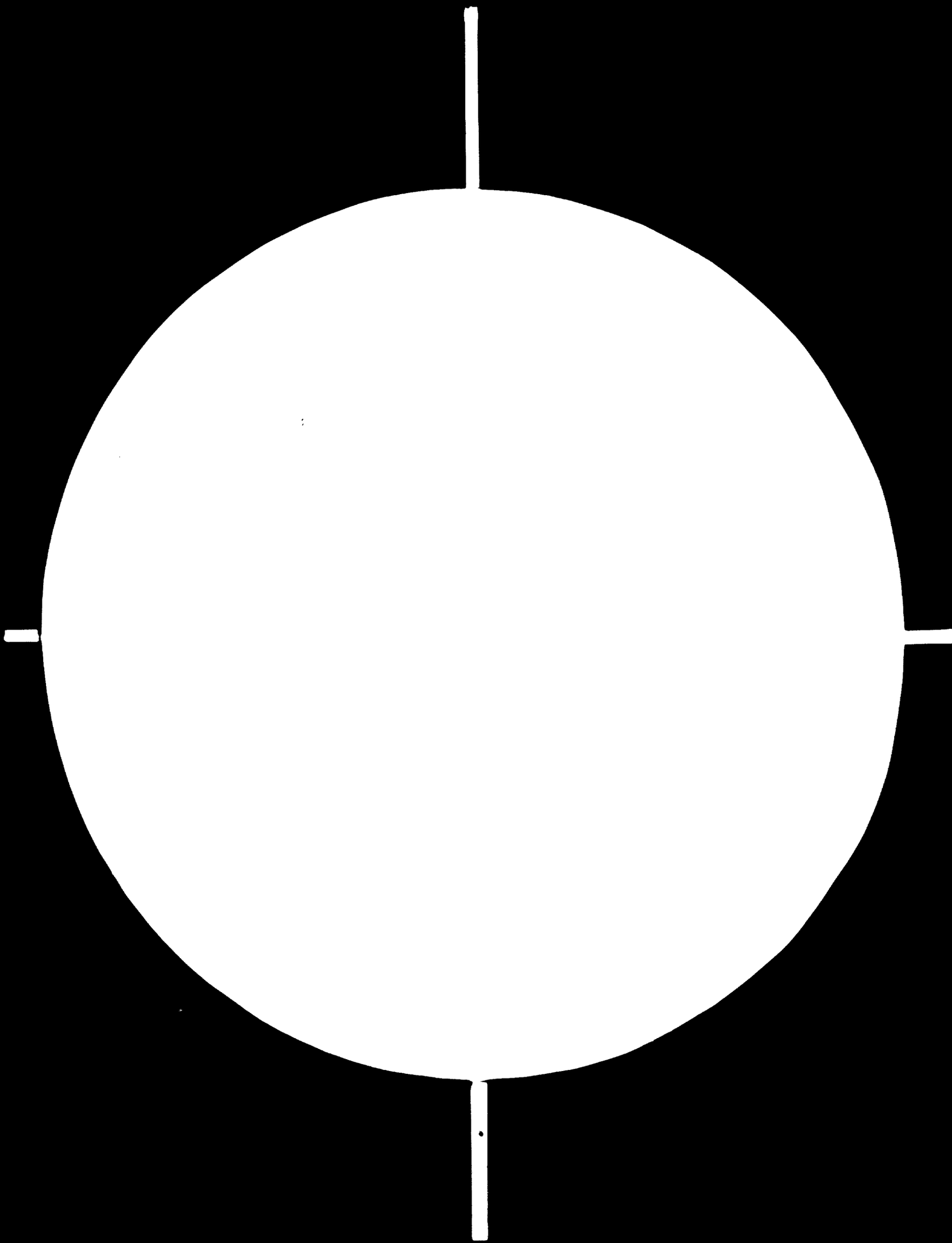
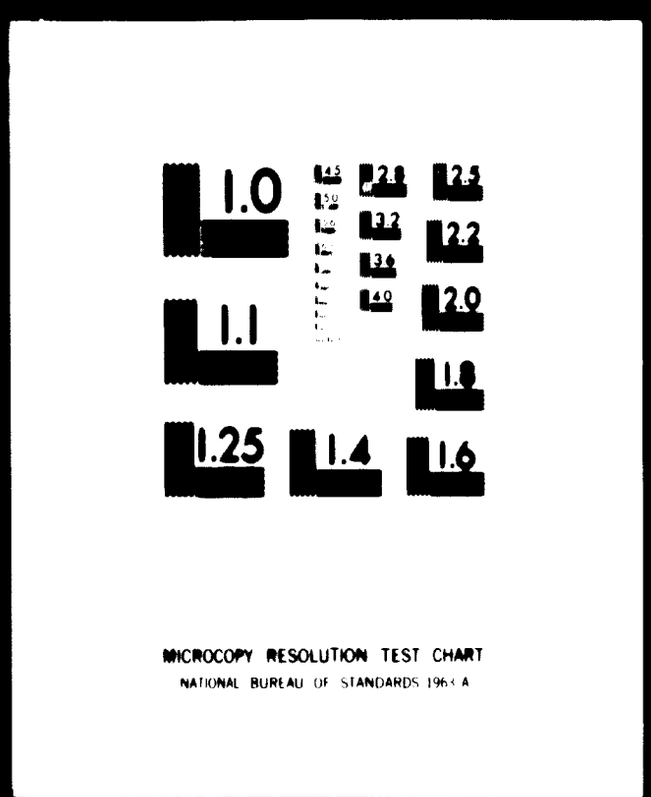
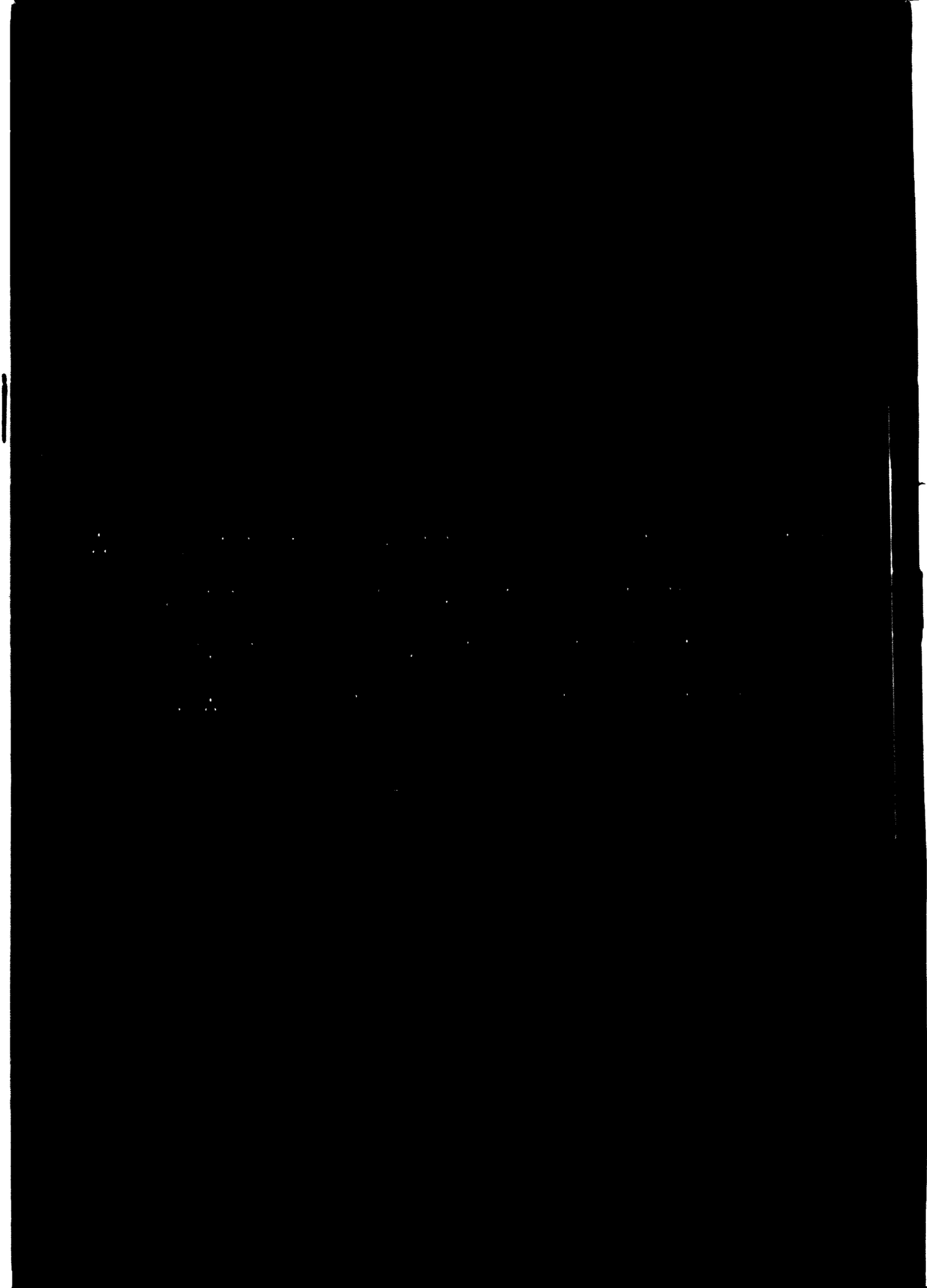






Acknowledging the existence of certain distortions in the domestic market prices, the Manual recommends a procedure for price adjustments. Three important points are to be noted in this respect. First, the existing or expected market prices relevant to the project in question are to be analyzed and obvious distortions identified which 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. Second, the price adjustments should be made before embarking on national profitability analysis. Third, relatively simple practical procedures are recommended for carrying out the adjustments of the actual market prices (adding subsidy, relying on actual FOB or CIF prices, etc.), instead of constructing sophisticated theoretical models and relying on doubtful assumptions.

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

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

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

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

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

An important feature of national profitability analysis is the application of a set of national parameters measuring in quantitative terms certain preferences from the national point of view, in the framework of a coherent economic policy, setting up certain out-off levels of efficiency, etc. For the sake of praoticality only the two most essential national parameters are suggested - social rate of discount and adjusted rate of foreign exchange. These national parameters should in principle be computed by a competent national agency, i.e. national planning agency, ministry of economy, central bank, central statistical office, etc.

As in the case of commercial profitability, for national profitability analysis, too, several 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 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 the other expected results of the project. This will afford material to the decision-maker about the overall impact of the project on the economy as well as on the branch of the economy in which he is particularly interested or about which he likes to be cautious before making any commitments.

In the light of the above, 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/or expected future prices on the domestic and relevant world markets at which the outputs can actually be marketed and the inputs can actually be procured. Those traded at the domestic market are valued at actual domestic market prices and those traded on the international market at actual CIF or FOB prices transformed into domestic prices by the adjusted rate of foreign exchange

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

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

The second step would be to segregate these influences and to bring actual market prices to levels which may 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 have to 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, 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 its outputs which represent the benefits and its inputs which entail costs. The output can broadly be divided into four parts, namely, (i) exported, (ii) import substituting, (iii) domestically marketed, and (iv) infrastructural services. Similarly, the inputs can be divided broadly into (i) imported, (ii) domestically produced, (iii) infrastructural services, (iv) land and (v) labour. The following pricing rule table suggests the <u>pricing rules</u> which can be conveniently adopted:

Exported outputs should be valued at actual FOB prices since this is the real social price which the country receives. The project evaluator should, however, exercise sound judgement as to whether there are no hidden dumping and/or other distortive elements in this price which may make it misleading. For instance, the actual FOB price may have been set too low for a certain time to conquer a market with the intention of increasing it later on. Such a potential increase in the FOB price will affect the project positively; there might, however, be other distortions which may affect it negatively.

Outputs may be domestically marketed at present, but they are actually import substituting. The establishment of the new project discontinues imports of the same product(s). Such outputs should be valued at actual CIF prices since this is the real cost for the country. The above remarks concerning distortive elements apply to the CIF price too. This should be done only when a direct link exists between the establishment of a project and the discontinuation of the importing of certain product(s) of the same quantity and quality. From now on, any reference to CIF price should be understood to mean that all import taxes, import duties, internal charges of transport, insurance, etc., are to be also taken into consideration.

Governments often decide to help in creating and maintaining appropriate economic conditions for continued production of certain basic domestically marketed goods. One of the very 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 which is high enough. At the same time, for essential goods of basic importance, the price should be low enough to make them easily accessible to the lowest income groups. In setting up a low price the governments usually pay subsidies to accomodate 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 CIF prices plus internal charges of transport, insurance, etc. This is the real price being paid by the country. As in the case of exported output, here too one should be careful with regard to a possible hidden dumping component or other distortive

elements. It may well happen that the actual CIF 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. This will affect the project negatively.

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

(a) The actual FOB price is higher than the actual domestic market price. In this case one should use the FOB price because it expresses the opportunity cost of said input - if not used in the project, it may be exported. If this input were to be exported a country would have received the FOB price. In doing so, one gets a true picture of the real social value. For instance, the actual domestic price for cement in a country is 9 dinars/ton, while the export price is 19 dinars/ton The FOB price of 19 dinars/ton should be used for project evaluation. This will, no doubt, create economic incentives for a better utilization of the cement in a country.

Such an approach may increase the investment cost or the current material inputs of a project, but this will reflect the economic reality no matter whether one likes it or not. It will provide an indication of the real price for development which a nation 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. In addition to the above, the application of the FOB price for crude oil used for domestic processing will encourage the utilization of the huge quantities of associated gas waster at present. The quantity of flared gas in the Arab area alone is such that it is a sufficient raw material to produce fertilizers to meet the future demand of the whole world. The transportation costs for this gas are 80 per cent of

its market price which makes the transportation over long distances unattractive. With crude oil this rate is only 10 per cent. Therefore, the application of the FOB price will be a powerful level for the orientation of the petrochemical industry to associated gas while the export of crude oil continues.

(b) The actual domestic market price is higher than the FOB price. There might be many reasons for this; however, the country badly needs foreign exchange and is even prepared to subsidise exports. That means that the subsidy makes up for the difference between the actual domestic market price and the FOB price. A strong incentive is created for the project to go on exporting. In that case one should take the actual domestic market price 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:

- To take the actual domestic market price, which is higher than the FOB price;
- To take the FOB price and add up the subsidy.

(c) The FOB 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 which the society decided to make in order to solve certain practical problems. In such a case one should take the FOB price and add the subsidy.

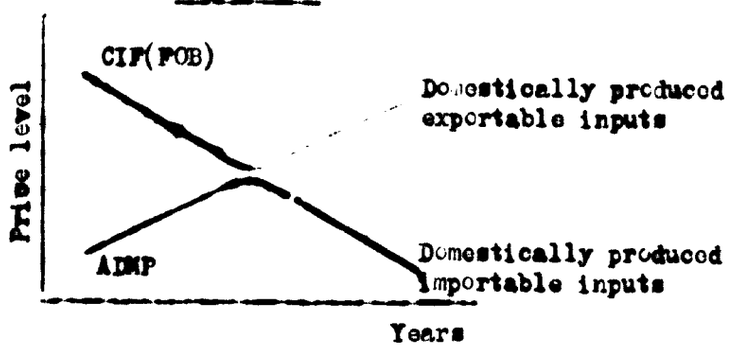
In the above three cases the starting point in the analysis is the price specified in the contract for exports. If the contract refers to a FOB price, it should be used; if the export of a commodity is expected on the basis of a CIF price, all adjustments should be based on that price.

Other material inputs are being domestically produced, but they are importable - have been imported before and could be imported now. For these inputs one should use the actual domestic market price, or the actual CIF price, whichever is lower. To take the higher price would mean overestimation of the real social value of the input. The real social value is represented by the lower price (i.e. CIF), because

it will be preferable to the society to import the input, being less expensive, instead of expanding its domestic production. In other cases the real value may be represented by the actual domestic market price, which is lower than the CIF price, and the society would prefer to expand the local production of this input, being cheaper, instead of importing it.

The above presentation concerning price adjustments on domestically produced exportable and importable inputs may be conveniently presented on the following simple diagram:

Figure B.1




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

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 neither importable nor exportable, the valuation is done using the actual domestic market price or the production cost, whichever is higher. Taking the higher value (market price or production cost) reflects 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 sometimes may be established below production cost, which 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 at 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 labourers and not on the grounds 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 so adjusted (as indicated above) should be used throughout the economic life of an investment project.

Using actual domestic market price (ADMP) does not mean picking up blindly, with no analysis, the price prevailing on the market at a given moment and applying it to the future. Picking up the prevailing relevant market price at the moment is only the starting point. The possibilities for expected, most likely future fluctuations of this price should be carefully analyzed. Through 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 FOB and CIF prices.

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

## Pricing Rule

| Item | Formula | Justification |
|---|---|---|
| **I. Outputs** | | |
| 1. Exported | APOB | Since this is real social price being realised by the country. A judgement has to be exercised whether there are no hidden dumping as well as other distortive elements in this price. |
| 2. Domestically marketed (import substituting) | ACIF | Same as above. |
| 3. Domestically marketed | | |
| (a) Basic goods | ADMP + subsidy (if any) | Since subsidy represents additional social costs which are borne by the government. |
| (b) Non-basic goods | ADMP (incl. 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 subsidised. |
| **II. Inputs** | | |
| 1. Imported (investment and current material inputs) | ACIF + internal incidental charges of transport, insurance, etc. | Since this is real social price being paid by the country; however, one should be careful with regard to possible hidden dumping component in this price. |
| 2. Domestically produced (investment and materials) | | |
| (a) Exportable (have been exported before and could be exported now) | ADMP/APOB, whichever is higher | However, judgement has to be exercised: in case the internal prices are much lower than FOB, 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/ACIF, whichever is lower | Here, too, a judgement might be necessary to adjust ADMP at some suitable level when it is substantially higher than the CIF price. |
| (c) Others | ADMP + subsidy | Since subsidy represents additional social cost 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 | Since ADMP of these services sometimes may be established below production costs, which is a hidden subsidy. |
| 4. Land | ADMP (on land for industrial construction) | |
| 5. Labour | Actual salaries and wages plus fringe benefits | |

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

### 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 value of inputs purchased from other units.

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

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

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

O = expected value of the output of 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):

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

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 which 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 whole life of the project.

Net value added for a single year:

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

where: D = annual depreciation.

Net value added for a project's whole economic life:

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

or (which is the same):

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

where:

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

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

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

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

As can be easily seen, the formulae B.4 and B.5 are identical substantively with formula B.1. They provide more explicit presentation of formula B.1, 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:

- Net national value added - that part which is produced and distributed in a country;
- Repatriated net value added - 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:

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

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

The total value added generated by an investment project comprises:

- Direct value added - produced within a project itself;
- 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 its magnitude is negligible and therefore not worth the effort, all calculations of efficiency may be based on the direct value added only.

At this stage the evaluator is confronted with taking into account the 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 the section "National Parameters".

### 3.1 Application of the value added criterion for evaluation of new investment projects

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

#### 3.1.1 Absolute efficiency test

(a) Simple formula: For small projects with 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 which manifests the normal operational conditions of the project. The normal year should be the same selected for commercial profitability analysis (Ref. para. 2.1). This estimate will provide only a preliminary idea of the benefits of a project to the nation. If the result shows positive value added, it is a good sign for proceeding further with the project. On the other hand, if the result is negative, it sounds an early warning and very careful thought has to be given before proceeding further with the project, with particular emphasis on those aspects of the economy in the context of which the project is being initiated.

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

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

where: $E_s$ = absolute efficiency test of the project in terms of value added surplus over the wages on the basis of data for a 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 on purpose 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 the formula B.7. If the project being formulated shows such a social surplus, it passes the absolute efficiency test at the early stages of formulation. This indicates that the project will yield a surplus after meeting its wages obligations. One can now undertake with some confidence a more detailed analysis of the project. Even if there is no such surplus, it may not be necessary to abandon the project at this stage but one may consider how it can be improved.

The application of the simple formula for an absolute efficiency test is illustrated by an example of the same hypothetical project considered in the commercial profitability section. Its data are derived from Table 9 and compiled in Table B.1.

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

$$E_s = 105 - (48 + 10) \geq 12$$

$$E_s = 47 \geq 12$$

The project generates in a normal year a social surplus of 35,000 dinars over and above wages and therefore passes the preliminary absolute efficiency test.

Table B.1 Absolute Efficiency Test - Simple Formula[1]
(000 dinars)

| Items | Amount |
|---|---|
| 1. Expected value of output in a normal year (O) Table 9, Row 1 | 105 |
| 2. Expected value of current material inputs in a normal year (MI) Table 9 Row 2.2 | 48 |
| 3. Expected depreciation of fixed capital in a normal year (D) Table 8, Row 2.2 [2] | 10 |
| 4. Expected wages in a normal year (W) Table 9, Rows 4.1 and 5.1 | 12 |

(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 on the nation during its lifetime is done with the help of the social rate of discount (SRD). The expected annual values added throughout the project's life are all reduced to one figure by application of SRD, taking into account the different years of their occurance This is done in the following manner:

Step 1: Model Table No. 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.

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1/ In consistence with the approach under commercial profitability, year 5 is selected as a normal year.

2/ Since this is the only case where 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.

**Step 2:** The market prices for all these items as assessed for commercial profitability analysis are already available. These may now be carefully reviewed and if obvious distortions are detected, 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 (basically sales revenue, subsidies and residual value) ($O_t$);
- Nominal values of investment ($I_t$);
- Nominal values of current material inputs ($MI_t$);
- Nominal values of repatriated payments (repatriated wages of expatriates, interest paid on foreign loans, net profits on expatriate shareholders, royalties and other foreign payments which are not included in material inputs)($R_t$).

**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. 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 ($O_t$); and
- 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:

$$(NDVA)_t = O_t - (MI + I)_t \qquad (B.8)$$

**Step 6:** Subtract from the annual values of net domestic value added, computed above, the annual values of repatriated payments ($R_t$) to arrive at the expected nominal annual values of Net National Value Added $(NNVA)_t$ for the respective years:

$$(NNVA)_t = O_t - (MI + I + R)_t \qquad (B.9)$$

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 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 $(NNVA)_t$ 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

$$\left[\sum_{t=o}^{n} (VA)_t a_t\right] :$$

$$\sum_{t=o}^{n} (VA)_t a_t = \sum_{t=o}^{n} \left[O_t - (MI + I + R)_t\right] a_t \qquad (B.10)$$

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

$$\sum_{t=o}^{n} (VA)_t a_t > 0 \qquad (B.11)$$

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

However, merely passing this test - though very important - is still not a sufficient condition for acceptable f 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 utilised for applying the absolute efficiency test to the project as follows:

$$E = \sum_{t=o}^{n} (VA)_t a_t \geq \sum_{t=o}^{n} W_t a_t \qquad (B.12)$$

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

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

$\sum_{t=o}^{n} (VA)_t a_t$ = present value of the expected value added for the whole lifetime of a project from year o to year n;

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

$n$ = number of years in the economic life of a project starting from year o;

$a_t$ = discounting factor in year t.

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 B.2 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 the rate of foreign exchange. The analysis is carried out on the basis of the same market prices, and official rate of foreign exchange $1 = 5 dinars, applied under commercial profitability. Applying the absolute efficiency formula one finds that:

$$E = \sum_{t=o}^{n} (VA)_t a_t \geq \sum_{t=o}^{n} W_t a_t$$

or $$137,800 > 84,300$$

Therefore, should there not be any price distortions, the project would pass the absolute efficiency test, i.e. it covers the wages of 84,300 dinars and generates a social surplus of 53,500 dinars.

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

Under 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. The adjusted rate of foreign exchange contains 30 per cent premium and $1 = 6.5dinars.

Table B.3 contains the adjusted figures for the absolute efficiency test.

Table B.2 Absolute Efficiency Test at Market Prices

(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| 1. Value of output (O) (Table 9, Row 1) | 0 | 0 | 80 | 110 | 108 | 105 | 102 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 115 | - |
| 2. Value of material inputs (MI + I) (Table 9, Row 2) | 100 | 100 | 30 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | - |
| 3. Net domestic value added (1 - 2) | (100) | (100) | 50 | 62 | 60 | 57 | 54 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 67 | - |
| 4. Repatriated payments (R)(Table 9, Row 4) | - | 5 | 15 | 16 | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 16 | - |
| 5. Net national value added (3 - 4) | (100) | (105) | 35 | 46 | 44 | 41 | 39 | 37 | 38 | 38 | 38 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 51 | - |
| 5.1 Wages (W) (Table 9, Row 5.1) | - | - | 7 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - |
| 5.2 Social surplus (SS)(Table 9, Row 5.2) | - | - | 28 | 37 | 35 | 32 | 29 | 27 | 27 | 27 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 39 | - |
| 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 | 0.25 | 0.23 | 0.21 | 0.19 | 0.18 | - |
| 7. Discounted values of net national value added (5 x 6) | (100) | (96.6) | 29.4 | 35.4 | 31.2 | 26.6 | 23.4 | 20.4 | 19.0 | 17.5 | 16.0 | 16.4 | 15.1 | 13.9 | 12.6 | 11.3 | 10.5 | 9.7 | 8.8 | 8.0 | 9.2 | 137.8 |
| 7.1 Discounted values of wages (5.1x6) | - | - | 5.9 | 6.9 | 6.4 | 5.8 | 6.0 | 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 |
| 7.2 Discounted values of social surplus (5.2 x 6) | (100) | (96.6) | 23.5 | 28.5 | 24.8 | 20.8 | 17.4 | 14.9 | 13.5 | 12.4 | 11.4 | 11.7 | 10.8 | 9.9 | 9.0 | 8.1 | 7.5 | 6.9 | 6.3 | 5.7 | 7.0 | 53.5 |

Table B.3 Absolute Efficiency Test at Corrected Prices 1/

(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| 1. Value of output (O) (Table 9, Row 1) | - | - | 99.5 | 137.0 | 135.0 | 132.0 | 129.0 | 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 | 132.0 | - |
| 2. Value of material inputs (MI + I) (Table 9, Row 2) | 122.5 | 135.5 | 32.4 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | - |
| 3. Net domestic value added (1 - 2) | (122.5) | (135.5) | 67.1 | 85.4 | 83.4 | 80.4 | 77.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 80.4 | - |
| 4. Repatriated payments (R) (Table 9, Row 4) | - | 6.5 | 19.5 | 20.8 | 20.8 | 20.8 | 19.5 | 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. Net national value added (3 - 4) | (122.5) | (142.0) | 47.6 | 64.6 | 62.6 | 59.6 | 57.9 | 55.9 | 57.2 | 57.2 | 57.2 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 59.6 | - |
| 5.1 Wages (W) (Table 9, Row 5.1) | - | - | 6.1 | 8.1 | 8.1 | 8.1 | 9.4 | 9.4 | 10.7 | 10.7 | 10.7 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | - |
| 5.2 Social surplus (SS)(Table 9, Row 5.2) | - | - | 41.5 | 56.5 | 54.5 | 51.5 | 48.5 | 46.5 | 46.5 | 46.5 | 46.5 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 57.6 | - |
| 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 | 0.25 | 0.23 | 0.21 | 0.19 | 0.18 | - |
| 7. Discounted value of net national value added (5 x 6) | (122.5) | (130.6) | 40.0 | 49.7 | 44.4 | 38.7 | 34.7 | 30.7 | 28.6 | 26.3 | 24.0 | 24.3 | 22.5 | 20.6 | 18.7 | 16.8 | 15.6 | 14.4 | 13.1 | 11.9 | 12.5 | 234.4 |
| 7.1 Discounted values of wages(5.1x6) | - | - | 5.1 | 6.2 | 5.8 | 5.3 | 5.6 | 5.2 | 5.3 | 4.9 | 4.5 | 4.7 | 4.3 | 4.0 | 3.6 | 3.2 | 3.0 | 2.8 | 2.5 | 2.3 | 2.2 | 80.5 |
| 7.2 Discounted values of social surplus (5.2 x 6) | (122.5) | (130.6) | 34.9 | 43.5 | 38.6 | 33.4 | 29.1 | 25.5 | 23.3 | 21.4 | 19.5 | 19.6 | 18.2 | 16.6 | 15.1 | 13.6 | 12.6 | 11.6 | 10.6 | 9.6 | 10.3 | 153.9 |

1/ Exported output, import substitution output, imported investment and current material inputs as well as repatriated payments are valued at adjusted rate of foreign exchange, $1 = 6.5 dinars. The adjustments were made on the basis of the data provided in Table 9. This table covers only the direct value added of a project. This is done on purpose in order to illustrate separately the computation of the total value added (direct and indirect) as it is done in Table B.7.

The discounted value added equals 234,400 dinars. This is an indication of the positive contribution of the project to the national income. Therefore, the project passes 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 is the social surplus.

By the application of formula B.12 it was found that, while the discounted value added is 234,400 dinars, the discounted value of the wages is 80,500 dinars The project generates enough value added to recover the wages paid to the labourers. It 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.

Had it not been so, i.e. the project does not generate social surplus, the designers should carefully review the project 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.

The comparison between Tables B.2 and B.3 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. from 137,800 dinars it increases to 234,400 dinars. It means that the price corrections and particularly 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 valuing of repatriated payments.

The discounted value of wages drops only by 3800 dinars, due to the higher valuation of the repatriated wages by the adjusted rate of foreign exchange.

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 53,500 dinars at corrected prices, it generates a considerably larger social surplus of 153,900 dinars.

3.1 2 Relative efficiency test

If several competing projects pass the absolute efficiency test, the project evaluator is faced with the problem of ranking. This ranking 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:

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

(ii) If there is no clearly pronounced scarce factor or there are 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 is the project to the economy.

(iii) 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 occurance 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 effect 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 most scarce factor in the country. Project ranking under three scarce situations relevant for many countries is illustrated below:

(a) Project ranking in the capital scarcity situation

The objective is to find which projects generate the maximum value added per unit of capital invested. This can be assessed by dividing the discounted value added by the present value of total investment (both compiled earlier for finding the absolute efficiency of the project):

$$E_C = \frac{P(VA)}{P(I)} \qquad (B.13)$$

The larger the ratio, the more beneficial is the project from the capital point of view, enabling it therefore to be selected in a capital scarcity situation. In the hypothetical example the discounted value added is 234,400 dinars and the discounted total investment is 247,200 dinars:

$$E_C = \frac{234,400}{247,200} = 0.95$$

Therefore, a dinar of discounted investment generates 0.95 dinars of value added. This co-efficient seems to be very high, but it has a real meaning only when compared with the same co-efficients for alternative projects. The higher the ratio, the better the project is.

(b) Project ranking in a foreign exchange scarcity situation

The position here is similar to that under capital scarcity, and the object is to find which project produces the maximum value added

per unit of net foreign exchange cost. It is obtained by applying the formula:

$$E_{FE} = \frac{P(VA)}{P(FE)} \qquad (B.14)$$

P(FE) will be the present value of the net foreign exchange cost of a project compiled in Table B.14 of the section "Net Foreign Exchange Effect". The net foreign exchange cost is obtained as a difference between foreign exchange spendings and foreign exchange earnings (savings) during the lifetime of a project. This formula is applicable only when the foreign exchange spendings exceed the foreign exchange earnings (savings) of a project. The higher the ratio, the larger is the value added contribution 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 spendings.

(c) Project ranking in skilled labour scarcity conditions

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

$$E_L = \frac{P(VA)}{P(L_s)} \qquad (B.15)$$

$P(L_s)$ 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 are to be used in the denominator of the above formula.

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

The discounted amount of the wages, salaries and fringe benefits of the local and foreign skilled labour in the hypothetical project was computed to equal 50,000 dinars. With this it follows that:

$$E_L = \frac{234,000}{50,000} = 4.69$$

A dinar of discounted wages, salaries and fringe benefits paid to the skilled labour helps to generate 4.69 dinars of value added. This co-efficient should also be compared with respective co-efficients for alternative projects. The higher the co-efficient 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 price imports, increasing exports, etc. This may lead to a certain relief in the foreign exchange scarcity situation. The same may apply to capital scarcity and skilled labour scarcity.

### 3.2 Application of the value added criterion for evaluation of modernization/expansion projects

Modernisation and expansion are very important aspects of the industrialisation programme of any country. It is particularly necessary to assess whether modernization/expansion of an existing production unit, which enjoys many infrastructural facilities, is not a more economical alternative than setting up a new project. Sometimes it may be necessary to undertake such a step for the survival of a continuously losing industrial unit. Modernisation is usually accompanied by expansion and vice versa. There is no clear-cut demarkation line between them. For the sake of brevity, modernisation/expansion projects will be referred to as modernisation projects.

One may distinguish different types of modernisation. In a single 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 bottleneck, to increase production, to improve quality, to decrease production cost, to improve working conditions, etc. On the other extreme, a modernization may comprise a complete reconstruction of an existing factory, replacing most of the machinery and equipment, and retaining only the factory buildings. This may lead to considerable increase in production capacity, lower production costs and capital costs per unit of output, better quality, improved working conditions, etc There might be in practice an unlimited number of variations of modernisation between these two extremes.

As stated above, 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 will use basically the same manpower. Maybe this is the most essential link between the old and the modernised factory

For very simple and limited in scale modernization projects, simple techniques for evaluation may be sufficient. For that purpose one may conveniently use simple rate of return (formulae A 1 or A.2), pay-back period (formula A.3) or the simple value added formula (formula B.7).

Larger modernization projects, like new projects, should be evaluated in a two-step procedure: first, absolute efficiency test and then relative efficiency test

Although throughout this section the terms "before" and "after" are used, actually the Manual advocates a comparison between the current level of operation - present or expected in the future, i.e. <u>without</u> modernisation, with the expected parameters of the same production unit being modernized - i.e. <u>with</u> modernisation.

The general sequence of operational steps is the same as described above for new projects There are, however, <u>peculiarities</u> 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 modernisation is completed:

- Value of output = Value of output at the current level of operation + additional value of output due to modernization;
- Value of material inputs = Material inputs at the current level of operation + additional inputs caused by modernisation;
- Value of capital = Market value or book value of the adopted machines, equipment, etc., from the existing production unit + new investment for modernisation;
- Value of repatriated payments = Value of payments going abroad at the current level of operation + additional repatriations due to modernisation (if any);
- Value of wages = Value of wages for employed labour at the current level of operation + wages for labour newly employed due to modernization. It may, however, happen that modernisation 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 <u>first question</u> which should be asked in evaluating a modernisation project is if value added after modernisation is larger or at least equal to the value added before modernisation. This could be expressed in the following way:

$$\frac{\text{P(VA) after modernisation}}{\text{P(VA) before modernisation}} \geq 1 \qquad \text{(B.16)}$$

where: P(VA) after modernisation = present worth of the value added expected to be generated by a project after modernisation;

$P(VA)$ 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: if the value added expected to be generated by the modernized project is larger or at least equal to the wages to be paid to the labourers:

$$E_m = P(VA)_{after} \geq P(W)_{after} \qquad (B.17)$$

where: $E_m$ = absolute efficiency test for modernization project;
$P(W)$ = 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, only passing 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 stand compared with the social surplus generated by the production unit prior to modernisation? What is the structure of the value added (wages + social surplus) after modernization as compared to before modernization?

It may be desirable for this type of projects 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: $E_m = P(VA) \geq P(W)$. This measures the level of efficiency before modernization;

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

Step 3: Compare the efficiency in terms of social surplus for the two levels - before and after modernization - and arrive at an absolute efficiency ratio:

$$E_m = \frac{P(VA) - P(W) \text{ (after modernization)}}{P(VA) - P(W) \text{ (before modernization)}} \geq 1 \quad \text{(B.18)}$$

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:

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

$$E_{SF} = \frac{P(VA)}{P(SF)} \quad \text{(B.19)}$$

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 due to 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 value added contribution to the economy per unit cost of the scarce factor.

Table B.4 contains the necessary aggregated data for assessment of an investment proposal to expand and at the same time considerably modernise an existing industrial establishment. This table contains two different types of data:

(a) Present value of value added, wages, investment and skilled labour which characterize the factory under the current level of operation, i.e. before modernization. They 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 skilled labour after modernization.

Table B.4 Evaluation of a Modernization Project

(in 000 dinars)

| Items | | Before expansion/ modernization | After expansion/ modernisation |
|---|---|---|---|
| 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 which is to be asked is whether the value added after modernisation of the factory, i.e. $P(VA)_1$, is larger than the value added before modernisation, i.e $P(VA)_0$. The available data confirm that it is:

$$\frac{P(VA)_1}{P(VA)_0} = \frac{90,000}{65,000} = 1.38 > 1$$

Since this condition is met, the second question follows: Is the expected value added, i.e. $P(VA)_1$, large enough to cover the wages paid to the labourers, i.e. $P(W)_1$, and to have a surplus over and above them? The data from Table B.4 confirm that it is:

$$P(VA)_1 \geq P(W)_1$$

or

$$90,000 > 64,000$$

With this condition having been met, the third question follows: Is the expected social surplus after modernisation larger than the one under the current level of operation? The answer to this question is also positive:

$$\frac{P(VA)_1 - P(W)_1}{P(VA)_0 - P(W)_0} = \frac{90,000 - 64,000}{65,000 - 63,000} = \frac{16,000}{2,000} = 8 > 1$$

Therefore, the proposed project for modernisation of the existing factory is acceptable. The project passes the absolute efficiency test.

Table B.4 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 modernised project is 300,000 dinars. Part of it is the book value of the adopted equipment of the existing factory:

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

A dinar of investment in the modernized project is expected to generate 0.30 dinars of value added. 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 modernisation assures a higher productivity of the investment in terms of value added compared with the existing factory but a lower productivity compared to 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 can be seem from Table B.4 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 increased on the account of the unskilled one which is reflected in the considerable increase in the present value of wages and fringe benefits paid to skilled labour:

$$\frac{P(VA)_1}{P(Ls)_1} = \frac{90,000}{45,000} = 2.00 \text{ dinars.}$$

One dinar of discounted salaries and fringe benefits paid to skilled labour is expected to generate 2.00 dinars of net national value added. This is higher than the same ratio in the existing factory before modernisation (1.86). This confirms the soundness of the proposed expansion.

The co-efficient 2.00 dinars is then compared with the same co-efficient in an alternative new project proposal. Assume it is higher. The conclusion is that the proposed expansion and modernisation assures

a higher productivity of the skilled labour in terms of value added as compared with the existing factory as well as 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 which are technologically, economically and geographically closely interrelated. Any substantial change in one of the interrelated 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 complex utilisation of different components of the raw material (chemical and petrochemical complexes); on participation in the production of parts which are assembled in a final product (engineering complexes); on utilization of common infrastructure, such as transport facilities, electricity, water, steam, gas supplies, etc.

An industrial complex may comprise only industrial projects (mining and manufacturing) as well as subsidiary projects from other sectors of the economy, i.e. agriculture, transport and communications, etc. The constituent projects may or may not be under the same management.

An industrial complex may comprise three groups of constituent projects:

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

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

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

In addition to this, the suggested approach may help to "internalise" some external (indirect) effects, which are difficult to measure, and to eliminate the implications of heavily distorted market prices of items exchanged among the constituent projects. The former is achieved by evaluating all individual projects as one unit, i.e. the industrial complex; and the latter 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 two-fold:

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

(b) To provide an opportunity for "techno-economic redesigning" of the constituent projects if the evaluation results suggest. This redesigning may lead to considerable benefits through the economy of scale, better utilisation of planned productive capacities, more efficient marketing, etc. An estimate of such advantages can be done 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 as to which constituent projects of the complex are weaker, and where to look for efficiency reserves. The evaluation has to be done by applying the absolute efficiency test suggested for new projects. This individual evaluation of each constituent project should not imply that each project should pass the absolute efficiency test on its own. As stated above, the application of this test only aims at identifying the weak links of the complex.

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

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

- The value of expected repatriation payments: (a) for new projects - their total amount; (b) for modernization/expansion projects - as suggested in the section for evaluation of modernization projects; and (c) for units with idle capacities - foreign payments under normal level of operation plus any additional foreign payments caused by the better utilization of the capacity.

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

- Sum total of the values of output, produced by the different constituent units and delivered by the complex $(O)^c_t$;
- Sum total of the values of all material inputs (investment and current material inputs) used by the constituent units, procured from outside the complex $(MI + I)^c_t$.

Subtract for each year the nominal values of all material inputs $(MI + I)^c_t$ from the nominal values of output $(O)^c_t$, to arrive at the nominal values of the Net Domestic Value Added produced by the complex $(NDVA)^c_t$ for the respective years:

$$(NDVA)^c_t = (O)^c_t - (MI + I)^c_t \qquad (B.20)$$

**Step 4:** Subtract from the annual values of Net Domestic Value Added computed above the annual values of Repatriated Payments $(R)^c_t$ to arrive at the expected annual values of Net National Value Added $(NNVA)^c_t$ for the respective years:

$$(NNVA)^c_t = (O)^c_t - (MI + I + R)^c_t \qquad (B.21)$$

**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 $(NNVA)^c_t$ 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:

$$\left[\sum_{j=1}^{m}\sum_{t=o}^{n}(VA)^c_{j,t}\,a_t\right]$$

which can be expressed in the following way:

$$\sum_{j=1}^{m}\sum_{t=o}^{n}(VA)^c_{j,t}\,a_t = \sum_{j=1}^{m}\sum_{t=o}^{n}\left[(O)^c_t - (MI + I + R)^o_t\right]a_t \qquad (B.22)$$

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

$$\sum_{j=1}^{m}\sum_{t=o}^{n}(VA)^c_{j,t}\,a_t > 0 \qquad (B.23)$$

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 $(SS)^c$. 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: (a) for new projects - total wages, excluding the repatriated portion; (b) for modernisation/expansion projects as suggested in the section for evaluation of modernisation projects; and (c) for units

with idle capacities - wages paid under current level of operation plus any wages for additionally appointed personnel to secure better utilization of the available idle capacity.

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 surpluses $(SS)^c_t$ thus computed are multiplied by the corresponding discount factors (reference 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:

$$\left[ \sum_{j=1}^{m} \sum_{t=o}^{n} (W)^c_{j,t}\, a_t \right] .$$

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:

$$E^c = P(VA)^c \geq P(W)^c \qquad (B.24)$$

or the same expressed in more elaborate terms:

$$E^c = \sum_{j=1}^{m} \sum_{t=o}^{n} (VA)^c_{j,t}\, a_t \geq \sum_{j=1}^{m} \sum_{t=o}^{n} (W)^c_{j,t}\, a_t \qquad (B.25)$$

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 be only new projects, or new and modernized/expanded projects, or new projects along with modernized/expanded production units and existing units with idle capacities.

$\sum_{j=1}^{m} \sum_{t=o}^{n}$ means the total sum of the value added (wages) for all constituent projects in the complex from j to m

$(\sum_{j=1}^{m})$ for all years of their economic life starting from year t=o (the beginning of construction) and ending in year n

$(\sum_{t=o}^{n})$

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

If the ranking of industrial complexes is required, it will also be possible to find the efficiency of the complex as a whole under capital, foreign exchange or skilled labour scarcity conditions by applying the same formulae as have been earlier suggested for individual projects.

Table B.5 contains the necessary aggregated data for evaluation of a hypothetical investment proposal to set up an industrial complex comprising two new projects which will be closely related with three existing factories, two of them having idle capacities.

The values of the output on Row 1 of the Table express only 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 the Table) 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

Table B.5 Evaluation of an Industrial Complex[1]

(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 0-15 |
| 1. Value of output (O)[a] | 0 | 0 | 80 | 120 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | - |
| 2. Value of material inputs (MI + I)[a] | 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 (R)[a] | - | - | 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 NEVA (5 x 6) | (100) | (138) | 4.2 | 30.8 | 39.0 | 32.6 | 30.0 | 27.5 | 25.0 | 23.0 | 21.0 | 19.5 | 18.0 | 16.5 | 15.0 | 13.5 | 77.6 |
| 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 profit (5.2 x 6) | (100) | (138) | (4.2) | 19.3 | 24.8 | 19.6 | 18.0 | 16.5 | 15.0 | 13.8 | 12.6 | 11.7 | 10.8 | 9.9 | 9.0 | 8.1 | ( 53.1) |

1/ 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. $1 = 6.5 dinars. 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.

which will 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 is expected to be 16 years, including the construction and the running-in periods.

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

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

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

(b) Two of the three existing factories have had a very poor performance thus far. Part of their capacities have not been utilized for years, the technology was found to be very obsolete, part of the equipment was old and the management inefficient. The government was supporting them by subsidies. Two years ago there was a proposal for their modernisation, but the action was postponed in view of their proposed joining the industrial complex when the position of the two factories will be reviewed in line with their being part of

the complex. The experts came to the conclusion and proposed a major reconstruction, modernisation and expansion of the two factories to fit better 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 is expected to increase from 150,000 dinars to 200,000 dinars. For that purpose additional 50,000 dinars of investment will be needed, making use also of much of the available equipment before the modernisation. The annual current material inputs are expected to increase from 80,000 dinars before the modernization to 90,000 dinars afterwards. Due to the more up-to-date equipment and technology, in spite of the increase in output, the number of people employed will drop by 10 per cent, but the average level of skill will increase and along with that, the average annual wage. The total annual wage bill, consumed in the country, however, remains unchanged, i.e. 20,000 dinars.

This being so, the new economic picture of the industrial complex is presented in a very aggregate way in Table B.6.

The evaluation of the redesigned industrial complex leads to positive conclusions:

$$E^c = \sum_{j=1}^{m} \sum_{t=o}^{n} (VA)^c_{j,t}\, a_t \geq \sum_{j=1}^{m} \sum_{t=o}^{n} (W)^c_{j,t}\, a_t$$

or

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

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

Table B.6 Re-evaluation of an Industrial Complex

(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 0-15 |
| 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 (ME + 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 (R)[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 |

1/ All foreign components as in Table B.5, 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.

### 3.3.2 Measuring the indirect effects of an investment project

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

An investment project may provoke the establishment of other new projects, modernization/expansion of existing production units and/or help 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 counted for only as long as their occurance is due to the project under consideration.

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

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

Step 1: Compute the direct value added and direct wages 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; requiring modernization or expansion; better utilization 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 the economic life which will be produced in the linked projects due to the establishment of the project under consideration:

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

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

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

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

$$P(VA) = \sum_{j=1}^{m} \sum_{t=o}^{n} (VA)_{j,t}\, a_t \qquad (B.26)$$

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

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

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

$$P(W) = \sum_{j=1}^{m} \sum_{t=o}^{n} (W)_{j,t}\, a_t \qquad (B.27)$$

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

$$E = P(VA) \geq P(W)$$

or expressed in more elaborate terms:

$$E = \sum_{j=1}^{m} \sum_{t=o}^{n} (VA)_{j,t}\, a_t \geq \sum_{j=1}^{m} \sum_{t=o}^{n} (W)_{j,t}\, a_t \qquad (B.28)$$

where: $\sum_{j=1}^{m} \sum_{t=o}^{n}$ stands for the total value added or wages (direct and indirect) occuring in a project under consideration and in all linked-up projects from $j$ to $m$ ($\sum_{j=1}^{m}$) for their entire economic life from the year $o$ to the year $n$ ($\sum_{t=o}^{n}$).

If the net result is a positive value added and a surplus of value added over wages, or at least equals 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 in principle 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 as may be found possible.

The application of the suggested approach for measuring the total (direct and indirect) effect of an investment project is illustrated below. Table B.7 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 B.7 contains seven basic items, but for the sake of clarity, the breakdown of each item on direct and indirect components was also thought to be useful and therefore included in the table.

The analysis of the data in Table B.7 provides a clear picture of the total (direct and indirect) effects of the hypothetical project.

Evaluated on the grounds of its <u>direct effects only</u>, the project is sound enough. It is expected to generate a present worth of value added of 234,400 dinars (Table B.7, Row 7.1) while the present value of the wages to be paid is 80,500 dinars (Table B.7, Row 7.1.1):

$$E = \sum_{t=o}^{n} (VA)_t \, a_t \geq \sum_{t=o}^{n} (W)_t \, a_t$$

or $234{,}400 \geq 80{,}500$

or 153,900 dinars of social surplus

Therefore, the proposed project is expected to cover the wages and to generate a social surplus of 153,900 dinars. With this characteristic the project is acceptable.

Table B.7 Measuring the Total Value Added (Direct and Indirect)[1]
(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| 1. Value of output (O) | - | - | 99.5 | 137.0 | 135.0 | 132.0 | 129.0 | 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 | 132.0 | - |
| 1.1 Direct output (Table B.3, Row 1) | - | - | 99.5 | 137.0 | 135.0 | 132.0 | 129.0 | 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 | 132.0 | - |
| 1.2 Indirect output - computed | - | - | 20.0 | 30.0 | 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 | 50.0 | 50.0 | 50.0 | - |
| 2. Value of material inputs (MI + I) | 132.5 | 155.5 | 42.4 | 61.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | 71.6 | - |
| 2.1 Direct material inputs (Table B.3, Row 2) | 122.5 | 135.5 | 32.4 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | - |
| 2.2 Indirect material inputs - computed | 10.0 | 20.0 | 10.0 | 10.0 | 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 | 20.0 | 20.0 | 20.0 | 20.0 | |
| 3. Net domestic value added (1 - 2) | 132.5 | 155.5 | 77.1 | 105.4 | 113.4 | 110.4 | 107.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 105.4 | 110.4 | - |
| 3.1 Direct NDVA(1.1-2.1) | 122.5 | 135.5 | 67.1 | 85.4 | 83.4 | 80.4 | 77.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 75.4 | 90.4 | - |
| 3.2 Indirect NDVA(1.2-2.2) | (10.0 | (20.0 | 10.0 | 20.0 | 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 | 30.0 | 30.0 | 30.0 | 30.0 | - |
| 4. Repatriated payments (R) | - | 6.5 | 19.5 | 20.8 | 25.8 | 25.8 | 24.5 | 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 | - |
| 4.1 Direct repatriated payments (Table B.3, Row 4) | - | 6.5 | 19.5 | 20.8 | 20.8 | 20.8 | 19.5 | 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 | |
| 4.2 Indirect repatriated payments - computed | - | - | - | - | 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 | 5.0 | 5.0 | 5.0 | - |
| 5. Net national value added (3 - 4) | 132.5 | 162.0 | 57.6 | 84.6 | 87.6 | 84.6 | 82.9 | 80.9 | 82.2 | 82.2 | 82.2 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 87.4 | 84.6 | - |
| 5.1 Direct NDVA(3.1-4.1) | 122.5 | 142.0 | 47.6 | 64.5 | 62.6 | 59.6 | 57.9 | 55.9 | 57.2 | 57.2 | 57.2 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 69.6 | - |
| 5.1.1 Direct wages ($W_d$) Table B.3, Row 5.1) | - | - | 6.1 | 8.1 | 8.1 | 8.1 | 9.4 | 9.4 | 10.7 | 10.7 | 10.7 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | - |
| 5.2 Indirect NDVA(3.2-4.2) | (10.0 | (20.0 | 10.0 | 20.0 | 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 | 25.0 | 25.0 | 25.0 | - |
| 5.2.1 Indirect wages ($W_i$) computed | - | - | 2.0 | 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 | 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 | 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 NDVA (5 x 6) | 132.5 | 149.0 | 48.4 | 65.1 | 62.1 | 55.0 | 49.7 | 44.5 | 41.1 | 37.8 | 34.5 | 34.0 | 31.5 | 28.9 | 26.2 | 23.6 | 21.9 | 20.2 | 18.3 | 16.7 | 17.0 | 395.0 |
| 7.1 Discounted direct NDVA (5.1 x 6) | 122.5 | 130.6 | 40.0 | 49.7 | 44.4 | 38.7 | 34.7 | 30.7 | 28.6 | 26.3 | 24.0 | 24.3 | 22.5 | 20.6 | 18.7 | 16.8 | 15.6 | 14.4 | 13.1 | 11.9 | 12.5 | 234.4 |
| 7.1.1 Discounted direct wages (5.1.1 x 6) | - | - | 5.1 | 6.2 | 5.8 | 5.3 | 5.6 | 5.2 | 5.3 | 4.9 | 4.5 | 4.7 | 4.3 | 4.0 | 3.6 | 3.2 | 3.0 | 2.8 | 2.5 | 2.3 | 2.2 | 80.5 |
| 7.2 Discounted indirect NDVA (5.2 x 6) | (10.0 | (18.4 | 8.4 | 15.4 | 17.7 | 16.3 | 15.0 | 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 |
| 7.2.1 Discounted indirect wages (5.2.1 x 6) | - | - | 1.7 | 3.8 | 3.6 | 3.3 | 3.0 | 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 |

1/ All foreign components, as in preceding tables, 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 necessary, in compliance with the Pricing Rules.

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 being broaden by <u>including the indirect effects</u> of the project under consideration, the above conclusion is being confirmed and amplified. The expected present worth of the total value added (direct plus indirect) goes as high as 395,000 dinars (Table B.7, Row 7). The expected present value of the direct and indirect wages is 119,100 dinars (Table 7, Rows 7.1.1 and 7.2.1). It follows that

$$E = \sum_{j=1}^{m} \sum_{t=o}^{n} (VA)_{j,t}\, a_t \geq \sum_{j=1}^{m} \sum_{t=o}^{n} (W)_{j,t}\, a_t$$

or $$395{,}000 \geq 119{,}100$$

or 275,900 dinars of social surplus

Therefore, the total (direct plus irdirect) value added expected to be generated by the proposed project covers the expected wages and provides a social surplus of 275,900 dinars. With all the uncertainties for the future which may affect the project, one may be more confident that, although the expected social surplus may not be exactly achieved for unforeseen reasons, there is a large margin of safety. Most likely the project will still be sound under more difficult economic conditions (higher prices for inputs or lower prices for output, lower capacity utilisation, etc.). More precise information on that could be obtained only after the application of sensitivity and probability analysis. On these grounds the project could be <u>recommended</u> to the decision-maker for acceptance.

## 4. <u>Additional Indices</u>

Additional indices in project evaluation reflect the fulfilling of development objectives <u>other than</u> those encountered by the basic

criterion and therefore require the appraisal of the project's contribution to the said objective(s).

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

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

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

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

### 4.1 Employment effect

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

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

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

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

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

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

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

**Step 1:** Calculate the number of unskilled and skilled workers employed directly in the project in a normal year (Ref. 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 neglected, except in cases of large projects;

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

These can be illustrated as follows:

Table B.8 Total New Employment Opportunities

| Effect / Location of effect | Number of workers employed: Unskilled workers ($W_u$) | Skilled workers ($W_s$) | Total ($W_T$) | Capital invested (000 dinars) (I) |
|---|---|---|---|---|
| 1. Within a project | 50 | 150 | 200 | 200 |
| 2. Input supplying projects | 20 | 30 | 50 | 30 |
| 3. Output using projects | 10 | 40 | 50 | 40 |
| Total | 80 | 220 | 300 | 270 |

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

Further, all foreign personnel should be subtracted from the number of workers to whom the employment opportunities are going to be opened. Finally, the total amount of capital invested is derived by adding up the nominal values of investments in different years, i.e. without discounting.

Table B.8 gives the elements to determine the employment effect of a project. Three different indicators may be computed for this purpose:

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

(b) $$Z_e^T = \frac{W_T}{I} \qquad (B.29)$$

showing the number of new job opportunities created by a unit of investment, both within the project and in the linked projects, if possible. A unit of investment could be 100,000, 1,000,000 dinars or any other convenient figure;

(c) $$Z_e^u = \frac{W_u}{I} \qquad (B.30)$$

giving the number of new job opportunities for unskilled workers created by a unit of investment

where:

$Z_e^T$ = Total employment effect (for skilled and unskilled labour) per unit of investment;

$Z_e^u$ = Employment effect for unskilled labour only per unit of investment.

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

It might be of some interest also to compute the employment/capital ratios only for the project under consideration, for input supplying project, and for output using projects if reliable information is available.

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

Table B.8 contains data on new employment opportunities for skilled and unskilled workers, broken down into three groups: within a project, in input supplying projects and in output using projects:

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

$$Z_e^T = \frac{W^T}{I^T} \qquad (B.31)$$

where: $Z_e^T$ = total employment effect;

$W^T$ = total number of new job opportunities (direct and indirect);

$I^T$ = total investment (direct and indirect);

thus:

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

Ten thousand dinars of total investment (direct and indirect) create 11 new job opportunities.

(b) Direct employment effect:

$$Z_e^d = \frac{W^d}{I^d} \qquad (B.32)$$

where: $Z_e^d$ = direct employment effect;

$W^d$ = new job opportunities only in the project considered;

$I^d$ = direct investment;

thus:

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

Ten thousand dinars of direct investment create 10 direct new job opportunities.

(c) Indirect employment effect:

$$Z_e^i = \frac{W^i}{I^i} \qquad (B.33)$$

where: $Z_e^i$ = indirect employment effect;

$W^i$ = new job opportunities in related projects;

$I^i$ = indirect investment;

thus:

$$Z_e^i = \frac{W^i}{I^i} = \frac{100}{70,000} = 0.0043$$

Ten thousand dinars of indirect investment create 43 indirect new job opportunities.

4.2 Distribution effect[1/]

The execution of industrial projects can affect the distribution of value added in two ways. First, it can be distributed differently

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1/ 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.

among the social groups, in which case a group distribution effect is relevant. Second, the value added may be allocated differently among the regions in a country, and one speaks of the regional distribution effect.

It may be pointed out that distribution objectives could be achieved mainly through 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 desired distribution effect or at least to soften social inequalities. In addition to this, 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 four steps:

Step 1: Identifying the target social groups or regions

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

Very important is the analysis of the distribution of the value added among the different production agents - wage earners, profit

earners and the government. The pattern of distribution of the value added is of not only economic but also of great social significance. It is economically significant because two projects with the same value added will be appraised differently in accordance with the share of wages from one side and the social 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, having different social and economic implications. Due to the difficulties which governments in developing countries often face in establishing an efficient tax system to generate revenues, income in the hands of the government may be more desirable than income in the hands of the profit earners.

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

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

The analysis of the distribution effects of an investment project in a developing country has another very important aspect too, namely the distribution of the expected net domestic value added between net national value added and repatriations. The very fact that the Manual advocates net national value added clearly indicates the importance placed on this crucial aspect of the distribution of the benefits generated by an investment project. It is undoubtedly important to find out how much of the value added remains and will be used within the boundaries of a country for the benefit of a nation and how much will be repatriated abroad and used for someone else's benefit.

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

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

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

The 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 the immigrants from other regions. In case the project reduces the number of workers employed elsewhere in the region, only the net increase of wages should be accounted for. Often foreign (normally only skilled) labour is employed by a new project, and only the part of wages and salaries spent in the region concerned should be included in the net distribution benefits. A similar case may be with profits and interest, part of which may leave the region.

Fringe benefits usually take the form of welfare facilities, such as housing, education, health or recreation institutions.

The net distribution benefits to a social group or to a region have to 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 B.9 presents a framework of tracing the net distribution benefits in the case of a social group distribution effect.

The items in Table B.9 could easily be broken down into low income and high income groups to get another aspect of the social groups distribution effect.

In case one wants to trace the regional distribution effect, Table B.10 may be used as a suggested format to supply the necessary data.

It has to be pointed out that the items in Table B.10 represent only a model breakdown of the net distribution benefits. Other breakdowns may be used as well, depending on the circumstances of each case.

Table B.11 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 B.9 Net Distribution Benefits for Social Groups

(in 000 dinars)

| Items | Normal year 1/ |
|---|---|
| 1. Wage earners (VA)$^{W}$ | 11 |
| 1.1 Wages (Table B.3, Row 5.1) 2/ | 9 |
| 1.2 Fringe benefits (computed) | 2 |
| 2. Domestic profit earners (VA)$^{P}$ | 5 |
| 2.1 Net profits - dividends to domestic shareholders (Table 8, Row 7.3) | 2 |
| 2.2 Interest on domestic private capital (Table 8, Row 7.2) | .. |
| 2.3 Rent received by domestic private owners (computed) | - |
| 2.4 Fringe benefits (computed) | 1 |
| 3. Government (VA)$^{g}$ | 2 |
| 3.1 Taxes paid to the treasury (Table 8, Row 4.1) | 8 |
| 3.2 Interest on loans from public banks (Table 8, Row 7.2) | 5 |
| 3.3 Profits - dividends to state-owned shares (Table 8, Row 7.3) | - |
| 3.4 Rent and insurance charges received by the state (computed) | 2 |
| 4. Undistributed (VA)$^{u}$ | 1 |
| 5. Net national value added of the project (VA) (Table 9, Row 5) | 17 |
| | 41 |

1/ Year 5 was selected as a normal year.

2/ Which means repatriated wages are excluded.

Table B.10 Net Distribution Benefits for a Region of a Country

(in 000 dinars)

| Items | Normal year 1/ |
|---|---|
| 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, recreation facilities, kindergardens, schools, transport network, etc.) | 5 |
| 6. Total regional benefits (VA)$^{r}$ | 15 |

Table B.11 Distribution of the Net Domestic Value Added

(in 000 dinars)

| Items | Normal year 1/ | | |
|---|---|---|---|
| | Used in a country | Repatriated | Total |
| 1. Wages (Table 9, Row 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 B.9, Rows 2.3 and 3.4) | 2 | - | 2 |
| 6. Fringe benefits (Table B.9, Rows 1.2 and 2.4) | 4 | - | 4 |
| 7. Undistributed profit (Table B.9, Row 4) | 17 | - | 17 |
| Total | 41 2/ | 16 3/ | 57 4/ |

1/ Year 5 was selected as a normal year.

2/ The figure 41 equals net national value added (Table 9, R w 5).

3/ The figure 16 equals repatriated payments (Table 9, Row 4).

4/ The figure 57 equals net domestic value added (Table 9, Row 3).

Step 3: Computing the distribution index

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

$$DB^W = \frac{VA^W}{VA} \qquad (B.34)$$

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.

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

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

Table B.9 provides the necessary data for computation of the distribution indexes by social groups in a hypothetical project:

(a) Distribution index of the wage earners:

$$DB^W = \frac{VA^W}{VA} = \frac{11,000}{41,000} \times 100 = 26.83\%$$

The wage earners are expected to receive 26.83 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:

$$DB^P = \frac{VA^P}{VA} = \frac{5,000}{41,000} \times 100 = 12.19\%$$

The domestic profit earners are expected to receive 12 19 per cent of the value added generated by the project as dividends, rents and fringe benefits. The repatriated portions of dividends, interest, rents are not accounted for here since the analysis is based on the net national value added only.

(c) Distribution index of the government:

$$DB^G = \frac{VA^G}{VA} = \frac{8,000}{41,000} \times 100 = 19.54\%$$

The government is expected to receive 19.54 per cent of the value added generated by the project as taxes, dividends to state-owned share, insurance charges, rents.

(d) Undistributed value added:

$$\text{Undistributed} = \frac{VA^U}{VA} = \frac{17,000}{41,000} \times 100 = 41.46\%$$

A considerable portion of the value added (41.46 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 utilisation 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 from the implementation of the project are expected to be the wage earners and the government. They

will capture directly 46.37 per cent of the value added and will derive also the bulk of the benefits through the utilization of the undistributed value added.

Table B.10 provides the data for computation of the regional distribution index:

$$DB^r = \frac{VA^r}{VA} = \frac{15,000}{41,000} \times 100 = 36.58\%$$

The region where the project will be located is expected to be the main beneficiary. It will capture 36.58 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 often 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 to either 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 B.11 could be conveniently used to derive the shares of the repatriated payments (R) and the net national value added (NNVA) within the net domestic value added (NDVA):

$$\frac{R}{NDVA} = \frac{16,000}{57,000} \times 100 = 28.07\%$$

$$\frac{NNVA}{NDVA} = \frac{41,000}{57,000} \times 100 = 71.93\%$$

Therefore, a considerable portion (28.07 per cent) of the net domestic value added generated by the project will be repatriated abroad and will respectively 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

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

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

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

The analysis of the foreign exchange effect of an investment project is important not only to countries facing a shortage of foreign exchange. It is equally essential for others which are presently enjoying a surplus balance of payments. The establishment of sophisticated industrial projects adds considerably to the import requirements in multifarious directions: raw materials, components, replacements, machinery, purchase of know-how, technicians, royalty payments, repatriation of profits and on many other accounts. A project may help the country in manufacturing an important item or

provide a substitute for an imported commodity, but at the same time it may add new items to the import schedule and impose many payment/repatriation obligations. It is, therefore, useful to make a comprehensive analysis of the effects of an investment project on the balance of payments of any country

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

- The forces shaping the future balance of payments, such as unusually high or low prices for key exports and/or imports, large capital movements in terms of loans and/or foreign aid, temporary profitable exports and others;
- The trends in basic demand for imports and the supply of exports;
- The eventual changes of policy related to the import restrictions;
- Strategic significance of a product;
- 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, first of all for each year of its construction and operation and, secondly, for its total economic life. The effects for each year will be important for the annual Balance of Payments Statement of the country and the sum total of the annual effects will depict the impact of a project on the overall foreign exchange position of the country for the lifespan of the project. For this purpose it is important to compile a statement of all the inflows and outflows of foreign exchange of a project. Table B.12 offers a standard format containing the specimen of essential items for calculation of the foreign exchange inflows and outflows of an investment project. This table offers a format for a liquidity analysis of the project in terms of foreign exchange.

Table B.12 Foreign Exchange Flows of a Project

(in foreign exchange)

| Items | Years | | | | |
|---|---|---|---|---|---|
| | $t_o$ | $t_1$ | $t_2$ | .... | $t_n$ |
| I. FOREIGN EXCHANGE INFLOWS (FI) | | | | | |
| A. Direct Inflows | | | | | |
| 1. Foreign equity capital | | | | | |
| 2. Loans in cash | | | | | |
| 3. Foreign aid or grant | | | | | |
| 4. Goods or equipment on credit or deferred payment | | | | | |
| 5. Exports of goods or services | | | | | |
| 6. Others | | | | | |
| B. Indirect Inflows (for linked projects) | | | | | |
| 7. 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 Outflows | | | | | |
| 12. Survey, technical consultancy, engineering fees | | | | | |
| 13. Import of capital goods, equipment, machinery, replacements, etc. | | | | | |
| 14. Import of raw materials, components, parts and semi-finished goods | | | | | |
| 15. Imported goods purchased from domestic market | | | | | |
| 16. Construction and installation charges | | | | | |
| 17. Direct charges on imports of raw materials, intermediates, replacements, etc. (payable in foreign currency) | | | | | |
| 18. Salaries payable in foreign exchange | | | | | |
| 19. Repayment of foreign borrowing | | | | | |
| 20. Royalty, know-how and patent rights | | | | | |
| 21. Repatriation of profits and capital | | | | | |
| 22. Others | | | | | |
| B. Indirect Outflows (for linked projects) | | | | | |
| 23. Import of capital goods, equipment, machinery, etc. | | | | | |
| 24. Import of raw materials, intermediates, replacement, etc. | | | | | |
| 25. Imported goods purchased on domestic market | | | | | |
| 26. Others | | | | | |
| III. NET FOREIGN EXCHANGE FLOW (I - II) (positive +; negative -) | $FE_{t_o}$ | $FE_{t_1}$ | $FE_{t_2}$ | ... | $FE_{t_n}$ |

It can be seen from Table B.12 that the foreign exchange inflows and outflows include both direct and indirect flows, taking into account not only the flows directly connected with the project but also those in the linked projects. The presence of items related to foreign borrowing and aid in Table B.12 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 $t^{th}$ year, while the negative sign represents the amount by which the country's foreign exchange availability is reduced by this project.

It should be possible to compile the above table from the data contained in the feasibility study or compiled earlier for ascertaining the commercial and national profitability of the project. Only the indirect inflows and outflows are new items required for this analysis and will have to be compiled if possible and if worth the effort.

In actual practice, there may be many events during the economic life of the project which may substantially affect its foreign exchange inflows and outflows. Bilateral or multilateral trade agreements, devaluation or re-evaluation of currencies, interplay of some abnormal forces of supply and demand of certain important items in particular years either on the domestic or international markets, changes in the import and export policies of the country, inflation and many other factors may have perceptible influence on the foreign exchange inflows and outflows of the project in question. If there are any such known factors with a certain degree of certainty, they would be reflected in the Feasibility Study, or in data compiled for earlier evaluation exercises. Since these very figures are being used for ascertaining the effects of the project on the balance of payment position of the country, these factors will be covered appropriately. It will be hazardous and inconsistent to introduce any new elements at this stage

of evaluation. All such factors which have not been considered thus far should be left to be covered in the Sensitivity and Probability Analysis.

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

$$P(FE) = \sum_{t=o}^{n} (FI - FO)_t \, a_t \qquad (B.35)$$

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

$FI_t$ = foreign exchange inflow of a project in the $t^{th}$ year;

$FO_t$ = foreign exchange outflow of a project in the $t^{th}$ year;

$a_t$ = 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 very significant figure. It measures the project's net contribution to, or usurpation of, the foreign exchange of the country over this period. Other things being equal, the project with the largest net foreign exchange flow will be considered for selection.

Step 2: Determine the impact of a set of projects on the national balance of payments

For the purposes 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 B.12 provides the foreign exchange flows for each year of the lifespan 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. This is presented in Table B.13.

The evaluation presented in Table B.13 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 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 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 due 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 CIF value of the quantity of previously imported (or would-be imported) items, which will now be produced by this project and supplied to the domestic market.

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

The net foreign exchange effect of a project includes the net foreign exchange flow computed under Step 1. and the import substitution effect computed under Step 3. above. This is shown in Table B.14

In the cases of commodities in large demand in the country, the analysis in Table B.14 may even convert a negative foreign exchange flow of a project during its whole economic life into a positive figure of Net Foreign Exchange Effects. This would be indicative of the import substitution effect of the project.

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

Table B.13 Impact of a Set of Projects on the Balance of Payments (in foreign exchange)

| Net foreign exchange flows | Years $t_o$ | $t_1$ | ..... | $t_n$ |
|---|---|---|---|---|
| Project 1 - $FE_1$<br>Project 2 - $FE_2$<br>.<br>.<br>Project M - $FE_m$ | | | | |
| Net balance of payments effects of a set of projects | $\sum_{i=1}^{m} FE_i^{t_o}$ | $\sum_{i=1}^{m} FE_i^{t_1}$ | ..... | $\sum_{i=1}^{m} FE_i^{t_n}$ |
| Balance of payments surplus (deficit) prior to the implementation of a set of projects | $S_o$ | $S_1$ | ..... | $S_n$ |
| Expected residual (surplus or deficit) in the balance of payments after implementation of the set of projects | $S_o + \sum_{i=1}^{m} FE_i^{t_o}$ | $S_1 + \sum_{i=1}^{m} FE_i^{t_1}$ | ..... | $S_n + \sum_{i=1}^{m} FE_i^{t_n}$ |

Table B.14 Net Foreign Exchange Effect of a Project

(in foreign exchange)

| Items | Years | | | | |
|---|---|---|---|---|---|
| | $t_o$ | $t_1$ | $t_2$ | ..... | $t_n$ |
| 1. Net foreign exchange flow (Row III, Table B.12) | | | | | |
| 2. Import substitution effect | | | | | |
| Total net foreign exchange effect (positive +; negative -) | | | | | |

Table B.15 provides the data for estimation of the net foreign exchange effect. It has been compiled on the basis of the model tables B.12 and B.14 above. All elements are expressed in US dollars.

Table B.15 reflects the direct net foreign exchange effect only because the evaluators failed to obtain reliable data on the indirect foreign exchange effect to be incorporated in this table. They only found that there is definitely a positive indirect net foreign exchange effect, but the inconsistency of the data did not permit an appropriate measurement of this effect. Therefore, it is safer to proceed with the analysis on the direct foreign exchange effects alone being aware that the indirect effects will add only 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. The whole lifespan of the project is, of course, more indicative.

The analysis confirms that the annual nominal net foreign exchange flow (Table B.15, Row 3) is negative between the years 2 and 10 inclusively. The annual foreign exchange outflows for these years exceed the annual foreign exchange inflows. This is due to the import of current material inputs, repayment of the foreign loan (principal and interest) and repatriation of wages and dividends. However, due to

Table B.1) **Elements for Estimation of the Net Foreign Exchange Effect**[1]

(in 000 dollars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| 1. Foreign exchange inflow (FI) | 10.0 | 22.0 | 1.0 | 2.0 | 4.0 | 4.0 | 5.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | - |
| 1.1 Foreign equity capital (Table 6, Row 2.1.2) | 8.0 | 12.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.2 Equipment on foreign credit (Table 6, Row 2.2.2) | 2.0 | 10.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.3 Exports (Table 9, Row 1.1) | - | - | 1.0 | 2.0 | 4.0 | 4.0 | 5.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | - |
| 2. Foreign exchange outflow (FO) | - | 1.0 | 4.6 | 7.6 | 7.6 | 7.6 | 7.4 | 7.4 | 7.2 | 7.2 | 7.2 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 5.6 | - |
| 2.1 Royalties (Table 9, Row 4.4) | - | 1.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2.2 Imported materials (Table 9, Row 7.2.1) | - | - | 1.6 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | - |
| 2.3 Repayment of the foreign loan (Table 8, Row 7.1) | - | - | - | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | - | - |
| 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 (NE) (1 - 2) | 10.0 | 21.0 | (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) | 10.0 | 21.0 | 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 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 | - |
| 7. Discounted net foreign exchange flow (3 x 6) | 10.0 | 19.3 | (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 | 17.3 |
| 8. Discounted net foreign exchange effect (5 x 6) | 10.0 | 19.3 | 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 | 122.4 |

1/ The computation of the net foreign exchange effect expressed in dollars has been made on the basis of the official rate of foreign exchange $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.

foreign equity capital and the equipment on credit obtained during the construction period, and the positive annual net foreign exchange flows from year 11 onward, the overall discounted net foreign exchange flow is US $17,300 (Table B.15, Row 7).

The situation changes considerably when the foreign exchange saved due to import substitution (Table B.15, Row 4) is taken into consideration. In this case the net foreign exchange effect (Table B.15, Row 5) is positive throughout the project's life. By discounting the annual net foreign exchange effects at the selected social rate of discount 9 per cent, one arrives at the present value of the net foreign exchange effect amounting to US $122,400 (Table B.15, 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 is still a surplus which in terms of present value amounts to US $122,400.

### 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 as such have a chance of being exported. This assessment is of particular importance also for projects the economic scale of production of which is larger than what can be absorbed in the domestic market.

For finding the international competitiveness for the products of any project, it is necessary to compare the input of domestic resources for the production of the exported items with the benefit (the net foreign exchange earnings) that one will get from exports.

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

Step 1: As indicated under Price Adjustments, the actual present or expected export prices (FOB) have to be taken as a starting point. These are the actual prices at which certain commodities produced by the project will be exported. If the

project produces only several products, this analysis should be done for each product separately and then for the project as a whole. By multiplying the quantities to be exported by the expected FOB prices, the gross foreign exchange earnings are attained or, in other words, the expected output in export prices (FOB). The FOB price is converted into local currency at the adjusted rate of foreign exchange. Add to the expected output in export prices the foreign equity capital 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 inputs should be computed. In the Pricing Rule Table the actual CIF price is to be provided for the imported inputs used in the production of the goods to be exported. One can find the per unit foreign component of the inputs for each product separately or, if this is not possible, for a group of products. The CIF price is converted into local currency at the 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 B.12 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 so 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 have to be computed next, i.e. domestically procured investment, current material inputs, infrastructural services, domestic wages. In the Pricing Rule Table the prices of all inputs are adjusted to obtain an approximation of their real costs to the country. These represent the real value of domestic inputs. Multiply the nominal annual values of domestic resource inputs thus computed by the respectivs 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 under Step 3:

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

with the present value of the domestic resource inputs as obtained under Step 4:

$$\sum_{t=0}^{n} DR_t \, a_t$$

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:

$$IC = \frac{\sum_{t=0}^{n} (FI - FO)_t \, a_t}{\sum_{t=0}^{n} DR_t \, a_t} \geq 1 \qquad (B.36)$$

where: IC = international competitiveness indicator;

$FI_t$ = 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 resources 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;

$a_t$ = discounting 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 grinful to export the product(s) irrespective of prices expressed in monetary terms based on controlled rates of foreign exchange. In fact, the difference between the FOB/CIF prices calculated at the adjusted and official rates of foreign exchange determines the maximum amount of subsidy that the government can offer for exports or impose taxes on imports without leading to any unrewarded transfer of resources from the country.

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

Step 6: Compare the result obtained above with the <u>cut-off criterion</u> 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 be improved if possible. If a reliable cut-off rate is not existent in a country, this step of the analysis is <u>omitted</u>.

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

The cut-off criterion for international competitiveness expresses in numerical terms the minimum acceptable level of international competitiveness. In principle, it is set at a level ensuring at least a recovery of the domestic real social costs, namely 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. Very often, however, as a result of the severe conditions on the international market as compared to the national productivity in a developing country, and as an encouragement to exports under very difficult foreign exchange situations, the competent agency may establish a cut-off rate less than one. In doing so the government offers incentives over and above what is determined on the basis of real social costs and benefits. In other cases, as a result of the dominant position of a country on the international market of certain commodities, the cut-off rate may be established above one. These are cases to meet extraordinary situations and much depends on evaluation of the overall current and future economic situations.

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

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

Tables B.16 and B.17 provide an illustration of the practical application of the approach for calculating the international competitiveness suggested above.

Table B.16 Net Foreign Exchange Earnings[1]
(for calculation of international competitiveness)
(in 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| Share of exports in total output(%) | - | - | 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) | 21.5 | 47.2 | 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 B.15, Row 1.1) | 17.2 | 25.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.2 Equipment on credit (Table B.15, Row 1.2) | 4.3 | 21.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.3 Exports (Table B.15, 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) | - | 2.1 | 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 B.15, Row 2.1) | - | 2.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2.2 Imported materials (Table B.15, 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 B.15, Row 2.3) | - | - | - | 1.4 | 2.9 | 2.9 | 3.6 | 4.3 | 4.3 | 4.3 | 4.3 | - | - | - | - | - | - | - | - | - | - | - |
| 2.4 Repatriated wages (Table B.15, 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 B.15, 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 B.15, 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) | 21.5 | 45.1 | 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 % | 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) | 21.5 | 41.5 | 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 | 227.6 |

1/ Foreign exchange inflows and outflows are computed on the basis of Table B.15, but only for the exported portion of the output, which varies from 8 per cent in year 2 to 33 per cent in most of the years. They are converted in dinars at the adjusted rate of exchange $1 = 6.5 dinars and then discounted at the social rate of discount, i.e. 9 per cent.

Table 3.17 [redacted] a/
(For calculation of international competitiveness)
(In 000 dinars)

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21-on |
| Share of exports in total output(%) | - | - | 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. Investments domestically procured (Table 9, Row 2.1.2) | 8.3 | 8.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 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 | - |
| 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 | - |
| 5. Domestic resource inputs (1 + 2 + 3 + 4) | 8.3 | 8.3 | 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 9 per cent | 1.00 | 0.92 | 0.84 | 0.77 | 0.71 | 0.65 | 0.60 | 0.55 | 0.50 | 0.46 | 0.42 | 0.39 | 0.35 | 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 | 7.6 | 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 | 120.4 |

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 case of the future.

Foreign exchange inflows and outflows have already been computed in dollars in Table B.15, but there they were stated for the total annual production. Since the international competitiveness is analysed only for exports, one has to account for the foreign exchange inflows and outflows related only to the quantity of exported output. 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 B.16, 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. $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 $8,000 (Table B.15, Row 1.1). Thirty-three per cent of it should be accounted for in this part of the output, which goes for export, namely $2,640. This figure is then multiplied by the adjusted rate of foreign exchange, i.e. $1 = 6.5 dinars, to arrive at this portion of the foreign equity capital expressed in local currency:

$2,640 x 6.5 = 17,200 dinars (Table B.16, Row 1.1).

Table B.17 "Domestic Resource Inputs" is compiled basically from Table 9, but there these inputs were stated for the total annual production. In this case one has to account only for that part of domestic resource inputs related to exported output. 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 export is 227,600 dinars (Table B.16, Row 5). The present value of domestic

resource inputs needed to produce the output going for export is 120,400 dinars (Table B.17, Row 7).

After introducing the above figures in the expression for international competitiveness, one obtains:

$$IC = \frac{\sum_{t=o}^{n} (FI - FO)_t \, a_t}{\sum_{t=o}^{n} DC_t \, a_t} = \frac{227,600}{120,400} = 1.89$$

A unit of domestic resource inputs occuring in the hypothetical project is expected to generate 1.89 units of net foreign exchange in terms of present value. Therefore, in addition to the recovery of domestic resources used in the project, there will be a considerable surplus of foreign exchange over and above the domestic resource inputs.

## 5. Supplementary Considerations

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

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

### 5.1 Infrastructural implications

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

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

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

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

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

Greater difficulty, however, arises in cases where the costs or benefits cannot be so directly estimated, e.g. the roads have to be widened, the capacities of schools and hospitals have to be increased, the size of post offices, banks, etc , has to be increased. In such cases, the whole problem of allocating the infrastructural costs to various projects should be viewed within the context of a development programme or an industrial complex composed of a given or envisaged number of projects. In such cases the total investment costs of general or regional infrastructure should not be charged to the first implemented project (the subsequent ones being charged only the variable costs). This is obviously not justified, and one project should not be burdened at the beginning stage of the development programme with the total additional investment costs of infrastructure. It should be only a reasonable proportion of the infrastructural investment costs, based on the infrastructural services to be utilized by the project under consideration.

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

5.2 Technical know-how implications

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

The fact is that the project's contribution to raising the industrial status and improving skills in a country is impossible to measure, but this imposes the need to account for this impact at

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

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

5.3 Environmental implications

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

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

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

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

location of a plant to be built may have to be reconsidered or additional infrastructure investment may be necessary to avoid the hazards.

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

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

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

The first step in estimating the environmental implications is to identify and classify them into positive and negative ones. As already mentioned, the socio-cultural implications are hard to identify and impossible to measure. The natural environmental effects offer

better chances of assessment. Determination of all possible sources of the natural environmental deterioration is basically of a technical nature, as well as designing the possible solutions to these problems, but the solutions to be implemented are selected and evaluated in financial terms. Technologically, the problems of natural environmental deterioration can be solved relatively easily. What matters is the fact whether the social benefits of avoided environmental losses are significant enough to justify the costs accrued to prevent them.

The appraisal of environmental implications thus turns out to be a matter not of a technical, but of economic and social concern which is rather often overlooked If environmental safeguards are inevitable, the least-costs solutions have to be found and their impact on both the commercial and national profitability of a project has to be determined. If these safeguards turn out to be too costly relative to investment, it may be worthwhile to calculate commercial and/or national profitability indicators with and without the cost elements related to the environmental implications. In some instances, it may well be that a project is commercially sound without such additional costs, but only marginally if the investor has no other choice than to accept them. The question then arises whether the project can be redesigned or relocated in order to make the ecology less sensitive to the project concerned. If these alternatives are not feasible, government grants or subsidies may be sought, provided that a project is socially profitable under these conditions.

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

## 6. National Parameters

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

The national parameters are variables set up outside of a project and are given by a national planning institution, reflecting an attempt towards better allocation of resources from the point of view of the society. Subject to the prevailing conditions in a developing country, a set of national parameters could be used. As stated in Part I under 3.7, this Manual recommends the utilisation 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 in value terms of the weight the society assigns to future benefits and costs, or in other words, the rate at which the society's weight on future benefits and costs declines over time. The need for such an estimate arises for the compilation of the present value of the social costs and benefits of a project spread over a long span of time. The social rate of discount provides the link between costs and benefits occuring in different time periods. The social rate of discount should, in principle, be uniform for the country.

The essential economic role of the social rate of discount is to help allocate public investment funds to their socially most desirable uses. If the SRD is set too low, demand for public investment resources will exceed supply, since too many projects will have a positive present value added. If it is set too high, too few projects will pass the

absolute efficiency test of a positive present value added and there will be an excess supply of public investment funds. In principle, the SRD should be so chosen that the demand for public investment resources will more or less exhaust the available supply. The selection of a social rate of discount for the purposes of project evaluation is a very 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 social discount 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 can be the following:

Step 1: The interest rate at which a country can actually lend, invest or borrow capital from a relevant international capital market should be taken as an objective basis and reference point for the estimation of the social rate of discount to be used in the evaluation of investment projects. Out of 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. Within each maturity 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, interest rates on the Eurodollar capital market, etc. There might be different interest rates on long-term loans to different countries, subject to whether they have a history of nationalisations, 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 step down on 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. There may be a situation where a country can be regarded as a capital lender and another situation in which the country is a capital borrower:

(a) When a country is a capital lender, it should be taken into account that investment in domestic projects has various advantages, particularly from a long-term development p int of view over investments abroad. On the one hand, there are national economic and political considerations; on the other, investments abroad are subject to various uncertainties as regards repayments, inflationary factors and 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 a promotion of such projects, since the social discount rate used in their evaluation is lower than the rate based on the relevant world capital market. This can be expressed in the following way:

$$SRD = r_w - p_d \times r_w \qquad (B.37)$$

where: SRD = social rate of discount;

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

$p_d$ = "premium" for domestic projects

"Premium" interest rate for domestic projects ($p_d$) can be estimated on the basis of experience and overall guessing for the 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 and/or the long-term forecasts as to world political situations are gloomy, the "premium" should be rather high. In such a case, the "premium" ($p_d$) could be near about 25 per cent of the relevant world capital market rate of interest:

$$SRD = r_w - 0.25\, r_w$$

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 <u>capital borrower</u>, the social rate of discount should be no less than the actual rate of interest on the capital market from which the capital is borrowed:

$$SRD \geq r_w \qquad (3.38)$$

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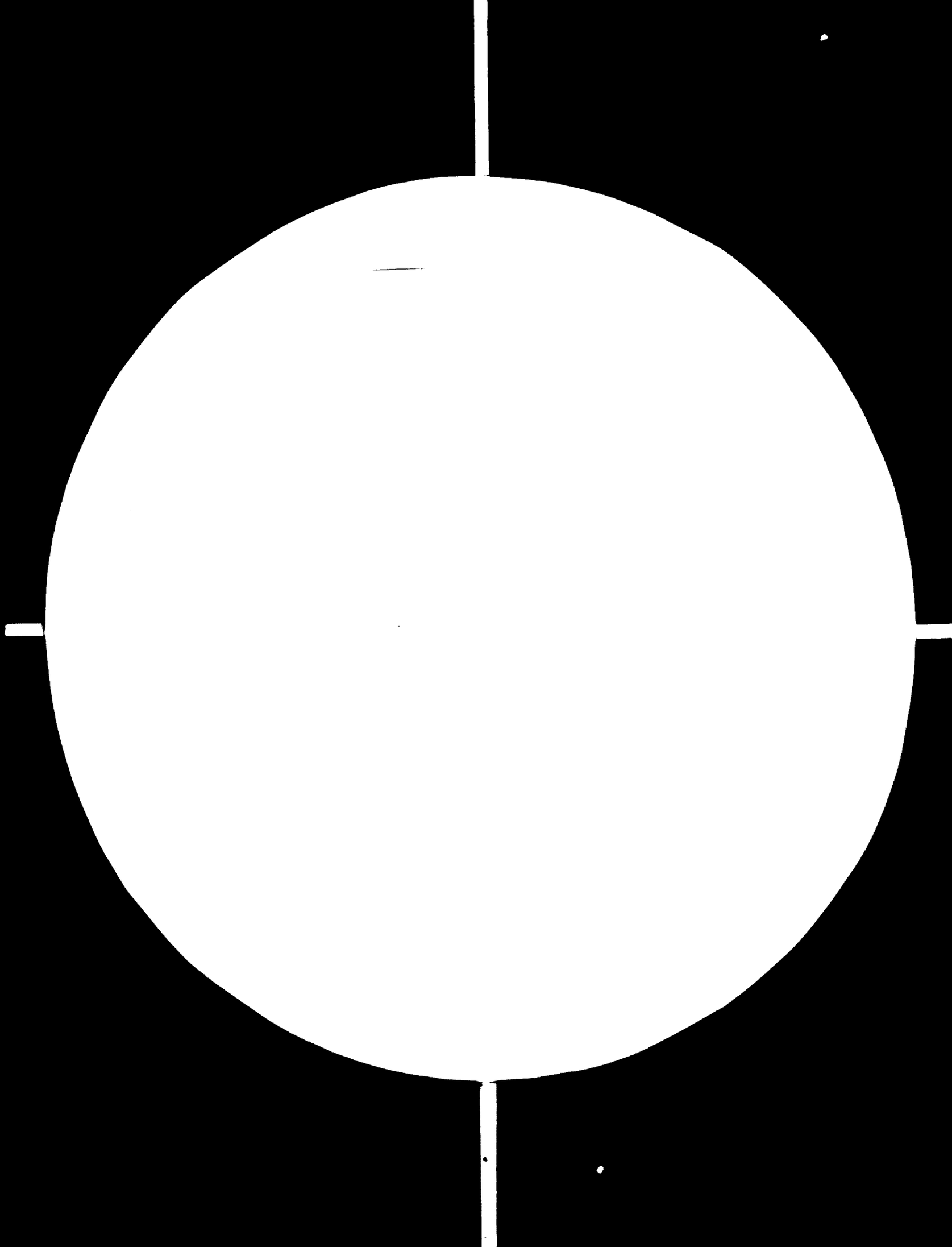
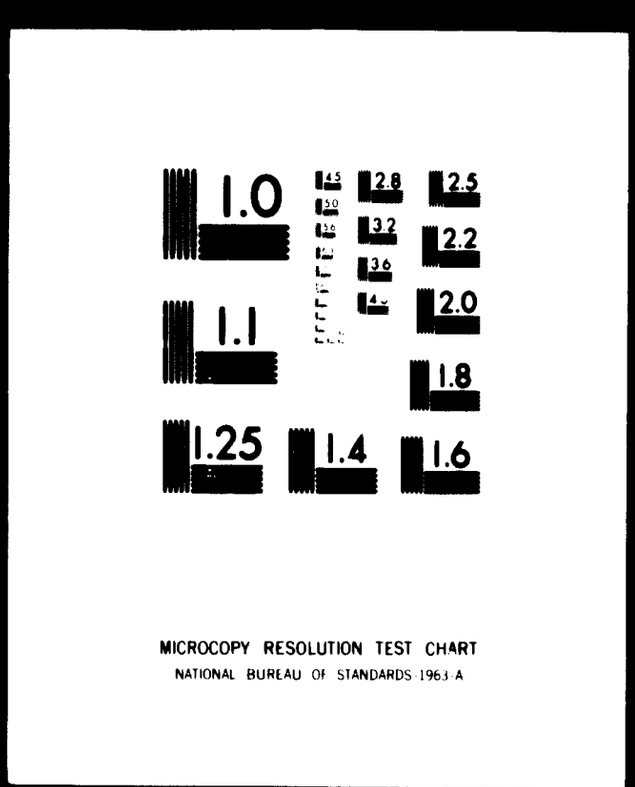




It ought to be <u>even higher</u> than $r_w$ if the country's absorptive capacity is higher than possibility to borrow capital from abroad. In such a situation establishing SRD on $r_w$ level would mean opening the door for less efficient projects.

There might be a country which is <u>not a clearly pronounced</u> either as a lender or a borrower from 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 puts an emphasis on 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 passed 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 <u>nation-wide uniform</u> social rate of discount is established and should generally be applied to all projects in a country and particularly to alternative projects. There are, however, two situations in which a <u>modification</u> in this SRD to achieve some objectives may be necessary. The first set of such circumstances relates to the need for speedy development of some basic/strategic industries. The second refers to the speedy development of backward regions of a country:

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

certain period of the industrialization process for certain industries. This means a differentiation in the rates of discount by industrial branches. A decision on this is to be taken by a national policy-making institution.

(b) Similarly, the second category of circumstances in which different rates of discount are suggested concern the speedy development of less-developed regions. The speeding up of their development may be justified on social, economic and political grounds, e.g. better income distribution, employment, politically sensitive areas, etc. Strict application of a uniform rate of discount may not allow the projects for these areas to pass the absolute efficiency test and therefore to promote the development of such backward regions. The rationale behind the suggested approach is that it is more expedient to lower the rate of discount instead of trying to estimate the project's impact on distributional policy objectives and/or additional expected future benefits. This means that a differentiation in the social rate of discount for backward regions of a country may be desirable. A decision on setting up regional social rates of discount is to be made again by 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:

$$r_i = SRD - p_i \qquad (B.39)$$

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 which leads to lowering the special SRD compared with the uniform one.

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

$$r_i = SRD + p_i \qquad (B.40)$$

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 social rates of discount 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 in a country.

The social rate of discount 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, inflation rates, etc. These periodic reviews should be consistent with the elaboration of the medium-term development plans or 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 higher than the possibility to borrow capital from abroad. The National Planning Agency was aware that under these circumstances the social rate of discount should be somewhat higher than the actual rate of interest on the capital market in order not to open the door for less efficient projects to pass the efficiency test easily. Taking all this into consideration, the

National Planning Agency established a uniform social rate of discount 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 national profitability section of the Manual.

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 under such circumstances, the foreign exchange components have to be valued at the adjusted rate of exchange in order to obtain an approximation to a more realistic picture about the social benefits and costs of a project.

Generally speaking, 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 the present position of balance of payments should be taken into account but consideration would need to be given to the expected changes as a result of the implementation of different development programmes and large projects, and the economic and fiscal policies which the country would follow.

By definition the 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 appropriate results of project evaluation. In doing so, he should act in

close co-ordination with the respective national agency - planning office, development bank, central statistical bureau, etc.

The acute lack of information and experience needed for a comprehensive estimate of adjusted rate of foreign exchange prevailing in developing countries compels the Manual to recommend at this stage only a very simplified approach for estimating the adjusted rate of foreign exchange within an acceptable range of approximation.

It is felt that under the prevailing data and other constraints in developing countries, only a simple approach is possible in practice. Two methods are therefore suggested: (a) deficit in the balance of payments ratio and (b) 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 as an approximation is based on the ratio of the deficit in the balance of payments to the receipts and is given by the following expression:

$$P^F = R^F \left(1 + \frac{M - B}{B}\right) \qquad (B.41)$$

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 projects 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 finding out 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 if the rate could be recalculated every year skipping the first and including the sixth year and so on into the calculations in order to get moving five-year average estimates.

The 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 - certain premiums should be added to it. The expression

$$\left(1 + \frac{M - B}{B}\right)$$

measures 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 B.18 provides data concerning the balance of payments situation in a hypothetical country for the last five years from 1973 to 1977. It is obvious from Table B.18 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

Table B.18 **A Hypothetical Balance of Payments 1973-1977**

(in million dinars)

| Years | Receipts | | | Payments | | | Surplus/deficit of payments over receipts (4 - 7) | Adjusted rate of exchange ($\frac{7}{4}$) |
|---|---|---|---|---|---|---|---|---|
| | 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 | - 660 | 1.35 |
| 1974 | 1,880 | 80 | 1,960 | 2,260 | 170 | 2,430 | - 470 | 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 | -3,070 | 1.30 |

exchange from the national 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:

$$P^F = R^F \left(1 + \frac{M - B}{B}\right) = 5 \left(1 + \frac{13,330 - 10,260}{10,260}\right)$$

$$= 5 \left(1 + \frac{3,070}{10,260}\right)$$

$$= 5((1 + 0.30)$$

$$= 5 \times 1.30$$

$$= 6.50$$

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

### 6.2.2 Tourist exchange rate

If, for any reason whatsoever, the above method is impossible to apply, the evaluator can take recourse to using the tourist exchange rate as the representative adjusted rate of exchange for evaluating investment projects.

The ratio between domestic and foreign currency expresses certain supply and demand for foreign exchange. The foreigners need domestic currency to buy some attractive domestic goods which are usually non-basic commodities. The nationals of a developing country need foreign exchange also to buy attractive foreign goods because they may not be available on the domestic market, or their quality is better, etc. These goods are usually non-basic commodities, too. The above factors along with the risk considerations, determine the black market rate of exchange. The main conclusion from this 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 very reason such a rate is not acceptable from the national point of view. This 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 and demand of foreign exchange, the official rate would be the right one; but usually this is not the case.

It follows from the above 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 exchange. This is the value of the national commodities exchanged against a unit of foreign currency. The theory suggests methods for their assessment, but unfortunately they are not operational. This forces us to go back and look for an acceptable approximation somewhere between the official and the black market rates of foreign exchange. The tourist rate of exchange is such an approximation.

The tourist rate of foreign exchange is usually determined by a competent national agency at a top decision-making level in order to perform a certain function - to attract foreign currency, which is valued by and needed in the country. If the originally established tourist rate did not properly perform its functions, it would 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 by other people for other purposes. 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 above presentation of the methods of commercial and national profitability analysis has been made under the assumption that one has a perfect knowledge of the future whenever information about the future is required for making an investment decision. Each decision as to volume of production, size of investment, operating costs, prices, discount rate, lifetime of the project, etc., was a logical outcome of an assumption about a known sequence of future developments. As a result, it was possible to recommend that a project be accepted, modified or rejected.

But in practice there is always uncertainty about the future. It will rarely, if ever, turn out that events occur exactly as forecast. The project evaluator and the decision-maker must be realistic. Usually, their knowledge of the future, and very often even of the present, is imperfect. Each decision taken now is a product of a set of assumptions concerning the future - political and social developments, technological developments, the behaviour of prices on 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 which involve some uncertainty. When the decision-maker assesses the desirability of a project, he - consciously or unconsciously - evaluates the element of uncertainty inherent in the project, converts this into known risks and decides whether the probability of these risks renders the project acceptable or not.

As stated above, the future is always uncertain. A good choice between projects cannot be made simply on the basis of net present value

or net national value added figures without also taking into account how uncertain these calculations are for the alternative projects.

Countries with a comprehensive national planning may reduce to a considerable extent the degree of uncertainty, but even there the uncertainty can never be completely eliminated.

Having made allowance for these uncertainties, especially those having a sizeable impact on the project's profitability, and for other factors outside the scope of economic analysis, project evaluators will have 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 which enters into the calculation of commercial or national profitability could be a source of uncertainty, even though uncertainty of some variables could have a greater impact than others. Some variables are usually common sources of uncertainty while evaluating investment projects. These variables are: size of investment, operating costs and sales revenue. Each of them is composed of a quantity and a price. In addition, since time is a key element in investment planning, the phasing of a project may prove to be critical to its evaluation. Uncertainties concerning discount rates may also be of crucial importance in project evaluation. A major task of the evaluator is to identify the key variables to which he should apply uncertainty analysis.

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

3. Causes of Uncertainty

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

- Inflation, where it is understood that prices of most items, be they inputs or outputs, do move up with time causing changes in relative prices. The exact magnitude of price increases will always be unknown. Prices may change up and down for other reasons, too.
- Changes in technology - both quantities and qualities of inputs and outputs used for project evaluation - are estimated according to the present state of knowledge, yet new teohnologies might come up in the future to alter these estimates.
- The rated capacity used in projeot evaluation may never be attained. This in turn will affeot operating costs as well as sales revenue.
- It often turns out that the needed investment for both fixed and working capital is underestimated and the construction and running-in periods are considerably longer than expeoted. This affects the size of investment, operating costs, sales revenue.

Some uncertainties are outside the oontrol of planners; others can be influenoed 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 more risky alternative by a less risky one. However, such a decision is not easy to make because the more risky project may prove to be a more attraotive one.

## 4. Uncertainty Analysis

Methods for assessing the soundness of a project from both commercial and national points of view were outline in the preceding sections. The procedure for applying uncertainty analysis is basically the same for all these methods. The application of simple uncertainty analysis to some selected methods of both commercial and national profitability is shown below. The breakeven analysis is recommended as a first step out of the world of certainty and into the world of uncertainty. As a second step, the Manual proposes sensitivity analysis where instead of one estimate of each variable several estimates are used under varying conditions. Finally, the Manual recommends probability analysis where one can use all the probable values of each variable which have a significant chance of occurrance. It is up to the evaluator to decide how far to go in uncertainty analysis for verifying the calculations obtained under deterministic conditions.

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

Before embarking on the uncertainty analysis of an investment project one should carefully examine whether this is really indispensable. Uncertainty analysis, and particularly probability analysis, requires a lot of computation which should be avoided if possible. Only under conditions of great uncertainty regarding the future operation of a project is the evaluator advised to carry out probability analysis.

### 4.1 Breakeven analysis

#### Introduction

Breakeven 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 breakeven point (BEP)

is used to indicate a level of operating 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 breakeven point could also be expressed as a minimum selling price for outputs or maximum purchasing price for inputs as well as the maximum operating cost per unit of output.

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

Breakeven analysis may be particularly useful in a situation where a decision is very sensitive to a certain variable. If the breakeven 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 breakeven 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.

As stated above, the magnitude of the breakeven 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, type of technology, etc., may also affect the breakeven point directly or indirectly.

Operating costs can be broken down conditionally into two main groups: fixed costs and variable costs. Fixed costs are independent of actual production. They usually remain constant, regardless of the volume of production, or they increase, but much slower than production volume (depreciation, administrative expenses, etc.). Variable costs

are directly related to the level of output. They increase or decrease with the increase or decrease of the level of production (raw materials, power, fuel, direct labour inputs, etc.).

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

The breakeven point of an investment project may be determined graphically and algebraically on the basis of data in any normal year - level of output, of inputs, prices, product-mix, etc. To be meaningful a breakeven analysis should be limited to an individual project (plant) with an appropriate grouping of costs and sales records. Output should be measured in some kind of physical units for a product mix that is similar to the current and future mix. Perhaps the best measure of output for a multi-product project is production valued at a set of constant sales prices for the various products. For instance, an output series from 1980 to 1995 could be measured by valuing all products through the entire period at their 1980 prices. Of course, if output is in constant dinars, the total cost line must also be in constant dinars. It must be adjusted to eliminate variations caused only by changes in wages and material prices.

The breakeven 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 breakeven chart (assuming single product, fixed costs remain constant regardless of the sales volume and linear relationship between quantity of output and variable cost) may also be expressed in the following way in Figure C.2.

To be closer to the real life, one may assume non-linear relationship between quantity of output and variable cost. Then the breakeven chart may take the form as shown in Figure C.3. There one can see two breakeven points, i.e. A and B. The profit area is between the two points and the loss areas, below and above them.

Such a breakeven chart may be helpful in identifying the minimum, maximum and optimal capacities of an investment project under considera-

Figure C.1 Breakeven Chart-1

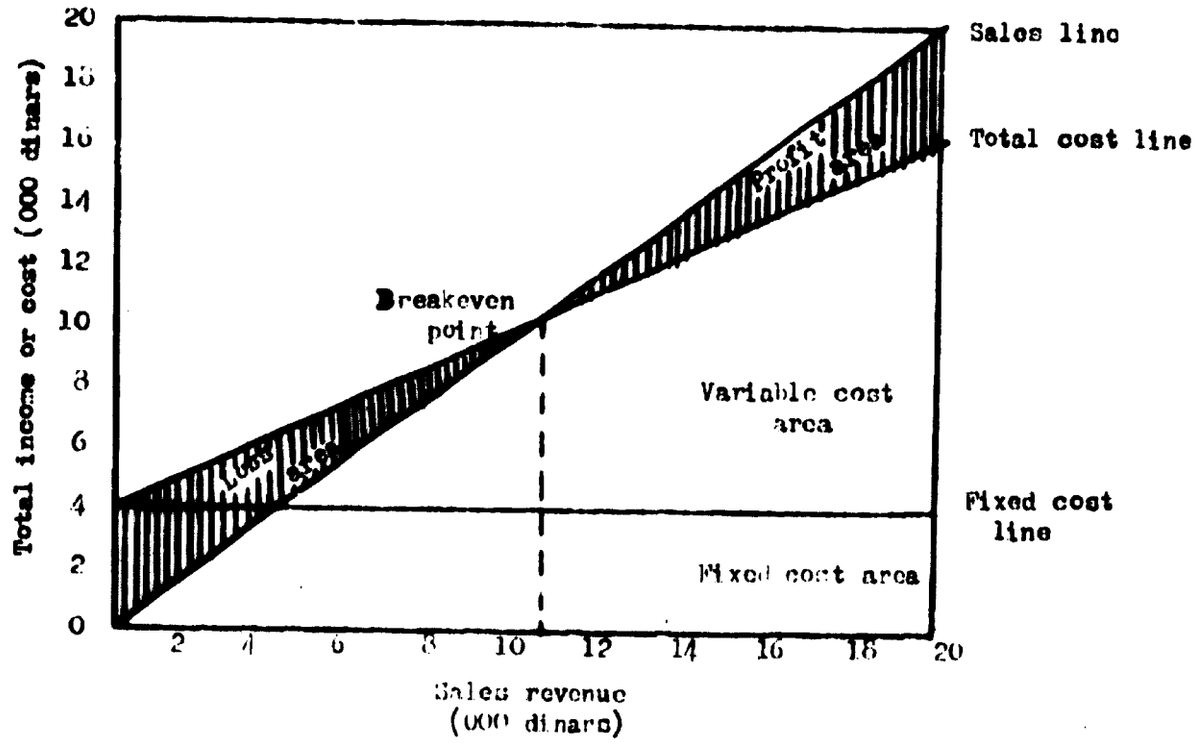



Figure C.2 Break-even Chart-2

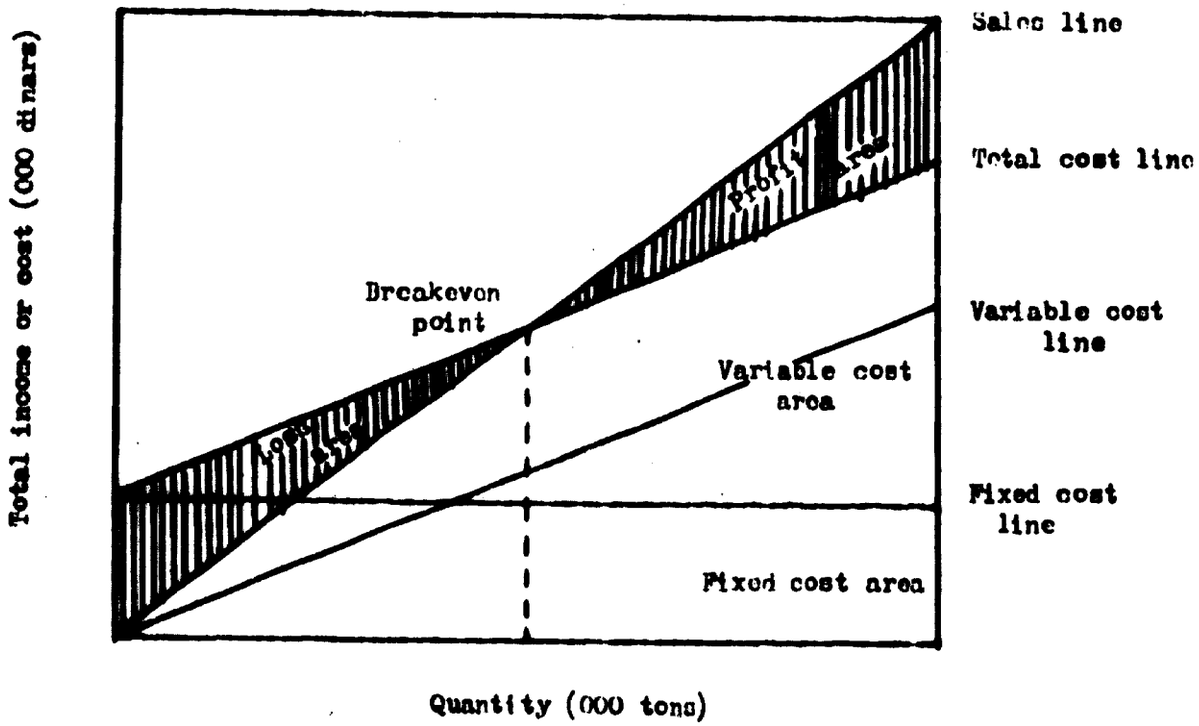
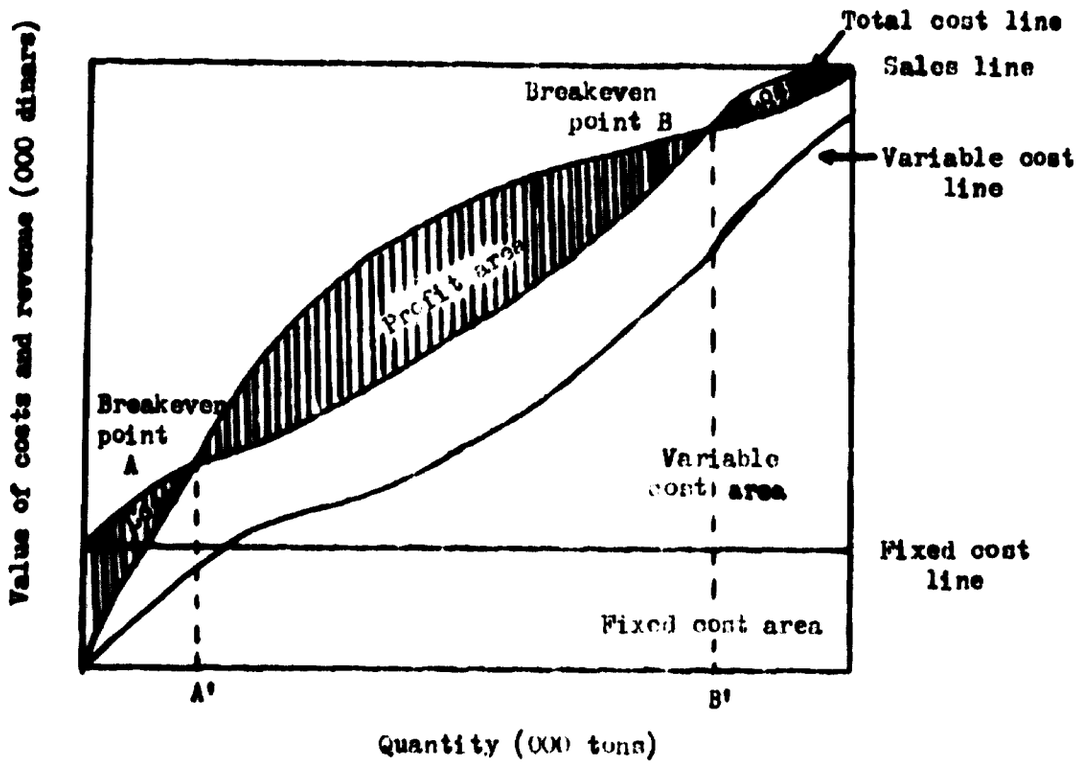


Figure C.3 Breakeven Chart-3



tion. For that purpose a well founded economic criterion is needed. Maximasation of net profit or of net national value added could be such a criterion. The minimum economically justified capacity is expressed by the breakeven point A when the project is expected to make neither profit nor loss. From this point upwards with the increase of capacity the profit also increases. The point at which the distance between the sales line and the total cost line is the largest, i.e. where the profit margin is the largest, indicates the optimal capacity. With further increase of capacity, the project still makes profit, but the safety margin becomes narrower until it reaches the breakeven point B, at which capacity the project makes neither profit nor loss. This is the maximum economically justified capacity. An increase of the capacity beyond this point is no longer justified; the project is expected to make losses.

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

(a) In terms of physical units:

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

(b) In terms of sales revenue:

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

where: BEP = the breakeven point in terms of physical units or of sales revenue;

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

SP = selling price per unit of output;

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

The above formulae could be used for deriving a formula for a BEP in terms of a selling price (SP). This will be the minimum selling price which a project could afford, making neither profit nor loss.

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

$$Q_1 \times SP_1 + Q_2 \times SP_2 = FC + Q_1(VC)_1 + Q_2(VC)_2 \qquad (C.3)$$

where: $Q_1$, $Q_2$ = quantities in physical terms of products one and two, respectively;

$SP_1$, $SP_2$ = selling prices for products one and two, respectively;

$VC_1$, $VC_2$ = variable costs per unit for products one and two, 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 will enable substitution and relatively easy solution of the equation C.3. Another possibility might be to take one of the products being a major 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) Breakeven 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 breakeven point in terms of physical units.

Step 4: Divide the figure computed under Step 3. above by total installed capacity defined in physical units to arrive at a BEP expressed as a rate of 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 2.0 dinars
- Total fixed cost 30,000 dinars
- Variable cost per unit 0.9 dinars
- Installed capacity 50,000 units

Hence:

$$BEP = \frac{FC}{SP - VC} = \frac{30,000}{2.0 - 0.9} = \frac{30,000}{1.1} = 27,273 \text{ units}$$

BEP as a rate of utilization of production capacity equals:

$$\frac{27,273}{50,000} = 54.5\%$$

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 breakeven point.

(b) Breakeven point in sales revenue

$$BEP = SP\left(\frac{FC}{SP - VC}\right) = 2.0\left(\frac{30,000}{2.0 - 0.9}\right) = 2.0 \times \frac{30,000}{1.1}$$

$$= 2.0 \times 27,273$$

$$= 54,546 \text{ dinars.}$$

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,

$$\frac{54,546 \text{ dinars}}{100,000 \text{ dinars}} = 54.5\% \text{ capacity utilization in monetary terms}$$

In other words, the breakeven 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 breakeven point is relatively low, which is an indication of low risk of making losses and a high chance of earning profit.

The breakeven point is calculated usually under 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 pre-conditions seldom hold true and this may affect negatively the outcome of the breakeven analysis.

In spite of the above limitations, breakeven 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 breakeven point can be calculated from data usually available in the feasibility study.

The breakeven point varies widely according to the characteristics of the industry to which the project belongs. High fixed-cost operations have relatively high breakeven points, while industries operating with a high variable cost rate have relatively low breakeven points.

In addition to the variable cost rate, fixed costs and percentage markups on variable costs are the primary determinants of a project's breakeven point. A given percentage change in fixed costs changes the breakeven point by the same percentage and in the same direction. Overhead cost control is therefore particularly important in highly competitive industries such as construction and manufacturing, since

each additional dinar of fixed cost incurred may be multiplied many times in the additional amount of sales income that must be generated to break even.

4.2 Sensitivity analysis

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

Sensitivity analysis may be used in early stages of project preparation to identify those variables to the estimation of which special care should be devoted. In practice it is not necessary to analyze the variations of all possible variables. It is sufficient to confine the analysis to the key variables which affect 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 made under conditions of certainty, but also other possible values. For instance, any efficiency indicator may be recalculated using pessimistic or optimistic alternatives to the "normal" or "realistic" estimate(s) applied in the first round under deterministic conditions. Sensitivity analysis

provides a better understanding of which variable is in fact crucial to the project's appraisal. Such analysis will also be helpful for those in charge of managing the project later. It will indicate critical areas requiring close managerial attention in order to ensure commercial success of a project.

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 were estimated to be 200 dinars with 100 dinars spent in the year zero and another 100 dinars spent in the year one. This resulted, when combined with other cash flow elements, in a net present value of 115,000 dinars (Table A.3, Row V).

Assume that due to 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 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 (000 dinars) | Discount factors at discount rate = 7 % | Present value (000 dinars) |
|---|---|---|---|
| $Y_0$ | 90 | 1.00 | 90.0 |
| $Y_1$ | 90 | 0.93 | 83.7 |
| | | Present value of investment | 173.7 |
| | | Present value of net cash inflow (Table A.3, years 2-20) | 308.0 |
| | | Net present value (NPV) | 134.3 |

Pessimistic estimate:

| Year | Annual investment (000 dinars) | Discount factors at discount rate = 7 % | Present value (000 dinars) |
|---|---|---|---|
| $Y_0$ | 120 | 1.00 | 120.0 |
| $Y_1$ | 130 | 0.93 | 120.9 |
| | | Present value of investment | 240.9 |
| | | Present value of net cash inflow (Table A.3, years 2-20) | 308.0 |
| | | Net present value (NPV) | 67.1 |

Therefore, the net present value of the project is sensitive to changes of 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's under the worst expected circumstances in terms of investment costs.

The recalculation of the efficiency criterion under alternate assumptions thus demonstrates a project's pronounced sensitivity with regard to uncertainties of estimates. This project may well be considered risky. Stiff conditions may be attached to the approval of the project such as additional consultants' services or firm assurances or behalf of the government to safeguard critical areas.

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

4.3 Probability analysis

Probability refers to the frequency of occurence 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 one's judgement to a single optimistic, pessimistic or realistic estimation by identifying the possible range of each variable and attaching a probability of occurrence to each possible value of the variables within this range. These judgements take the form of probability distribution - each possible value of each variable is associated with a number between 0 and 1, such that for each variable the sum of all these numbers (probabilities) is equal to one. This numerical description of the likelihood of an event's occurrence makes possible an objective measure of many situations that could otherwise be expressed only instinctively or intuitively. Therefore, from a mathematical point of view, probability analysis consists of aggregating probabilities.

As stated above, one of the most important elements of probability analysis is assigning probabilities of occurrence to each possible value of the variables. This is a highly intellectual exercise and its product is educated 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 will be applied to two selected criteria: the pay-ba period (commercial profitability analysis) and the value added criterion (national profitability analysis). 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 which are subject to a high degree of uncertainty. The findings of this analysis were:

| Variable | Expected range of variations |
|---|---|
| Investment | 200,000-250,000 dinars |
| Fixed cost per annum 1/ | 28,000- 35,000 dinars |
| Variable cost per unit 1/ | 0.9- 1.25 dinars |
| Selling price per unit 1/ | 1.8- 2.00 dinars |
| Sales volume per annum 1/ | 40,000- 60,000 units |
| Economic life of the project | 15- 20 years |

1/ All these data refer to a normal year. In compliance with the earlier approach, year 5 has been selected as a normal year.

The possible range of variation of investment between 200,000 and 250,000 dinars does not mean that only these two figures are likely with the respective 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 likely values. For each of these values assign a probability of occurrence (the sum total of the probabilities always adding up to 1):

| Variable | Alternatives | | |
|---|---|---|---|
| | A | B | C |
| Investment - dinars | 200,000 | 250,000 | |
| Probability | 0.70 | 0.30 | |
| Total fixed cost - dinars | 28,000 | 30,000 | 35,000 |
| Probability | 0.10 | 0.70 | 0.20 |
| Variable cost - dinars per unit | 0.90 | 1.25 | |
| Probability | 0.75 | 0.25 | |
| Selling price - dinars per unit | 1.8 | 2.0 | |
| Probability | 0.20 | 0.80 | |
| Sales volume - units | 40,000 | 50,000 | 60,000 |
| Probability | 0.30 | 0.60 | 0.10 |
| Economic life - years | 15 | 20 | |
| Probability | 0.20 | 0.80 | |

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

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

(a) For sales volume 40,000 units (probability 0.30)

| Total cost alternatives | | | Probability | | |
|---|---|---|---|---|---|
| 28,000 + 40,000 x 0.90 | = | 64,000 | 0.10 x 0.75 | = | 0.075 |
| 28,000 + 40,000 x 1.25 | = | 78,000 | 0.10 x 0.25 | = | 0.025 |
| 30,000 + 40,000 x 0.90 | = | 66,000 | 0.70 x 0.75 | = | 0.525 |
| 30,000 + 40,000 x 1.25 | = | 80,000 | 0.70 x 0.25 | = | 0.175 |
| 35,000 + 40,000 x 0.90 | = | 71,000 | 0.20 x 0.75 | = | 0.150 |
| 35,000 + 40,000 x 1.25 | = | 85,000 | 0.20 x 0.25 | = | 0.050 |
| Total probability of alternative costs when sales 40,000 units | | | | | 1.000 |

(b) For sales volume 50,000 units (probability 0.60)

| Total cost alternatives | | | Probability | | |
|---|---|---|---|---|---|
| 28,000 + 50,000 x 0.90 | = | 73,000 | 0.10 x 0.75 | = | 0.075 |
| 28,000 + 50,000 x 1.25 | = | 90,500 | 0.10 x 0.25 | = | 0.025 |
| 30,000 + 50,000 x 0.90 | = | 75,000 | 0.70 x 0.75 | = | 0.525 |
| 30,000 + 50,000 x 1.25 | = | 92,500 | 0.70 x 0.25 | = | 0.175 |
| 35,000 + 50,000 x 0.90 | = | 80,000 | 0.20 x 0.75 | = | 0.150 |
| 35,000 + 50,000 x 1.25 | = | 97,500 | 0.20 x 0.25 | = | 0.050 |
| Total probability | | | | | 1.000 |

(c) For sales volume 60,000 units (probability 0.10)

| Total cost alternatives | | | Probability | | |
|---|---|---|---|---|---|
| 28,000 + 60,000 x 0.90 | = | 82,000 | 0.10 x 0 75 | = | 0.075 |
| 28,000 + 60,000 x 1.25 | = | 103,000 | 0.10 x 0.25 | = | 0.025 |
| 30,000 + 60,000 x 0.90 | = | 84,000 | 0.70 x 0.75 | = | 0.525 |
| 30,000 + 60,000 x 1.25 | = | 105,000 | 0.70 x 0.25 | = | 0.175 |
| 35,000 + 60,000 x 0.90 | = | 89,000 | 0.20 x 0.75 | = | 0.150 |
| 35,000 + 60,000 x 1.25 | = | 110,000 | 0.20 x 0.25 | = | 0.050 |
| Total probability | | | | | 1.000 |

Step 4: Estimate alternative annual sales revenues along with their respective probabilities of occurrence:

| Sales volume (units) | Probability | Selling price (dinars) | Probability | Sales revenue (dinars) | Probability |
|---|---|---|---|---|---|
| 40,000 | 0.30 | 1.8 | 0.20 | 72,000 | 0.06 |
| 40,000 | 0.30 | 2.0 | 0.80 | 80,000 | 0.24 |
| 50,000 | 0.60 | 1.8 | 0.20 | 90,000 | 0.12 |
| 50,000 | 0.60 | 2.0 | 0.80 | 100,000 | 0.48 |
| 60,000 | 0.10 | 1.8 | 1.00 | 108,000 | 0.10 |
| Total probability of all possible sales revenues | | | | | 1.00 |

Notice that sales volume 60,000 is only associated with selling price of 1.8 dinars per unit, the probability of which will be 1.0 as presumed.

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

Step 6: Estimate the expected annual profit by summing up profit alternatives weighed with their respective chances of occurrence. This is shown in the last column of Table C.1.

Comparison of the expected annual profit under conditions of uncertainty (equal to 15,015 dinars) with the annual profit in the deterministic case, i.e. by using only the most likely alternative of each variable, indicates how far one is off track when one adopts the deterministic approach for this particular project. In the example it is:

| | | | |
|---|---|---|---|
| Most likely annual sales revenue | 50,000 x 2.0 | = | 100,000 dinars |
| Its probability | 0.60 x 0.80 | = | 0.48 |
| Most likely annual fixed cost | | | 30,000 dinars |
| Its probability | | | 0.70 |
| Most likely annual variable cost | 50,000 x 0.9 | = | 45,000 dinars |
| Its probability | | | 0.75 |

Therefore, the profit will be:

100,000 - (30,000 + 45,000) = 25,000 dinars (see Table 8, Row 4.1, year 5)

The probability of its occurrence is:

$$0.48 \times 0.70 \times 0.75 = 0.252.$$

Note that this annual profit which results from the combination of the most likely values of each variable has only a 25 per cent chance of occurrence.

The expected annual profit under conditions of uncertainty is by 9,985 dinars less than the expected annual profit under deterministic conditions. This is a substantial difference, a warning signal deserving special attention both by the evaluator and by the decision-maker.

Table C.1 **Expected Annual Profits under Conditions of Uncertainty**

(in dinars)

| Sales volume (units) | Sales revenue | Probability | Total cost | Probability | Profit | Probability | Profit |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | | | | (2 - 4) | (3 x 5) | (6 x 7) |
| 40,000 | 72,000 | 0.06 | 64,000 | 0.075 | 8,000 | 0.005 | 40.0 |
| | | | 78,000 | 0.025 | - 6,000 | 0.001 | - 6.0 |
| | | | 66,000 | 0.525 | 6,000 | 0.032 | 192.0 |
| | | | 80,000 | 0.175 | - 8,000 | 0.010 | - 80.0 |
| | | | 71,000 | 0.150 | 1,000 | 0.009 | 9.0 |
| | | | 85,000 | 0.050 | -13,000 | 0.003 | - 39.0 |
| 40,000 | 80,000 | 0.24 | 64,000 | 0.075 | 16,000 | 0.018 | 288.0 |
| | | | 78,000 | 0.025 | 2,000 | 0.060 | 120.0 |
| | | | 66,000 | 0.525 | 14,000 | 0.126 | 1,764.0 |
| | | | 80,000 | 0.175 | - | 0.042 | - |
| | | | 71,000 | 0.150 | 9,000 | 0.036 | 324.0 |
| | | | 85,000 | 0.050 | - 5,000 | 0.012 | - 60.0 |
| 50,000 | 90,000 | 0.12 | 73,000 | 0.075 | 17,000 | 0.009 | 153.0 |
| | | | 90,500 | 0.025 | - 500 | 0.003 | - 1.5 |
| | | | 75,000 | 0.525 | 15,000 | 0.063 | 945.0 |
| | | | 92,500 | 0.175 | - 2,500 | 0.021 | - 52.5 |
| | | | 80,000 | 0.150 | 10,000 | 0.018 | 180.0 |
| | | | 97,500 | 0.050 | - 7,500 | 0.006 | - 45.0 |
| 50,000 | 100,000 | 0.48 | 73,000 | 0.075 | 27,000 | 0.036 | 972.0 |
| | | | 90,500 | 0.025 | 9,500 | 0.012 | 114.0 |
| | | | 75,000 | 0.525 | 25,000 | 0.252 | 6,300.0 |
| | | | 92,500 | 0.175 | 7,500 | 0.084 | 630.0 |
| | | | 80,000 | 0.150 | 20,000 | 0.072 | 1,440.0 |
| | | | 97,500 | 0.050 | 2,500 | 0.024 | 60.0 |
| 60,000 | 108,000 | 0.10 | 82,000 | 0.075 | 26,000 | 0.007 | 182.0 |
| | | | 103,000 | 0.025 | 5,000 | 0.002 | 10.0 |
| | | | 84,000 | 0.525 | 24,000 | 0.052 | 1,248.0 |
| | | | 105,000 | 0.175 | 3,000 | 0.017 | 51.0 |
| | | | 89,000 | 0.150 | 19,000 | 0.015 | 285.0 |
| | | | 110,000 | 0.050 | - 2,000 | 0.004 | - 8.0 |
| **Total probability of all possible profit alternatives** | | | | | | 1.000 | |
| **Expected value of profit in a normal year** | | | | | | | 15,015.0 |

Step 7: As stated in Section A. Commercial Profitability, the expected pay-back period (p) is the number of years which make:

$$I = \sum_{t=0}^{p} F_t$$

where: $I$ = total investment;

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

The expected pay-back periods when I = 200,000 dinars and 250,000 dinars respectively are:

200,000 = 15,015 dinars x 13.32 years[1/]
its probability = 0.70

250,000 = 15,015 dinars x 16.65 years[1/]
its probability = 0.30

Therefore, the expected pay-back period considering the uncertainties about the investment I is:

$p = 13.32 \times 0.70 + 16.65 \times 0.30 = 14.32$ years

The same result could be obtained by dividing expected investment by expected average annual profits (15,015 dinars) where expected investment is:

$I = 200{,}000 \times 0.70 + 250{,}000 \times 0.30 = 215{,}000$ dinars

$$p = \frac{215{,}000}{15{,}015} = 14.32 \text{ years}$$

The most probable pay-back period is, therefore, 14.32 years, plus the duration of the construction period, i.e. two years. If the payback period is the preferred indicator of commercial profitability, an investment decision with due regard to risk should be based on expected more than 16 years pay-back period.

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1/ A pay-back period calculated this way is only an approximation since it assumes an even annual flow of profits and does not take into consideration the construction and the running-in periods. This is an over-simplification and is being used here only for illustrative purposes. Actually the approach suggested on pp. 74-78 is to be followed.

In addition to the observation in the footnote on the preceding page, concerning the procedure for calculating the pay-back period, it should also be stated that the expected pay-back period will be even longer than 14.32 years plus the construction period. This is so for the simple reason that the above calculations are based on annual profit before taxes equalling 15,015 dinars computed in Table C.3. If taxes are to be subtracted (5,000 dinars in year 5, see Table 8, sub-row 4.1), the net profit will go as low as 10,015 dinars and the expected pay-back period will be more than 21 years:

$$p = \frac{215,000}{10,015} = 21.5 \text{ years}$$

With the above being said, the simple comparison between the expected pay-back period under deterministic conditions (11.5 years) and the expected pay-back period under conditions of uncertainty (more than 21 years) indicates that the project will not be sound enough in terms of duration of the pay-back period. It was not particularly attractive even under deterministic conditions with a pay-back period equalling 11.5 years. In reality it may become even worse, exceeding the optimistic expectation on the economic life (20 years), if the assumptions of the probability analysis materialize.

(b) Value added criterion (absolute efficiency test)

Step 1: The key elements which enter this criterion have to be scrutinized in order to determine the key variables which (a) are subject to pronounced uncertainty and (b) the change in which would greatly affect the value added. In the hypothetical project it was found that:

- domestic demand;
- prices of domestic and imported inputs;
- investments;
- the adjusted rate of foreign exchange

fall into this category with the latter affecting foreign components of both inputs and outputs as well as repatriated payments.

Step 2: The sales revenue in a normal year of operation (year 5) at market prices is expected to be 100,000 dinars, comprising 70,000 dinars for the local market as import substitution, 20,000 dinars for export, and 10,000 dinars infrastructural services. Due to some uncertainties on the domestic market the probability of selling goods worth 70,000 dinars is 0.60, the probability of selling goods for 60,000 dinars is 0.30, and at the level of 55,000 dinars, 0.10. The export of goods for 20,000 dinars has been assured by long-term commercial agreements.

The value of the infrastructural services as well as the subsidies is considered to be more certain. The residual value is very uncertain, but since it is more than 20 years from now, cannot affect the soundness of the project and is therefore considered not to be a key variable.

As stated above, the adjusted rate of foreign exchange was computed at the level of 6.5 dinars = $1, i.e. 30 per cent premium over and above the official exchange rate 5.0 dinars = $1. The probability of having this adjusted rate is assessed to be 0.70. However, it is considered likely that the premium may go up to 50 per cent over and above the official rate, and the probability for that is 0.30.

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 in Table C.2. Hence the most probable sales revenue in year 5 is equal to:

(117,000 x 0.42) + (104,000 x 0.21) + (97,500 x 0.07) + (135,000 x 0.18) + (120,000 x 0.09) + (112,500 x 0.03) = 115,110 dinars plus infrastructural services and subsidies worth 15,000 dinars, or total probable output = 130,110 dinars.

Step 4: The lifetime of the project is 21 years, including construction period. Compute probable outputs for the rest of the economic life in the same manner as above. This yields the probable annual outputs as shown in Table C.3.

Step 5: Material inputs in year 5, priced at actual market prices, were estimated to be 48,000 dinars (ref. Table 9, Row 2.2). There are, however, uncertainties concerning the behaviour of both domestic market prices and CIF prices for material inputs. The

probability of producing the above output with 36,000 dinars domestically procured current material inputs (Table 9, Row 2.2.2) is 0.60, the probability of paying for the same inputs 39,000 dinars is 0.30, and the probability of spending 41,000 dinars is 0.10.

The probability of obtaining the imported current material inputs for 12,000 dinars is 0.70, and the probability of paying for the same quantity of imported materials 15,000 dinars is 0.30.

On this ground one may compute the most probable value of current material inputs at actual market prices in the normal year as shown in Table C.4.

The most probable value of current material inputs at actual market prices in year 5 is equal to:

(48,000 x 0.42) + (51,000 x 0.21) + (53,000 x 0.07) + (51,000 x 0.18)

+ (54,000 x 0.09) + (56,000 x 0.03) = 50,300 dinars.

The value of the imported current material inputs converted into local currency by the official rate of foreign exchange is:

(12,000 x 0.70) + (15,000 x 0.30) = 12,900 dinars

**Step 6:** The imported component of the material inputs enters the figure of current material inputs computed under Step 5. above at CIF 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 probable annual value of imported current material inputs at adjusted rate of foreign exchange as shown in Table C.5.

The most probable value of imported current material inputs converted into local currency at the adjusted rate of foreign exchange is:

(15,600 x 0.49) + (19,500 x 0.21) + (18,000 x 0.21) + (22,500 x 0.09)

= 17,550 dinars.

Hence, due to the impact of the adjusted rate of foreign exchange alone (with the two probable rates) the value of the imported materials is likely to increase by 4,650 dinars from 12,900 dinars, as computed under Stpe 5, to 17,550 dinars.

It was computed under Step 5. above, that the most probable value of current material inputs at actual market prices is 50,300 dinars. The increase in the value of imported material inputs due to the application of adjusted rate of foreign exchange (4,650 dinars) should be added to this figure. That makes the most probable current material inputs at adjusted prices in year 5 equal to 54,950 dinars.

**Step 7:** Most probable current material inputs at adjusted prices should be computed for each year of the economic life of the project, following the approach prescribed above as shown in Table C.6.

**Step 8:** It has been stated earlier on many occasions that material inputs comprise current material inputs and investment. The most probable values of the former have been computed, the most probable value of the latter has to be computed next. As stated before, 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 x 0.70) + (250,000 x 0.30) = 215,000 dinars.

The imported component, converted into local currency at the official rate of foreign exchange amounts to 150,000 dinars with probability 0.70, and 187,500 dinars with probability 0.30. Consequently, the most probable value of the imported investment component is:

(150,000 x 0.70) + (187,500 x 0.30) = 161,250 dinars.

This component, in compliance with the pricing rules of the Manual, should be converted at local currency by the adjusted rate of foreign exchange, taking into account the two probable rates, i.e. 1.3 and 1.5; this is demonstrated in Table C.7.

The most probable value of imported investment component converted into local currency at the adjusted rate of foreign exchange is:

(195,000 x 0.49) + (243,750 x 0.21) + (225,000 x 0.21) + (281,250 x 0.09)

= 219,300 dinars.

It follows from the above that the value of the imported investment component increases by 57,050 dinars (219,300 - 161,250) on the account of the

adjusted rate of foreign exchange alone. This increase should be added to the most probable value of total investment (domestic and imported) at market prices (215,000 dinars) to arrive at the most likely value of the investment at adjusted prices:

$$215,000 + 58,050 = 273,050 \text{ dinars}$$

distributed throughout the construction period as follows:

Year 0 = 136,000 dinars;

Year 1 = 137,050 dinars.

**Step 9:** It has been assumed from the beginning that the repatriated payments are not a key variable (although in other cases they may very well be). Their magnitude is, however, affected by the probability of having two adjusted rates of foreign exchange, i.e. 1.3 and 1.5. Therefore, the most probable value of the repatriated payments in a normal year, and then throughout the economic life of the project, should be computed.

As stated earlier, the probability of having an adjusted rate of foreign exchange 1.3 is 0.70, and at the level of 1.5, 0.30. Then the most probable adjusted rate of exchange is:

$$(1.3 \times 0.70) + (1.5 \times 0.30) = 1.36.$$

Under these circumstances the most probable value of the repatriated payments in year 5 is expected to be:

$$16,000 \times 1.36 = 21,760 \text{ dinars,}$$

as compared to 20,800 dinars at an adjusted rate of 1.3 only (ref. Table B.3, Row 4).

Following the same procedure, the most probable annual repatriated payments throughout the project's life should be computed as shown in Table C.8.

**Step 10:** 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 B.3 and compile the information such as is demonstrated in Table C.9.

The discounted most probable value added under conditions of uncertainty equals 91,400 dinars, as compared to 234,400 dinars under conditions of certainty (Table B.3, Row 7). This is an indication of the expected still positive contribution of the project to the national income even under uncertain conditions, i.e. uncertain domestic demand, increasing prices for domestically procured and imported current material inputs, probability of exceeding the investment requirements originally envisaged, strong possibility of having even more unfavourable adjusted rate of foreign exchange (1.5), as compared to the one under conditions of certainty (1.3). Therefore, the project passes the first part of the absolute efficiency test under conditions of uncertainty

As stated earlier, although this is of paramount importance, it is not sufficient for recommending a decision on the project. It is very 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 remains as a social surplus.

By the application of formula B.12, one finds:

$$91{,}400 > 84{,}700 \longrightarrow 6{,}700 \text{ dinars}$$

of social surplus, as compared to 153,900 dinars under conditions of certainty (Table B.3, Row 7.2). Hence the project generates enough value added to recover the wages and produces a negligible amount of social surplus. Therefore, from the national point of view under conditions of uncertainty, the project is marginally acceptable.

The project evaluators should call to the designers' attention the need to carefully re-examine and if possible to improve the basic parameters of the project in view of the expected uncertainties with regard to domestic demand, prices of domestic and imported current material inputs, investments and the rate of foreign exchange. They should also bring the matter to the attention of the decision-maker to have it in mind when taking a decision and, if possible, to take the necessary action to prevent or at least limit the unfavourable effect of the uncertain domestic demand, prices, rate of exchange, etc.

## Table C.2 Probable Adjusted Sales Revenue

| Sales Revenue[1] | | | | | Adjusted Sales Revenue | |
|---|---|---|---|---|---|---|
| Domestic sales (dinars) | Probability | Exports (dinars) | Adjusted rate of foreign exchange | | Value | Probability |
| | | | Rate | Prob. | | |
| 70,000 | 0.60 | 20,000 | 1.3 | 0.70 | (70,000 x 1.3) + (20,000 x 1.3) = 117,000 | 0.60 x 0.70 = 0.42 |
| 60,000 | 0.30 | 20,000 | 1.3 | 0.70 | (60,000 x 1.3) + (20,000 x 1.3) = 104,000 | 0.30 x 0.70 = 0.21 |
| 55,000 | 0.10 | 20,000 | 1.3 | 0.70 | (55,000 x 1.3) + (20,000 x 1.3) = 97,500 | 0.10 x 0.70 = 0.07 |
| 70,000 | 0.60 | 20,000 | 1.5 | 0.30 | (70,000 x 1.5) + (20,000 x 1.5) = 135,000 | 0.60 x 0.30 = 0.18 |
| 60,000 | 0.30 | 20,000 | 1.5 | 0.30 | (60,000 x 1.5) + (20,000 x 1.5) = 120,000 | 0.30 x 0.30 = 0.09 |
| 55,000 | 0.10 | 20,000 | 1.5 | 0.30 | (55,000 x 1.5) + (20,000 x 1.5) = 112,500 | 0.10 x 0.30 = 0.03 |
| | | | | | | 1.00 |

1/ Sales revenue includes exports, import substitution and infrastructural services (Table 9, Rows 1.1, 1.2 and 1.4). Infrastructural services, according to the pricing rules are valued at actual domestic market price or cost, whichever is higher. Exports and import substitution are valued at FOB and CIF prices, respectively. Therefore, the probable adjusted rates of foreign exchange, 1.3 and 1.5, are applicable only to the import substitution and exports, and not to infrastructural services, which in addition to that are not considered to be a key variable. For this reason infrastructural services are not included in Table C.2.

Table C.3 Most Probable Adjusted Annual Outputs

(in dinars)

| Year | Probable sales revenues | Infrastructural services | Subsidies | Residual value | Probable output |
|---|---|---|---|---|---|
| 0 | - | - | - | - | - |
| 1 | - | - | - | - | - |
| 2 | 73,000 | [illegible],000 | 10,000 | - | 88,000 |
| 3 | 106,000 | 10,000 | 10,000 | - | 126,000 |
| 4 | 110,000 | 10,000 | 8,000 | - | 128,000 |
| 5 | 115,110 | 10,000 | 5,000 | - | 130,110 |
| 6 | 116,000 | 10,000 | 2,000 | - | 128,000 |
| 7 | 117,000 | 10,000 | - | - | 127,000 |
| 8 | 115,000 | 10,000 | - | - | 125,000 |
| 9 | 113,000 | 10,000 | - | - | 123,000 |
| 10 | 111,000 | 10,000 | - | - | 121,000 |
| 11 | 110,000 | 10,000 | - | - | 120,000 |
| 12 | 10 ,000 | 10,000 | - | - | 118,000 |
| 13 | 108,000 | 10,000 | - | - | 118,000 |
| 14 | 106,000 | 10,000 | - | - | 116,000 |
| 15 | 105,000 | 10,000 | - | - | 115,000 |
| 16 | 105,000 | 10,000 | - | - | 115,000 |
| 17 | 104,000 | 10,000 | - | - | 114,000 |
| 18 | 99,000 | 10,000 | - | - | 109,000 |
| 19 | 98,000 | 10,000 | - | - | 108,000 |
| 20 | 70,000 | 10,000 | - | 15,000 | 95,000 |

**Table C.4 Probable Current Material Inputs at Market Prices**
**(in dinars)**

| Material Inputs at Market Prices | | | | Adjusted Material Inputs at Market Prices | |
|---|---|---|---|---|---|
| Domestic | | Imported | | | |
| Value | Probability | Value | Probability | Value | Probability |
| 36,000 | 0.60 | 12,000 | 0.70 | 36,000 + 12,000 = 48,000 | 0.60 x 0.70 = 0.42 |
| 39,000 | 0.30 | 12,000 | 0.70 | 39,000 + 12,000 = 51,000 | 0.30 x 0.70 = 0.21 |
| 41,000 | 0.10 | 12,000 | 0.70 | 41,000 + 12,000 = 53,000 | 0.10 x 0.70 = 0.07 |
| 36,000 | 0.60 | 15,000 | 0.30 | 36,000 + 15,000 = 51,000 | 0.60 x 0.30 = 0.18 |
| 39,000 | 0.30 | 15,000 | 0.30 | 39,000 + 15,000 = 54,000 | 0.30 x 0.30 = 0.09 |
| 41,000 | 0.10 | 15,000 | 0.30 | 41,000 + 15,000 = 56,000 | 0.10 x 0.30 = 0.03 |
| | | | | | 1.00 |

Table C.5 **Probable Imported Material Inputs at Adjusted Prices**
(in dinars)

| Imported Inputs at Official Rate of Exchange | | Adjusted Rate of Foreign Exchange | | Adjusted Imported Material Inputs | |
|---|---|---|---|---|---|
| Value | Probability | Value | Probability | Value | Probability |
| 12,000 | 0.70 | 1.3 | 0.70 | 12,000 x 1.3 = 15,600 | 0.70 x 0.70 = 0.49 |
| 15,000 | 0.30 | 1.3 | 0.70 | 15,000 x 1.3 = 19,500 | 0.30 x 0.70 = 0.21 |
| 12,000 | 0.70 | 1.5 | 0.30 | 12,000 x 1.5 = 18,000 | 0.70 x 0.30 = 0.21 |
| 15,000 | 0.30 | 1.5 | 0.30 | 15,000 x 1.5 = 22,500 | 0.30 x 0.30 = 0.09 |
| | | | | | 1.00 |

Table C.6 Most Probable Annual Current Material Inputs at Adjusted Prices
(in dinars)

| Year | Imported and Domestic Current Material Inputs | Infrastructural Services 1/ | Total |
|---|---|---|---|
| 0 | - | - | - |
| 1 | - | - | - |
| 2 | 34,280 | 2,000 | 36,280 |
| 3 | 53,790 | 3,000 | 56,790 |
| 4 | 54,150 | 3,000 | 57,150 |
| 5 | 54,950 | 3,000 | 57,950 |
| 6 | 55,300 | 3,000 | 58,300 |
| 7 | 55,420 | 3,000 | 58,420 |
| 8 | 55,510 | 3,000 | 58,510 |
| 9 | 55,670 | 3,000 | 58,670 |
| 10 | 55,760 | 3,000 | 58,760 |
| 11 | 55,840 | 3,000 | 58,840 |
| 12 | 55,950 | 3,000 | 58,950 |
| 13 | 56,030 | 3,000 | 59,030 |
| 14 | 56,180 | 3,000 | 59,180 |
| 15 | 56,260 | 3,000 | 59,260 |
| 16 | 56,340 | 3,000 | 59,340 |
| 17 | 56,480 | 3,000 | 59,480 |
| 18 | 56,660 | 3,000 | 59,660 |
| 19 | 56,850 | 3,000 | 59,850 |
| 20 | 57,120 | 3,000 | 60,120 |

1/ Infrastructural services, as in the case of outputs, are not a key variable and they are valued at domestic market prices or cost, whichever is higher. They are taken readily available from Table 9, Row 2.2.3.

Table C.7 **Probable Imported Investment Component at Adjusted Prices**

(in dinars)

| Imported component of investment at market prices | | Adjusted rate of foreign exchange | | Adjusted Imported Investment Component | |
|---|---|---|---|---|---|
| Value | Probability | Value | Prob. | Value | Probability |
| 150,000 | 0.70 | 1.3 | 0.70 | 150,000 x 1.3 = 195,000 | 0.70 x 0.70 = 0.49 |
| 187,500 | 0.30 | 1.3 | 0.70 | 187,500 x 1.3 = 243,750 | 0.30 x 0.70 = 0.21 |
| 150,000 | 0.70 | 1.5 | 0.30 | 150,000 x 1.5 = 225,000 | 0.70 x 0.30 = 0.21 |
| 187,500 | 0.30 | 1.5 | 0.30 | 187,500 x 1.5 = 281,250 | 0.30 x 0.30 = 0.09 |
| | | | | | 1.00 |

Table C.8 Most Probable Annual Repatriated Payments
(in dinars)

| Year | Repatriated payments at official rate of exchange 1/ | Most probable rate of foreign exchange | Most probable repatriated payment |
|---|---|---|---|
| 0 | - | - | - |
| 1 | 5,000 | 1.36 | 6,800 |
| 2 | 15,000 | 1.36 | 20,400 |
| 3 | 16,000 | 1.36 | 21,760 |
| 4 | 16,000 | 1.36 | 21,760 |
| 5 | 16,000 | 1.36 | 21,760 |
| 6 | 15,000 | 1.36 | 20,400 |
| 7 | 15,000 | 1.36 | 20,400 |
| 8 | 14,000 | 1.36 | 19,040 |
| 9 | 14,000 | 1.36 | 19,040 |
| 10 | 14,000 | 1.36 | 19,040 |
| 11 | 10,000 | 1.36 | 13,600 |
| 12 | 10,000 | 1.36 | 13,600 |
| 13 | 10,000 | 1.36 | 13,600 |
| 14 | 10,000 | 1.36 | 13,600 |
| 15 | 10,000 | 1.36 | 13,600 |
| 16 | 10,000 | 1.36 | 13,600 |
| 17 | 10,000 | 1.36 | 13,600 |
| 18 | 10,000 | 1.36 | 13,600 |
| 19 | 10,000 | 1.36 | 13,600 |
| 20 | 16,000 | 1.36 | 21,760 |

1/ Table 9, Row 4.

**Table C.9 Most Probable Present Value of the Value Added**

**(in 000 dinars)**

| Items | Years | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 0-20 |
| 1. Most probable value of output (Table C.3) | - | - | 88.0 | 86.0 | 88.0 | 90.1 | 86.0 | 87.0 | 85.0 | 23.0 | 21.0 | 20.0 | 18.0 | 18.0 | 16.0 | 15.0 | 15.0 | 14.0 | 99.0 | 98.0 | 95.0 | - |
| 2. Most probable value of material inputs (Table C.6) | 136.0 | 137.1 | 36.3 | 56.8 | 57.2 | 58.0 | 58.3 | 58.4 | 58.5 | 58.7 | 58.8 | 58.8 | 58.9 | 59.0 | 59.1 | 59.3 | 59.3 | 59.5 | 59.7 | 59.8 | 60.1 | - |
| 3. Most probable net domestic value added (1 - 2) | (136.0) | (137.1) | 51.7 | 69.2 | 70.8 | 72.1 | 69.7 | 68.6 | 66.5 | 64.3 | 62.2 | 61.2 | 59.1 | 59.0 | 56.9 | 55.7 | 55.7 | 54.5 | 49.3 | 48.2 | 34.9 | - |
| 4. Most probable repatriated payments (Table C.8) | - | 6.8 | 20.4 | 21.8 | 21.8 | 21.8 | 20.4 | 20.4 | 19.0 | 19.0 | 19.0 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 21.8 | - |
| 5. Most probable net national value added (3 - 4) | (136.0) | (143.9) | 31.3 | 47.4 | 49.0 | 50.3 | 49.3 | 48.2 | 47.5 | 45.3 | 43.2 | 47.6 | 45.5 | 45.4 | 43.3 | 42.1 | 42.1 | 40.9 | 35.7 | 34.6 | 13.1 | - |
| 5.1 Wages (Table 9, Row 5.1)1/ | - | - | 7.0 | 9.0 | 9.0 | 9.0 | 10.0 | 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 | - |
| 5.2 Social surplus | (136.0) | (143.9) | 24.3 | 38.4 | 40.0 | 41.3 | 39.3 | 38.2 | 36.5 | 34.3 | 32.2 | 35.6 | 33.5 | 33.4 | 31.3 | 30.1 | 30.1 | 28.9 | 23.7 | 22.6 | 1.1 | - |
| 6. Discount factors at 9% discount rate2/ | 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 | - |
| 7. Discounted most probable net national value added (5 x 6) | (136.0) | (132.4) | 26.3 | 36.5 | 34.8 | 32.7 | 29.6 | 26.5 | 23.7 | 20.8 | 18.1 | 18.6 | 16.4 | 15.0 | 13.0 | 11.4 | 10.5 | 9.4 | 7.5 | 6.6 | 2.4 | 91.4 |
| 7.1 Discounted wages (5.1 x 6) | - | - | 5.9 | 6.9 | 6.4 | 5.9 | 6.0 | 5.5 | 5.5 | 5.1 | 4.6 | 4.7 | 4.3 | 4.0 | 3.6 | 3.2 | 3.0 | 2.8 | 2.8 | 2.3 | 2.2 | 84.7 |
| 7.2 Discounted social surplus (5.2 x 6) | (136.0) | (132.4) | 20.4 | 29.6 | 28.4 | 26.8 | 23.6 | 21.0 | 18.2 | 15.7 | 13.5 | 13.9 | 12.1 | 11.0 | 9.4 | 8.2 | 7.5 | 6.6 | 4.7 | 4.3 | 0.2 | 6.7 |

1/ Since uncertainty with regard to wages is considered relatively insignificant; the expected annual wage bills enter the analysis without adjustments.

2/ The project analysts carrying out the probability analysis assumed that the discount rate 9 per cent is certain and decided to apply the same rate used under deterministic conditions. However, it may often happen that the discount rate is uncertain, too. In such cases the discount rate should be treated as a key variable and the same approach followed as prescribed above.

5. Common operational steps of uncertainty analysis

Uncertainty analysis of any c terion could be facilitated if the following common operational steps are followed:

Step 1: Identify the key variables, which are expected to have large magnitudes and high variabilities and, therefore, 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 which have significant chances of occurrance;

Step 4: Assign probabilities of occurrence to each value based on experience, expectations as well as market and financial analysis;

Step 5: Combine the alternative values of relevant variables as well as their respective probabilities to get the probability of occurrence of each outcome as outlined above for each measure.

6. Data Requirements

Project analysis under deterministic and uncertainty situations requires the same type of information. The additional information required for sensitivity and probability analysis centres mainly around 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 essence of introducing uncertainty to project evaluation is to introduce into project analysis as much as possible the realities of life concerning future behaviour of relevant variables. Realizing that several values are likely and estimating them and their probabilities of occurance, using some value judgement, may be more accurate than completely ignoring them and imposing just one estimate for each variable as in the deterministic analysis.

However, uncertainty analysis requires more elaborate computations as compared to the deterministic case. The computational work will vastly increase as the number of possible values of each variable increases. One could cut down the volume of computations by concen-

trating only on the most important variables, risk-wise, judging from their values and their probability distributions.

The additional effort required for uncertainty analysis has to be justified by the additional benefits of introducing it. The higher the uncertainties concerning some variables, and the larger their ranges, the higher the benefits and the more urgent it is to introduce this analysis to 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: _____

Implementation: To start: _____

To be completed: _____

| Criteria[1] | Evaluation Results[2] |
|---|---|
| **I. Commercial Profitability** | |
| 1. Simple rate of return | ..... |
| 2. Net present value | ..... |
| 3. Financial aspects | ..... |
| 4. ..... | ..... |
| | General conclusions on Commercial Profitability: |
| | ..... |
| | ..... |
| **II. National Profitability** | |
| 1. Net national value added formation: | |
| 1.1 Absolute efficiency test | ..... |
| 1.2 Relative efficiency test | ..... |

1/ Under criteria the evaluator should list the criteria actually used for evaluating an investment project's commercial and national profitability under conditions of both certainty and uncertainty. The listing of the criteria here is for illustrative purposes only.

2/ The evaluator should briefly explain the most essential evaluation results to give the decision-maker in a very condensed way an idea about the merits and demerits of the project and a justification for its being recommended for selection, modification or rejection. The Evaluation Summary should be an "identify card" of the project. The presentation of the evaluation results should not be written using a very professional terminology. It should be easily understandable to those who read it without having gone 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 3-5 pages for a small and simple project to 10-15 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 on National Profitability:

.....

.....

III. Uncertainty Analysis

1. Breakeven analysis .....

2. Sensitivity analysis .....

3. Risk analysis .....

General Conclusions on 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:**

.....

..... .....

.....

# III. ANNEXES

## ANNEX A.

### List of Symbols used in the Manual

| | |
|---|---|
| ACIF | Actual cost insurance and freight price |
| ADMP | Actual domestic market price |
| AFOB | Actual free on board price |
| $a_t$ | Discount factor in year t |
| B | Value of visible and invisible receipts in the balance of payments |
| BEP | Breakeven point |
| CI | Cash inflow |
| CO | Cash outflow |
| D | Annual depreciation of fixed capital in a normal year |
| $DB^g$ | Distribution index of the government |
| $DB^p$ | Distribution index of the profit earners |
| $DB^w$ | Distribution index of the wage earners |
| $DB^r$ | Regional distribution index |
| DR | Domestic resource inputs |
| E | Absolute efficiency test for the whole economic life of a project |
| $E_c$ | Relative efficiency test under capital scarcity situation |
| $E_{FE}$ | Relative efficiency test under foreign exchange scarcity situation |
| $E_L$ | Relative efficiency test under skilled labour scarcity situation |
| $E_m$ | Absolute efficiency test for modernization project |
| $E_S$ | Absolute efficiency test for a normal year |
| $E_{SF}$ | Relative efficiency of a modernization project with regard to respective scarce factor (capital, foreign exchange, skilled labour) |
| F | Net profit in a normal year after taxes, interest, depreciation |
| FC | Fixed cost |
| FE | Net foreign exchange flow |
| FI | Foreign exchange inflow |
| FO | Foreign exchange outflow |

| | |
|---|---|
| $I$ | Investment, comprising equity and loans |
| $I^c$ | Value of investment for an industrial complex |
| $I^d$ | Direct investment |
| $I^i$ | Indirect investment |
| $I^T$ | Total investment (direct and indirect) |
| IC | International competitiveness indicator |
| $i_{min}$ | Cut-off rate of return |
| $i_r$ | Internal rate of return |
| $i_1$ | Lower discount rate at which NPV is still positive but close to zero |
| $i_2$ | Higher discount rate at which NPV is already negative but close to zero |
| L | Long-term loans |
| M | Value of visible and invisible payments in the Balance of Payments |
| MI | Value of current material inputs |
| $MI^c$ | Value of current material inputs used by an industrial complex |
| m | Number of constituent projects in an industrial complex |
| NCF | Net cash flow of a project |
| NDVA | Net domestic value added of a project |
| $(NDVA)^c$ | Net domestic value added of an industrial complex |
| NNVA | Net national value added of a project |
| $(NNVA)^c$ | Net national value added of an industrial complex |
| NPV | Net present value |
| NPVR | Net present value ratio |
| NV | Negative value of NPV at the higher discount rate in absolute terms |
| NVA | Net value added |
| n | Number of years |
| O | Value of output of an investment project |
| $O^c$ | Value of output of an industrial complex |
| $P^F$ | Adjusted rate of foreign exchange |
| P(FE) | Present value of the net foreign exchange flow |
| P(I) | Present value of investment |

| | |
|---|---|
| $P(I)_o$ | Present value of investment before (without) modernization |
| $P(I)_1$ | Present value of investment after (with) modernization |
| $P(L_s)$ | Present value of wages and fringe benefits paid to skilled labour |
| $P(L_s)_1$ | Present value of wages and fringe benefits paid to skilled labour after (with) modernization |
| P(SF) | Present value of expected scarce factor (capital, foreign exchange, skilled labour) committed to a modernization project |
| PV | Positive value of NPV at the lower discount rate |
| P(VA) | Present value of value added produced by a project |
| $P(VA)^o$ | Present value of value added produced by an industrial complex |
| $P(VA)_o$ | Present value of value added before (without) modernization |
| $P(VA)_1$ | Present value of value added after (with) modernization |
| P(W) | Present value of wages for a project |
| $P(W)^o$ | Present value of wages for an industrial complex |
| $P(W)_o$ | Present value of wages before (without) modernization |
| $P(W)_1$ | Present value of wages after (with) modernization |
| p | Pay-back period |
| $p_d$ | "Premium" for domestic projects |
| $p_i$ | "Premium" for an industry or a region |
| $p_m$ | Cut-off pay-back period |
| Q | Quantity in physical terms |
| R | Simple rate of return on total capital |
| $R_e$ | Simple rate of return on equity capital |
| $R_{de}$ | Debt-equity ratio |
| $R^F$ | Official rate of foreign exchange |
| $R_t$ | Value of repatriations from a project in year t |
| $(R)^o$ | Value of repatriations from an industrial complex |
| $r_i$ | Special promotional [illegible] for an industry or a region |

| | |
|---|---|
| $r_w$ | Actual rate of interest on the relevant world capital market |
| S | Balance of payments surplus (residual) |
| SP | Selling price |
| SRD | Social rate of discount |
| SS | Value of social surplus for a project |
| $(SS)^c$ | Value of social surplus for an industrial complex |
| VA | Value added produced by a project |
| $(VA)^c$ | Value added produced by an industrial complex |
| $VA^G$ | Value added received by the government |
| $VA^P$ | Value added received by the profit earners |
| $VA^r$ | Value added received by a region |
| $VA^u$ | Undistributed value added (at the disposal of the firm) |
| $VA^W$ | Value added received by the wage earners |
| VC | Variable cost per unit |
| W | Value of salaries and wages for a project |
| $(W)^c$ | Value of salaries and wages for an industrial complex |
| $W^d$ | Number of new direct job opportunities |
| $W^i$ | Number of new indirect job opportunities |
| $W^T$ | Total number of new job opportunities |
| $W_s$ | Number of new job opportunities for skilled workers |
| $W_u$ | Number of new job opportunities for unskilled workers |
| Y | Annual interest charges on loans in a normal year |
| $z_e^d$ | Direct employment effect per unit of investment |
| $z_e^i$ | Indirect employment effect per unit of investment |
| $z_e^T$ | Total employment effect (skilled plus unskilled) per unit of investment |
| $z_e^u$ | Employment effect of unskilled labour per unit of investment |

ANNEX B.

## 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 dinar 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 can be postponed for next year. Since both receipts and expenditures are spread over the whole 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. It is not recommended to use different rates of discount over different years. 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 time periods is known as the discount factor. If the rate of discount is constant, the discount factor for the $n^{th}$ year 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, which have been worked out. A table, providing the values of the discount factors at different values of the rate of discount (from 2 per cent to 30 per cent) and different number of years (from 1 to 50) is at the conclusion of this Annex. In this table, discount factors corresp nding to different rates of discount for a particular year are shown, row-wise. Similarly, 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 the fifth and sixth year would be 0.681 and 0.630, respectively; similarly, for the fifth year 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 with the sum of discount factors for these years. For instance, on page 116, Table B.3, Row 5, the net national value added is the same between the eleventh year and the ninteenth year. If one multiplies the annual value added of 62,400 dinars 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), one gets 157,870 dinars, which is equal to the sum total of discounted values added for this period (Row 7 of the Table).

TABLE I. PRESENT VALUE OF $D_1$ AT a RATE r PAYABLE IN n YEARS $\frac{1}{(1+r)^n}$

| 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 | 0.890 | 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 |

| n \ r | 9 % | 9½ % | 10 % | 11 % | 12 % | 13 % | 14 % | 15 % | 16 % | 18 % | 20 % | 25 % | 30 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 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 |
| 2 | 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 |
| 3 | 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 |
| 4 | 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 |
| 5 | 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 |
| 6 | 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 |
| 7 | 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 |
| 8 | 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 |
| 9 | 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 |
| 10 | 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 |
| 11 | 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 |
| 12 | 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 |
| 13 | 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 |
| 14 | 0.299 | 0.281 | 0.263 | 0.232 | 0.205 | 0.181 | 0160 | 0.141 | 0.125 | 0.099 | 0.078 | 0.044 | 0.025 |
| 15 | 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 |
| 16 | 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 |
| 17 | 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 |
| 18 | 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 |
| 19 | 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 |
| 20 | 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 |
| 21 | 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 |
| 22 | 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 |
| 23 | 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 |
| 24 | 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 |
| 25 | 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 |
| 26 | 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 |
| 27 | 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 |
| 28 | 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 |
| 29 | 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 |
| 30 | 0.075 | 0.066 | 0.057 | 0.044 | 0.033 | 0.026 | 0.020 | 0.015 | 0.012 | 0.007 | 0.004 | 0.001 | |
| 40 | 0.032 | 0.027 | 0.022 | 0.015 | 0.011 | 0.008 | 0.005 | 0.004 | 0.003 | 0.001 | 0.001 | | |
| 50 | 0.013 | 0.011 | 0.009 | 0.005 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | | | | |

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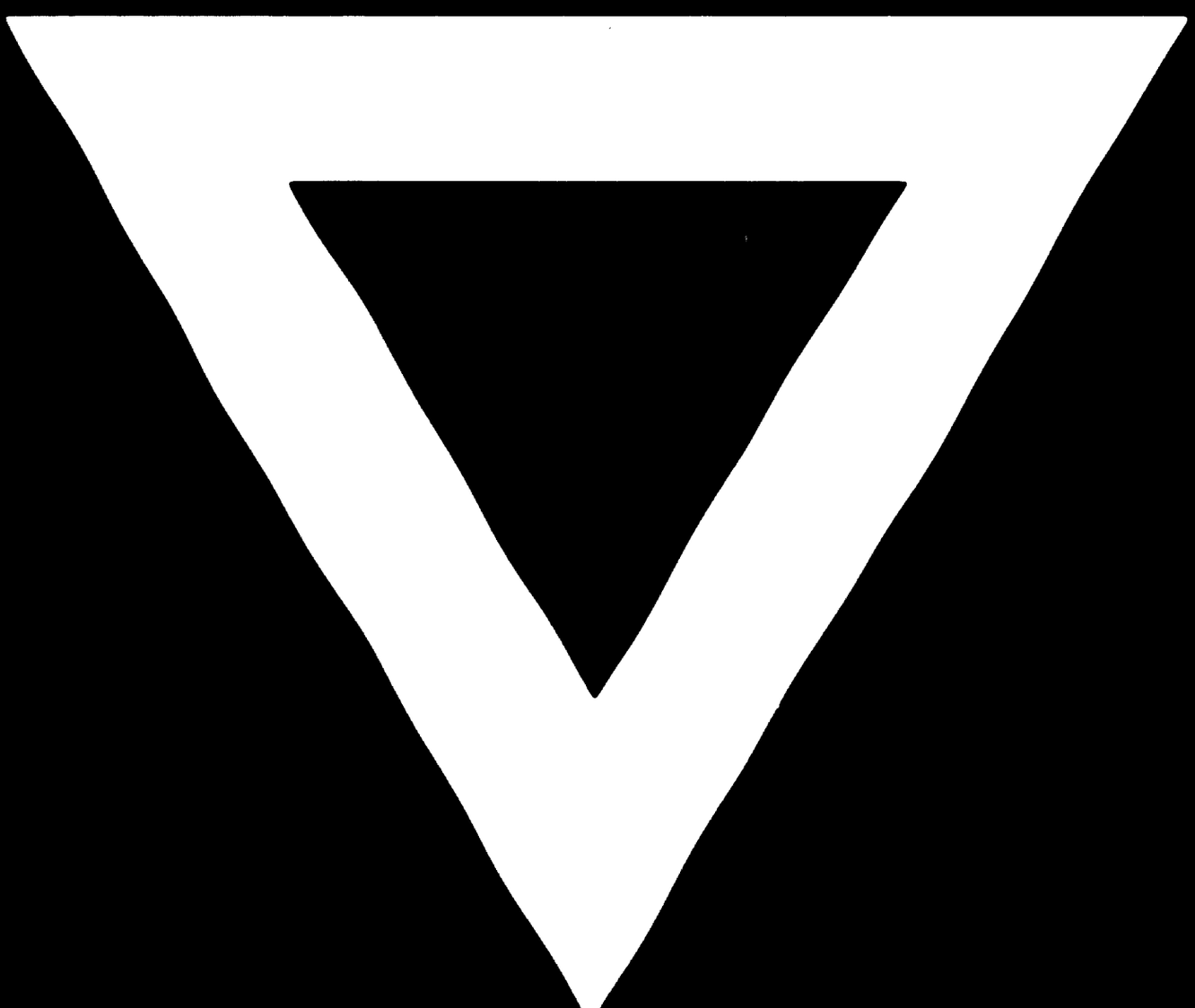

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