INTERAMERICAN DEVELOPMENT BANK (IDB)

NATIONAL INVESTMENT PROJECTS DATA BANK

LATIN AMERICA AND CARIBBEAN INSTITUTE FOR ECONOMIC AND SOCIAL PLANNING (ILPES)

PROJECT AND ADVISORY ASSISTANCE PROGRAMME

MANUAL FOR PROJECT IDENTIFICATION, FORMULATION AND APPRAISAL

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DNP

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DEPARTMENT OF NATIONAL PLANNING
INVESTMENTS AND PUBLIC FINANCES UNIT
METHODOLOGIES DIVISION

PROJECT AND ADVISORY ASSISTANCE PROGRAMME

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VOLUME IV

Manual for Project Identification, Formulation and Appraisal

* Prepared by Mr. Francisco Mejía, Coordinator, during the first two years, at the National Investment Projects Data Bank of Colombia (DNP/IDB/ILPES ATN/JF-3342-CO Agreement). The views expressed in this document, not submitted to editorial revision, are the sole responsibility of the author and do not necessarily coincide with those of the Organizations.

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PROLOGUE

Efforts to enhance macroeconomic efficiency must be complemented by the appropriate preparation and selection of public investment projects. Experience has shown that in a context of greater overall efficiency, the profitability and impact of projects is significantly increased.

Likewise, better-prepared projects take on greater importance in a more competitive, open and decentralized environment. All of these factors are closely related to the efficiency of public spending and the way in which resources are allocated to meet priority needs. In other words, the challenges of macroeconomic adjustment require, at the microeconomic level, high-yield project portfolios and consequently different ways of making public investment plans and budgetary allocations.

In light of the foregoing considerations, ILPES, in cooperation with the World Bank's Economic Development Institute (EDI) and ECLAC, have promoted a number of regional meetings in recent years for the exchange of experiences and ideas on the subject of investment programming and project cycles.

This two-volume publication contains all of the material covered in the seminar on **"Project Data Bank and Public Sector Investment Programming"**, held in Kingston, Jamaica, from 20 to 22 November 1991.

Our aim is to help not only to publicize the advances made in individual countries, but also to intensify the search for new methods and systems for increasing the yield of public investment.

Edgar Ortegón
Director
Projects and Advisory Assistance

THE INSTITUTIONAL FRAMEWORK

INTRODUCTION

The identification, formulation and evaluation of projects and programmes of public investment in Colombia is not a common practice in the process of their financing at the different levels of management (national, regional, departmental and municipal). Through the Law number 38, of 1989 ("Organic Budget Law") and its regulation of Project Data Banks, the institutional framework has been generated so that the budgets of the different administrative levels may be formulated and discussed effectively, based upon investment projects correctly formulated and evaluated. This institutional space has served as the base, so that, as part of the development of the Law and its regulations, the Department of National Planning is in the process of developing the Colombia Bank of Investment Projects (CBIP).

A central element of this process of institutional change is the development of the methodologies (general and sectorial) to identify, formulate and evaluate investment projects at the different administrative levels.

The development of manuals for the formulation and evaluation of investment projects requires a reference manual, upon whose structure should be based the specific manuals which must also serve for those sectors which do not have sectorial manuals. The main purpose of this Manual is to serve as a working tool which indicates what is required in order to identify, prepare and evaluate a project. This means that it intends to be neither a reference book nor a university text. It rather tries to be an instrument which may be applied clearly to the process of identification, formulation and evaluation of projects proposed by public servants.

The sense of the Manual, if one allows the comparison, is similar to that of the manual which comes with an automobile. This type of Manual does not suppose that the person who buys the car is an expert automobile mechanic, nor does it explain the process of internal combustion. When the car won't start, because of troubles with the spark plugs, the owner usually consults the car's manual. If what he finds in this manual is a detailed description of the role of the spark plugs, the owner won't know what to do.

Alternatively, the car's owner may find, under the heading of what to do when the spark plugs do not spark, instructions to dry the plugs if they are wet, to clean them, or to change them if they are burnt. If the car does not start after trying these possibilities, the manual usually will suggest taking the car to a mechanic.

The methodological Manual of identification, formulation and evaluation of projects of the Project Data Bank intend to provide the basic tools to identify, formulate and evaluate at a profile level, specific projects.

STRUCTURE OF THE MANUAL

The Manual attempts to be self-contained, and to provide the knowledge which the user of the Project Data Bank needs to satisfy his requirements, in terms of a minimum quality of information. The Manual is divided in two major parts: the first part, the Manual itself, is divided into Modules; the second part is composed of the Annexes.

The main body of this Manual is composed of Modules. Each Module is designed to resolve a specific problem in the cycle identification-preparation-evaluation. Each one should conclude, independently of the others, in a concrete result. Each Module is divided into two sections; the first is a description of the specific problem and the corresponding instructions for its solution, that require filling-out a series of previously established Forms; the second part is composed of the specific Forms to be filled-out in this Module.

The Manual has **seven Modules**. The first two do not lead to concrete results nor precise instructions. They simply give the frame of reference: the institutional-legal framework and the formal structure of the cycle of projects. Modules three to seven take the user step-by-step until he obtains a relatively solid understanding of the principal characteristics of a project at the profile level. The sequence of the different Modules may be consulted in Module 2.

The second part is composed of **eleven Annexes**. Annex 1 gives the instructions of how to present the project, once the analyses requested in each of the Modules have been completed. Annex 2 includes the empty Forms, ready to photocopy. Annex 3 presents the financial flow conventions used in this Manual. Annex 4 gives the tables of financial equivalents that should be used in applying this Manual. Annex 5 presents the formulas used in the tables of financial equivalents. Annex 6 gives the classifications of the labor force, according to whether it is specialized or not. Annex 7 presents formally the cycle of a project. Annex 8 details the principal criteria for project selection. Annex 9 is a table of project indicator terms which may serve for reference. Annex 10 is a small bibliography of references which are easy to obtain in Colombia. Annex 11 is a list of addresses where technical assistance may be obtained in the formulation of projects.

APPLICATION OF THIS MANUAL

In principle, a project may be registered at any time of the year. However, those projects which will be financed with resources of the General National Budget in 1993, must arrive in the Operations Division at the latest in January 1992.

Those projects which were presented for funding in 1992, were not required to include a study of identification, preparation and evaluation.

The following criteria will be followed for projects submitted for 1993:

a) All **new projects** must be identified, prepared and evaluated according to this Manual, except for those in sectors which have a specific methodology.

b) Those projects which extend over more than two years (1993, 1994 or more) and are already registered in the CBIP, must be identified, prepared and evaluated based upon the methodology described here, unless the sector has a specific Form.

c) Projects which are registered in the CBIP and whose execution finishes in 1993, are the only projects which do not have to be evaluated with these methodologies.

Remember that you should not send all the filled-out Forms, but **only the project summary**, as indicated in Annex 1. Do not forget that the code of the general methodology (or the general methodological Manual) is number 001, and that you should fill-out this BIS card according to the norms established in Volume I of this Manual.

THE CYCLE OF THE PROJECT

INTRODUCTION

This Module, called **"Module of the Cycle of the Project"**, is the second Module of this methodological manual. In this introduction we describe the so-called "cycle of a project" in general terms. In the second section, called **"The Cycle of the Project and the CBIP"**, we describe the relation between the general cycle and the cycle of the project, in the context of the project register in the Colombia Data Bank of Investment Projects (CBIP).

An investment project, from its gestation (because there is a problem, or several problems to solve, until the end of its operation) passes through three phases: the **pre-investment** phase, the **investment** phase and the **operational** phase.

In the **pre-investment** phase one must compile information and study the convenience of the project based upon this information. The phase has several **stages**. The first stage is called the **stage of the idea.** In this stage, one must identify the problem (or problems) which one desires to solve by the execution of the project, and identify the ideas for its solution. These ideas should be submitted to a test of identification, and if they are reasonable, one proceeds to prepare and evaluate them at the profile level. The second stage is called the **profile stage.** Here, the preparation and evaluation of the project is based upon secondary information. With this, one tries to make a decision: Should the project be tackled? Should it be abandoned? Should it be postponed? If the project is abandoned or postponed, the cycle terminates here.

If the project should be studied more deeply, we pass on to the stages of **pre-feasibility** and **feasibility.** In these stages, more detailed information is required, in the case of projects of large dimension. If the information about the project at the profile level is sufficient to decide to finance it, the project will then pass to the second phase: the **investment phase.**

The **investment phase** covers the actual development or construction of the project, up to the point when it begins to operate. In some cases, this phase includes the elaboration of the definitive designs of the project. When the project enters into operation, we say that it has passed to the **operation phase.** In this phase, the project should begin to produce the results for which it was designed.

THE CYCLE OF A PROJECT AND THE CBIP

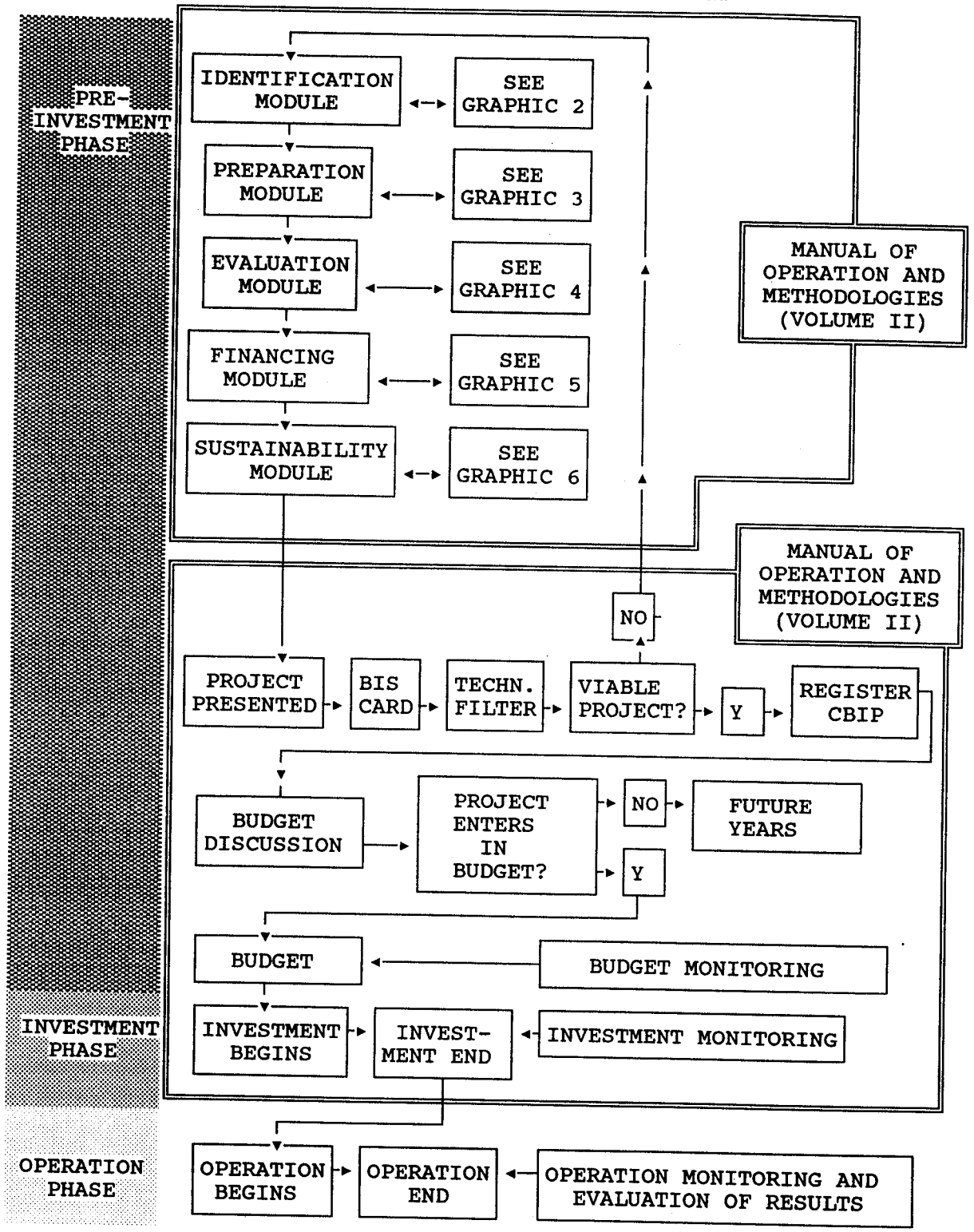
A project should thus pass through the phases of pre-investment, investment and operation. In Graphic 1 is presented the relation between this cycle and the Colombia Data Bank Investment Projects. For this purpose, the analysis of the project starts in the Identification Module. These ideas should be submitted to an initial test of their viability; that is, there should be some assurance that we shall find viable technical, economic or institutional solutions. Once the problem and the alternatives of solution are identified, these should be prepared and quantified for study. This is the purpose of the **Preparation Module.** It is possible that some of the alternatives should be abandoned in this process, because they are clearly not viable. The next step is to evaluate the different alternatives and to choose the one which is best from the social point of view; that is, the one which will best solve the problem.

This alternative should be studied from the perspective of the viability of its financing: Are there adequate resources for its financing? This is the purpose of the **Module of Financing.**

Once the sources of the resources are defined, the selected alternative should be studied in terms of its institutional viability, in medium and long-term scales. It is helpful to know if the institutions that will contribute to the project have the structure, the funds and the capacity to take the project through its phases of investment and operation. This is the purpose of the **Module of Sustainability.**

Once the study of the project is completed, it should be presented in summary form in the presentation scheme suggested in Annex 1 of this Volume.

GRAPHIC 1
THE PROJECT CYCLE AND THE CBIP



At the same time, if you want the project to receive funds from the General National Budget (GNB), you must fill-out the card called "Basic Investment Statistics" (BIS), only for the selected alternative. The instructions for this purpose may be found in Volume 1 of this Manual.

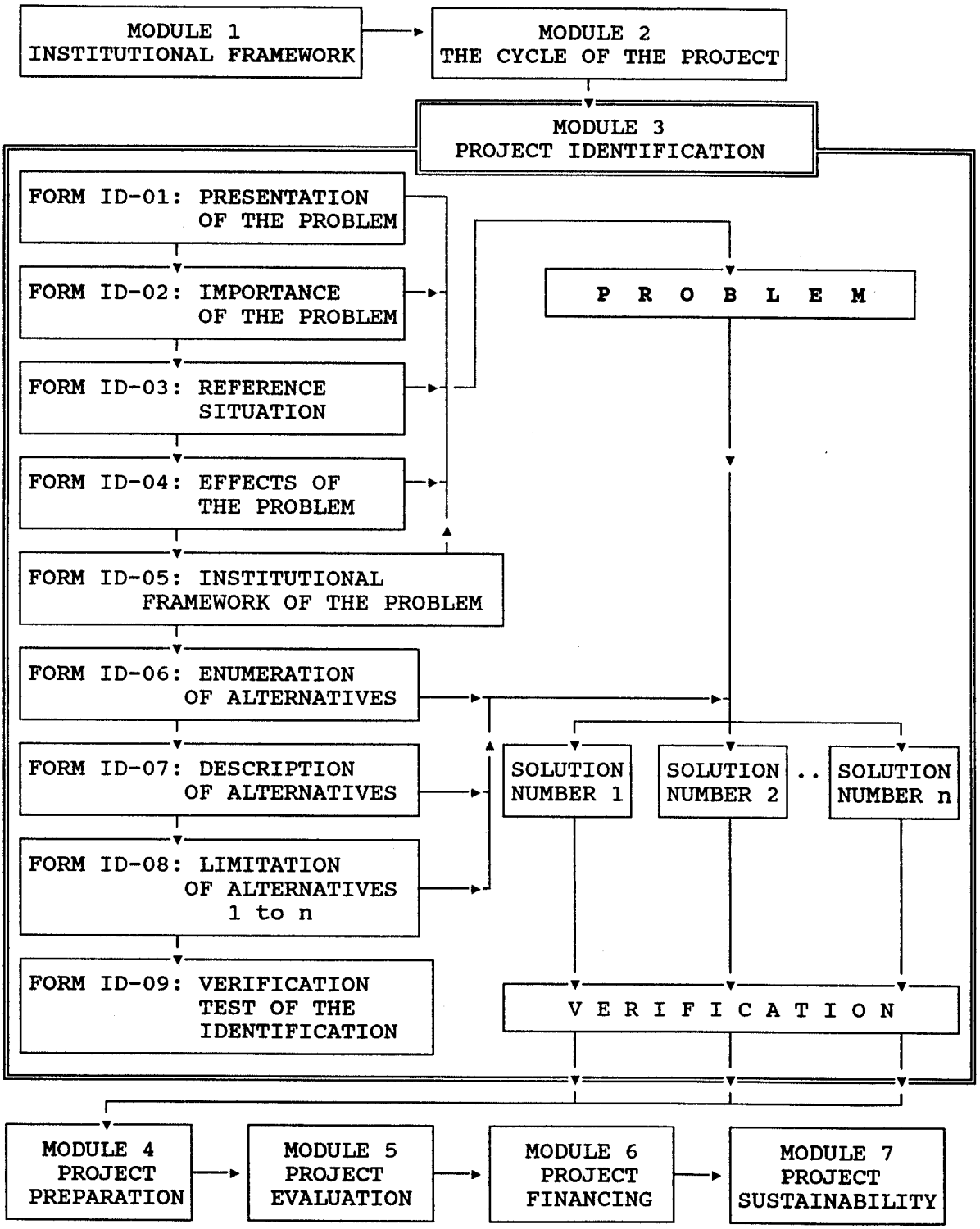
Remember that this Manual should be used to **compare different alternatives of solution for the same problem.** It is possible, however, that some problems have only one solution (alternative) technically viable. When in this methodology we speak of "alternatives" and of "selection of alternatives", we are talking about the possible solutions to the same problem, **not about projects that solve different problems.** That is, do not confuse the selection of alternatives for one project with the selection (and prioritization) of projects which solve different problems.

DO NOT USE THE METHODOLOGY TO SET PRIORITIES FOR DIFFERENT INVESTMENT PROJECTS. USE IT ONLY TO COMPARE AMONG ALTERNATIVE SOLUTIONS TO THE SAME PROBLEM.

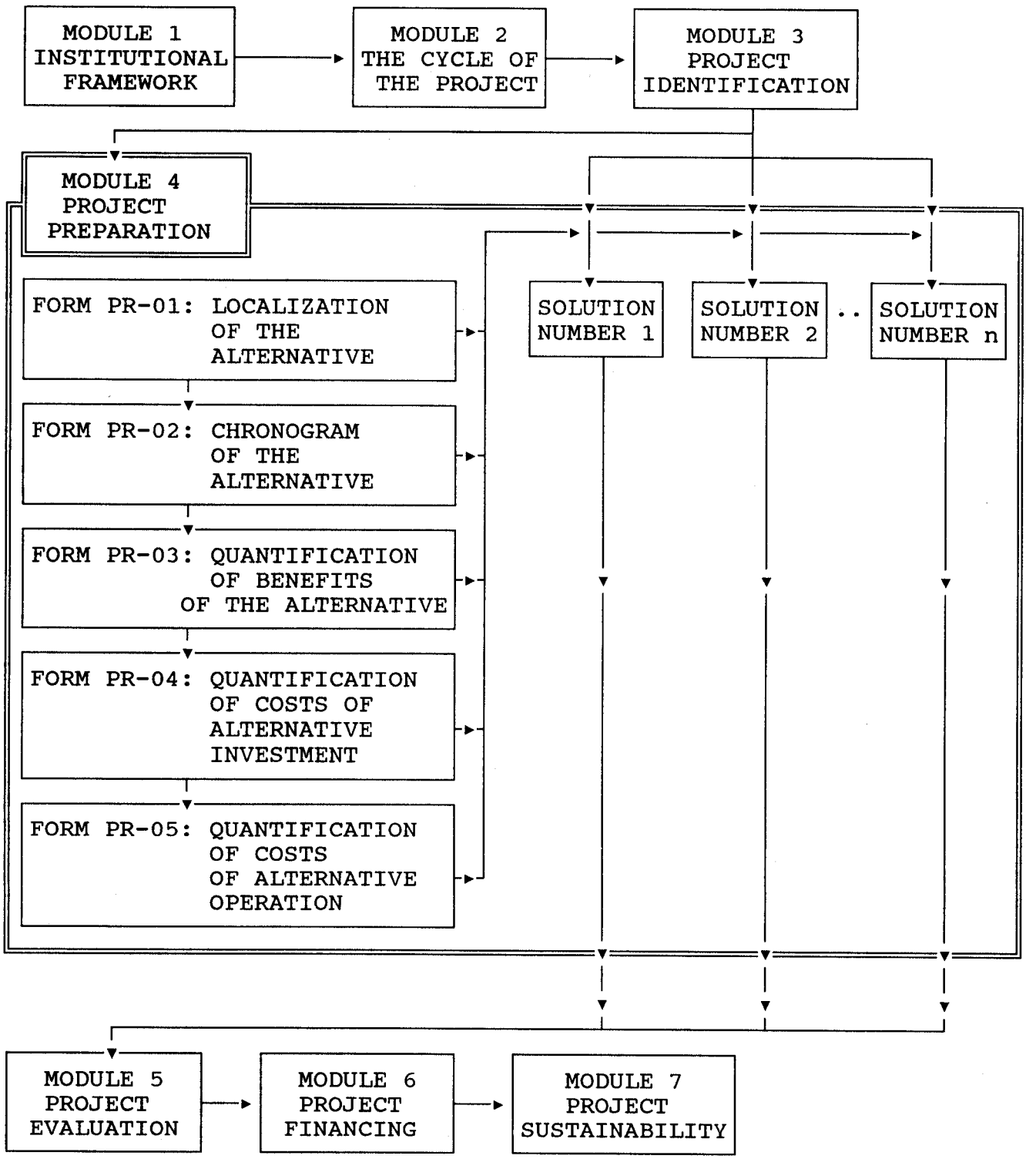
Once the BIS card is filled-out, and taking into account the information of the project, the DNP will study its viability, after following the processes defined in the Regulatory Decrees of Law number 38, that refer to the Data Bank of Investment Projects. If the project is not viable, it must be reformulated and the cycle must be begun again. If it is viable, it will be registered in the CBIP, and its budget feasibility will be studied in the appropriate instances (functional committees, National Congress). Once the project receives funds from the GNB, the investment phase will begin. When this phase is completed, it passes on to the operation phase, as indicated in Graphic 1. All the instructions for this purpose may be found in Volume I of this Manual.

Given that the emphasis of this Volume is that associated with the procedures required to identify, prepare and evaluate investment projects, in Graphics 2 to 6 we present the structure of each of the Modules that compose this Manual. You should keep in mind what was mentioned in the previous Module: All investment projects that require funds from the GNB, and whose execution does not finish in 1993, must be evaluated with this methodology, except for those projects which have special methodologies for their preparation.

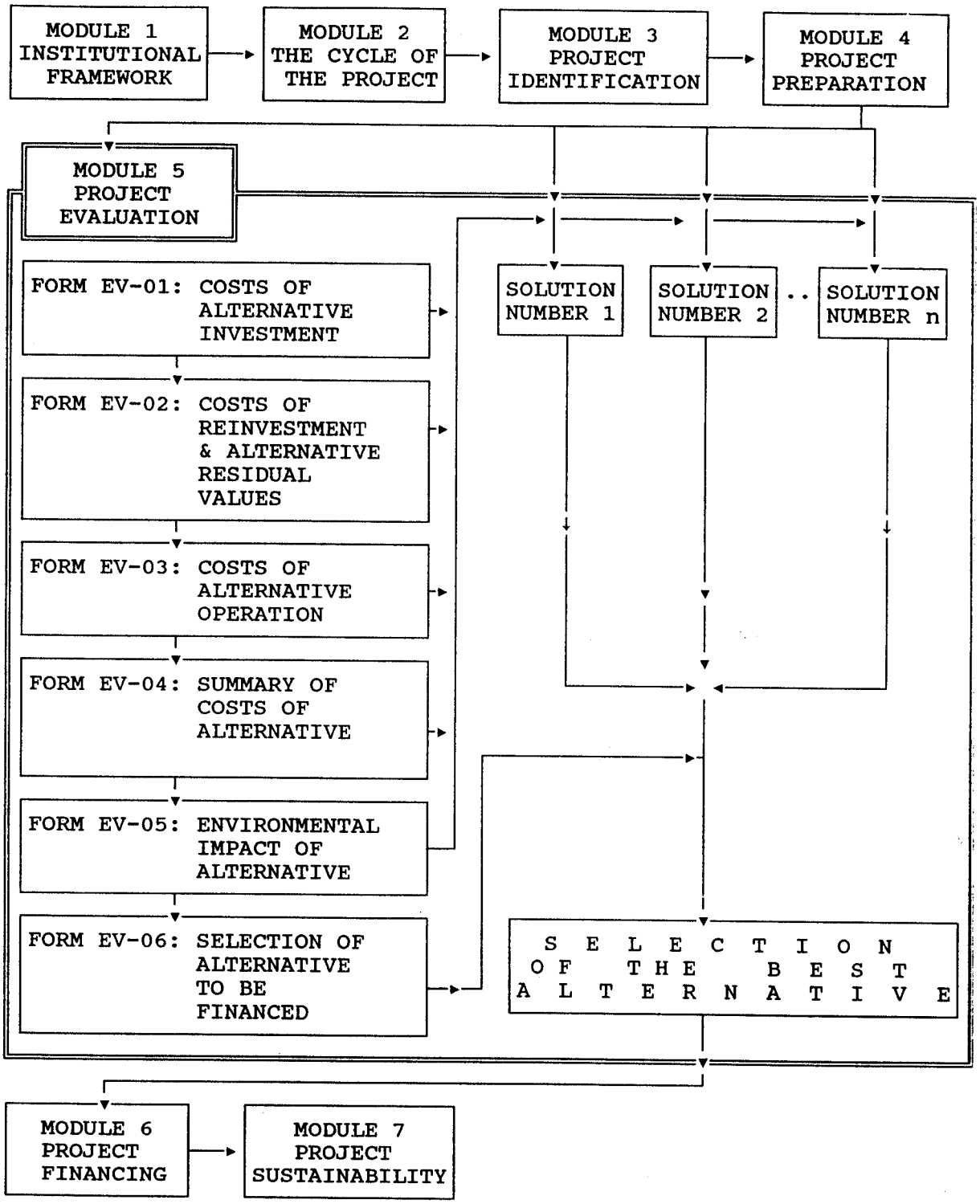
GRAPHIC 2
MODULE 3: PROJECT IDENTIFICATION



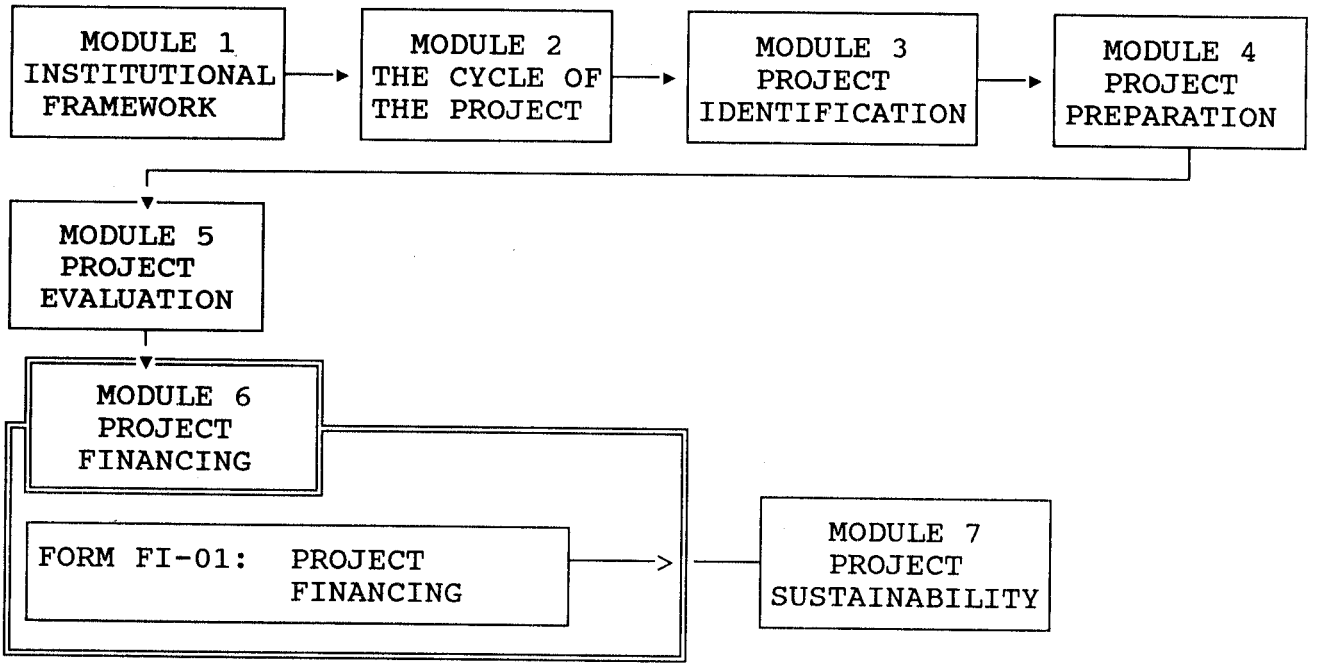
GRAPHIC 3
MODULE 4: PROJECT PREPARATION



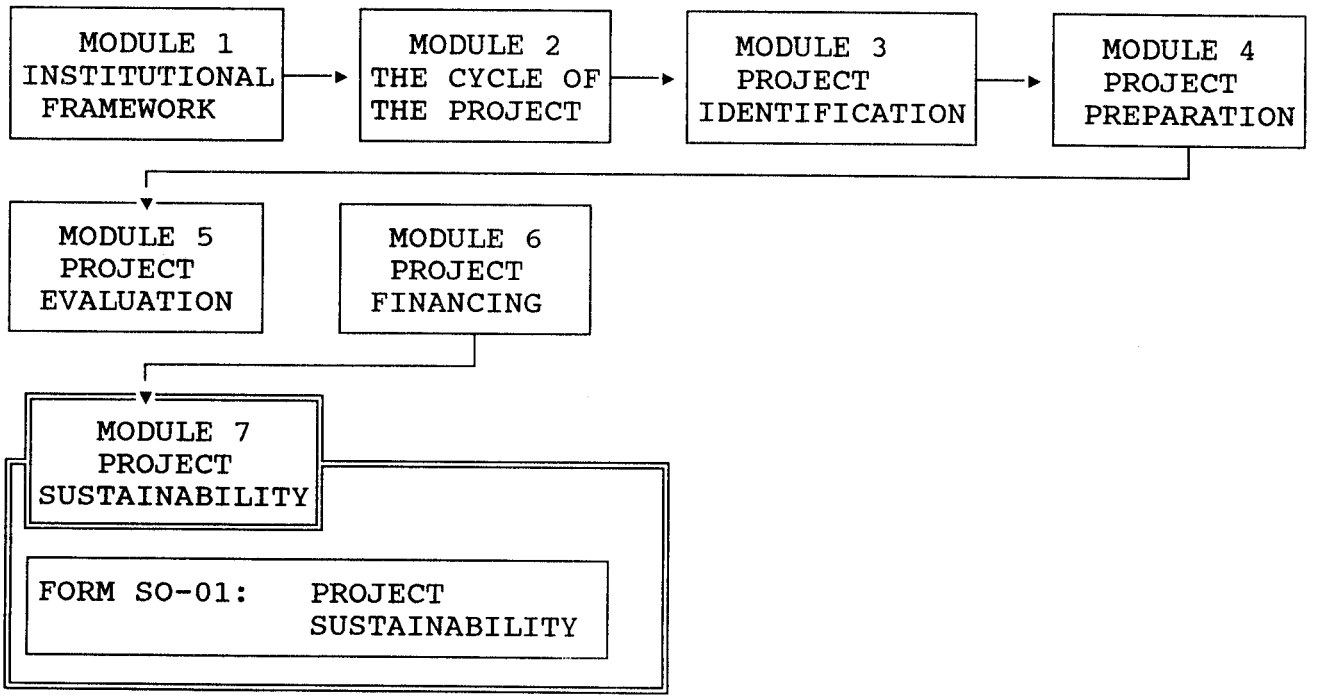
GRAPHIC 4
MODULE 5: EVALUATION OF THE PROJECT



GRAPHIC 5
MODULE 6: PROJECT FINANCING



GRAPHIC 6
MODULE 7: PROJECT SUSTAINABILITY



IDENTIFICATION

INTRODUCTION

This Module, called the **Identification Module** is the **third** Module of this Chapter, but the first in which the user should follow a set of precise instructions to fill-out its **nine Forms.** Before continuing with the following Module (Project Preparation), all of the accompanying nine Forms should be completed.

As in the other Modules of this Manual, we first describe the purpose of the Module. In this case, it is the correct **identification** of the problem that is to be solved, and the general description of the different possible alternatives for its solution. This is presented in the following section, called **In what does the identification of a project consists?** Following this description, we present the nine Forms (section **Instructions for Identification Forms**). This should be filled-out according to the instructions, answering in an orderly fashion to the questions presented in them. In Annex 2 we present these Forms ready to use or photocopy. It is important to note that the Forms of the present Module are numbered sequentially with the prefix "ID".

IN WHAT DOES THE IDENTIFICATION OF A PROJECT CONSISTS?

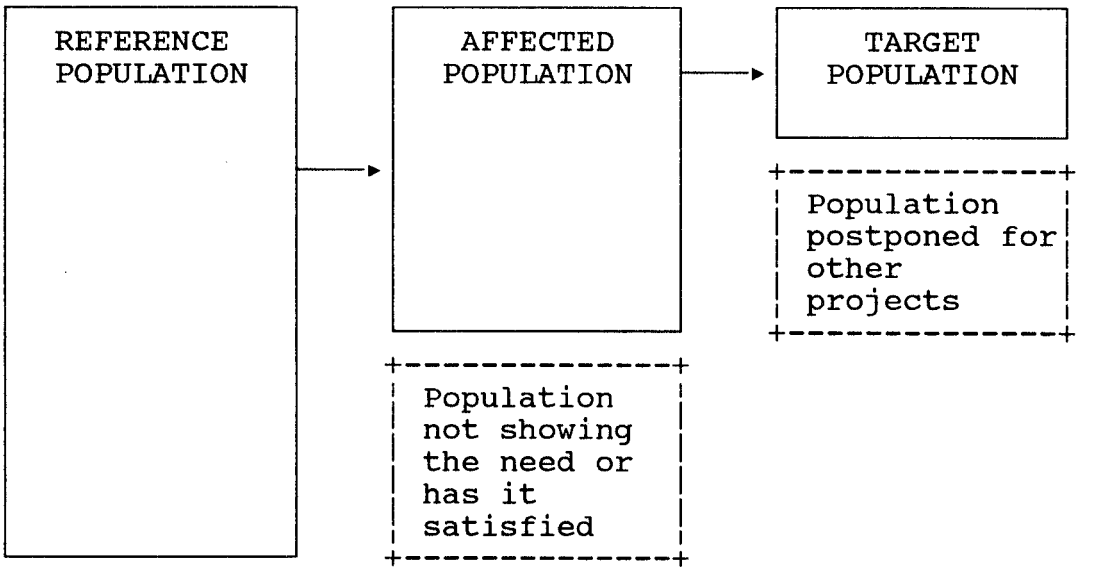
Although there are many definitions of what a project is, it should be understood as a group of investments or institutional and other kind of measures designed to obtain a specific objective (or series of objectives) of development within a period. This definition suggests that a project may include both a physical operation and/or a group of institutional measures that lead to the solution of a problem. The purpose of all public investment projects is precisely that of solving --with the application of public funds-- one or several of the problems that the community faces.

For this reason, it is important to have clear what is the problem which is desired to solve. The Forms ID-01 to ID-05 are intended to give a guide on how to formulate the main characteristics of the problem to be solved, in terms of its dimensions, causes, effects, complexity, available resources (public and private), etc. All this is aimed at defining the problem as precisely as possible. Having the problem clear will improve the possibility of success of a project which intends to solve it.

In the process which should be used in filling-out the Forms ID-01 to ID-05, what should be kept in mind is that you are trying to delimit the problem clearly. For example, the general problem that one wishes to solve might be the poor health situation of a neighborhood of a town. In more specific terms, the problem may be defined as that of diarrheal sicknesses in the infantile population (caused, for example, by the consumption of contaminated water). In this case (see Graphic ID-1) the target population would be the infantile population (for example, less than six years of age) of the neighborhood most affected by the problem, since the rest of the population of the neighborhood (of other ages) and of the town do not appear affected by the problem.

GRAPHIC ID-1

Example of the delimitation of a problem in terms of the affected population



Of this infantile population of the neighborhood affected by gastrointestinal problems one could argue, by way of example, that the infantile population of a sector A which lives farther away from the foci of infection is not so seriously affected, and therefore it is more urgent to solve the problem of the infantile population in sector B, which live beside the stream which is the focus of infection. This later population could be called the target population.

The problem should first be presented in the most concrete terms possible (Form ID-01). Next should be presented the importance of the problem and the effects that it has on the population (Forms ID-02 and ID-04). Clearly, if the problem is important, it is possible that other attempts to solve it have already presented, or that its solution has been discounted because it is not urgent. This is what Form ID-03 tries to determine.

Finally, in the presentation of the problem, if it requires an urgent solution, you should try to identify what is the institutional framework into which the problem falls. It is possible, for example, that the problem is technically feasible to solve, but that there are no institutions in existence which permit the project to be developed without difficulties. The purpose of Form ID-05 is to solve these doubts.

Once the problem (or problems) to solve have been defined, the possible alternatives of solution should be described in one or two phrases, each in Form ID-06. These alternatives should be presented in more detail in Forms ID-07 and ID-08. It is important to note that among the alternatives which are proposed, it is always convenient to include one that describes what will happen if no project is undertaken (this is normally called the "situation without project"). The situation without project should serve as a base or standard of comparison for all the other alternatives.

It is also important to propose one of the alternatives as that which barely requires minimum improvements to solve the problem. This is normally called the "optimized base situation". The description of these two situations is extremely important, since in many occasions the problem which is being proposed could be solved with administrative measures or with the other kind of measures which are relatively simple and without major costs.

In summary, a general problem has commonly more concrete manifestations. The purpose of all projects should be to solve these problems. The reason for the existence of an alternative solution is only that of another way to solve the problem. The objective is to convert the needs into projects which satisfy them. For this reason, it is recommendable to analyze and detail the problem; to have an idea of its dimension, its causes, its effects and its complexity, in order to configure possible alternatives of solution. In Graphic ID-2 is presented an example of this conversion.

GRAPHIC ID-2

FROM PROBLEMS TO ALTERNATIVES OF SOLUTION
(Some examples)

Problem or necessity	Possible alternatives of solution
Lack of drinking water	- Buy a trunk truck - Enlarge the aqueduct - Build a public water source - Improve the existing service by reducing losses
Children without school	- Enlarge the existing schools - Build a new school - Send children to neighboring town in rented bus - Half-day school sessions
Dirty streets	- Clean-up campaign - Buy garbage trucks - Hire a garbage-collecting service - Reorganize the existing service
Lack of water for irrigation	- Build a new irrigation canal - Enlarge the existing canal
Flooding of a neighborhood	- Relocate the neighborhood - Build a dam - Channel the water

Finally, it is important to recapitulate all the previous questions in one Form. This is Form ID-09, which presents a "list of verification of identification". When you fill-out this Form you should use the information from the answers from all the previous Forms. Remember that this completed Form will be used for the preparation of the project in Module 4. For this reason, it is vital to go over the Forms already filled-out and discuss the answers given based upon what was answered in the Forms. The process of identification (as well as preparation and evaluation) is essentially iterative and dynamic, in the sense that the information which is accumulated enriches the identification of the problem and its possible alternatives of solution. Do not go on to the next Module until you have solved completely at least all the questions asked in the Forms.

The process of identification of a project should be understood as a dynamic process, in which the number of ideas and possibilities for the solution to a problem should be reduced, and those which merit a more detailed analysis are defined in some detail. You should remember that the iterative and dynamic process of identification of a project means that you should go back over the Forms already filled-out **as often as needed**, to improve the quality of the information included. Frequently, the difference between the task of identification and that of preparation (next Module) is more on degree than on type.

The Graphic ID-3 shows the type of information that is generated in the following Modules. However, it is important to have a first approximation to these elements, once the Module of identification is completed.

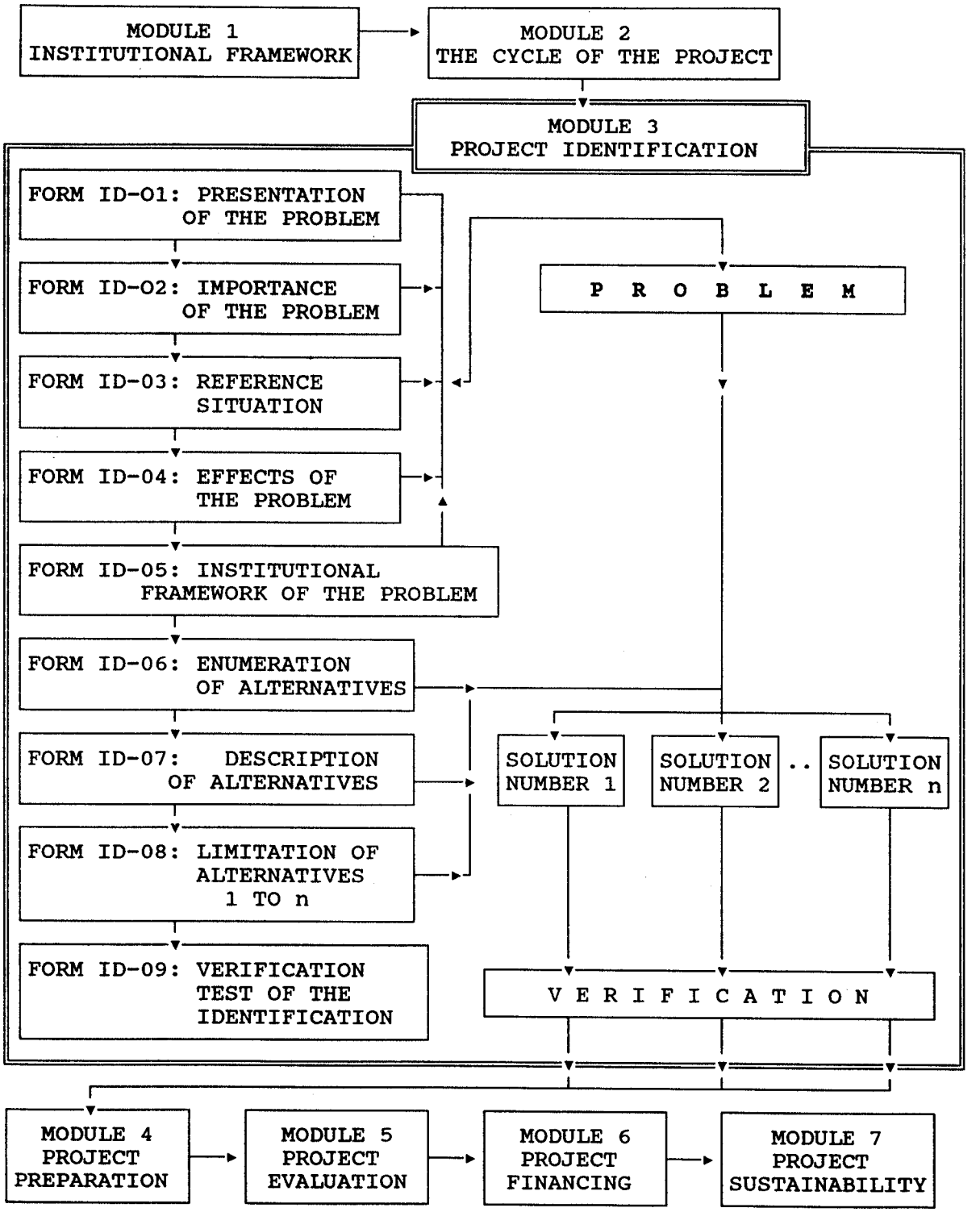
GRAPHIC ID-3

SUMMARY OF THE QUESTIONS OF THE IDENTIFICATION MODULE AND TYPE OF STUDY IN WHICH IT WOULD BE INCORPORATED

WHAT NECESSITY WILL BE SOLVED? WHAT GOOD OR SERVICE IS REQUIRED TO BE PRODUCED? HOW MUCH SHOULD BE PRODUCED?	→ MARKET STUDY
HOW WILL IT BE PRODUCED?	→ TECHNICAL STUDY OF ALTERNATIVES
WHAT RESOURCES WILL BE USED? HOW AND WHEN?	→ MARKET STUDY OF RESOURCES
WHERE WILL IT BE PRODUCED?	→ STUDY LOCALIZATION
HOW WILL THE PROJECT BE EXECUTED?	→ ORGANIZATION STUDY
HOW WILL THE PROJECT BE FINANCED?	→ FINANCING STUDY

In terms of the content of the present Module, the entire process previously described for the identification of the problems and its possible solutions is presented in Graphic ID-4. Never forget that the process is recursive, and that the answer to some of the questions may oblige you to revise previous answers.

GRAPHIC ID-4


MODULE 1
INSTITUTIONAL FRAMEWORK
MODULE 2
THE CYCLE OF THE PROJECT
MODULE 3
PROJECT IDENTIFICATION
FORM ID-01: PRESENTATION OF THE PROBLEM
FORM ID-02: IMPORTANCE OF THE PROBLEM
FORM ID-03: REFERENCE SITUATION
FORM ID-04: EFFECTS OF THE PROBLEM
FORM ID-05: INSTITUTIONAL FRAMEWORK OF THE PROBLEM
FORM ID-06: ENUMERATION OF ALTERNATIVES
FORM ID-07: DESCRIPTION OF ALTERNATIVES
FORM ID-08: LIMITATION OF ALTERNATIVES 1 TO n
FORM ID-09: VERIFICATION TEST OF THE IDENTIFICATION
P R O B L E M
SOLUTION NUMBER 1
SOLUTION NUMBER 2
..
SOLUTION NUMBER n
V E R I F I C A T I O N
MODULE 4
PROJECT PREPARATION
MODULE 5
PROJECT EVALUATION
MODULE 6
PROJECT FINANCING
MODULE 7
PROJECT SUSTAINABILITY

Each of the Forms of this Module has a central question whose answer should be given in the clearest possible form. For this purpose, in each Form you will find a series of questions. Those questions, marked with the symbol "√" should necessarily be answered. Those without the symbol are optional. Many of these questions require interdisciplinary and group work. In many occasions no one person can solve them alone. From the beginning of the identification of the problem and of its possible solutions, it is important to work in interdisciplinary groups that include the professions required for an adequate statement of the problem, and particularly of the solutions.

The first five Forms (ID-01 to ID-05) should be filled-out to determine the problem, and attempt to delimit it adequately. Forms ID-07 and ID-08 should be filled-out **for each one of the possible alternative solutions** listed in Form ID-06. Remember that these alternatives will be analyzed in more detail later on. The information that is included in them should be as close as possible to reality. Possibly, some of the alternatives identified may or should be abandoned in this stage, because some of their characteristics imply that they do not deserve more detailed study.

It is important to note that, when you respond to the questions in each of the Forms, you must try to be sure that the answers reflect the content of the questions. For example, to answer the question " Is the problem you wish to solve new to the communities or areas affected by it?", you should not answer with a simple yes or no. The response to the question should try to include the information contained in the question.

Finally, it should be mentioned that in each one of the Forms you should identify the name of the project. It is difficult, however, to give a specific name when you are in the stage of describing the problem and its possible alternative solutions. Therefore, to fill-in correctly the space for the project name, you should use the following procedure:

1. Entitle Forms with a phrase which summarizes the problem according to the responses given in Form ID-01. For example: "Lack of drinking water in Cubiti", "Illiteracy in Sucre", "Housing problem in the Air Force Base in Palanquero".

2. Once the Forms have been completed, choose the name of one of the possible alternatives of solution, according to the norms of the CBIP (process, object, localization) established in Volume I of this Manual.

3. Entitle Forms ID-01 to ID-09 with this name, and take the opportunity to revise the answers given in each of them.

4. Use this name in the following Modules.

Always remember that the response to the questions asked may lead you to reconsider earlier answers. Be sure that you have reviewed in detail all the Forms, and have responded at least to all the obligatory questions. Do not forget that, even in this stage, some of the alternatives may be discarded. Be clear in your answers, and try to answer in complete, clear sentences.

Do not forget to use, in this and in the following Modules, copies of the empty Forms contained in Annex 2 of this Chapter.

SPACE FOR THE PROJECT NAME

FORM ID-01: PRESENTATION OF THE PROBLEM

Question Nº 1	**Describe** the problem or need in general terms.
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-01 of Annex 2.

✓ **Describe what is the problem or unsolved need that requires some kind of action for its solution.**

✓ **What are the causes of the problem or unsolved needs to be solved?**

✓ **What are the repercussions and effects of the stated problem?**

✓ **Where is the problems located geographically?**

Why is a solution required to the problem?: Has there been or will there be a calamity; has a solution to this problem been needed for some time; is the solution to the problem contemplated in some action plan or in a plan of the municipal, departmental, regional or national government? Does the community demand a solution?

With what specific criteria was the problem identified? Technical, economic, social or other criteria.

SPACE FOR THE PROJECT NAME	
FORM ID-02: IMPORTANCE OF THE PROBLEM	

Question Nº 2	How **important** is the problem, or what priority does it have, compared to other problems?
Instructions:	Try to answer **at least** the questions marked with the symbol "√". Work in Form ID-02 of Annex 2.

√ **How generalized is the problem?:**
- **Is this problem or necessity shared by the entire population, or only by a part of it?**

Has the problem been discussed with those affected by it?

What opinions exist about the problem?

Are the needs which may be solved with the execution of the project of recent occurrence, or have they been around for some time?

Is this a problem which presents itself regularly? (For example, every winter).

SPACE FOR THE PROJECT NAME

FORM ID-03 REFERENCE SITUATION

Question Nº 3	What will be the evolution of the problem situation if **nothing is done** to solve it, and what **former solution** or similar attempts have existed or exist in the problem area?
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-02 of Annex 2.

✓ **If no project is executed (without knowing its characteristics yet) to solve the problem, what are the perspectives that the problem will get seriously worse in the next two years? Be specific.**

✓ **What similar experiences exist of solutions that have solved similar problems?**

What potential or unused capacity exists of these similar projects or services, close to those that would be needed to solve the problem?

Could the problem be solved with a better use of these goods or services? How much of the problem could they solve?

Can the problem be resolved without monetary investment?

To what point has the redistribution of the use of available resources (physical, financial, institutional, etc.) been considered? For example, transfer a nearby doctor instead of building a new medical post?

SPACE FOR THE PROJECT NAME

FORM ID-04: EFFECTS OF THE PROBLEM

Question Nº 4	What are the effects or repercussions of the problem?

Instructions: Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-04 of Annex 2.

In the whole population or reference area, which group is most affected? This is called "affected population or area". For this area or population, answer the following:

[AFFECTED POPULATION OR AREA]

✓ **Which population or area is affected by the necessities or deficiencies which you wish to solve?**
What socioeconomic characteristics has the population or area suffering the problem?
In what way are these characteristics different from those of the neighboring population or area?

Which sex and/or age ranges have the problem?
In what way are their characteristics different from those of the neighboring population or area?

For the affected population or area, try to describe the target population or area, in terms of the following questions:

[TARGET POPULATION OR AREA]

✓ **Of all those affected by the problem, for which group should it be solved first?**
For which part of the population affected by the problem is it reasonable to consider solving it by means of the execution of a project?
For which part of the population affected by the problem is it urgent to consider solving it by means of the execution of a project?

SPACE FOR THE PROJECT NAME

FORM ID-05: INSTITUTIONAL FRAMEWORK OF THE PROBLEM (1/2)

Question Nº 5	What is the **institutional framework** and what are the **technical assistance needs** that are required in the presentation of the solutions?
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-05 of Annex 2.

✓ **In which instances has the problem (and possible alternative to solution) be presented previously?**

✓ **What have been the results of these presentations?**

✓ **Has the possibility been examined that the necessity could be resolved or solved by other institutional or economic agents, apart from the government? (The community itself, local action groups, direct contracts with the private sector, etc.)**

✓ **What kind of characteristics should the desirable alternative have, so that the project will be accepted without problems by its beneficiaries?** Try to state this in terms of size, location, financing, community participation or whatever other criteria that in your judgement is relevant, so that the alternatives in general will have no problems of acceptance in their execution or operation.

✓ **If the problem must be resolved at government spending, have you thought of which entities could be responsible for:**

a) financing the execution of the project;
b) financing the operation of the project;
c) beginning and operating the project when it is in operation?

What political, institutional and financial difficulties exist for the direct solution of the problem, without requiring government funds?

CONTINUED.....

SPACE FOR THE NAME OF PROJECT

FORM ID-05: INSTITUTIONAL FRAMEWORK OF THE PROBLEM (2/2)

Question Nº 5 (Continued)	What is the **institutional framework** and what are the **technical assistance needs** that are required in the presentation of the solutions?
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-05 of Annex 2.

Does the problem have special characteristics that make you think that technical assistance will be required in the preparation or execution of the project?

In the case that technical assistance is required, which governmental entities could provide it?

Which entities of the private sector, universities and non governmental organizations (including technical cooperation) could perform this function?

Are there quality requirements of goods, services or whose manufacture and/or equipment are contemplated, and which would be common to all the possible alternatives of solution? (For example, requirements of quality of water).

Are there quality requirements for the materials necessary for the production of the goods, services or products, and which would be common to all the possible alternatives of solution? (For example, requirements of the quality of asphalt to be used)?

Are there relevant technical norms common to the different alternatives? What are they?

SPACE FOR THE PROJECT NAME	
FORM ID-06: ENUMERATION OF ALTERNATIVES	

Question Nº 6	Describe the principal characteristics of each alternative of solution.
Instructions:	List and describe with one or more phrases each of the possible alternatives of solution. Work in Form ID-06 of Annex 2.
Alternative 1...	
Alternative 2...	
Alternative n...	

SPACE FOR THE PROJECT NAME	
FORM ID-07: DESCRIPTION ALTERNATIVE Nº	

Question Nº 7	Describe the principal characteristics of **this** alternative of solution.
Instructions:	Try to answer **at least** the questions marked with the symbol "√". Work in Form ID-07 of Annex 2.

√ **Describe the principal characteristics of this alternative in terms of the following elements:**

- Specific geographic **location.**
- First approximation to what this alternative covers: what proportion of the problem would be resolved with the execution of this alternative.
- First approximation, descriptive and without detailed calculations, **of the principal benefits.**
- First general description of the entities which might eventually assume the costs of investment and operation of this alternative.
- First approximation, descriptive and without detailed calculations, of the **principal costs.**
- First description of the possible social costs and environmental impact of this alternative.
- First general description of what would be, in this alternative, the necessity organization for its successful execution. Include, if appropriate, the degree of community participation that has been achieved in the decisions, and that is expected to be achieved during the operation of the project.

SPACE FOR THE PROJECT NAME	
FORM ID-08: LIMITATIONS OF ALTERNATIVE Nº	

Question Nº 8	Describe the principal limitations of **this** alternative of solution.
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-08 of Annex 2.

✓ **What practices, beliefs or costumes of the area or population affected by the problem would have effects upon the design of this alternative?**

✓ **If the problem were to be solved with this alternative, what type of political, legal or institutional restrictions are relevant to the proposal of this alternative of the project?**

✓ **What natural events (droughts, floods, earthquakes, etc.) must be taken into account with this alternative of solution?**

What are the needs of data and information to develop this alternative?

What are the possible sources of information?

How do you propose to compile this information?

How reliable are the data that you intend to compile to "explain" this alternative?

How easy is it to obtain this information?

How much do you think it would cost to obtain more reliable information? For example, would it be necessary to contract or to dedicate resources for a long time to obtain additional information?

SPACE FOR THE PROJECT NAME

FORM ID-09: VERIFICATION TEST OF THE IDENTIFICATION

Question Nº 9	Summarize the principal characteristics of the problem and of its possible alternatives of solution.
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-09 of Annex 2. If you are not sure of your answers, review the content of Forms ID-01 to ID-08.

✓ **What is the problem? When and where does it occur?**

✓ **Define clearly the problem that is to be solved in terms of its priority, causes and possible effects?**

✓ **To what point could the problem be resolved with administrative measures which require lower costs?**

✓ **Identify all the possible options for solution (alternatives). Have some been selected? With what criteria have these options been selected?**

✓ **What does each solution try to do?**

What institutions would be evolved in the investment phase and operation phase in each of the proposed alternatives?

How compatible is each alternative with national and territorial development plans (regional, county or municipal, if these exist)?

What resources are required for each alternative to solution?

PREPARATION

INTRODUCTION

This Module, called the **"Preparation Module"**, is the **fourth** of this Manual, and the second in which you should follow a group of precise instructions to fill-out **five** Forms. Before going on to the next Module (Project Evaluation), you should complete all of the five Forms included.

As in the other Modules of this Manual, first we describe in what consists the preparation of the different alternatives of the Project. This is presented in the section called **"In what does the Preparation of the Project Consists?"** Next, in the section **"Instructions for the Forms"**, come the instructions to fill-out correctly the Forms. In Annex 2 you will find empty Forms ready to be photocopied and used. In this Module, all the Forms are codified with the prefix "PR".

IN WHAT DOES THE "PREPARATION" OF A PROJECT CONSISTS?

As mentioned earlier, we understand a "project" as a series of investments or institutional and other kind of measures designed to achieve an objective (or a series of objectives) of development in a given period. The process begins when a problem (or series of problems) and the possible alternatives to solutions are identified; continues with the process of preparation (this Module) and evaluation (next Module) of the alternatives, and leads to the planning of the assignation of funds for the selected alternative (Finance Module) and to the sustainability of this alternative, in terms of its long-term viability (Module of Project Sustainability).

This process is generally not an ordered and consecutive process, but rather iterative, which means returning to the previous Forms to reformulate the ideas of solution. The objectives of each alternative and the means to obtain them should be refined: this is the purpose of the preparation. Both the investment and operation costs should be defined and quantified, and the characteristics of the affected people should be defined in terms of the number that will be benefitted with each alternative,

their location and social characteristics. As the objectives and alternatives to reach them are refined, the latter should be reduced to a reasonable number. As the project (and its alternatives) begin to acquire form, the alternatives that remain should be developed in more detail. Even though you are still not ready to estimate the costs of each alternative, it is possible to get a preliminary idea of this cost. These estimations will be made in the next Module. The main purpose of this Module is to **quantify** each of the alternatives.

In this Manual, we distinguish between **quantify** and **set values**. Quantification refers to the process of estimation of quantities (of work, for example). Valuation refers to the process of assigning values (prices) to each of these quantities.

The preparation of a project (and of its alternatives) implies the presentation of a series of questions which should be kept in mind during the process. In Graphic PR-1 we give the principal questions, and in which Forms (of this or other Modules) the answers are searched, for so that each proposed alternative complies with the central objective of solving efficiently a problem or group of problems.

GRAPHIC PR-1
QUESTIONS, OBJECTIVES AND FORMS

Question	O b j e c t i v e s	F o r m s
Which problem?	Definition of problem	ID-01 to ID-03
To whom?	Target population	ID-04 & PR-03
From whom?	Institutional Responsibility	ID-05
What to do?	Description of alternatives	ID-06 & ID-07
Where?	Localization	PR-01
When?	Duration	PR-02
What? How?	Technology	PR-04 & PR-05
How much?	Size and scope	PR-04 & PR-05
What is the cost?	Costs	EVALUATION MODULE
With what?	Resources	FINANCE MODULE
Long-term viability?	Sustainability	SUSTAINABILITY MODULE

The problem or problems that you wish to solve, it's effects on the target population or area and a first description to the alternatives to solution should already been proposed in the Identification Module. The central purpose of this preparation is to **quantify** each of the alternatives listed in the Identification Module. Keep in mind that this process is iterative. If you consider that one of the alternatives may be discarded, in view of the new information that is being compiled and included in the preparation Forms, you should do so.

The Preparation Module has five Forms that should be filled-out **for each of the alternatives to solution** identified in the previous Module. The structure of this Module and its relation with the other Modules is presented in Graphic PR-2.
The forms should be filled-out in order. Do not fill-in a Form until you have completed the previous ones. However, it is important to remember that filling-out one Form may lead to the reformulation of other Forms, both of this and other Modules.

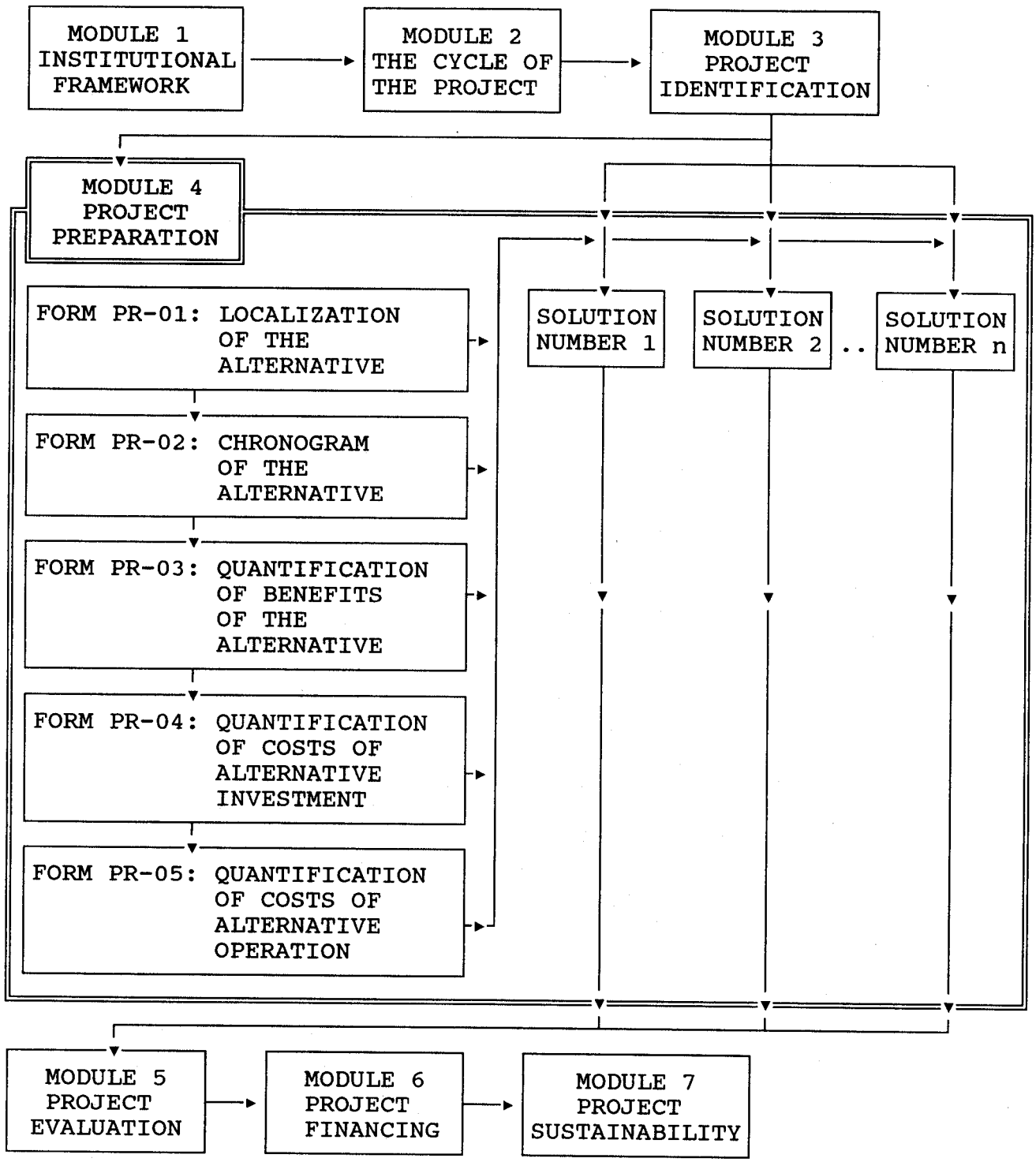
INSTRUCTIONS FOR PREPARATION FORMS

The Preparation Module begins with **Form PR-01**, called **"Localization of Alternative Nº"**. In this Form it is compulsory to respond to the questions marked with the symbol "/". The answers to the questions which do not have the symbol is optional. The purpose of these Form is to locate (geographically and/or specifically), both in the area of influence of each alternative and in its physical sense.

The Form also searches some aspects relevant to the products and labor force markets in which their localization and location, with respect to the alternative, is important. For example, you may be presenting an alternative that requires specialized workers for some job, and these are not available in the town or in the neighboring communities. Also, the alternative you are describing might require some product in its operation phase that would not be easy to obtain.

An empty Form PR-01 (should be photocopied, since one is required for each alternative) is found in Annex 2 of this Chapter.

GRAPHIC PR-2


MODULE 1
INSTITUTIONAL
FRAMEWORK
MODULE 2
THE CYCLE OF
THE PROJECT
MODULE 3
PROJECT
IDENTIFICATION
MODULE 4
PROJECT
PREPARATION
FORM PR-01: LOCALIZATION OF THE ALTERNATIVE
FORM PR-02: CHRONOGRAM OF THE ALTERNATIVE
FORM PR-03: QUANTIFICATION OF BENEFITS OF THE ALTERNATIVE
FORM PR-04: QUANTIFICATION OF COSTS OF ALTERNATIVE INVESTMENT
FORM PR-05: QUANTIFICATION OF COSTS OF ALTERNATIVE OPERATION
SOLUTION NUMBER 1
SOLUTION NUMBER 2
..
SOLUTION NUMBER n
MODULE 5
PROJECT
EVALUATION
MODULE 6
PROJECT
FINANCING
MODULE 7
PROJECT
SUSTAINABILITY

SPACE FOR THE PROJECT NAME

FORM PR-01: LOCALIZATION OF ALTERNATIVE Nº

Question Nº 1	**Describe** the localization of this alternative.
Instructions:	Try to answer **at least** the questions marked with the symbol "✓". Work in Form ID-01 of Annex 2. Not all the questions are relevant for each alternative.

✓ **Locate** in terms of region, area, town and locality (suburb, neighborhood, etc.) **this alternative to the project.**

✓ **How far away form the target population or area is this alternative located?** Express it in meters, kilometers, walking time or some other unit.

✓ **Does the necessary labor force exist and is it available for this alternative?**
For example, consider if in this area bricklayers (or plumbers) are required in the investment phase.
Consider, for example, if there are doctors (or teachers) needed in the operation phase.
Is it important that these be found close by?

✓ **Do the principal products, utilities and raw materials required for the investment phase and operation phase exist, and are they available?**
Consider, for example, if in this area you can find the machinery required for earth movements in the investment phase.
For example, consider if the education materials needed for the operation of a school can be found in this area.
Is it important that these be found close by?

✓ **Do the principal public services** (current water, electricity, etc.) **required for the investment and operation phases exist and are they available?**
Is it important that they be available?

CONTINUED...

SPACE FOR THE PROJECT NAME

FORM PR-01: LOCALIZATION OF ALTERNATIVE Nº

Question Nº 1 (Continued)	**Describe** the localization of this alternative.

Does this location have the topographical conditions and the soil quality needed to locate the alternative there?
Consider, for example, if in this place the ground is very swampy or mountainous.
Is this alternative located in a zone of disaster risk? If you have a map of disaster risk areas, is it in one of them?
Describe the existence, availability and condition of the relevant transportation routes for this alternative.
Describe the existence, availability and condition of the relevant means of transportation for this alternative.
Does the location of this alternative have environmental conditions that suggest that site is not convenient?
Consider, for example, of locating a health unit near a garbage dump.
If this alternative had adverse environmental impact, does this location have greater risks than the other alternatives?
Consider, for example, locating a garbage dump close to a source of drinking water.
If there is a plan of municipal or area development, does this location conflict with the plan?
Consider, for example, if the location of a transport terminal should be planned in a residential area.

IMPORTANT NOTE: Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05) and reconsider your answer.

Once you have located each one of the alternatives, it is important to determine how long will be needed for: studies (Pre-Investment Phase), construction (if appropriate, Investment Phase) and operation (Operation Phase). To make these estimations, you should fill-out **Form PR-02**, called **Chronogram of Alternative No.**

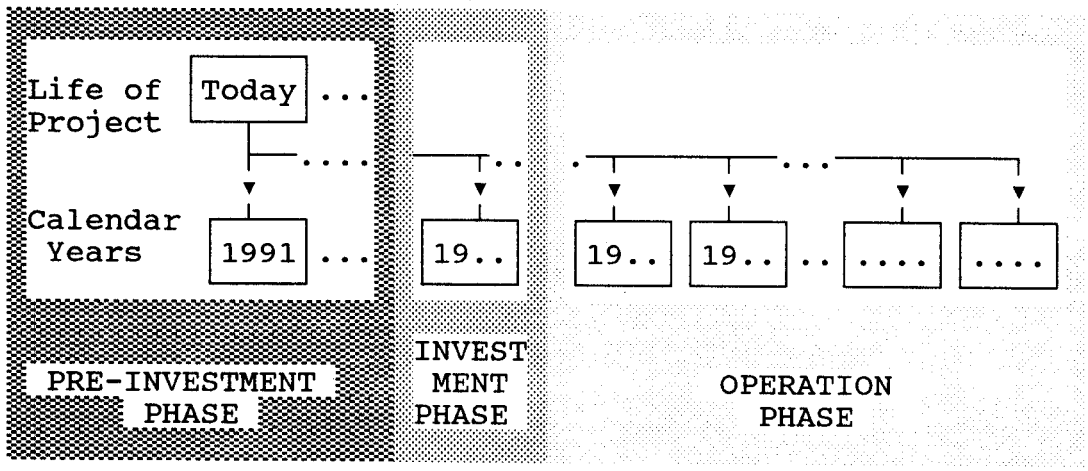
SPACE FOR THE PROJECT NAME

FORM PR-02: CHRONOGRAM OF ALTERNATIVE Nº

SECTION A: DURATION

Nº of months Pre-investment Phase	Nº of years Investment Phase	Nº of years Operation Phase	Starting year Operation Phase (Year "k")
	i=	m=	k=i+1=...

SECTION B: CHRONOGRAM



Fourth year of operation: k+3 =

Form PR-02 is divided in two sections. The first, **Section A** is called **"Duration"**. In it, the approximate total duration of this alternative is determined. In the first cell should be entered the number of **months** that the pre-investment phase will last. This number of moths is the total, until the beginning of the investment phase. Thus, for example, if the execution of the project is programmed to begin in January 1993, and it is now september of 1991, there are 16 months between these two dates. The pre-investment phase is the entire time estimated between the date that the project is being prepared and the date the corresponding investment will begin.

The second cell requests the time that the investment phase will last (see Module 2 for an explanation). Remember that the investment phase refers to the period of time in which investments are made so that later on the project may begin its operation. Graphic PR-3 gives the number of years that should be entered, according to the number of months that the investment will require, and the first year of operation (k), that corresponds to the year in which this phase begins.

GRAPHIC PR-3

Number of months	Number of years	Factor "k"
0 to 12	0	1
13 to 24	1	2
25 to 36	2	3
37 to 48	3	4
49 to 60	4	5
61 to 72	5	6
73 to 12	6	7

For those projects which do not require investments, such as some programs of literacy, vaccination, capacitation, etc., there will not be investments, and thus, there will not be an investment phase. These projects enter directly in operation, and thus, there is no reason to respond to questions which refer to the investment phase. In these cases, put "0".

The third cell of **Section A** requests the number of years that the operation phase of the project will last (or more precisely, this alternative to the project). This estimation should be made considering the total time that the operation of the project will last. This number of years of operation is denoted "m".

Finally, this section asks for a factor "k", which indicates in which year the operation phase of the project begins. If the investment phase lasts from 1 to 12 months, k=2, etc. (See Graphic PR-3.)

In **Section B** of this Form you should indicate the requested information in terms of calendar years. If the investment phase of the project lasts **up to** one year, and if this is contemplated for 1993, in the cell of the investment phase you should put "1993". If the project will begin operations in this same year, you should again put 1993 for the first year of operation, and add one year more for each of the succeeding cells. If the operation of the project begins in the following year, you should put "1994" as the first year of operation. Follow a similar procedure if the investment phase lasts more than one year. Thus, for example, if the investment lasts for three years and will begin in 1993, you should put 1993 for the year of investment. Since the investment lasts three years, these correspond to 1993, 1994 and 1995. If the

operation begins in the last year, 1995 is the first year of operation, while if it begins in the following year, you should put 1996. In Annex 2 of this Chapter, you will find empty Forms ready to be photocopied and used for each of the alternatives of the project.

Once you have completed this Form, you should continue with **Form PR-03: Description and Qualification of the Benefits of Alternative Nº**. This Form has two sections: **Section A (Description of Benefits)** and **Section B (Quantification of Benefits).**

SPACE FOR THE PROJECT NAME

FORM PR-03: DESCRIPTION AND QUANTIFICATION OF THE BENEFITS OF ALTERNATIVE Nº

SECTION A: DESCRIPTION OF BENEFITS

Describe the principal **benefits** of this project alternative.

Space for text of description.

SPACE FOR THE PROJECT NAME

FORM PR-03: DESCRIPTION AND QUANTIFICATION OF THE BENEFITS OF ALTERNATIVE Nº

SECTION B: QUANTIFICATION OF BENEFITS

Quantify the principal **benefits** of this project alternative.

Space for text of description

TYPE OF BENEFIT	MEASURE-MENT	QUANTITY FIRST YEAR OPERATION	QUANTITY FOURTH YEAR OPERATION

In **Section A: Description of Benefits**, you should describe the principal benefits which this alternative would produce.

Keep in mind that these benefits are only those that would be produced if this alternative is implemented. Do not include those benefits that would be produced anyway, even if this alternative is not chosen. For example, if the alternative under study is to enlarge a health post by building a new ward, the benefits are not those of the entire health post, but rather those **additional** benefits that the new ward would produce. Try to describe all the additional benefits associated with this alternative to the project, even though they cannot be measured or given a value.

In **Section B: Quantification of Benefits**, you should try to quantify the principal additional benefits that the project would produce in its first year of operation, and in the fourth year of operation. That is, indicate estimated quantities of benefits (for example, students). The purpose of this Form is to place dimensions on the alternative under study: that is, it's capacity to solve the problem. The first two columns ask for the type of benefit (if this corresponds) and the unit of measure in which it is expressed. Table PR-4 gives some examples.

TABLE PR-4

Type of project	Type of benefit	Measurement units
Aqueduct	Increase of water	m3/month/family
Irrigation	Area benefitted	Hectares
Electricity	Product of energy	Kw/hour
Transport	Greater capacity	Passengers/year
Garbage	Garbage collected	Tons/year
Market place	Greater sales	Tons/year
Slaughter house	Animals sacrificed	Tons/year
Health	Patients attended	Patients/year
		Number beds
Culture/ recreation	More diffusion	Events/year

Once the type of benefit generated by this alternative has been defined, you should calculate how many units will be produced or served in the first and in the fourth year of the operation of the project. For example 100 students in the first year and 130 in the fourth year; 20 training courses in the first year and 22 in the fourth year of operation.

TABLE PR-5

FACTORS FOR PROJECTING THE FOURTH YEAR OF OPERATION

Annual rate of increase (%)	Factor
1 %	1.03
2 %	1.06
3 %	1.09
4 %	1.12
5 %	1.16
6 %	1.19
7 %	1.23
8 %	1.26
9 %	1.30
10 %	1.33
15 %	1.52
20 %	1.73
25 %	1.95
30 %	2.20
40 %	2.74
50 %	3.38
100 %	8.00

If you can only estimate the units for the first year, you may use Table PR-5 to calculate the units estimated for the fourth year of operation. For example, if you estimate that the units (or number of beneficiaries) will increase by 10 per cent each year, and the number is 135 in the first year, you should multiply 135 by the factor that corresponds to 10 per cent (1.33), which gives 180 for the fourth year (always round to whole numbers). If the operation phase lasts less than four years, do not fill-in the space for the fourth year.

Once you have finished this Form, continue with **Form PR-04: Description and Quantification of the Investment Costs of Alternative Nº.** This Form has four sections: **Section A (Description of Investment Costs), Section B (Estimate of Physical Works), Section C (Estimate of Machinery and Equipment)** and **Section D (Estimate of Personnel).** Remember that if the project (or alternative) does not include investment costs (for example, an inoculation campaign that does not require initial investment), these Forms need not be filled-out.

In **Section A** you should describe the principal investment costs in physical works (including acquisition of land), machinery and equipment and personnel.

SPACE FOR THE PROJECT NAME

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF THE INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION A: DESCRIPTION OF INVESTMENT COSTS

Describe the principal **investment costs** of this project alternative.

Space for text of description.

In **Section B** you should quantify (without estimating costs yet) the investments such as acquisition of land, constructions, remodelations and all the complementary works related to this alternative. In order to quantify these investments (without costs) we recommend using approximate measurement units (for example, square meters of complemented construction), and not the details of all the investments.

SPACE FOR THE PROJECT NAME

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION B: ESTIMATE OF PHYSICAL WORKS

Quantify the principal **investment costs** in **physical works** of this project alternative.

Item	Measurement Unit	Quantity	Useful Life	Year Investment

In the first column should be listed each of the required constructions (finished physical plant, in m2; warehouses, in m2, etc.), the land (if necessary), the access routes and the installations. In the second column you should identify each of the measurement units. For example, linear meters, square meters, cubic meters, units, etc. It is important to define correctly the measurement units, so that you may **put values on these investments** in the evaluation Module. In the third column you should indicate the quantity of each of the investments in physical works. Each of these elements will have a useful life, and this should be noted in the fourth column of the Form. Useful life refers to the number of years that the investment will last until it must be completely replaced. It is possible that some of the items of investment in physical works may have different useful life spans. If the project includes the acquisition of land, its useful life will be the entire duration of the project.

Finally, in the last column, the year of each item of investment should be indicated. Use "0" if the investment is **during** the first year, "1", if it is **during** the second year, etc. If one specific investment is done **during** more that a year, put apart this investment in the corresponding years (see Annex 3 for more details).

If the alternative of the project under study includes the rent of a physical structure, for example a building, this should not be included in this estimate, but should be incorporated in the operational costs of the project, since it is not an investment but rather a cost incurred during the operation of the project.

In **Section C**, all the investments in machinery and equipment should be quantified. This includes all the investments that permit the normal operation of the alternative under study. Here should be included machinery and equipment in general, vehicles and furniture. In the first column, you should include the information on the type of machinery and equipment that is relevant. Try to group the items in broad categories, so, you do not go into great detail (for example, it is not important to know the number of bolts and screws needed for the construction of a health post). In the second column, put the quantity of each element described in the estimate. In the third column, put the useful life of each element (category) included in the estimate of machinery and equipment. This useful life may be less (or more) than the useful life of the project (years of operation). For example, a required vehicle may not be expected to last as long as the project.

Finally, as in the previous section, you should include the year in which each investment must be made.

SPACE FOR THE PROJECT NAME

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION C: ESTIMATE OF MACHINERY AND EQUIPMENT

Quantify the principal **investment costs** in **machinery and equipment** of this project alternative.

Item	Measurement Unit	Quantity	Useful Life	Year Investment

Finally, in **Section D** indicate the quantity of personnel that is required during the investment phase of the project. Be specially careful in two aspects. First, do not include the costs of personnel, since this is included in other categories in the estimate of physical works.

SPACE FOR THE PROJECT NAME

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF THE INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION D: ESTIMATE OF PERSONNEL (INVESTMENT)

Quantify the principal **investment costs** in **personnel** of this project alternative.

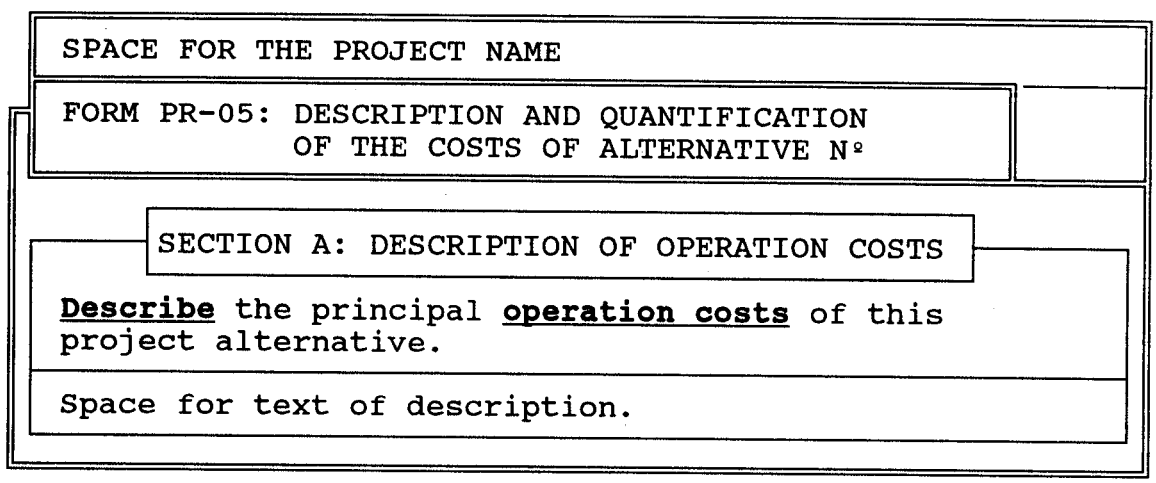
	Number of persons	Year of invest.
SKILLED MANPOWER		
UNSKILLED MANPOWER		

For example, it is possible that the investment in the construction of a schoolroom is specified in square meters of building, and when it's cost is calculated, the labor force costs will be included in the value.

Distinguish between skilled and unskilled manpower, according to the instructions in Annex 6 of this Chapter. Secondly, do not include the personnel already employed by the agency responsible for the project, even though they will participate in it. You should include in this item only the additional persons who must be employed during the investment phase. In the second column, put the number of persons that will be employed for each type of worker. In the third column, in which year this costs will occur. It is important to keep in mind the norms for "year of investment", already described for Form PR-04

The next Form (**PR-05: Description and Quantification of Operation Costs of Alternative Nº**) refers to the recurrent costs (that will be repeated throughout the operation phase) of the alternative under study. This Form has three sections: **Description (Section A)**, **Quantification of Inputs and Materials (Section B)**, and **Quantification of Labor Costs (Section C)**.

As in the previous Forms, in the first section (Section A) the principal costs of operation of the project should be described. Include in this Form all important information concerning costs of maintenance and operation, skilled and unskilled manpower (according to the categories established in Annex 6) required for the operation phase of the alternative under study.



Section B asks for the quantitative information of operation costs in inputs and materials required both for the first year and fourth year of operation. In the first column, put each item of inputs and materials. As for the investment costs, you should combine these in broad categories for each alternative. The quantities in the third and fourth columns are those that will be used by the project (or this alternative) in these years. If you must project the quantities for the fourth year according to rates of increase, use the factors given in Table PR-5.

Keep in mind that these operation costs should be only those that would be necessary for the operation of this alternative. The inputs and materials that must be acquired whether the project is carried out or not, should not be included in this Form, since they are not costs attributable to the project.

SPACE FOR THE PROJECT NAME

FORM PR-05: DESCRIPTION AND QUANTIFICATION OF THE OPERATION COSTS OF ALTERNATIVE Nº

SECTION B: COSTS OF INPUTS AND MATERIALS

Quantify the principal **operation costs** in **inputs and materials** of this project alternative.

Item	Measu-rement Unit	Quantity Useful Life	Year Investment

Finally, in inputs and materials should be included all those that will be used due to the operation of the project. Thus, you should include the inputs of production (if relevant) and the materials required for the project to function normally. These quantities will be directly related to the size of the project. If it is to produce some good or service (water, health, education, roads, etc.), it will be related to the amount of good or service that will be provided. You should also include all the general inputs required, such as drinking water, electricity, fuel, insurance, etc. If machinery and/or equipment is rented, the rental costs should be included. Finally, in those goods and services which cannot be put in measurement units because they are grouped into categories, values should be expressed in monetary units. Remember that in the Evaluation Module each of these items will receive a price, and with these prices and the quantities produced, you will calculate the cost of each item and the total operational cost of this alternative.

In **Section C: Labor Costs**, you should estimate the number of employees (calculated as number of employees per year) that will be required for the first and fourth years of operation. Use the classifications of Annex 6 to distinguish between skilled and unskilled manpower. If you need to project the number in the fourth year based upon an estimated growth rate, use Table PR-5.

Remember that filling-out any one of the Forms of this Module may require re-stating or re-calculating another of the Forms of the Module. Do not go on to the next Module until you are sure that all the information is reliable and internally consistent. Also remember that these initial calculations may lead you to re-state the alternative under study. It is even possible that you may decide to abandon an alternative if you decide that it is not viable based upon the compiled information. Always keep in mind the potential availability of the inputs, materials and labor force, both in the investment phase and in the operation phase. More than one project has had to be abandoned after the investments have been made, because the materials or the personnel needed for it's execution were not available. Do not forget to photocopy the Forms of Annex 2.

SPACE FOR THE PROJECT NAME

FORM PR-05: DESCRIPTION AND QUANTIFICATION OF THE OPERATION COSTS OF ALTERNATIVE Nº

SECTION C: LABOR COSTS

Quantify the principal **operation costs** in **personnel** of this project alternative. Distinguish between skilled and unskilled manpower.

	Number of persons	Year of investment
SKILLED MANPOWER		
UNSKILLED MANPOWER		

EVALUATION

INTRODUCTION

This Module, called **Module of Evaluation**, is the fifth of the Manual and the third in which you should follow a group of precise instructions to fill-out **six** Forms. Before going on to the next Module (Project Finances), you should complete all of the six Forms included.

As in the other Modules of this Manual, first we describe the task of the evaluation of the different alternatives that have been prepared in the previous Modules. This is presented in the section called **In what does the evaluation of a project consist?** Next, in the section **Instructions for the Forms**, come the instructions to fill-out correctly the Forms. In Annex 2 you will find empty Forms ready to be photocopied and used.

IN WHAT DOES THE EVALUATION OF A PROJECT CONSIST?

The evaluation of a project (and of its possible alternatives) consists in comparing the costs associated with the project, to the benefits that would accrue if it is carried-out. Evidently, the "evaluation" of a project consists in obtaining the information with which to judge if it is convenient to carry-out a project (or one of its alternatives). In general, there are two necessary conditions to make this judgement. First, that alternatives exist, and second, that there is an objective or purpose.

The existence of alternatives is necessary, because if they do not exist there is no need to choose one of them. The second condition for decision-making derives from the fact that time and effort are necessary to make a decision. The person who evaluates, will not take the time and effort if he does not expect that one of the alternatives will be preferable to the others, in terms of its contribution to achieve some objective or purpose. If the evaluator does not perceive alternatives, or if he does not see some reason to prefer one of them, no decision will be made.

Once we accept that these two conditions are necessary in order to evaluate a project, we cannot make a decision until we have **put values** on the alternatives. The only reason that one evaluates alternatives is in order to select one of them (or none, in some cases). Therefore, we may say that the **method of setting values** used is related to the objective that one has in mind when one wishes to choose an alternative. For example, if our object were to get from point A to point B in the least possible time, we could put values on the possible routes with the common criterion of travel time, and we would choose the one which would get us from place to place in the least time. Suppose, on the other hand, that we have three alternative routes to get from A to B, and that one of them is valued for its transit time, the second value for the distance and the third for the beauty of the road. Evidently, we could not choose one of them because we do not have a common criterion of values.

The objectives of a project determine the way in which its costs and benefits are defined. Everything that contributes to the objective is a benefit, and everything that affects it adversely is a cost. However, there may be multiple objectives. A factory owner may want to maximize his earnings, minimize his risks, maximize his sales or become famous. In a similar way, a country may wish to increase the per capita earnings, improve the distribution of earnings, increase employment, generate foreign earnings, etc. In theory, the evaluation of projects may be governed by as many objectives as one wishes. In practice, however, we should concentrate on a few objectives. This means that just as the maximization of monetary earnings is the central objective of an entrepreneur, we consider that the objective for the evaluation of projects in this Manual is the maximization of the national income.

The comparison of options or alternatives to satisfy an objective (that is, in terms of our terminology, the solution of a problem such as the lack of drinking water in a community) is an essential aspect in the evaluation of projects. As should now be clear, one must consider, identify and prepare the different alternatives. Normally, the costs and benefits of each alternative are compared, choosing the alternative with the greater net benefit (benefits less costs). However, as we shall see, in this Manual we suppose that it will be sufficient to choose the one which resolves the problem with a minimum cost per unit of benefit.

All projects (or the alternative of a project) use scarce inputs to create and generate goods or services. If the alternative under analysis is not carried-out (**situation without a**

project), the availability of these goods and inputs will be different than if it is carried-out (**situation with a project**). The comparison of the situation without a project to the situation with a project is the basic way to measure the additional costs and benefits that may be attributed to each of the alternatives of the project. In many cases, the situation without a project is not simply the continuation of the existing situation. As a general rule, the evaluation of the situation without a project should be supported with the judgement of "what would happen" if the project is not carried out. Remember that you should always try to identify, prepare and evaluate the situation without a project.

Once the costs and benefits of each project alternative have been identified (Identification Module) and quantified (Preparation Module), including the situation without a project, we must try to **put values on** these benefits and costs.

The purpose of this Evaluation Module is to put values on these costs. We should note that the benefits of each project alternative will not be given values, since at the level of profile, which is the level of this Manual, this process is extremely complicated in many cases.

INSTRUCTIONS FOR THE FORMS

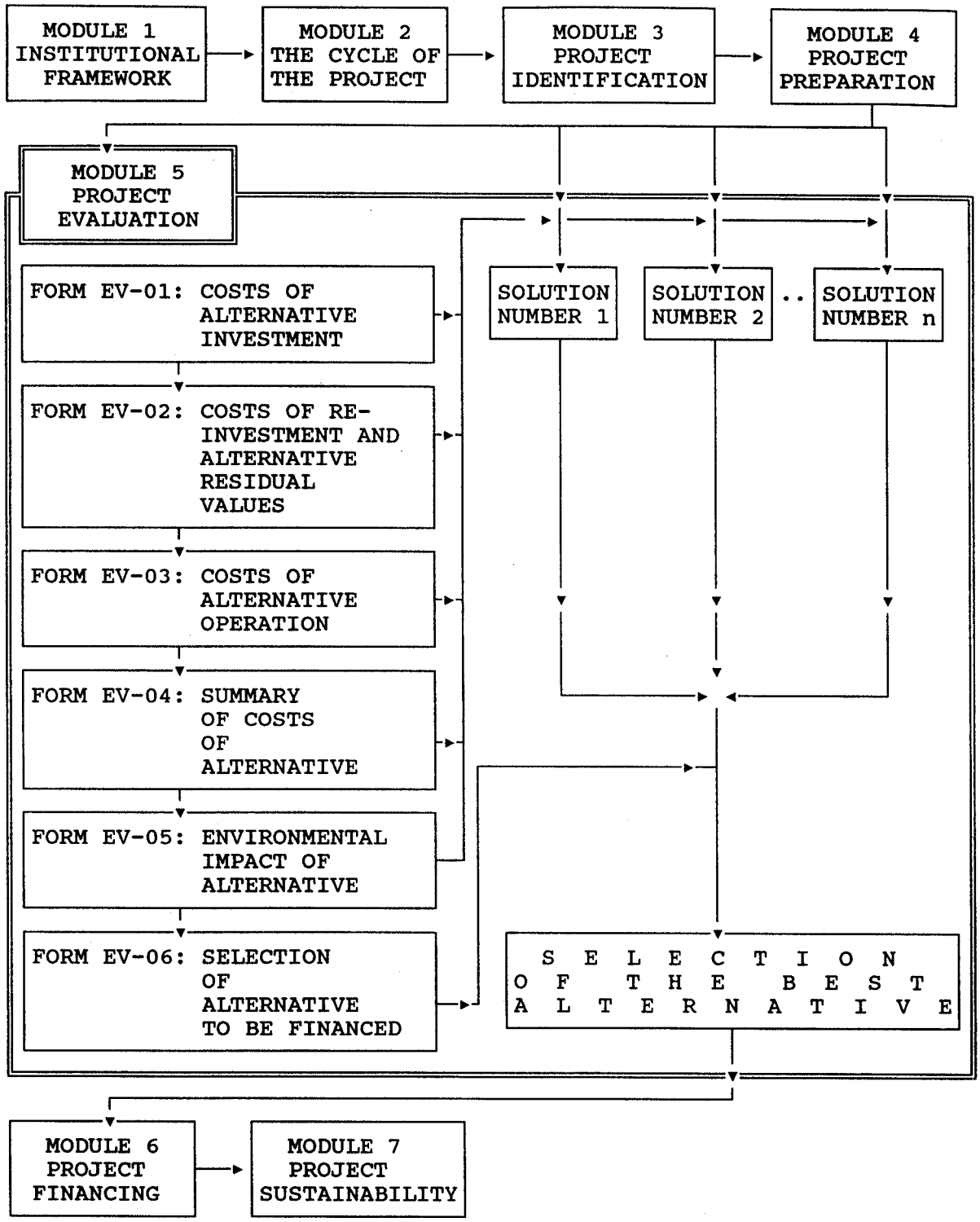
The Evaluation Module of this Manual has six Forms in which you should try to put values on the costs identified and quantified in earlier Modules. In Graphic EV-1 we show the structure of this Module and its Forms.

The Evaluation Module begins with **Form EV-01 (Description and Values of the Costs of Alternative Nº)**, whose purpose is to put values on the investment costs of each alternative, and which has five sections.

In the first section (**Section A: Description of Unitary Prices**), you should describe where the unitary prices that will be used in putting values on the investment costs are obtained. For example, if the project includes the purchase of an X-Ray machine, you should describe here the source of the unitary price that is used. Always remember that the prices to be used refer to the unitary costs of each investment item. Express the price in **thousands of dollars** in the following sections.

The second section (**Section B: Prices of Estimates of Physical Works**) serves to put values on the quantified costs indicated in Form PR-04 (Section B) of the Preparation Module. In the first column, you should put each of the items (arranged by year of investment) that you indicated in Form PR-04 (B). The data for "Measurement units" (column 1), "Quantity" (column 2) and "Year of Investment" (column 5) should be copied into the shaded cells (the shading of the cells indicates that the data entered there come from previously completed Forms).

GRAPHIC EV-1


MODULE 1 INSTITUTIONAL FRAMEWORK
MODULE 2 THE CYCLE OF THE PROJECT
MODULE 3 PROJECT IDENTIFICATION
MODULE 4 PROJECT PREPARATION
MODULE 5 PROJECT EVALUATION
FORM EV-01: COSTS OF ALTERNATIVE INVESTMENT
FORM EV-02: COSTS OF RE-INVESTMENT AND ALTERNATIVE RESIDUAL VALUES
FORM EV-03: COSTS OF ALTERNATIVE OPERATION
FORM EV-04: SUMMARY OF COSTS OF ALTERNATIVE
FORM EV-05: ENVIRONMENTAL IMPACT OF ALTERNATIVE
FORM EV-06: SELECTION OF ALTERNATIVE TO BE FINANCED
SOLUTION NUMBER 1
SOLUTION NUMBER 2
..
SOLUTION NUMBER n
SELECTION OF THE BEST ALTERNATIVE
MODULE 6 PROJECT FINANCING
MODULE 7 PROJECT SUSTAINABILITY

In column 3 you should put the **unit** cost for each investment item. Remember to express this in thousands of dollars, and always in historical prices (present values). For example, if the remodelation of an auditorium costs $150.000 per square meter, put 150 in column 3. Column 4 is the result of the multiplication of the preceding two columns. Column 6 refers to the factor by which column 4 should be multiplied to take into account that part of the investment may be made during more than one year. Thus, for example, if 80 square meters of the auditorium are to be remodeled at the beginning of the project and each square meter costs $150.000, the total cost of this item will be 12.000.000 (80 x 150.000).

Given that this cost corresponds to the beginning of the project, it corresponds to "year 0", for which it must be multiplied by the factor "1". If this investment were to occur during the fourth year of investment (Form PR-4), the investment would be made in "year 3" (see Annex 3: Flow Conventions), for which it should be multiplied for 0.712. The result of the multiplication is placed in column 7, which gives the total cost per item, expressed in what it is called "present value". Try to group the items by year of investment.

SPACE FOR THE NAME OF THE PROJECT	
FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº	

SECTION A: DESCRIPTION OF UNITARY PRICES

Describe how you obtained each of the prices used for this alternative, and the source of information.

Space for text of description of prices (investment).

SPACE FOR THE PROJECT NAME

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION B: PRICES OF ESTIMATE OF PHYSICAL WORKS

Place values on the principal investment costs of **physical works** for this project alternative. Use the items from **Form PR-04, Section B.** In the shaded areas, put the values from this Form. In the non-shaded areas, put the requested information.

Item	(1) Measurement Unit	(2) Quantity	(3) Unit Costs	(4)=(2)*(3) Total Costs	(5) Year Investment	(6) Factor	(7) (4)*(6) Total Cost in PV
TOTALS							SUM

DATA FROM FORM PR-04 (B)

TABLE OF FACTORS FOR COLUMN (6)

Investment Year	Multiplication Factor	Investment in Year	Multiplication Factor
0	1.000	3	0.712
1	0.893	4	0.636
2	0.797	5	0.567

The procedure to follow in **Section C (Prices of Estimate of Machinery and Equipment)** and **Section D (Estimate of Personnel)** is identical to that just described. Always keep in mind that prices should be expressed in thousands of dollars, and that you should always try to group items by year of investment. This way, it will be easier to fill-out the following section.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE N°

SECTION C: PRICES OF ESTIMATE OF MACHINERY AND EQUIPMENT

Place values on the principal investment costs of **machinery and equipment** for this project alternative. Use the items from **Form PR-04, Section C**. In the shaded areas, put the values from this Form. In the non-shaded areas, put the requested information.

Item	(1) Quantity	(2) Unit Costs	(3)=(1)*(2) Total Costs	(4) Year Investment	(5) Factor	(6) = (3)*(5) Total Costs in PV
TOTALS						SUM

DATA FROM FORM PR-04 (C)

TABLE OF FACTORS FOR COLUMN (6)

Investment in Year	Multiplication Factor	Investment in Year	Multiplication Factor
0	1.000	3	0.712
1	0.893	4	0.636
2	0.797	5	0.567

SPACE FOR THE NAME OF THE PROJECT

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION D: PRICES OF ESTIMATED PERSONNEL

Place values on the principal investment costs in **personnel** for this project alternative. Use the items from **Form PR-04, Section D**. In the shaded areas, put the values from this Form. In the non-shaded areas, put the requested information.

Item	(1) Number of Persons	(2) Unit Salary	(3)= (1)*(2) Total Costs	(4) Year of Invest-ment	(5) Factor	(6) = (3)*(5) Total Costs in PV
	SKILLED MANPOWER					
	UNSKILLED MANPOWER					
TOTALS						SUM

DATA FROM FORM PR-04 (C)

TABLE OF FACTORS FOR COLUMN (6)

Investment in Year	Multiplication Factor	Investment in Year	Multiplication Factor
0	1.000	3	0.712
1	0.893	4	0.636
2	0.797	5	0.567

The last section (**Section E: Summary of Investment Costs**) of this Form summarizes the information generated in the previous sections. Put the requested information in the shaded areas and add for each year of investment.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION E: SUMMARY OF INVESTMENT COSTS

	YEAR OF INVESTMENT	0	1	2	3	4
1	COST OF PHYSICAL WORKS					
2	COST OF MACHINERY & EQUIP.					
3	COST OF SKILLED MANPOWER					
4	COST OF UNSKILLED MANPOWER					
	TOTAL (1 + 2 + 3 + 4)					

FORM EV-01 (D) COL.4 (ADD FOR EACH YEAR OF INVESTMENT)

FORM EV-01 (C) COL.4 (ADD FOR EACH YEAR OF INVESTMENT)

FORM EV-01 (B) COL.4 (ADD FOR EACH YEAR OF INVESTMENT)

	Cost in PV
COST OF PHYSICAL WORKS	
COST OF MACHINERY & EQUIPMENT	
COST OF SKILLED MANPOWER	
COST OF UNSKILLED MANPOWER	
TOTAL INVESTMENT COSTS	

FORM EV-01

(B)

(C

(D)

The second Form of the Evaluation Module is **Form EV-02**, called **Present Value of Costs of Re-investment and Residual Values of Alternative.** In this Module we estimate the present value of the re-investment (in order to consider the reposition costs of the goods that have useful lives, less than that of the project), and the present value of the residual values of the investment costs in goods (to consider the value that will be recovered at the end of the useful life of the project, if the good has a useful life longer than that of the project. All this is calculated together, applying financial tables.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-02: PRESENT VALUE OF RE-INVESTMENT COSTS AND RESIDUAL VALUES OF ALTERNATIVE Nº

SECTION A: CHRONOGRAM

First year of operation ("Year "k")		FORM PR-02 SECTION A
Number of year of Operation (m)		

SECTION B: PRESENT VALUE OF RE-INVESTMENT COSTS AND RESIDUAL VALUES OF ALTERNATIVE Nº

Item	(1) Investment Value	(2) Useful Life	(3) PV Factor	(4)=(1)*(3) Present Value
				TOTAL ADDIT.

FORM EV-01 (B) Col.4		FORM PR-02 (B)&(C)	TABLE 2 ANNEX 4
FORM EV-01 (C) Col.3			

In **Section A: Chronogram**, transfer the requested information from Form PR-02, Section B.

In **Section B: Present Value of Re-investment Costs and Residual Values of Alternative Nº**, begin by bringing forward the investment items (both of machinery and equipment and for physical works) for each line of this section. The total cost of each item (column 1) is obtained by adding the costs for each year **for each item** from Form EV-01 (that is, Cost Year 0 + Cost Year 1, etc.). In column (2) you should put the useful life of each item, that is, how many years it can be used, according to technical criteria. Column (3), called "Present Value Factor (PV)", corresponds to the factors that are found in Table 2 (Annex 4). This factor depends upon the duration of the operation phase (m) and the useful life of the item (v). If the investment phase lasts one year (k=1), the PV Factor is copied directly from the table.

If the investment phase lasts more than one year (k>1), you should do the following:

If k=2, the factor obtained from the table should be multiplied by 0.893.

If k=3, the factor obtained from the table should be multiplied by 0.797.

If k=4, the factor obtained from the table should be multiplied by 0.712.

Note in the table that the factor may be positive, 0 or negative. Bring it forward along with the sign.

Finally, the last column of the Form, present values of the re-investment and residual values, is obtained for each line by multiplying columns (1) and (3). Note that the resulting value may be positive, 0 or negative. To finish, all the costs of re-investment and residual values, expressed in present value, should be added algebraically (taking signs into account) to obtain the total of present values.

Once the costs of investment (and re-investment) have been quantified, and you have put values on them in Forms EV-01 and EV-02, the next step is to put values on the operation costs for the first year of operation (year "k") and the fourth year of operation (year k+3). These costs were quantified in the Preparation Form PR-05. This is the purpose of **Form EV-03: Description and Values of Operation Costs of Alternative Nº**. This Form has **seven** sections: **A** to **G**.

In the first section of this Form (**Section A: Description of Unit Prices**), you should describe the process used to obtain the unit prices of operation costs for each of the alternatives. Keep in mind that the prices to be used are the marked prices in the project site. This means that you must incorporate transportation and other costs necessary to bring the items to the project site.

SPACE FOR THE NAME OF THE PROJECT	
FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE Nº	

SECTION A: DESCRIPTION OF UNIT COSTS

Describe how you obtained each one of the unit prices used in this project alternative for operation costs, and where the prices come from.

Text for description.

Section B: Values of inputs and materials for the first year of operation, estimates the total costs (in present value) of inputs and materials for the first year of operation. For each item of operation of inputs and materials, you should bring forward the measurement units and quantities from Form PR-05 Section B, and enter them in the first two columns. In the third column put the corresponding unit price, and in the fourth, the result of multiplying column 2 by column 3 (unit price x quantity = value). These values should be added as indicated in the Form. In the column for present value (5) you should copy the value from Table 3 (Annex 4), if the investment phase lasts only one year (k=1). Otherwise, the value of the factor will depend upon the duration of the operation phase.

If the investment phase lasts more than one year (k>1), you should do the following:

If k=2, the factor obtained from the table should be multiplied by 0.893.

If k=3, the factor obtained from the table should be multiplied by 0.797.

If k=4, the factor obtained from the table should be multiplied by 0.712. For example, if k=1, and the project will operate for 20 years, the value from the table is 2.4018. If k=2, the factor 2.4018 should be multiplied by 0.893, giving as result 2.145, which should be entered in the Form.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-03: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION B: VALUES OF INPUTS AND MATERIALS FOR THE **FIRST** YEAR OF OPERATION

Place values on the costs of operation in **inputs and materials** for this project alternative. Use the items from **Form PR-05**, **Section B**. In the non-shaded areas, place the requested information.

Item	(1) Measurement Unit	(2) Quantity First Year	(3) Unit Price First Year	(4)=(2)*(3) Total Cost First Year	(5) Factor	(6)=(4)*(5) Total Cost in PV
TOTALS				SUM		SUM

DATA FROM FORM PR-05 (B)

TABLE OF FACTORS FOR COLUMN (5)
TABLE 3 ANNEX 4

In **Section C: Values of Inputs and Materials for the Fourth Year of Operation**, you will estimate the total costs (in present value) of inputs and materials for the fourth year of operation. For each item of operation inputs and materials, you should bring forward the measurement units and quantities from Form PR-05 Section B, and enter them in the first two columns. In the third column put the corresponding unit price, and in the fourth, the result of multiplying column 2 by column 3 (unit price x quantity = value). These values should be added as indicated in the Form. In the column for present value (5) you should copy the value from Table 3 (Annex 4), if the investment phase lasts only one year (k=1). Otherwise, the value of the factor will depend upon the duration of the operation phase.

If the investment phase lasts more than one year (k>1), you should do the following:

If k=2, the factor obtained from the table should be multiplied by 0.893.

If k=3, the factor obtained from the table should be multiplied by 0.797.

If k=4, the factor obtained from the table should be multiplied by 0.712. For example, if k=1, and the project will operate for 20 years, the value from the table is 5.0676. If k=2, the factor 5.0676 should be multiplied by 0.893, giving as result 4.525, which should be entered in the Form.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-03: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION C: VALUES OF INPUTS AND MATERIALS FOR THE **FOURTH** YEAR OF OPERATION

Place values on the costs of operation in **inputs and materials** for this project alternative. Use the items from **Form PR-05**, **Section B**. In the shaded areas, place the numbers from this Form, and in the non-shaded areas put the requested information.

Item	(1) Measu-rement Unit	(2) Quantity Fourth Year	(3) Unit Price Fourth Year	(4)= (2)*(3) Total Cost Fourth Year	(5) Factor	(6)= (4)*(5) Total Cost in PV
TOTALS				SUM		SUM

DATA FROM FORM PR-05 (B)

TABLE OF FACTORS FOR COLUMN (5)
TABLE 3 ANNEX 4

In **Section D: Description of the Employment of this Alternative**, you should describe the effect of the project on the generation of employment. In this section you should detail the effect of the project (or the alternative) on the work market in the area of influence of the project. Try to be particularly clear about the availability of the kinds of workers that will be required in the operation phase of the project (or alternative).

SPACE FOR THE NAME OF THE PROJECT	
FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE N°	

SECTION D: DESCRIPTION OF THE EMPLOYMENT OF THIS ALTERNATIVE

Describe in detail the effect of employment generation of this project alternative. If appropriate, refer to the principal characteristics of the employment market in the area of influence of the project.

Space for descriptive text of employment generation.

In **Section E: Values of Labor Costs in the First Year of Operation**, you will estimate the total operation costs (in present value) of labor costs for the first year of operation. For each item of operation labor costs, you should bring forward the number of persons from Form PR-05 Section C, and enter this in the first column. In the second column, put the corresponding unit salary, and in the third, the result of multiplying column 1 by column 2 (unit price x quantity=value). These values should be added as indicated in the Form. In the column for present value (column 4) you should copy the value from Table 3 (Annex 4), if the investment phase lasts only one year (k=1). Otherwise, the value of the factor will depend upon the duration of the operation phase.

If the investment phase lasts more than one year (k>1), you should do the following:

If k=2, the factor obtained from the table should be multiplied by 0.893.

If k=3, the factor obtained from the table should be multiplied by 0.797.

If k=4, the factor obtained from the table should be multiplied by 0.712. For example, if k=1, and the project will operate for 20 years, the value from the table is 2.4018. If k=2, the factor 2.4018 should be multiplied by 0.893, giving as result 2.145, which should be entered in the Form.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-03: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION E: VALUES OF LABOR COSTS FOR THE **FIRST** YEAR OF OPERATION

Place values on the costs of operation in **labor costs in the first year** for this project alternative. Use the items from **Form PR-05, Section C**. In the non-shaded areas, place the requested information.

Job	(1) Number of Persons	(2) Annual Salary	(3) = (1)*(2) Annual Value Labor	(4) Factor	(5) = (3)*(4) Amount in PV
SKILLED MANPOWER					
	SUM		SUM		SUM
UNSKILLED MANPOWER					
	SUM		SUM		SUM

DATA FROM FORM PR-05 (C)

TABLE OF FACTORS FOR COLUMN (4)
TABLE 3 ANNEX 4

In **Section F: Values of Labor Costs in the Fourth Year of Operation**, you will estimate the total operation costs (in present value) of labor costs for the fourth year of operation. For each item of operation labor costs, you should bring forward the number of persons from Form PR-06, Section C, and enter this in the first column (you must remember that this is the fourth year of operation). In the second column, put the corresponding unit salary, and in the third, the result of multiplying column 1 by column 2 (unit price x quality=value). These values should be added as indicated in the Form. In the column for present value (column 4) you should copy the value from Table 3 (Annex 4), if the investment phase lasts only one year (k=1). Otherwise, the value of the factor will depend upon the duration of the operation phase.

If the investment phase lasts more than one year (k>1), you should do the following:

If k=2, the factor obtained from the table should be multiplied by 0.893.

If k=3, the factor obtained from the table should be multiplied by 0.797.

If k=4, the factor obtained from the table should be multiplied by 0.712. For example, if k=1, and the project will operate for 20 years, the value from the table is 5.0676. If k=2, the factor 5.0676 should be multiplied by 0.893, giving as result 4.525, which should be entered in the Form.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-03: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION F: VALUES OF LABOR COSTS FOR THE **FOURTH** YEAR OF OPERATION

Place values on the costs of operation in **labor costs in the fourth year** for this project alternative. Use the items from **Form PR-05, Section C**. In the non-shaded areas, place the requested information.

Job	(1) Number of Persons	(2) Annual Salary	(3) = (1)*(2) Annual Value Labor	(4) Factor	(5) = (3)*(4) Amount in PV
SKILLED MANPOWER					
	SUM		SUM		SUM
UNSKILLED MANPOWER					
DATA FROM FORM PR-05 (C)	SUM		SUM		SUM

TABLE OF FACTORS FOR COLUMN TABLE 3 ANNEX 4

SPACE FOR THE NAME OF THE PROJECT

FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE Nº

SECTION G: SUMMARY OF OPERATION COSTS

		1st YEAR OPERATION	4th YEAR OPERATION	Costs in PV
1	INPUTS AND MATERIALS			
2	SKILLED MANPOWER			
3	UNSKILLED MANPOWER			
	TOTAL OPERATION COSTS (1 + 2 + 3)			

FORM EV-03 (E) SUM OF COL.3

FORM EV-03 (B) SUM OF COL.4

FORM EV-03 (F) SUM OF COL.3

FORM EV-03 (C) SUM OF COL.4

FORM EV-03 SUM TOTALS COL.6 SECTIONS (B) & (C)

FORM EV-03 SUM TOTALS COL.5 SECTIONS (E) & (F)

SPACE FOR THE NAME OF THE PROJECT

FORM EV-04: SUMMARY OF COSTS OF ALTERNATIVE Nº

SECTION A: VALUES OF TOTAL COSTS

	COSTS CATEGORY	(1) Value at Market Prices		(2) Social Price Factor	(3) = (1)*(2) Value at Social Prices
	INVESTMENT COSTS				
1	COSTS OF PHYSICAL WORKS		←	0.80	
2	COSTS OF MACHINERY & EQUIPMENT		←	0.77	
3	COSTS OF SKILLED MANPOWER		←	0.60	
4	COSTS OF UNSKILLED MANPOWER		←	1.00	
5	TOTAL INVESTMENT COSTS (1+2+3+4)		←		
6	COSTS OF RE-INVESTMENT & R. V.		←	0.79	
	OPERATION COSTS				
7	COSTS OF INPUTS & MATERIALS		←	0.79	
8	COSTS OF SKILLED MANPOWER		←	1.00	
9	COSTS OF UNSKILLED MANPOWER		←	0.60	
10	TOTAL OPERATION COSTS (7+8+9)		←		
11	TOTAL COSTS (5 + 6 + 10)				

V. COMES FROM FORM EV-03 G & EV-01 E in PV

In **Form EV-04: Summary of Costs of the Alternative**, you will calculate the total of the costs associated with this alternative in the first column. The data for this column come from previous Forms, and should be copied in the shaded areas. Always remember to use photocopies of the copies in Annex 2 of this Chapter.

The second column, **Social Price Factors**, gives the factors that should be used to convert the previous values, which are market prices, to their respective "social prices". The third column is the multiplication of the first two columns, which will gives the value of the project (and each alternative) expressed in social prices.

Section B of Form EV-04, called **Equivalent Annual Costs**, permit the estimation of the "cost efficiency" for the alternative under study. The first row, "f1", indicates the total costs at market prices in **thousands of dollars**. This information comes from Form EV-04, Section A, Column 1, Row 11. The total costs at social prices comes from Column 3 of the corresponding part of the same Form. The second column, the equivalence factor, will contain the factors which translate these costs to their annual equivalents, which will go in Column 3. The equivalence factors are found in Table 4 of Annex 4. In Row f3 you should copy the number of units, and in Row f4 the number of beneficiaries. It is possible that some projects may not have one of these values. In rows f5 and f6 you calculate the indicators of cost efficiency, dividing the corresponding total cost by the number of units and beneficiaries. These indicators may be either in present value (arrow from shaded area) or in annual equivalents (arrow from column 3).

For example, let us suppose that an aqueduct project costs $9.600.000 in present value. Thus, you should put 9.600 in column 1 (thousands of dollars) in market prices in Row f1 (we shall ignore both social costs and equivalent annual costs). From the preparation Forms, we find that the project intends to produce 24.000 cubic meters per year for 80 families. Thus, Row 3 may be cubic meters per year, and Row 4 the number of families benefitted. For this case, the indicators f5 and f6 would be 0.400 and 120. This means that with this project the additional cost per cubic meter is $400, and the cost per benefitted family is $120.000. This is expressed in present value. To obtain the equivalent annual costs you must use Annex 4.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-04: SUMMARY OF COSTS OF ALTERNATIVE Nº

SECTION B: EQUIVALENT ANNUAL COSTS

		(1) Total	(2) Equiv. Factor	(3) = (1)*(2) Equiv. Annual Costs
f1	TOTAL COSTS AT MARKET PRICES			
f2	TOTAL COSTS AT SOCIAL PRICES			

COMES FROM FORM EV-04(A)

COMES FROM TABLE 4, ANNEX 4

COMES FROM FORM PR-03 (B)

f3	NUMBER OF UNITS		
f4	NUMBER OF BENEFICIARIES		
f5	COST/EFFICIENCY INDICATOR 1		f1 / f3
f6	COST/EFFICIENCY INDICATOR 2		f1 / f4

Note: Indicate if the indicator is expressed in PV or in equivalent annual cost.

The "environmental impact" of the project is considered as the interaction between the technological actions of the project and the elements of the environment. In **Form EV-05: Environmental Impact of the Alternative**, you will not try to measure the environmental impact of the project, but rather indicate a subjective impression of the impacts that it may produce on different elements of the environment. In **Section A: Description**, you should summarize the effects of the project, if any, on the soil, air, water, fauna, flora and culture.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-05: ENVIRONMENTAL IMPACT OF ALTERNATIVE Nº

SECTION A: DESCRIPTION

Describe the environmental impact of this alternative in terms of its effect on the soil, air, water, fauna, flora and culture.

Space for text.

However, this information should be completed with that requested in **Section B: Evaluation of the Impact**, in the following way:

- **Type of effect:** refers to the benefits or damages of the impact, and is classified as **positive or negative.**
- **Probability of occurrence:** refers to the probability that the effect under study may occur. Classify it as **sure, probable, low** or **null.**
- **Magnitude of the effect:** refers to the degree of impact on the environment, classified as **low, moderate** or **high.**
- **Duration:** refers to the persistence of the effect over time, which may be **temporary** or **permanent.**
- **Tendency:** evaluates or predicts what will happen to the effects in the future, classified as **increasing, stable** or **decreasing.**

SPACE FOR THE NAME OF THE PROJECT

FORM EV-05: ENVIRONMENTAL IMPACT OF ALTERNATIVE Nº

SECTION B: EVALUATION OF THE IMPACT

COMPONENT OR EFFECT	Type Impact	Probab ocurr.	Magni tude	Dura- tion	Ten- dency
ON THE SOIL					
✓Modific. to the surface soil					
✓Preservation of the soil					
✓Generation erosive processes					
✓Instability					
ON THE AIR					
✓Air quality					
ON THE WATER					
✓Quality of superficial water					
✓Subterranean water					
ON THE FAUNA					
✓Hydrobiological deterioration					
✓Perturb or scare of animals					
ON THE FLORA					
✓Removal of vegetation					
✓Pressure on forests					
ON THE CULTURE					
✓Impact on native cultures					

Finally, in **Form EV-06: Selection and Justification of the Chosen Alternative**, you should respond to all of the questions. Include in this Form all the arguments that led you to conclude that this alternative is the best (assuming that it is viable).

SPACE FOR THE NAME OF THE PROJECT	
FORM EV-06: SELECTION AND JUSTIFICATION OF THE CHOSEN ALTERNATIVE	

SELECT one of the alternatives and **JUSTIFY** your selection. In the justification, try to respond to all of the following questions. Indicate all the elements that led you to choose this alternative.

✓ Order the project alternatives in order of preference.

✓ Select the alternative that you consider best.

✓ What is the name of the selected alternative?
Use the name (process ——▸ object ——▸ localization) in all the Forms of this Manual of the project.

✓ What criteria allows you to state that this is the best alternative?

✓ Is the selected alternative the one which costs less?

✓ Is the project technically well designed?

✓ Is it feasible from an administrative point of view?

✓ Does the selected alternative have all the financial characteristics desired?

✓ Does the selected alternative have all the desired social characteristics?

FINANCING

The purpose of this Module is to describe and put values on the sources of financing defined for the chosen project alternative, and has **one format** (Form FI-01: Description and Values of the Sources of Financing for the Project). This Form has three sections: Description (**Section A**), Values for the Sources of Financing for **Investment** (**Section B**), and Values of the Sources of Financing for the **Operation** of the Project (**Section C**).

In **Section A**, you should describe in general terms the sources of financing for the project, both for investment and operation. Indicate if these represent sources from the General National Budget (GNP), of area or local budgets, of State commercial industries, or donations of international technical cooperations. List each one of the sources. For example, the project might be financed by the DRI Fund (50%) and the town of Lérida (50%). Also indicate if the operation of the project will produce income from the sale of services.

SPACE FOR THE NAME OF THE PROJECT	
FORM FI-01: DESCRIPTION AND VALUES OF THE SOURCES OF FINANCING OF THE PROJECT	

SECTION A: DESCRIPTION OF SOURCES OF FINANCING

Describe the possible sources of financing of the chosen project alternative. Include, if appropriate, income from the sale of services or other items.

Space for descriptive text.

In **Section B**, Values of the Sources of Investment Financing, you should estimate the different sources of financing of the project in the investment stage. The total value of the investment should coincide with the total, for each year, of **Form EV-01 (E)**. The next row, "total financing", is the sum of the different sources of investment financing. For each year of investment, if appropriate, you should determine the quantities, to be financed from the General National Budget and the other sources mentioned above. In the case of the General National Budget, distinguish between resources of the National Budget and those of national public entities. In the first column, indicate the source of finances. In the following columns indicate the amount in **thousands of dollars.** Be sure that the sum of the sources is the same is the investment cost. For a detailed description of sources of financing and the relation of this information with the BIS card, **see Volume I of this Manual (Annex 9).**

SPACE FOR THE NAME OF THE PROJECT

FORM FI-01: DESCRIPTION AND VALUES OF THE SOURCES OF FINANCING OF THE PROJECT

SECTION B: VALUES OF THE SOURCES OF INVESTMENT FINANCING

Indicate values (in thousands of dollars) for the possible sources of financing for the investment of the chosen project.

Project year	0	1	2	3	4
Calendar year					
TOTAL INVESTMENT					
FORM EV-01 (E)	▲ = ▼	▲ = ▼	▲ = ▼	▲ = ▼	▲ = ▼
TOTAL FINANCING					
	SUM	SUM	SUM	SUM	
SOURCE OF FINANCING 1					
SOURCE OF FINANCING 2					
.....					
SOURCE OF FINANCING n					

Next, complete **Section C** of the Form (Values of the Sources of Financing for Project Operation). Remember that these sums corresponds to financing during the **operation phase of the project** in the **first year** and the **fourth year** of project operation. For each year, separate the total operation costs into the different sources of financing. Note clearly what are the entities that will finance the operation of the project. If appropriate, separate the income from sales. Do not include entities as sources, unless you have backing from them. Remember that when you send the BIS card you must demonstrate the promise of support from these entities.

SPACE FOR THE NAME OF THE PROJECT

FORM FI-01: DESCRIPTION AND VALUES OF THE SOURCES OF FINANCING OF THE PROJECT

SECTION C: VALUES OF THE SOURCES OF OPERATING FINANCING

Indicate values (in thousands of dollars) for the possible sources of financing for the operation of the chosen project.

Project year	FIRST YEAR	FOURTH YEAR
Calendar year		
TOTAL OPERATION → FORM EV-03 (G)		
TOTAL FINANCING		
	SUM	SUM
SOURCE OF FINANCING 1		
SOURCE OF FINANCING 2		
.....		
SOURCE OF FINANCING n		

SUSTAINABILILTY

INTRODUCTION

This Module, called the **Sustainability Module**, is the **seventh** of this Manual and the last one in which you should follow a group of precise instructions to fill-out its **one** Form. Once this Module is completed, you should collect the summarized project information to prepare the "Project Summary", which should be presented together with the BIS card. This summary, and the way to present it, is discussed in Annex 1, "How do we present the project?".

As in the other Modules of this Manual, we first describe the concept of Sustainability (of the selected project alternative). This is presented in the section called **"What does the sustainability of a project mean?"**. In the section **Instructions for the Form**, we present the instructions on how to fill-out the Form correctly. In Annex 2 you will find an empty Form ready to be photocopied and used. In this Module, the Form is coded with the prefix "SO".

WHAT DOES THE SUSTAINABILITY OF A PROJECT MEAN?

There are two definitions of the concept of sustainability. The first refers to the ecological sustainability of a process of global development. A common definition of sustainable development, in this sense, is "the development achieved with present purposes without compromising the capacity of future generations to satisfy their objectives of well-being". The focus of this type of sustainability is wide and long-term.

The second definition of sustainability, which we use in this Manual, concentrates upon analyzing the capacity of an investment project to continue producing benefits once it enters in its operation phase. Suppose that two highways are built at the same time. If after 10 years, highway A continues to serve without problems, and highway B is deteriorated and unusable, we would say that the project of highway A was more sustainable than that of highway B.

The suggested definition of sustainability as the capacity of a project to maintain the flow of benefits during a long time period suggests two elements of analysis. First, the definition refers to an investment project. However, it is not the sustainability of the project itself that we want, but rather the physical maintenance of the investment, the long-term financial viability of the project, institutions capable of maintaining the project functions, and human resources that will sustain the project and not let it "decay".

Second, we should define an adequate level of benefits. Since in this Manual we do not put values on the benefits, it is reasonable to classify the sustainability of the project as high, moderate or low, in terms of maintenance of the level of benefits. For example, if the health care for which the project was designed will continue to be provided at the appropriate level.

INSTRUCTIONS FOR THE SUSTAINABILITY FORM

Based upon the above definition of sustainability, **Form SO-01 (Project Sustainability)** checks to see if the project which has been evaluated complies with three basic conditions which will assure that it really does resolve the problem for which it was designed.

First, it is important to know if external factors exist, or might exist, that would delay the investment, such as the importation of required goods, etc. Second, if there is a high probability that the elements required for operation will be available. Third, that the sources of financing, both for investment and for operation, have a reasonable chance of materializing.

For this purpose, you should answer at least the questions marked with the symbol ✓ in Form SO-01. Remember that Annex 2 contains the blank Form.

SPACE FOR THE NAME OF THE PROJECT

FORM SO-01: PROJECT SUSTAINABILITY

Instructions: Try to answer **at least** the question marked with the symbol "✓".
Work in Form SO-01 of Annex 2.

✓ **Verify if factors exist that could delay the execution of the project. For example, requirements of importation of goods, negotiation of finances with other entities, political changes in the different levels of government.**

✓ **Verify that you have considered all the requirements of operation and maintenance of the project during its useful life.**

✓ **What chance is there (high, medium, low), that each of the sources of financing of the project, both in the investment phase and in the project operation, will materialize? If the chance is low, have you identified alternative sources of financing?**

Verify that the size of the project, and its future expansion, are in agreement with the demand for the good/service that will be produced.

If the project will sell goods or services, what factors might cause changes in the prices contemplated in the project design?

Estimate, if appropriate, the sell price over unit cost and compare it to that of projects which are functioning and have worked well.

Classify (high, medium or low) the capacity of the entity which will operate the project. If it is low, have you considered alternatives?

A N N E X 1

NORMS OF PROJECT PRESENTATION

NORMS OF PROJECT PRESENTATION

Once you have finished the identification, preparation and evaluation, all that remain is to decide which of the filled-out Forms should be included in an **executive summary of the project.** Remember that the name of the project (or the selected alternative) should follow the norms established in Volume I of this Manual. The table below indicates which of the Forms must **NECESSARILY** be included (shaded lines), and which are **OPTIONAL.** The Forms in shaded lines must necessarily be included in the executive summary of the project. The optional Forms may or may not be included in the summary. You should judge which (if any) of them to include. **Include only Forms of the selected alternative.**

EXECUTIVE SUMMARY TABLE

IDENTIFICATION MODULE

FORM ID-01: PRESENTATION OF THE PROBLEM	**OBLIGATORY**
FORM ID-02: IMPORTANCE OF THE PROBLEM	**OPTIONAL**
FORM ID-03: REFERENCE SITUATION	**OPTIONAL**
FORM ID-04: EFFECTS OF THE PROBLEM	**OPTIONAL**
FORM ID-05: INSTITUTIONAL FRAMEWORK	**OPTIONAL**
FORM ID-06: LIST OF ALTERNATIVES	**OBLIGATORY**
FORM ID-07: DESCRIPTION OF ALTERNATIVE XX	**OPTIONAL**
FORM ID-08: LIMITATIONS OF ALTERNATIVE XX	**OPTIONAL**
FORM ID-09: VERIFICATION TEST	**OBLIGATORY**

EXECUTIVE SUMMARY TABLE (CONTINUED)

PREPARATION MODULE

FORM PR-01: LOCALIZATION OF ALTERNATIVE	**OPTIONAL**
FORM PR-02: CHRONOGRAM OF ALTERNATIVE	**OPTIONAL**
FORM PR-03: QUANTIFICATION OF BENEFITS	**OPTIONAL**
FORM PR-04: QUANTIFICATION OF INVESTMENT COSTS	**OPTIONAL**
FORM PR-05: QUANTIFICATION OF OPERATION COSTS	**OPTIONAL**

EVALUATION MODULE

FORM EV-01: DESCRIPTION AND VALUES OF THE INVESTMENT COSTS OF THE ALTERNATIVE	
SECTION A: DESCRIPTION OF UNITARY PRICES	OPTIONAL
SECTION B: VALUES OF ESTIMATE OF PHYSICAL WORKS	OPTIONAL
SECTION C: VALUES OF ESTIMATES OF MACHINERY AND EQUIPMENT	OPTIONAL
SECTION D: VALUES OF ESTIMATES OF PERSONNEL	OPTIONAL
SECTION E: SUMMARY OF INVESTMENT COSTS	**OBLIGATORY**
FORM EV-02: PRESENT VALUE OF COSTS OF RE-INVESTMENT AND RESIDUAL VALUES OF THE ALTERNATIVE	
SECTION A: CHRONOGRAM	OPTIONAL
SECTION B: PRESENT VALUE OF RE-INVESTMENT COSTS AND RESIDUAL VALUES OF THE ALTERNATIVE	OPTIONAL

EXECUTIVE SUMMARY TABLE (CONTINUED)

EVALUATION MODULE (CONTINUED)

FORM EV-03:	**DESCRIPTION AND VALUES OF THE OPERATION COSTS OF THE ALTERNATIVE**	
SECTION A:	DESCRIPTION OF UNITARY PRICES	OPTIONAL
SECTION B:	VALUES OF INPUTS AND MATERIALS IN FIRST YEAR OF OPERATION	OPTIONAL
SECTION C:	VALUES OF INPUTS AND MATERIALS IN FOURTH YEAR OF OPERATION	OPTIONAL
SECTION D:	DESCRIPTION OF EMPLOYMENT IN THE ALTERNATIVE	OPTIONAL
SECTION E:	VALUES OF LABOUR COSTS IN FIRST YEAR OF OPERATION	OPTIONAL
SECTION F:	VALUES OF LABOUR COSTS IN FOURTH YEAR OF OPERATION	OPTIONAL
SECTION G:	**SUMMARY OF OPERATION COSTS**	**OBLIGATORY**
FORM EV-04:	**SUMMARY OF COSTS OF THE ALTERNATIVE**	
SECTION A:	**VALUES OF TOTAL COSTS**	**OBLIGATORY**
SECTION B:	**EQUIVALENT ANNUAL COSTS**	**OBLIGATORY**
FORM EV-05:	**ENVIRONMENTAL IMPACT OF THE ALTERNATIVE**	
SECTION A:	DESCRIPTION	OPTIONAL
SECTION B:	**EVALUATION OF IMPACT**	**OBLIGATORY**
FORM EV-06:	**SELECTION AND JUSTIFICATION OF SELECTED ALTERNATIVES**	**OBLIGATORY**

EXECUTIVE SUMMARY TABLE (CONTINUED)

FINANCING MODULE

FORM FI-01: DESCRIPTION AND JUSTIFICATION OF SOURCES OF FINANCING OF THE SELECTED ALTERNATIVE	
SECTION A: DESCRIPTION OF SOURCES OF FINANCING	OPTIONAL
SECTION B: VALUES OF SOURCES OF INVESTMENT FINANCING	**OBLIGATORY**
SECTION C: VALUES OF SOURCES OF OPERATION FINANCING	**OBLIGATORY**

SUSTAINABILITY MODULE

FORM SO-01: PROJECT SUSTAINABILITY	**OBLIGATORY**

ASSIGNING NAMES TO PROJECTS

Finally, it should be mentioned that in each one of the Forms you should identify the name of the project. It is difficult, however, to give a specific name when you are in the stage of describing the problem and its possible alternative solutions. Therefore, to fill-in correctly the space for the project name, you should use the following procedure:

1. Title Forms ID-01 to ID-09 with a phrase which summarizes the problem, according to the responses given in Form ID-01.

2. Once the Forms have been completed, choose the name of one of the possible alternatives to solution listed in Form ID-06, according to the norms of the CBIP (process, object, localization), established in Volume I of this Manual.

3. Title Forms ID-01 to ID-09 with this name, and take the opportunity to revise the answers given in each of them.

4. Use this name in the following Modules.

5. In all of the Forms there is an empty box in the upper right corner. Put here the number of the alternative you are analyzing.

6. Once you have chosen one of the alternatives, give it a name according to the norms established in Volume I. Use this name in the Forms you send.

Do not forget to use copies of the empty Forms contained in Annex 2 of this Chapter.

A N N E X 2

FORMS

FORM ID-01: PRESENTATION OF THE PROBLEM

Question Nº 1	**Describe** the problem or need in general terms.
Instructions:	Try to answer **at least** the questions marked with the symbol √. Work in this Form or a photocopy.

FORM ID-02: IMPORTANCE OF THE PROBLEM

Question Nº 2	How **important** is the problem or what priority does it have compared to other problems?
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

FORM ID-03: REFERENCE SITUATION

Question Nº 3	What will be the evolution of the problem situation if **nothing is done** to resolve it, and what **former solutions** or similar attempts have existed in the problem area?
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

FORM ID-04: EFFECTS OF THE PROBLEM

Question Nº 4	What are the effects of repercussions of the problem?
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

FORM ID-05: INSTITUTIONAL FRAMEWORK OF THE PROBLEM

Question Nº 5	What is the **institutional framework** and what are the **technical assistance needs** that are required in the presentation of the solutions?
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

SPACE FOR THE NAME OF THE PROJECT

FORM ID-06: ENUMERATION OF ALTERNATIVES

Question Nº 6	Describe the principal characteristics of each alternative of solution.
Instructions:	List and describe with one or more phrases each of the possible alternatives to solution.

FORM ID-07: DESCRIPTION OF ALTERNATIVE Nº	

Question Nº 7	Describe the principal characteristics of **this** alternative to solution.
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

FORM ID-08: LIMITATIONS OF ALTERNATIVE Nº

Question Nº 8	Describe the principal limitations of **this** alternative to solution.
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

FORM ID-09: VERIFICATION TEST OF THE IDENTIFICATION

Question Nº 9	Summarize the main characteristics of the problem and of the possible alternatives of solution.
Instructions:	Try to answer **at least** the questions marked with the symbol ✓. Work in this Form or a photocopy.

FORM PR-01: LOCALIZATION OF THE ALTERNATIVE Nº	

Question Nº 1	**Describe** the localization of this alternative.
Instructions:	Answer the questions asked. Keep in mind that not all of these questions are relevant to each alternative.

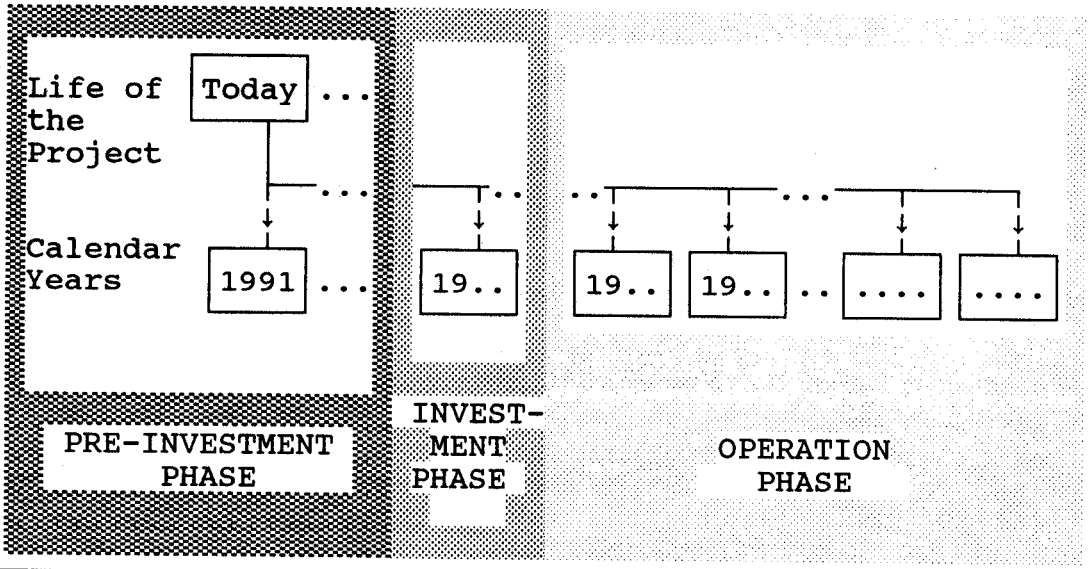
IMPORTANT NOTE:	**Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.**

FORM PR-02: CHRONOGRAM OF THE ALTERNATIVE Nº .

SECTION A: DURATION

Nº of Months Pre-investment phase	Nºof Years Investment phase	Nºof Years Investment phase	Year that Operation phase begins (Year "k")
	i=	m=	k=i+1=.....

SECTION B: CHRONOGRAM



Fourth Year of Operation:_____

IMPORTANT NOTE : Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.

FORM PR-03: DESCRIPTION AND QUANTIFICATION OF THE BENEFITS OF THE ALTERNATIVE Nº

SECTION A: DESCRIPTION OF BENEFITS

Describe the main **benefits** of this project alternative.

IMPORTANT NOTE: **Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.**

FORM PR-03: DESCRIPTION AND QUANTIFICATION OF THE BENEFITS OF THE ALTERNATIVE Nº

SECTION B: QUANTIFICATION OF BENEFITS

Quantify the principal benefits of this project alternative.

TYPE OF BENEFIT	MEASURE-MENT UNIT	QUANTITY FIRST YEAR OPERATION	QUANTITY FOURTH YEAR OPERATION

IMPORTANT NOTE: Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF THE INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION A: DESCRIPTION OF INVESTMENT COSTS

Describe the principal **investment costs** of this project alternative.

IMPORTANT NOTE: **Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.**

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF THE INVESTMENT COSTS OF ALTERNATIVE N°

SECTION B: ESTIMATE OF PHYSICAL WORKS

Quantify the main investment costs in **physical works** of this project alternative.

Item	Measure-ment Unit	Quantity	Useful Life	Year of Investment

IMPORTANT NOTE: **Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.**

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF THE INVESTMENT COSTS OF ALTERNATIVE N°

SECTION C: ESTIMATE OF MACHINERY AND EQUIPMENT

Quantify the main investment costs in **machinery and equipment** of this project alternative. Include lands.

Item	Quantity	Useful Life	Year of Investment

IMPORTANT NOTE: Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.

FORM PR-04: DESCRIPTION AND QUANTIFICATION OF THE INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION D: ESTIMATE OF PERSONNEL (INVESTMENT)

Quantify the main investment costs in **personnel** of this project alternative.

	Number of Persons	Year of Investment
SKILLED MANPOWER		
UNSKILLED MANPOWER		

IMPORTANT NOTE: Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.

FORM PR-05: DESCRIPTION AND QUANTIFICATION OF THE OPERATION COSTS OF ALTERNATIVE Nº

SECTION A: DESCRIPTION OF OPERATION COSTS

Describe the main **operation costs** of this project.

IMPORTANT NOTE: **Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.**

FORM PR-05: DESCRIPTION AND QUANTIFICATION OF THE OPERATION COSTS OF ALTERNATIVE Nº

SECTION B: COSTS OF INPUTS AND MATERIAL

Quantify the main operation costs in **inputs and materials** of this project alternative. Include maintenance costs.

Item	Measu-rement Unit	Quantity First Year Operation	Quantity Fourth Year Operation

IMPORTANT NOTE: Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.

FORM PR-05: DESCRIPTION AND QUANTIFICATION OF THE OPERATION COSTS OF ALTERNATIVE Nº

SECTION C: LABOR COSTS

Quantify the main costs in personnel in this project alternative. Distinguish between skilled and unskilled manpower.

	Number of Persons First Year Operation	Number of Persons Fourth Year Operation
SKILLED MANPOWER		
UNSKILLED MANPOWER		

IMPORTANT NOTE: **Come back to this Form once you have completed ALL of the preparation Forms (PR-01 to PR-05), and reconsider your answers.**

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION A: DESCRIPTION OF UNITARY PRICES

Describe how you obtained each of the prices used for this alternative, and the source of the information.

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION B: PRICES OF ESTIMATE OF PHYSICAL WORKS

Place value on the main investment costs of **physical works** for this project alternative. Use the items from **Form PR-04, Section B**. In the shaded areas, put the values from this Form. In the non-shaded areas, put the requested information.

Item	(1) Measure-ment Unit	(2) Quan tity	(3) Unit Cost	(4) = (2)*(3) Total Cost	(5) Year of Inv.	(6) Factor	(7) = (4)*(6) Total Cost in PV
TOTALS							SUM

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION C: PRICES OF ESTIMATE IN MACHINERY AND EQUIPMENT

Place values on the main investment costs of **machinery and equipment** for this project alternative. Use the items from **Form PR-04, Section C**. In the shaded areas, place the values from this Form. In the non-shaded areas, place the requested information.

Item	(1) Quantity	(2) Unit Cost	(3) = (1)*(2) Total Cost	(4) Year of Inv.	(5) Factor	(6) = (3)*(5) Total Cost in PV
TOTAL						SUM

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE Nº

SECTION D: PRICES OF ESTIMATE OF PERSONNEL

Place values on the main investment costs of **Personnel** for this project alternative. Use the items from **Form PR-04, Section D**. In the shaded areas, put the values from this Form. In the non-shaded areas, put the requested information.

Jobs	(1) Number of Persons	(2) Unit Salary	(3) = (1)*(2) Total Cost	(4) Year of Inv.	(5) Factor	(6) = (3)*(5) Total Cost in PV
SKILLED MANPOWER						
UNSKILLED MANPOWER						
TOTALS						SUM

FORM EV-01: DESCRIPTION AND VALUES OF INVESTMENT COSTS OF ALTERNATIVE N°

SECTION E: SUMMARY OF INVESTMENT COSTS

	YEAR OF INVESTMENT	0	1	2	3	4
1	COST OF PHYSICAL WORKS					
2	COST OF MACHINERY AND EQUIP.					
3	COST OF SKILLED MANPOWER					
4	COST OF UNSKILLED MANPOWER					
	TOTAL (1 + 2 + 3 + 4)					

FORM EV-01 (D) COL.4 (ADD FOR EACH YEAR OF INVESTMENT)
FORM EV-01 (C) COL.4 (ADD FOR EACH YEAR OF INVESTMENT)
FORM EV-01 (B) COL.4 (ADD FOR EACH YEAR OF INVESTMENT)

	Cost in PV
COST IN PHYSICAL WORKS	
COST IN MACHINERY AND EQUIP.	
COST IN SKILLED MANPOWER	
COST IN UNSKILLED MANPOWER	
TOTAL INVESTMENT COSTS	

FORM EV-01 → (B), (C), (D)

FORM EV-02: PRESENT VALUE OF OPERATION COSTS AND RESIDUAL VALUES OF ALTERNATIVE Nº

SECTION A: CHRONOGRAM

First year of Operation ("Year k")	
Number of years of Operation (m)	

SECTION B: PRESENT VALUE OF OPERATION COSTS AND RESIDUAL VALUES OF ALTERNATIVE Nº

Item	(1) Investment Value	(2) Useful Life	(3) Factor VP	(4)=(1)*(3) Present Value
TOTAL				

FORM EV-03: DESCRIPTION AND PRESENT VALUE OF OPERATION COSTS AND RESIDUAL VALUES OF ALTERNATIVE Nº

SECTION A: DESCRIPTION OF UNIT COSTS

Describe how you obtained each one of the unit prices used in this project alternative for operation costs, and where the prices come from.

FORM EV-03: DESCRIPTION AND PRESENT VALUE OF OPERATION COSTS AND RESIDUAL VALUES OF ALTERNATIVE Nº

SECTION B: VALUES OF INPUTS AND MATERIALS FOR THE **FIRST** YEAR OF OPERATION

Place values on the costs of operation of **inputs and materials** for this project alternative. Use the items from **Form PR-05, Section B**. Place the numbers from this Form in the shaded areas. In the non-shaded areas place the requested information.

Item	(1) Measurement Unit	(2) Quantity First Year	(3) Unit Cost First Year	(4)= (2)*(3) Total Cost First Year	(5) Factor	(6)= (4)*(5) Total Cost in Present Value
TOTALS				SUM		SUM

FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE Nº

SECTION C: VALUES OF INPUTS AND MATERIALS FOR THE **FOURTH** YEAR OF OPERATION

Place values on the costs of operation of **inputs and materials** for this project alternative. Use the items from **Form PR-05, Section B**. Put the numbers from this Form in the shaded areas. In the non-shaded areas place the requested information.

Item	(1) Measu-rement Unit	(2) Quantity Fourth Year	(3) Unit Cost Fourth Year	(4)= (2)*(3) Total Cost Fourth Year	(5) Factor	(6)= (4)*(5) Total Cost in Present Value
TOTALS				SUM		SUM

FORM EV-03: DESCRIPTION AND PRESENT VALUE OF THE OPERATION COSTS OF ALTERNATIVE Nº

SECTION D: DESCRIPTION OF EMPLOYMENT OF THIS ALTERNATIVE

Describe in detail the effect of **employment generation** of this project alternative. If appropriate, refer to the principal characteristics of the employment market in the area of influence of the project.

FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE Nº

SECTION E: VALUES OF LABOR COSTS FOR THE **FIRST YEAR** OF OPERATION

Place values of operation in **labor costs in the first year** for this project alternative. Use the Jobs listed in **Form PR-05**, Section C. In the shaded areas, put the numbers from that Form. In the non-shaded areas, place the requested information.

Job	(1) Number of Persons	(2) Annual Salary	(3) = (1)*(2) Annual Value of Labor	(4) Factor	(5) = (3)*(4) Total Cost in PV
SKILLED MANPOWER					
TOTALS (SUM)					
UNSKILLED MANPOWER					
TOTALS (SUM)					

FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE Nº

SECTION F: VALUES OF LABOR COSTS FOR THE **FOURTH** YEAR OF OPERATION

Place values of operation in **labor costs in the Fourth year** for this project alternative. Use the Jobs listed in **Form PR-05, Section C**. In the shaded areas, put the numbers from that Form. In the non-shaded areas, place the requested information.

Job	(1) Number of Persons	(2) Annual Salary	(3) = (1)*(2) Annual Value of Labor	(4) Factor	(5) = (3)*(4) Total Cost in PV
SKILLED MANPOWER					
TOTALS (SUM)					
UNSKILLED MANPOWER					
TOTALS (SUM)					

FORM EV-03: DESCRIPTION AND VALUES OF OPERATION COSTS OF ALTERNATIVE Nº

SECTION G: SUMMARY OF OPERATION COSTS

		1st YEAR OPERATION	4th YEAR OPERATION	COST IN PV
1	INPUTS AND MATERIALS			
2	SKILLED MANPOWER			
3	UNSKILLED MANPOWER			
	TOTAL OPERATION COSTS (1 + 2 + 3)			

FORM EV-04: SUMMARY OF COSTS OF ALTERNATIVE Nº

SECTION A: VALUES OF TOTAL COSTS

	COSTS CATEGORY	(1) Value at Market Prices		(2) Social Price Category	(3) = (1)*(2) Value at Social Prices
	INVESTMENT COSTS				
1	COSTS OF PHYSICAL WORKS		◄	0.80	
2	COSTS OF MACHINERY & EQUIP.		◄	0.77	
3	COSTS OF SKILLED MANPOWER		◄	1.00	
4	COSTS OF UNSKILLED MANPOWER		◄	0.60	
5	TOTAL INVESTMENT COSTS(1+2+3+4)		◄		
6	COSTS OF RE-INVESTMENT AND RESIDUAL VALUES		◄	0.79	
	OPERATION COSTS				
7	COSTS OF INPUTS AND MATERIALS		◄	0.79	
8	COSTS OF SKILLED MANPOWER		◄	1.00	
9	COSTS OF UNSKILLED MANPOWER		◄	0.60	
10	TOTAL OPERATION COSTS (7+8+9)		◄		
11	TOTAL COSTS (5 + 6 + 10)				

VALUES FROM EV-03(G) AND EV-01(E) IN VP

FORM EV-04: SUMMARY OF COSTS OF ALTERNATIVE Nº

SECTION B: EQUIVALENT ANNUAL COSTS

		(1) Total	(2) Equiv. Factor	(3) = (1)*(2) Equiv. Annual Costs
f1	TOTAL COSTS AT MARKET PRICES			
f2	TOTAL COSTS AT SOCIAL PRICES			

COMES FROM FORM EV-04 (SECTION A)

COMES FROM TABLE 4, ANNEX 4

COMES FROM FORM PR-03 (SECTION B)

f3	NUMBER OF UNITS	
f4	NUMBER OF BENEFICIARIES	

f5	COST/EFFICIENCY COST 1	f1 / f3
f6	COST/EFFICIENCY INDICATOR 2	f1 / f4

SPACE FOR THE NAME OF THE PROJECT

FORM EV-05: ENVIRONMENTAL IMPACT OF ALTERNATIVE Nº

SECTION A: DESCRIPTION

Describe the environmental **IMPACT** of this project alternative in terms of its effect on the soil, air, water, fauna, flora and culture.

SPACE FOR THE NAME OF THE PROJECT

FORM EV-05: ENVIRONMENTAL IMPACT OF ALTERNATIVE Nº

SECTION B: EVALUATION OF THE IMPACT

COMPONENT OR EFFECT	Type of Impact	Prob. of Occu.	Mag-ni-tude	Dura-tion	Ten-dency
ON THE SOIL					
✓ Modification of surf. soil					
✓ Preservation of the soil					
✓ Generation of erosive proce.					
✓ Instability					
ON THE AIR					
✓ Air quality					
ON THE WATER					
✓ Quality of superficial water					
✓ Subterranean water					
ON THE FAUNA					
✓ Hydrobiological deteriora.					
✓ Perturb. or scare off animal					
ON THE FLORA					
✓ Removal of vegetation					
✓ Pressure on forests					
ON THE CULTURE					
✓ Impact on native cultures					

FORM EV-06: SELECTION AND JUSTIFICATION OF THE SELECTED ALTERNATIVE	
SELECT one of the alternatives and **JUSTIFY** your selection.	

FORM FI-01: DESCRIPTION AND VALUES OF THE SOURCES OF FINANCING OF THE PROJECT

SECTION A: DESCRIPTION OF SOURCES OF FINANCING

Describe the possible sources of financing of the chosen project alternative. Include, if appropriate, income from the sale of services or for other items.

FORM FI-01: DESCRIPTION AND VALUES OF THE SOURCES OF FINANCING OF THE PROJECT

SECTION B: VALUES OF THE SOURCES OF INVESTMENT FINANCING

Indicate values (in thousands of dollars) for the possible sources of financing for the investment of the chosen project alternative.

Project Year	0	1	2	3	4
Calendar Year					
TOTAL INVESTMENT					
	↑ = ↓	↑ = ↓	↑ = ↓	↑ = ↓	↑ = ↓
TOTAL FINANCING					

SOURCES OF FINANCING					

FORM FI-01: DESCRIPTION AND VALUES OF THE SOURCES OF FINANCING OF THE PROJECT

SECTION C: VALUES OF THE SOURCES OF FINANCING FOR THE OPERATION OF THE PROJECT

Indicate values (in thousand of dollars) for possible sources of financing for the operation of the chosen project alternative.

Project Year	FIRST YEAR	FOURTH YEAR
Calendar Year		
TOTAL OPERATION		
	↑ = ↓	↑ = ↓
TOTAL FINANCING		

SOURCES OF FINANCING		

FORM SO-01: SUSTAINABILITY OF THE PROJECT

Instructions: Try to answer **at least** the questions marked with the symbol ✓ in Form SO-01 of Module 7.

A N N E X 3

FINANCIAL FLOW CONVENTIONS

THE PROJECT CYCLE

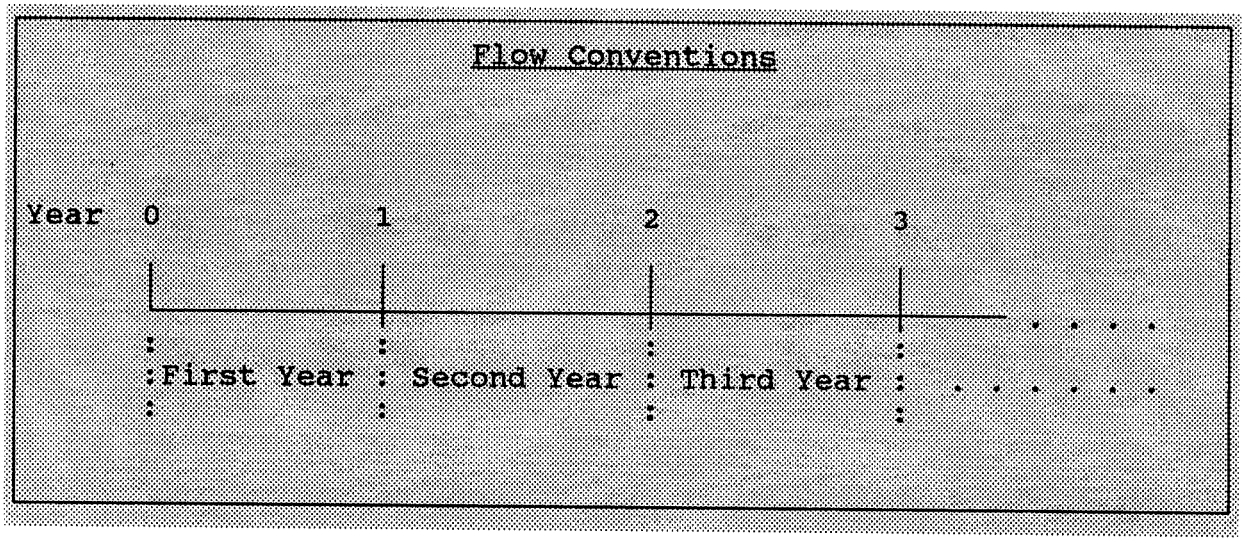
FINANCIAL FLOW CONVENTIONS

It is important to be clear about the type of financial (at market prices) and social (at social prices) flow conventions that are used in this Manual. We assume that all flows occur instantaneously on the last day of the year in which they occur. For example, a cost which arises at some moment in the second year of the project, is assumed to occur on the last day of the second year. The only exception to this rule is investment costs, which we assume occur on the **first** day of the corresponding year.

These assumptions are made for mathematical convenience, and do not affect significantly the results of evaluations.

This "Year 0" refers to the beginning of the first year (today), "Year 1" refers to the end of the first year, and simultaneously, to the beginning of the second year. The graphic summarizes the assumptions.

GRAPHIC



A N N E X 4

TABLES OF FINANCIAL EQUIVALENTS

TABLE 1

PRESENT VALUE FACTORS

(Value in Year 0 of cost of $1.00 in Year t)

Interest Rate: 12%

Year	Factor	Year	Factor
0	1.0000	26	0.0525
1	0.8929	27	0.0469
2	0.7972	28	0.0419
3	0.7118	29	0.0374
4	0.6355	30	0.0334
5	0.5674	31	0.0298
6	0.5066	32	0.0266
7	0.4523	33	0.0238
8	0.4039	34	0.0212
9	0.3606	35	0.0189
10	0.3220	36	0.0169
11	0.2875	37	0.0151
12	0.2567	38	0.0135
13	0.2292	39	0.0120
14	0.2046	40	0.0107
15	0.1827	41	0.0096
16	0.1631	42	0.0086
17	0.1456	43	0.0076
18	0.1300	44	0.0068
19	0.1161	45	0.0061
20	0.1037	46	0.0054
21	0.0926	47	0.0049
22	0.0826	48	0.0043
23	0.0738	49	0.0039
24	0.0659	50	0.0035
25	0.0588		

TABLE 2

PRESENT VALUE FACTORS FOR RE-INVESTMENTS AND RESIDUAL VALUES

When k=1

(When k is different than 1, the factor in the Table should be multiplied by 0.8929 for k=2; 0.7972 for k=3; or 0.7118 for k=4).

Interest Rate: 12%

m: years of operation
v: useful life of the good

m\v	1	2	3	4	5	6	7	8	9	10
1	0.0000	-0.4717	-0.6283	-0.7060	-0.7523	-0.7828	-0.8044	-0.8203	-0.8324	-0.8420
2	0.8929	0.0000	-0.2963	-0.4436	-0.5312	-0.5889	-0.6297	-0.6598	-0.6828	-0.7009
3	1.6901	0.4212	0.0000	-0.2092	-0.3337	-0.4158	-0.4737	-0.5165	-0.5492	-0.5749
4	2.4018	0.7972	0.2646	0.0000	-0.1574	-0.2612	-0.3345	-0.3886	-0.4300	-0.4624
5	3.0373	1.1329	0.5008	0.1868	0.0000	-0.1232	-0.2101	-0.2743	-0.3235	-0.3620
6	3.6048	1.4327	0.7118	0.3536	0.1405	0.0000	-0.0991	-0.1724	-0.2284	-0.2723
7	4.1114	1.7004	0.9001	0.5025	0.2660	0.1100	0.0000	-0.0813	-0.1435	-0.1923
8	4.5638	1.9393	1.0683	0.6355	0.3781	0.2083	0.0885	0.0000	-0.0677	-0.1208
9	4.9676	2.1527	1.2184	0.7542	0.4781	0.2960	0.1675	0.0726	0.0000	-0.0570
10	5.3282	2.3432	1.3525	0.8602	0.5674	0.3743	0.2381	0.1374	0.0604	0.0000
11	5.6502	2.5133	1.4722	0.9549	0.6472	0.4442	0.3011	0.1953	0.1144	0.0509
12	5.9377	2.6652	1.5790	1.0394	0.7184	0.5066	0.3573	0.2469	0.1626	0.0963
13	6.1944	2.8008	1.6744	1.1149	0.7820	0.5624	0.4075	0.2931	0.2056	0.1369
14	6.4235	2.9219	1.7596	1.1822	0.8387	0.6121	0.4523	0.3343	0.2440	0.1731
15	6.6282	3.0300	1.8357	1.2424	0.8894	0.6566	0.4924	0.3710	0.2783	0.2054
16	6.8109	3.1265	1.9036	1.2961	0.9347	0.6963	0.5281	0.4039	0.3089	0.2343
17	6.9740	3.2127	1.9643	1.3440	0.9751	0.7317	0.5600	0.4332	0.3362	0.2601
18	7.1196	3.2896	2.0184	1.3868	1.0111	0.7633	0.5885	0.4594	0.3606	0.2831
19	7.2497	3.3583	2.0667	1.4251	1.0433	0.7915	0.6140	0.4828	0.3824	0.3036
20	7.3658	3.4197	2.1099	1.4592	1.0721	0.8168	0.6367	0.5036	0.4019	0.3220
21	7.4694	3.4744	2.1484	1.4897	1.0978	0.8393	0.6570	0.5223	0.4192	0.3384
22	7.5620	3.5233	2.1828	1.5169	1.1207	0.8594	0.6751	0.5389	0.4347	0.3530
23	7.6446	3.5670	2.2136	1.5412	1.1412	0.8773	0.6912	0.5537	0.4486	0.3660
24	7.7184	3.6060	2.2410	1.5629	1.1594	0.8933	0.7057	0.5670	0.4610	0.3777
25	7.7843	3.6408	2.2655	1.5822	1.1758	0.9077	0.7186	0.5788	0.4720	0.3881
26	7.8431	3.6718	2.2873	1.5995	1.1903	0.9204	0.7301	0.5894	0.4818	0.3974
27	7.8957	3.6996	2.3069	1.6150	1.2033	0.9318	0.7404	0.5989	0.4906	0.4057
28	7.9426	3.7244	2.3243	1.6287	1.2150	0.9420	0.7495	0.6073	0.4985	0.4131
29	7.9844	3.7465	2.3399	1.6411	1.2253	0.9511	0.7577	0.6148	0.5055	0.4197
30	8.0218	3.7662	2.3538	1.6520	1.2346	0.9592	0.7650	0.6215	0.5118	0.4256
31	8.0552	3.7839	2.3662	1.6619	1.2429	0.9665	0.7716	0.6275	0.5174	0.4309
32	8.0850	3.7996	2.3773	1.6706	1.2502	0.9729	0.7774	0.6329	0.5224	0.4356
33	8.1116	3.8137	2.3871	1.6784	1.2568	0.9787	0.7826	0.6377	0.5268	0.4398
34	8.1354	3.8262	2.3960	1.6854	1.2627	0.9839	0.7872	0.6419	0.5308	0.4436
35	8.1566	3.8374	2.4039	1.6917	1.2680	0.9885	0.7914	0.6458	0.5344	0.4469
36	8.1755	3.8474	2.4109	1.6972	1.2727	0.9926	0.7951	0.6492	0.5375	0.4499
37	8.1924	3.8564	2.4172	1.7022	1.2768	0.9963	0.7984	0.6522	0.5404	0.4526
38	8.2075	3.8643	2.4228	1.7066	1.2806	0.9996	0.8014	0.6549	0.5429	0.4550
39	8.2210	3.8715	2.4278	1.7106	1.2839	1.0025	0.8040	0.6573	0.5452	0.4571
40	8.2330	3.8778	2.4323	1.7141	1.2869	1.0051	0.8064	0.6595	0.5472	0.4590
41	8.2438	3.8835	2.4363	1.7173	1.2896	1.0074	0.8085	0.6614	0.5490	0.4607
42	8.2534	3.8886	2.4399	1.7201	1.2919	1.0095	0.8103	0.6632	0.5506	0.4622
43	8.2619	3.8931	2.4430	1.7226	1.2941	1.0114	0.8120	0.6647	0.5520	0.4636
44	8.2696	3.8971	2.4459	1.7249	1.2960	1.0130	0.8135	0.6661	0.5533	0.4648
45	8.2764	3.9007	2.4484	1.7269	1.2977	1.0145	0.8148	0.6673	0.5545	0.4659
46	8.2825	3.9040	2.4507	1.7287	1.2992	1.0158	0.8160	0.6684	0.5555	0.4668
47	8.2880	3.9068	2.4527	1.7303	1.3005	1.0170	0.8171	0.6694	0.5564	0.4677
48	8.2928	3.9094	2.4545	1.7317	1.3017	1.0181	0.8181	0.6702	0.5572	0.4685
49	8.2972	3.9117	2.4561	1.7330	1.3028	1.0190	0.8189	0.6710	0.5579	0.4692
50	8.3010	3.9138	2.4576	1.7341	1.3037	1.0199	0.8197	0.6717	0.5586	0.4698

m\v	11	12	13	14	15	16	17	18	19	20
1	-0.8496	-0.8559	-0.8610	-0.8653	-0.8689	-0.8720	-0.8746	-0.8768	-0.8788	-0.8805
2	-0.7154	-0.7272	-0.7369	-0.7450	-0.7519	-0.7577	-0.7626	-0.7669	-0.7706	-0.7737
3	-0.5955	-0.6123	-0.6261	-0.6376	-0.6474	-0.6556	-0.6626	-0.6687	-0.6739	-0.6784
4	-0.4885	-0.5097	-0.5272	-0.5418	-0.5540	-0.5645	-0.5734	-0.5810	-0.5876	-0.5934
5	-0.3929	-0.4181	-0.4388	-0.4561	-0.4707	-0.4831	-0.4937	-0.5028	-0.5106	-0.5174
6	-0.3076	-0.3363	-0.3599	-0.3797	-0.3963	-0.4105	-0.4225	-0.4329	-0.4418	-0.4496
7	-0.2314	-0.2632	-0.2895	-0.3115	-0.3299	-0.3456	-0.3590	-0.3705	-0.3804	-0.3890
8	-0.1634	-0.1980	-0.2267	-0.2505	-0.2706	-0.2877	-0.3023	-0.3148	-0.3256	-0.3349
9	-0.1026	-0.1398	-0.1705	-0.1961	-0.2177	-0.2360	-0.2516	-0.2650	-0.2766	-0.2867
10	-0.0484	-0.0878	-0.1204	-0.1475	-0.1704	-0.1898	-0.2064	-0.2206	-0.2329	-0.2436
11	0.0000	-0.0414	-0.0756	-0.1042	-0.1282	-0.1486	-0.1660	-0.1810	-0.1939	-0.2051
12	0.0432	0.0000	-0.0357	-0.0654	-0.0905	-0.1118	-0.1300	-0.1456	-0.1590	-0.1707
13	0.0818	0.0370	0.0000	-0.0309	-0.0569	-0.0789	-0.0978	-0.1140	-0.1279	-0.1400
14	0.1163	0.0700	0.0319	0.0000	-0.0268	-0.0496	-0.0690	-0.0857	-0.1001	-0.1126
15	0.1471	0.0995	0.0603	0.0276	0.0000	-0.0234	-0.0434	-0.0605	-0.0753	-0.0882
16	0.1745	0.1259	0.0857	0.0522	0.0240	0.0000	-0.0205	-0.0380	-0.0532	-0.0663
17	0.1991	0.1494	0.1084	0.0741	0.0453	0.0209	0.0000	-0.0179	-0.0334	-0.0468
18	0.2210	0.1704	0.1286	0.0938	0.0644	0.0395	0.0183	0.0000	-0.0158	-0.0294
19	0.2405	0.1891	0.1467	0.1113	0.0815	0.0562	0.0346	0.0160	0.0000	-0.0139
20	0.2580	0.2058	0.1628	0.1269	0.0967	0.0710	0.0491	0.0303	0.0141	0.0000
21	0.2736	0.2208	0.1772	0.1409	0.1103	0.0843	0.0621	0.0431	0.0266	0.0124
22	0.2875	0.2341	0.1901	0.1534	0.1224	0.0962	0.0737	0.0545	0.0379	0.0235
23	0.2999	0.2460	0.2016	0.1645	0.1333	0.1067	0.0841	0.0647	0.0479	0.0333
24	0.3110	0.2567	0.2118	0.1744	0.1429	0.1162	0.0934	0.0737	0.0568	0.0422
25	0.3209	0.2662	0.2210	0.1833	0.1516	0.1246	0.1016	0.0819	0.0648	0.0500
26	0.3298	0.2747	0.2292	0.1912	0.1593	0.1322	0.1090	0.0891	0.0719	0.0571
27	0.3376	0.2822	0.2365	0.1983	0.1662	0.1389	0.1156	0.0956	0.0783	0.0633
28	0.3447	0.2890	0.2430	0.2046	0.1723	0.1449	0.1215	0.1013	0.0840	0.0689
29	0.3510	0.2950	0.2488	0.2103	0.1778	0.1502	0.1267	0.1065	0.0891	0.0739
30	0.3566	0.3004	0.2540	0.2153	0.1827	0.1550	0.1314	0.1111	0.0936	0.0784
31	0.3616	0.3052	0.2586	0.2198	0.1871	0.1593	0.1356	0.1152	0.0976	0.0824
32	0.3661	0.3095	0.2628	0.2238	0.1910	0.1631	0.1393	0.1189	0.1013	0.0860
33	0.3701	0.3133	0.2665	0.2274	0.1945	0.1665	0.1427	0.1222	0.1045	0.0892
34	0.3737	0.3168	0.2698	0.2306	0.1976	0.1696	0.1456	0.1251	0.1074	0.0920
35	0.3769	0.3198	0.2727	0.2334	0.2004	0.1723	0.1483	0.1277	0.1099	0.0945
36	0.3797	0.3226	0.2754	0.2360	0.2028	0.1747	0.1507	0.1300	0.1122	0.0968
37	0.3823	0.3250	0.2777	0.2383	0.2051	0.1769	0.1528	0.1321	0.1143	0.0988
38	0.3845	0.3272	0.2798	0.2403	0.2070	0.1788	0.1547	0.1340	0.1161	0.1006
39	0.3866	0.3291	0.2817	0.2421	0.2088	0.1805	0.1564	0.1356	0.1177	0.1022
40	0.3884	0.3308	0.2834	0.2437	0.2104	0.1821	0.1579	0.1371	0.1192	0.1037
41	0.3900	0.3324	0.2849	0.2452	0.2118	0.1835	0.1592	0.1384	0.1205	0.1050
42	0.3914	0.3338	0.2862	0.2465	0.2131	0.1847	0.1604	0.1396	0.1217	0.1061
43	0.3927	0.3350	0.2874	0.2476	0.2142	0.1858	0.1615	0.1407	0.1227	0.1071
44	0.3939	0.3361	0.2884	0.2487	0.2152	0.1868	0.1625	0.1416	0.1236	0.1080
45	0.3949	0.3371	0.2894	0.2496	0.2161	0.1876	0.1633	0.1425	0.1245	0.1089
46	0.3958	0.3380	0.2902	0.2504	0.2169	0.1884	0.1641	0.1432	0.1252	0.1096
47	0.3966	0.3388	0.2910	0.2511	0.2176	0.1891	0.1648	0.1439	0.1259	0.1102
48	0.3974	0.3395	0.2917	0.2518	0.2182	0.1897	0.1654	0.1445	0.1264	0.1108
49	0.3980	0.3401	0.2923	0.2524	0.2188	0.1903	0.1659	0.1450	0.1270	0.1113
50	0.3986	0.3407	0.2928	0.2529	0.2193	0.1908	0.1664	0.1455	0.1274	0.1118

m\v	21	22	23	24	25	26	27	28	29	30
1	-0.8819	-0.8832	-0.8843	-0.8853	-0.8862	-0.8869	-0.8876	-0.8882	-0.8887	-0.8892
2	-0.7765	-0.7789	-0.7810	-0.7829	-0.7845	-0.7860	-0.7872	-0.7883	-0.7893	-0.7902
3	-0.6824	-0.6858	-0.6888	-0.6915	-0.6938	-0.6958	-0.6976	-0.6992	-0.7006	-0.7018
4	-0.5983	-0.6027	-0.6065	-0.6098	-0.6127	-0.6153	-0.6176	-0.6196	-0.6214	-0.6229
5	-0.5233	-0.5285	-0.5330	-0.5369	-0.5404	-0.5434	-0.5461	-0.5485	-0.5506	-0.5525
6	-0.4563	-0.4622	-0.4673	-0.4718	-0.4758	-0.4793	-0.4824	-0.4851	-0.4875	-0.4896
7	-0.3965	-0.4030	-0.4087	-0.4137	-0.4181	-0.4220	-0.4254	-0.4284	-0.4311	-0.4334
8	-0.3431	-0.3502	-0.3564	-0.3618	-0.3666	-0.3708	-0.3746	-0.3778	-0.3807	-0.3833
9	-0.2954	-0.3030	-0.3097	-0.3155	-0.3206	-0.3252	-0.3292	-0.3327	-0.3358	-0.3385
10	-0.2528	-0.2609	-0.2680	-0.2742	-0.2796	-0.2844	-0.2886	-0.2923	-0.2956	-0.2986
11	-0.2148	-0.2233	-0.2307	-0.2372	-0.2429	-0.2480	-0.2524	-0.2563	-0.2598	-0.2629
12	-0.1809	-0.1897	-0.1975	-0.2042	-0.2102	-0.2155	-0.2201	-0.2242	-0.2278	-0.2310
13	-0.1505	-0.1597	-0.1678	-0.1748	-0.1810	-0.1864	-0.1912	-0.1955	-0.1992	-0.2026
14	-0.1235	-0.1330	-0.1413	-0.1485	-0.1549	-0.1605	-0.1655	-0.1699	-0.1737	-0.1772
15	-0.0993	-0.1091	-0.1176	-0.1251	-0.1316	-0.1374	-0.1425	-0.1470	-0.1510	-0.1545
16	-0.0778	-0.0877	-0.0965	-0.1041	-0.1108	-0.1167	-0.1219	-0.1266	-0.1306	-0.1342
17	-0.0585	-0.0687	-0.0776	-0.0854	-0.0922	-0.0983	-0.1036	-0.1083	-0.1125	-0.1161
18	-0.0413	-0.0517	-0.0607	-0.0687	-0.0757	-0.0818	-0.0872	-0.0920	-0.0963	-0.1000
19	-0.0259	-0.0365	-0.0457	-0.0538	-0.0609	-0.0671	-0.0726	-0.0775	-0.0818	-0.0856
20	-0.0122	-0.0229	-0.0323	-0.0404	-0.0476	-0.0540	-0.0596	-0.0645	-0.0689	-0.0727
21	0.0000	-0.0108	-0.0203	-0.0286	-0.0358	-0.0423	-0.0479	-0.0529	-0.0573	-0.0612
22	0.0109	0.0000	-0.0096	-0.0179	-0.0253	-0.0318	-0.0375	-0.0426	-0.0470	-0.0510
23	0.0207	0.0097	0.0000	-0.0085	-0.0159	-0.0224	-0.0282	-0.0333	-0.0378	-0.0418
24	0.0294	0.0183	0.0085	0.0000	-0.0075	-0.0141	-0.0199	-0.0251	-0.0296	-0.0336
25	0.0372	0.0260	0.0162	0.0076	0.0000	-0.0067	-0.0125	-0.0177	-0.0223	-0.0263
26	0.0441	0.0328	0.0230	0.0143	0.0067	0.0000	-0.0059	-0.0111	-0.0157	-0.0198
27	0.0503	0.0390	0.0290	0.0203	0.0127	0.0059	0.0000	-0.0052	-0.0099	-0.0140
28	0.0559	0.0444	0.0345	0.0257	0.0180	0.0112	0.0053	0.0000	-0.0047	-0.0088
29	0.0608	0.0493	0.0393	0.0305	0.0228	0.0160	0.0100	0.0047	0.0000	-0.0041
30	0.0652	0.0537	0.0436	0.0348	0.0270	0.0202	0.0142	0.0089	0.0042	0.0000
31	0.0692	0.0576	0.0475	0.0386	0.0308	0.0240	0.0179	0.0126	0.0079	0.0037
32	0.0727	0.0611	0.0509	0.0420	0.0342	0.0273	0.0213	0.0159	0.0112	0.0070
33	0.0758	0.0642	0.0540	0.0451	0.0373	0.0304	0.0243	0.0189	0.0142	0.0100
34	0.0786	0.0670	0.0568	0.0478	0.0400	0.0330	0.0269	0.0216	0.0168	0.0126
35	0.0811	0.0694	0.0592	0.0503	0.0424	0.0354	0.0293	0.0239	0.0192	0.0149
36	0.0834	0.0717	0.0614	0.0524	0.0445	0.0376	0.0315	0.0260	0.0213	0.0170
37	0.0854	0.0736	0.0634	0.0544	0.0465	0.0395	0.0334	0.0279	0.0232	0.0189
38	0.0871	0.0754	0.0651	0.0561	0.0482	0.0412	0.0351	0.0296	0.0248	0.0206
39	0.0887	0.0770	0.0667	0.0576	0.0497	0.0427	0.0366	0.0311	0.0263	0.0221
40	0.0902	0.0784	0.0681	0.0590	0.0511	0.0441	0.0379	0.0325	0.0277	0.0234
41	0.0914	0.0796	0.0693	0.0603	0.0523	0.0453	0.0391	0.0337	0.0289	0.0246
42	0.0926	0.0807	0.0704	0.0614	0.0534	0.0464	0.0402	0.0348	0.0299	0.0257
43	0.0936	0.0817	0.0714	0.0623	0.0544	0.0474	0.0412	0.0357	0.0309	0.0266
44	0.0945	0.0826	0.0723	0.0632	0.0552	0.0482	0.0420	0.0366	0.0317	0.0275
45	0.0953	0.0834	0.0731	0.0640	0.0560	0.0490	0.0428	0.0373	0.0325	0.0282
46	0.0960	0.0842	0.0738	0.0647	0.0567	0.0497	0.0435	0.0380	0.0332	0.0289
47	0.0966	0.0848	0.0744	0.0653	0.0573	0.0503	0.0441	0.0386	0.0338	0.0295
48	0.0972	0.0854	0.0750	0.0659	0.0579	0.0509	0.0446	0.0392	0.0343	0.0300
49	0.0977	0.0859	0.0755	0.0664	0.0584	0.0513	0.0451	0.0397	0.0348	0.0305
50	0.0982	0.0863	0.0759	0.0668	0.0588	0.0518	0.0456	0.0401	0.0352	0.0310

m\v	31	32	33	34	35	36	37	38	39	40
1	-0.8896	-0.8899	-0.8902	-0.8905	-0.8908	-0.8910	-0.8912	-0.8914	-0.8916	-0.8917
2	-0.7910	-0.7916	-0.7923	-0.7928	-0.7933	-0.7937	-0.7941	-0.7944	-0.7947	-0.7950
3	-0.7029	-0.7039	-0.7048	-0.7055	-0.7062	-0.7068	-0.7074	-0.7078	-0.7083	-0.7086
4	-0.6243	-0.6256	-0.6266	-0.6276	-0.6285	-0.6292	-0.6299	-0.6305	-0.6311	-0.6316
5	-0.5541	-0.5556	-0.5569	-0.5581	-0.5591	-0.5600	-0.5608	-0.5615	-0.5622	-0.5627
6	-0.4915	-0.4931	-0.4946	-0.4959	-0.4971	-0.4981	-0.4991	-0.4999	-0.5006	-0.5013
7	-0.4355	-0.4374	-0.4390	-0.4405	-0.4418	-0.4429	-0.4440	-0.4449	-0.4457	-0.4464
8	-0.3856	-0.3876	-0.3894	-0.3910	-0.3924	-0.3936	-0.3947	-0.3957	-0.3966	-0.3974
9	-0.3410	-0.3431	-0.3450	-0.3468	-0.3483	-0.3496	-0.3508	-0.3519	-0.3528	-0.3537
10	-0.3011	-0.3034	-0.3055	-0.3073	-0.3089	-0.3103	-0.3116	-0.3127	-0.3137	-0.3146
11	-0.2656	-0.2680	-0.2701	-0.2720	-0.2737	-0.2752	-0.2766	-0.2777	-0.2788	-0.2797
12	-0.2338	-0.2364	-0.2386	-0.2406	-0.2423	-0.2439	-0.2453	-0.2465	-0.2476	-0.2486
13	-0.2055	-0.2081	-0.2104	-0.2125	-0.2143	-0.2159	-0.2174	-0.2186	-0.2198	-0.2208
14	-0.1802	-0.1829	-0.1853	-0.1874	-0.1893	-0.1909	-0.1924	-0.1938	-0.1949	-0.1960
15	-0.1576	-0.1604	-0.1628	-0.1650	-0.1669	-0.1686	-0.1702	-0.1715	-0.1727	-0.1738
16	-0.1374	-0.1402	-0.1428	-0.1450	-0.1470	-0.1487	-0.1503	-0.1517	-0.1529	-0.1540
17	-0.1194	-0.1223	-0.1249	-0.1271	-0.1292	-0.1309	-0.1325	-0.1340	-0.1352	-0.1364
18	-0.1033	-0.1063	-0.1089	-0.1112	-0.1132	-0.1151	-0.1167	-0.1182	-0.1194	-0.1206
19	-0.0890	-0.0919	-0.0946	-0.0970	-0.0990	-0.1009	-0.1026	-0.1040	-0.1053	-0.1065
20	-0.0761	-0.0792	-0.0819	-0.0842	-0.0864	-0.0882	-0.0899	-0.0914	-0.0927	-0.0939
21	-0.0647	-0.0678	-0.0705	-0.0729	-0.0750	-0.0770	-0.0786	-0.0802	-0.0815	-0.0827
22	-0.0545	-0.0576	-0.0603	-0.0628	-0.0649	-0.0669	-0.0686	-0.0701	-0.0715	-0.0727
23	-0.0453	-0.0485	-0.0512	-0.0537	-0.0559	-0.0579	-0.0596	-0.0611	-0.0625	-0.0637
24	-0.0372	-0.0403	-0.0431	-0.0456	-0.0478	-0.0498	-0.0516	-0.0531	-0.0545	-0.0557
25	-0.0299	-0.0331	-0.0359	-0.0384	-0.0407	-0.0426	-0.0444	-0.0460	-0.0474	-0.0486
26	-0.0234	-0.0266	-0.0295	-0.0320	-0.0342	-0.0362	-0.0380	-0.0396	-0.0410	-0.0422
27	-0.0176	-0.0208	-0.0237	-0.0262	-0.0285	-0.0305	-0.0323	-0.0339	-0.0353	-0.0365
28	-0.0124	-0.0157	-0.0186	-0.0211	-0.0234	-0.0254	-0.0272	-0.0288	-0.0302	-0.0315
29	-0.0078	-0.0111	-0.0140	-0.0165	-0.0188	-0.0208	-0.0226	-0.0242	-0.0257	-0.0269
30	-0.0037	-0.0070	-0.0099	-0.0124	-0.0147	-0.0168	-0.0186	-0.0202	-0.0216	-0.0229
31	0.0000	-0.0033	-0.0062	-0.0088	-0.0111	-0.0131	-0.0149	-0.0165	-0.0180	-0.0193
32	0.0033	0.0000	-0.0029	-0.0055	-0.0078	-0.0099	-0.0117	-0.0133	-0.0147	-0.0160
33	0.0062	0.0029	0.0000	-0.0026	-0.0049	-0.0070	-0.0088	-0.0104	-0.0119	-0.0132
34	0.0089	0.0055	0.0026	0.0000	-0.0023	-0.0044	-0.0062	-0.0078	-0.0093	-0.0106
35	0.0112	0.0079	0.0049	0.0023	0.0000	-0.0021	-0.0039	-0.0055	-0.0070	-0.0083
36	0.0133	0.0100	0.0070	0.0044	0.0021	0.0000	-0.0018	-0.0035	-0.0049	-0.0062
37	0.0152	0.0118	0.0089	0.0062	0.0039	0.0018	0.0000	-0.0016	-0.0031	-0.0044
38	0.0168	0.0135	0.0105	0.0079	0.0056	0.0035	0.0016	0.0000	-0.0015	-0.0028
39	0.0183	0.0150	0.0120	0.0094	0.0070	0.0050	0.0031	0.0015	0.0000	-0.0013
40	0.0196	0.0163	0.0133	0.0107	0.0084	0.0063	0.0044	0.0028	0.0013	0.0000
41	0.0208	0.0175	0.0145	0.0119	0.0095	0.0074	0.0056	0.0039	0.0025	0.0012
42	0.0219	0.0185	0.0156	0.0129	0.0106	0.0085	0.0066	0.0050	0.0035	0.0022
43	0.0228	0.0195	0.0165	0.0139	0.0115	0.0094	0.0076	0.0059	0.0044	0.0031
44	0.0237	0.0203	0.0173	0.0147	0.0123	0.0103	0.0084	0.0067	0.0053	0.0040
45	0.0244	0.0211	0.0181	0.0154	0.0131	0.0110	0.0091	0.0075	0.0060	0.0047
46	0.0251	0.0217	0.0188	0.0161	0.0138	0.0117	0.0098	0.0081	0.0067	0.0054
47	0.0257	0.0223	0.0194	0.0167	0.0144	0.0123	0.0104	0.0087	0.0073	0.0059
48	0.0262	0.0229	0.0199	0.0172	0.0149	0.0128	0.0109	0.0093	0.0078	0.0065
49	0.0267	0.0234	0.0204	0.0177	0.0154	0.0133	0.0114	0.0097	0.0083	0.0069
50	0.0272	0.0238	0.0208	0.0181	0.0158	0.0137	0.0118	0.0102	0.0087	0.0074

m\v	41	42	43	44	45	46	47	48	49	50	Inf.
1	-0.8918	-0.8919	-0.8920	-0.8921	-0.8922	-0.8923	-0.8923	-0.8924	-0.8924	-0.8925	-0.89285
2	-0.7952	-0.7954	-0.7956	-0.7958	-0.7959	-0.7961	-0.7962	-0.7963	-0.7964	-0.7965	-0.79719
3	-0.7090	-0.7093	-0.7096	-0.7098	-0.7100	-0.7102	-0.7104	-0.7105	-0.7107	-0.7108	-0.71178
4	-0.6320	-0.6324	-0.6327	-0.6330	-0.6333	-0.6335	-0.6337	-0.6339	-0.6341	-0.6343	-0.63551
5	-0.5632	-0.5637	-0.5641	-0.5645	-0.5648	-0.5651	-0.5653	-0.5655	-0.5657	-0.5659	-0.56742
6	-0.5019	-0.5024	-0.5028	-0.5032	-0.5036	-0.5039	-0.5042	-0.5045	-0.5047	-0.5049	-0.50663
7	-0.4470	-0.4476	-0.4481	-0.4486	-0.4490	-0.4494	-0.4497	-0.4500	-0.4502	-0.4504	-0.45234
8	-0.3981	-0.3987	-0.3993	-0.3998	-0.4002	-0.4006	-0.4010	-0.4013	-0.4016	-0.4018	-0.40388
9	-0.3544	-0.3551	-0.3557	-0.3562	-0.3567	-0.3571	-0.3575	-0.3578	-0.3581	-0.3584	-0.36061
10	-0.3154	-0.3161	-0.3167	-0.3173	-0.3178	-0.3183	-0.3187	-0.3190	-0.3193	-0.3196	-0.32197
11	-0.2806	-0.2813	-0.2820	-0.2826	-0.2831	-0.2836	-0.2840	-0.2844	-0.2847	-0.2850	-0.28747
12	-0.2495	-0.2503	-0.2509	-0.2516	-0.2521	-0.2526	-0.2530	-0.2534	-0.2538	-0.2541	-0.25667
13	-0.2217	-0.2225	-0.2232	-0.2239	-0.2244	-0.2250	-0.2254	-0.2258	-0.2262	-0.2265	-0.22917
14	-0.1969	-0.1977	-0.1985	-0.1992	-0.1997	-0.2003	-0.2007	-0.2012	-0.2015	-0.2019	-0.20461
15	-0.1748	-0.1756	-0.1764	-0.1771	-0.1777	-0.1782	-0.1787	-0.1791	-0.1795	-0.1799	-0.18269
16	-0.1550	-0.1559	-0.1567	-0.1574	-0.1580	-0.1585	-0.1590	-0.1595	-0.1599	-0.1602	-0.16312
17	-0.1374	-0.1383	-0.1391	-0.1398	-0.1404	-0.1410	-0.1415	-0.1419	-0.1423	-0.1427	-0.14564
18	-0.1216	-0.1225	-0.1233	-0.1241	-0.1247	-0.1253	-0.1258	-0.1262	-0.1267	-0.1270	-0.13003
19	-0.1075	-0.1085	-0.1093	-0.1100	-0.1107	-0.1113	-0.1118	-0.1123	-0.1127	-0.1130	-0.11610
20	-0.0950	-0.0959	-0.0968	-0.0975	-0.0982	-0.0988	-0.0993	-0.0998	-0.1002	-0.1006	-0.10366
21	-0.0838	-0.0847	-0.0856	-0.0863	-0.0870	-0.0876	-0.0881	-0.0886	-0.0890	-0.0894	-0.09255
22	-0.0738	-0.0747	-0.0756	-0.0763	-0.0770	-0.0776	-0.0782	-0.0786	-0.0791	-0.0795	-0.08264
23	-0.0648	-0.0658	-0.0666	-0.0674	-0.0681	-0.0687	-0.0693	-0.0698	-0.0702	-0.0706	-0.07378
24	-0.0568	-0.0578	-0.0587	-0.0595	-0.0602	-0.0608	-0.0613	-0.0618	-0.0622	-0.0626	-0.06588
25	-0.0497	-0.0507	-0.0516	-0.0524	-0.0530	-0.0537	-0.0542	-0.0547	-0.0552	-0.0556	-0.05882
26	-0.0433	-0.0443	-0.0452	-0.0460	-0.0467	-0.0473	-0.0479	-0.0484	-0.0488	-0.0492	-0.05252
27	-0.0377	-0.0387	-0.0395	-0.0403	-0.0410	-0.0417	-0.0422	-0.0427	-0.0432	-0.0436	-0.04689
28	-0.0326	-0.0336	-0.0345	-0.0353	-0.0360	-0.0366	-0.0372	-0.0377	-0.0381	-0.0385	-0.04186
29	-0.0281	-0.0291	-0.0300	-0.0308	-0.0315	-0.0321	-0.0327	-0.0332	-0.0336	-0.0340	-0.03738
30	-0.0240	-0.0250	-0.0259	-0.0267	-0.0274	-0.0281	-0.0287	-0.0292	-0.0296	-0.0300	-0.03337
31	-0.0204	-0.0214	-0.0223	-0.0231	-0.0238	-0.0245	-0.0251	-0.0256	-0.0260	-0.0264	-0.02980
32	-0.0172	-0.0182	-0.0191	-0.0199	-0.0206	-0.0213	-0.0219	-0.0224	-0.0228	-0.0232	-0.02660
33	-0.0143	-0.0153	-0.0162	-0.0170	-0.0178	-0.0184	-0.0190	-0.0195	-0.0200	-0.0204	-0.02375
34	-0.0117	-0.0128	-0.0137	-0.0145	-0.0152	-0.0159	-0.0164	-0.0169	-0.0174	-0.0178	-0.02121
35	-0.0094	-0.0105	-0.0114	-0.0122	-0.0129	-0.0136	-0.0141	-0.0147	-0.0151	-0.0155	-0.01893
36	-0.0074	-0.0084	-0.0093	-0.0101	-0.0109	-0.0115	-0.0121	-0.0126	-0.0131	-0.0135	-0.01691
37	-0.0056	-0.0066	-0.0075	-0.0083	-0.0091	-0.0097	-0.0103	-0.0108	-0.0113	-0.0117	-0.01509
38	-0.0039	-0.0050	-0.0059	-0.0067	-0.0074	-0.0081	-0.0087	-0.0092	-0.0096	-0.0101	-0.01348
39	-0.0025	-0.0035	-0.0044	-0.0052	-0.0060	-0.0066	-0.0072	-0.0077	-0.0082	-0.0086	-0.01203
40	-0.0012	-0.0022	-0.0031	-0.0039	-0.0047	-0.0053	-0.0059	-0.0064	-0.0069	-0.0073	-0.01074
41	0.0000	-0.0010	-0.0020	-0.0028	-0.0035	-0.0042	-0.0048	-0.0053	-0.0057	-0.0062	-0.00959
42	0.0010	0.0000	-0.0009	-0.0017	-0.0025	-0.0031	-0.0037	-0.0042	-0.0047	-0.0051	-0.00856
43	0.0020	0.0009	0.0000	-0.0008	-0.0016	-0.0022	-0.0028	-0.0033	-0.0038	-0.0042	-0.00764
44	0.0028	0.0018	0.0008	0.0000	-0.0007	-0.0014	-0.0020	-0.0025	-0.0030	-0.0034	-0.00682
45	0.0035	0.0025	0.0016	0.0007	0.0000	-0.0007	-0.0012	-0.0018	-0.0022	-0.0026	-0.00609
46	0.0042	0.0031	0.0022	0.0014	0.0007	0.0000	-0.0006	-0.0011	-0.0016	-0.0020	-0.00544
47	0.0048	0.0037	0.0028	0.0020	0.0012	0.0006	0.0000	-0.0005	-0.0010	-0.0014	-0.00486
48	0.0053	0.0043	0.0033	0.0025	0.0018	0.0011	0.0005	0.0000	-0.0005	-0.0009	-0.00434
49	0.0058	0.0047	0.0038	0.0030	0.0022	0.0016	0.0010	0.0005	0.0000	-0.0004	-0.00387
50	0.0062	0.0052	0.0042	0.0034	0.0027	0.0020	0.0014	0.0009	0.0004	0.0000	-0.00346

TABLE 3

PRESENT VALUE FACTORS FOR OPERATION COSTS

When k=1

(When k is different than 1, the two factors obtained in the Table should be multiplied by: 0.8929 for k=2; 0.7972 for k=3; and by 0.7118 for k=4).

Interest Rate: 12%

YEARS OF OPERATION	1st YEAR OPERATION	4th YEAR OPERATION	YEARS OF OPERATION	1st YEAR OPERATION	4th YEAR OPERATION
1	0.8929	0.0000	26	2.4018	5.4938
2	1.6901	0.0000	27	2.4018	5.5407
3	2.4018	0.0000	28	2.4018	5.5826
4	2.4018	0.6355	29	2.4018	5.6200
5	2.4018	1.2029	30	2.4018	5.6534
6	2.4018	1.7096	31	2.4018	5.6832
7	2.4018	2.1619	32	2.4018	5.7098
8	2.4018	2.5658	33	2.4018	5.7335
9	2.4018	2.9264	34	2.4018	5.7547
10	2.4018	3.2484	35	2.4018	5.7737
11	2.4018	3.5359	36	2.4018	5.7906
12	2.4018	3.7925	37	2.4018	5.8057
13	2.4018	4.0217	38	2.4018	5.8192
14	2.4018	4.2263	39	2.4018	5.8312
15	2.4018	4.4090	40	2.4018	5.8419
16	2.4018	4.5722	41	2.4018	5.8515
17	2.4018	4.7178	42	2.4018	5.8601
18	2.4018	4.8478	43	2.4018	5.8678
19	2.4018	4.9639	44	2.4018	5.8746
20	2.4018	5.0676	45	2.4018	5.8807
21	2.4018	5.1602	46	2.4018	5.8861
22	2.4018	5.2428	47	2.4018	5.8910
23	2.4018	5.3166	48	2.4018	5.8953
24	2.4018	5.3825	49	2.4018	5.8992
25	2.4018	5.4413	50	2.4018	5.9027

TABLE 4

PRESENT VALUE FACTORS FOR YEARLY EQUIVALENT COST

Interest Rate: 12%

Years/k Operation/	1	2	3	4
1	1.1200	1.2544	1.4049	1.5735
2	0.5917	0.6627	0.7422	0.8313
3	0.4163	0.4663	0.5223	0.5849
4	0.3292	0.3687	0.4130	0.4626
5	0.2774	0.3107	0.3480	0.3897
6	0.2432	0.2724	0.3051	0.3417
7	0.2191	0.2454	0.2749	0.3078
8	0.2013	0.2255	0.2525	0.2828
9	0.1877	0.2102	0.2354	0.2637
10	0.1770	0.1982	0.2220	0.2487
11	0.1684	0.1886	0.2113	0.2366
12	0.1614	0.1808	0.2025	0.2268
13	0.1557	0.1744	0.1953	0.2187
14	0.1509	0.1690	0.1893	0.2120
15	0.1468	0.1644	0.1842	0.2063
16	0.1434	0.1606	0.1799	0.2015
17	0.1405	0.1573	0.1762	0.1973
18	0.1379	0.1545	0.1730	0.1938
19	0.1358	0.1521	0.1703	0.1907
20	0.1339	0.1499	0.1679	0.1881
21	0.1322	0.1481	0.1659	0.1858
22	0.1308	0.1465	0.1641	0.1838
23	0.1296	0.1451	0.1625	0.1820
24	0.1285	0.1439	0.1611	0.1805
25	0.1275	0.1428	0.1599	0.1791
26	0.1267	0.1419	0.1589	0.1779
27	0.1259	0.1410	0.1579	0.1769
28	0.1252	0.1403	0.1571	0.1760
29	0.1247	0.1396	0.1564	0.1751
30	0.1241	0.1390	0.1557	0.1744
31	0.1237	0.1385	0.1552	0.1738
32	0.1233	0.1381	0.1546	0.1732
33	0.1229	0.1377	0.1542	0.1727
34	0.1226	0.1373	0.1538	0.1722
35	0.1223	0.1370	0.1534	0.1718
36	0.1221	0.1367	0.1531	0.1715

Years/k Operation/	1	2	3	4
37	0.1218	0.1365	0.1528	0.1712
38	0.1216	0.1362	0.1526	0.1709
39	0.1215	0.1360	0.1524	0.1706
40	0.1213	0.1359	0.1522	0.1704
41	0.1212	0.1357	0.1520	0.1702
42	0.1210	0.1356	0.1518	0.1700
43	0.1209	0.1354	0.1517	0.1699
44	0.1208	0.1353	0.1516	0.1698
45	0.1207	0.1352	0.1515	0.1696
46	0.1207	0.1351	0.1514	0.1695
47	0.1206	0.1351	0.1513	0.1694
48	0.1205	0.1350	0.1512	0.1693
49	0.1205	0.1349	0.1511	0.1692
50	0.1204	0.1349	0.1511	0.1692

A N N E X 5

FINANCIAL EQUIVALENTS

INTRODUCTION 1/

Objectives: With financial tables in Annex 4 we pretend to:

1. Make it easy to obtain the present values of costs. These are obtained by multiplying the estimated cost by a "factor" from the Table, without having to start from the estimated costs for each year of the project's life. a) in the case of investment costs, you should begin with the estimated costs for each year of the estimated phase; b) for the re-investment costs and residual values, begin from the total investment costs for each item; c) for operation costs, begin with the estimated costs for the first and fourth years of the operation phase.

2. Make it easy to obtain the annual equivalent cost from the present value of the costs.

Initial note: The tables have been calculated for a 12% annual interest rate, and for a certain range of the variables. However, the formulas given are general; they may be used to generate tables or values valid for other rates and ranges.

Symbology:

Year 0:	Beginning of the investment phase.
Year k:	Beginning of operation phase.
Year n:	End of operation phase.
m:	n-k+1= number of years of operation phase.
t:	Time, in years.
v:	Useful life of an item.
r:	Annual interest rate.
PV:	Present value.
PVC:	Present value of costs.
EAC:	Equivalent annual cost.
I:	Initial investment.

1/ This Annex was prepared together with Coloma Ferrá, consultant.

TABLE 1: PRESENT VALUE FACTORS
(Value, in year 0, of cost of $1.00 in year t)

Use of this table: This table serves to calculate, from the investment costs for each year of the investment phase, the present value of the investment costs for each year. It may also be used to calculate the present value of any kind of cost that occurs in year t.

Range of Table: t = 1 to 50.

Formula: $$\text{PV Factor} = \frac{1}{(1+r)^t} \qquad [1]$$

TABLE 2: PRESENT VALUE FACTORS OF RE-INVESTMENT AND RESIDUAL VALUES

Use of this Table: To calculate, from the investment cost of an item, the present value of re-investment costs (to consider the replacement cost of an item whose useful life is less than the duration of the project) **minus** the present value of an item's residual value (the value that is recovered at the end of the project, if the item still has years of useful life). The PV Factor in the Table should be multiplied by the estimated cost of the item in the year that it will be bought. If the cost is paid over more than one year, sum the costs of each year, and multiply the sum by the PV.

Range of Table: m = 1 to 50, and v = 1 to 50

Assumptions:

1. Re-investments for an item with v years of useful life will be made every v years.

2. If at the end of the project (year n) an item has still useful life, the residual value will be equal to the PV on it's EAC, during the rest of the item years of useful life.

3. The beginning of the useful life of an item coincides with the beginning of the operation phase of the project (that is, independently of the year in which an item is bought, it begins to loose value only when the operation phase begins).

Formulas: Are obtained in the following way:

1º If k = 1:

a) Find the EAC of an item (that costs I) as a function of the useful life:

$$EAC\ (c) = I * \frac{(1+r)^v * r}{(1+r)^v - 1} \qquad [2]$$

b) Find the PV of the re-investment **minus** the PV of the residual value. This difference is the PV of all re-investments that will be made in the life of the project **minus** the PV of the residual value of the item in year n.

The number of re-investments is the integer part of m/v (for example, if m = 30 and v = 8, m/v = 3.75; there will be three re-investments, in year 8, year 16 and year 24). If m is the number of re-investments, the PV of the re-investments is:

$$PV(re\text{-}inv.) = I * [\frac{1}{(1+r)^v} + \frac{1}{(1+r)^{2v}} + \ldots + \frac{1}{(1+r)^{mv}}]$$

The PV (re-investments) may be expressed as the present value of the EAC of the item between the years v+1 and (m+1)v = mv+v. Remember that the calculation of the PV of the initial investment is implicit in the value of the PV of the EAC between the years 1 and v. Also, the last re-investment in the year mv will last v years, until (m+1)v. Thus:

$$PV(\text{re-inv.}) = EAC * \left[\frac{1}{(1+r)^{v+1}} + \frac{1}{(1+r)^{v+2}} + \ldots + \frac{1}{(1+r)^{(m+1)v}}\right]$$

The present value of the item's residual value in year n will be the present value of the EAC between the years n+1 and (m+1)v:

$$PV\ (\text{residual val}) = EAC * \left[\frac{1}{(1+r)^{n+1}} + \frac{1}{(1+r)^{n+2}} + \ldots + \frac{1}{(1+r)^{(m+1)v}}\right]$$

The difference between the PV (re-investments) and PV (residual value) will be the PV of the EAC between (v+1) and n, since the terms of the sums are identical beginning with n+1. Therefore, the difference between the two present values is:

$$PV = EAC * \left[\frac{1}{(1+r)^{v+1}} + \frac{1}{(1+r)^{v+2}} + \ldots + \frac{1}{(1+r)^{n}}\right]$$

To simplify this result, we apply the formula for the sum of a geometric progression (S):

$$S = a_1 * \frac{1 - R^N}{1 - R}$$

where a^1 = first term of the sum.
R = ratio of the progression.
N = number of terms of the progression.

$$PV = EAC * \frac{(1+r)}{(1+r)^{v+1}} * \frac{(1+r)^{n-v} - 1}{(1+r)^{n-v} * r}$$

Replacing EAC by using [2], we obtain:

$$PV = I * \frac{(1+r)^{v} * r}{(1+r)^{v} - 1} * \frac{(1+r)}{(1+r)^{v+1}} * \frac{(1+r)^{n-v} - 1}{(1+r)^{n-v} * r}$$

$$= I * \frac{(1+r)^{n-v} - 1}{[(1+r)^{v} - 1]\ (1+r)^{n-v}}$$

$$= I * \text{Factor PV}$$

In this formula, PV is expressed as a function of n and v. To express it in terms of m, we note that then k=1, m=n. Thus, the PV Factor becomes, for k=1:

$$\text{Factor PV} = \frac{(1+r)^{m-v} - 1}{[(1+r)^{v} - 1]\ (1+r)^{m-v}} \qquad [3]$$

Results: If v=m, there are no re-investments nor residual values; therefore the factor is 0; if v is lower than m, the factor is positive (the present value of re-investments is greater than the present value of the residual values); and if v is greater than m, the factor is negative (there is no re-investments but there is a residual value)

2º If k=2:

In this case, the first re-investment will be made in year v+1. Thus, the PV of the re-investments **minus** the PV of the residual value will be the PV of the EAC, between v+2 and n:

$$PV = EAC * \left[\frac{1}{(1+r)^{v+2}} + \frac{1}{(1+r)^{v+3}} + \ldots + \frac{1}{(1+r)^{n}}\right]$$

Following the same procedure as with k=1, we obtain:

$$PV = I * \frac{(1+r)^{n-v-1} - 1}{[(1+r)^{v} - 1]\ (1+r)^{n-v}}$$

But if k = 2, n = m+1, so that:

$$\text{Factor PV} = \frac{(1+r)^{m-v} - 1}{[(1+r)^{v} - 1]\ (1+r)^{m-v+1}} \qquad [4]$$

3°) If k=3:

In this case, the first re-investment will be made in the year v+2. Thus, the PV of the re-investment **minus** the PV of the residual values will be the PV of the EAC, between v+3 and n:

$$PV = EAC * \left[\frac{1}{(1+r)^{v+3}} + \frac{1}{(1+r)^{v+4}} + \ldots + \frac{1}{(1+r)^{n}}\right]$$

Following the same procedure as before, we obtain:

$$PV = I * \frac{(1+r)^{n-v-2} - 1}{[(1+r)^{v} - 1]\ (1+r)^{n-v}}$$

But if k=3, n = m+2, and thus:

$$\text{Factor PV} = \frac{(1+r)^{m-v} - 1}{[(1+r)^{v} - 1]\ (1+r)^{m-v+2}} \qquad [5]$$

4°) If k=4:

Following the same procedures as in the previous cases, we obtain:

$$\text{Factor PV} = \frac{(1+r)^{m-v} - 1}{[(1+r)^{v} - 1]\ (1+r)^{m-v+3}} \qquad [6]$$

Results for k different from 1:

It may be seen that formula [4] is the same that formula [3] multiplying by $1/(1+r)$; the formula [5] is the same that formula [3] multiplied by $1/(1+r)^2$; and formula [6] is the same that [3] multiplied by $1/(1+r)^3$.

Also, if r = 0.12:

$1/(1+r) = 0.8929$
$1/(1+r)^2 = 0.7972$
$1/(1+r)^3 = 0.7118$

Consequently, to obtain the PV Factor when k=2, the value in the Table should be multiplied by 0.8929; when k=3, by 0.7972; when k=4, by 0.7118.

TABLE 3: PRESENT VALUE FACTORS FOR OPERATION COSTS

Use of this Table: To calculate the PV for operation costs, from the yearly estimated cost for years k and k+3 (the first and fourth years of operation of the project). Factor F1 must be multiplied by the yearly cost of year k (called C1), and Factor F2 by the yearly cost of year k+3 (called C2).

Range of the table: m = 1 to 50.

Assumptions: We assume that the cost in year k (C1) remains the same in operation years 1, 2 and 3 of the project, and that the cost in year k+3 (C2) remains constant in years 4 to n of project operation.

Formula:

1°) If k=1:

In this case, m = n.

We shall find the values of the PV for operating costs for different durations on the operation phase:

a) If m =1, the operating cost PV is the PV of C1 in year 1:

$$PV = C1 \frac{1}{(1+r)} = C1 * F1, \text{ hence } F1 = \frac{1}{(1+r)}$$

If m=2, the operating cost PV is the of C1 in year 1 **plus** the PV of C1 in year 2:

$$PV = C1 \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2}\right] = C1 * F1,$$

$$\text{Thus: } F1 = \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2}\right]$$

b) If m=3, the operating cost PV is the PV of C1 in year 1 **plus** the PV of C1 in year 2 **plus** the PV of C1 in year 3:

$$PV = C1 \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right] = C1 * F1,$$

$$\text{and: } F1 = \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right]$$

c) If m=4, the operating cost PV is the PV of C1 for years 1 to 3 **plus** the PV of C2 in year 4:

$$PV = C1\left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right] + C2\,\frac{1}{(1+r)^4} =$$

$$= C1 * F1 + C2 * F2$$

$$\text{Hence: } F1 = \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right]$$

$$F2 = \frac{1}{(1+r)^4}$$

d) If m=5, the operating cost PV is the PV of C1 for years 1 to 3 **plus** the PV of C2 for years 4 and 5:

$$PV = C1\left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right] + C2\left[\frac{1}{(1+r)^4} + \frac{1}{(1+r)^5}\right]$$

$$= C1 * F1 + C2 * F2$$

$$\text{Where: } F1 = \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right]$$

$$F2 = \left[\frac{1}{(1+r)^4} + \frac{1}{(1+r)^5}\right]$$

e) If m=q, the operating cost PV is the PV of C1 for years 1 and 3 **plus** the PV of C2 for the years 4 to q:

$$PV = C1 \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right] +$$

$$+ C2 \left[\frac{1}{(1+r)^4} + \frac{1}{(1+r)^5} + \ldots + \frac{1}{(1+r)^q}\right] =$$

$$= C1 * F1 + C2 * F2$$

$$\text{Where: } F1 = \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3}\right]$$

$$F2 = \left[\frac{1}{(1+r)^4} + \frac{1}{(1+r)^5} + \ldots + \frac{1}{(1+r)^q}\right]$$

A simpler expression for F2 may be found by applying the formula for the sum of a geometric progression, from which we have:

$$F2 = \frac{(1+r)^{q-3} - 1}{(1+r)^q * r} \qquad [7]$$

2°) If k=2:

In this case, all operation costs occur one year later than if k=1. Thus, for a project with m years of operation, the factors obtained for k=1 must be multiplied by 1/(1+r), which is 0.8929, if r = 0.12.

3°) If k=3:

All operation costs occur two years later than if k=1. Thus, for a project with m years, the factors obtained for k=1 must be multiplied by $1/(1+r)^2$, which is 0.7972, if r=0.12.

4°) If k=4:

All operation costs occur three years later than if k = 1. Thus, for a project with m years of operation, the factors obtained for k = 1 must be multiplied by $1/(1+r)^3$, which is 0.7118 if r = 0.12.

TABLE 4: FACTORS OF EQUIVALENT ANNUAL COSTS

Use of this table: To transform present values of costs, PVC (calculated in year 0), to an equivalent annual cost (EAC). This is accomplished by multiplying the PVC by the EAC Factor.

Range of the table: k = 1 to 4, and m = 1 to 50.

Assumption: The EAC is calculated for the years of operation of the project, that is, from k to n. This assumption is explained by the fact that it only makes sense to calculate the EAC when there is some benefit obtained, and this only occurs during project operation.

Formula:

We must find the EAC which satisfies the following conditions:

$$PVC = EAC * \left[\frac{1}{(1+r)^k} + \frac{1}{(1+r)^{k+1}} + \ldots + \frac{1}{(1+r)^n}\right]$$

Again, using the formula for the sum of a geometric progression, we obtain:

$$PVC = EAC * \frac{(1+r)^{n-k+1} - 1}{(1+r)^{n} * r}$$

Where:

$$EAC = PVC * \frac{(1+r)^{n} * r}{(1+r)^{n-k+1} - 1} = EAC * Factor\ EAC$$

Since n = m + k - 1, we have:

$$Factor\ EAC = \frac{(1+r)^{m+k-1} * r}{(1+r)^{m} - 1} \qquad [8]$$

A N N E X 6

CLASSIFICATION OF THE LABOR FORCE

CLASSIFICATION OF THE LABOR FORCE

SKILLED WORKERS

Professionals

Physicist, chemist, technician
Architect, engineer
Draftsman, technical engineer
Air pilot, admiral
Biologist, agronomist, technician
Doctor, agronomist, veterinary
Medical technician, nurse, etc.
Statistician, mathematician
Economist
Auditor
Lawyer
Professor
Member of the clergy and similar
Author, writer, journalist
Sculptor, painter, photographer
Musician, artist
Athlete, sportsman
Other technical profession
Legislator
Manager, executive

Administratives

Office head
Administrative agent
Secretary-typist
Teller, accounts assistant
Head of transport, communications
Train Chief, money collector
Mailman, messenger
Telephone or telegraph operator
Other administrative personnel

Manual Workers

Foreman, head of crew
Miner, stonecutter
Metallurgic
Wood and paper worker
Chemical treatments worker
Spinner, weaver
Leather tanner worker
Food and drink worker
Tobacco worker
Cobbler, dressmaker
Shoemaker
Metal worker
Cabinetmaker
Mechanic
Electrician
Decorator
Television or radio operator
Plumber, welder
Jeweler
Glass and ceramics worker
Fixed lathe operator

UNSKILLED WORKERS

Janitors
Washing and ironing workers
Plastics and cork workers
Cardboard workers
Graphic Art worker
Painter
Manufacturing worker
Construction worker
Porters
Drivers
Gofers

Source: NDP-IDB, Estimación de precios de cuenta para Colombia, Washington D.C., 1990.

A N N E X 7

THE CYCLE OF PROJECTS

THE CYCLE OF PROJECTS

WHAT IS A PROJECT?

There is no universally accepted definitions of a project. The great majority of texts on the subject assume an implicit agreement of what "project" means. The challenge for a project evaluator is to identify and quantify (better, set prices) all the costs and benefits attributable to the project. This may be done from the individual perspective of the investor, or of other agents interested in or affected by the project, which some authors call "financial evaluation" or evaluation at market prices. This evaluation may be made with or without financing. If the evaluation is made from the point of view of its suitability for a country, it is usually called "economic evaluation" of a project. If this evaluation does not reward nor penalize the costs and benefits for a specific group of people, it is generally called "economic evaluation at efficiency prices". If certain groups are rewarded in the evaluation (for example, benefits for the poor are "worth more" than benefits for the rich), it is often called "economic evaluation at social prices". Other authors prefer to call evaluations from an individual perspective "economic evaluation", and evaluations from the perspective of the country as a whole "social evaluation". In this Manual we shall call an evaluation from an individual perspective **Financial Evaluation**, while one made from a global economic standpoint is a **Social Evaluation.** A financial evaluation will use **market prices**, and a social evaluation will use **social prices** or **shadow prices.**

Returning to the question of the definition of a project, if the evaluator must judge the flows of costs and benefits, a project may be defined as the source of these costs and benefits. However, this definition seems tautological. Although it is true that a project is the source of costs and benefits, it is preferable to define a project in terms of its characteristics. A project may be defined as an autonomous group of investments, policies, and institutional and other kinds of measures designed to achieve a

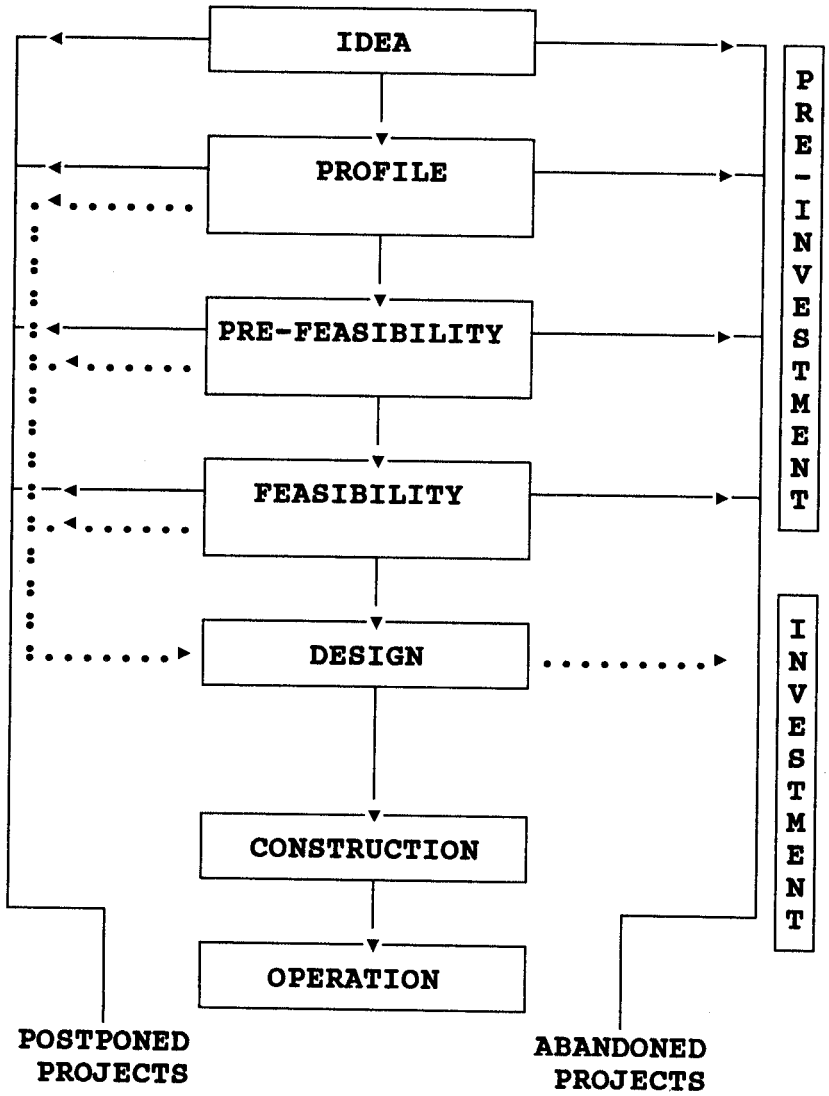
development objective (or group of objectives) in a given time period. This group of measures has associated costs and benefits attributable to the project, that is, the costs and benefits associated with the situation with the project, contrasted with the costs and benefits of the situation if the project is not carried-out (situation without project).

THE CYCLE OF A PROJECT

It is useful to think of a project as passing through different **phases**, and it is the group of these phases that is called "the cycle of a project". The different phases have a close reciprocal relationship, and follow a logical progression in that the proceeding phases help provide the base for the renovation of the cycle.

Different terms may be used to describe the phases of the cycle. In this Manual we assume that the project is first identified (identification process) and its information prepared (preparation), in order to decide if it is worth carrying out. This state is called **pre-investment**. However, the degree of preparation of information and its reliability depend upon the depth of the technical, economic, financial, market and other studies which corroborate it. In this manual, we assume that within the pre-investment phase, a project passes through the idea, profile, pre-feasibility and feasibility **stages**. Not every project goes through all of these stages (that depends upon the complexity of the project and the studies necessary). Once it has been decided to undertake the project, it passes on to the **investment phase** (also called the execution phase), in which its works and actions are accomplished. Once executed, the project reaches its **operation phase**, in which it begins to produce the goods and services for which it was designed. In the adjoining table is a summary of the cycle of a project, which will serve as reference for the following sections.

THE CYCLE OF A PROJECT



In what follows, we present each of the phases of a project in more detail, and indicate its importance in the correct use of this Manual.

PRE-INVESTMENT PHASE

The first phase in the cycle of a project is the pre-investment phase. Here, a project is identified, its information is prepared, and if possible, its costs and benefits are quantified and measured. Also, in this phase, preliminary designs are prepared, if required. The reason that a project should pass through this phase is that it is appropriate to determine the convenience of undertaking it before initiating the actions and works that it will require. It is important to note that not all projects pass through all stages: idea, profile, pre-feasibility and feasibility. Some stages may be eliminated if the reduction in the uncertainty provided by a stage is not worth the additional cost.

The **idea** of a project is born as a result of unsatisfied needs, general policies, a development plan, from other projects or studies, or simply because it seems appropriate. However, this step is not limited to describing the idea of the project in general terms. The idea must be refined and presented in the appropriate manner, in order to decide to continue its study. In the idea stage, an effort should be made to determine the possible solutions to the problem and to discard those which are clearly not viable. The objective of this stage is to generate possible solutions and information to decide if it is appropriate to undertake further studies. Both in this and in succeeding stages, you must fill-out the Project Register Card (BIS) of the CBIP.

In the **profile** stage, all of the accessory information related to the project should be gathered. For example, information about similar projects, markets, beneficiaries, etc., from libraries and agencies. In this stage, all the project alternatives should be verified, and their costs and benefits should receive a preliminary estimation. With this information, you should be able to eliminate some (or all) the alternatives, and decide which merit more detailed study. In the case of small projects, where multiple alternatives do not exist, from this stage one may proceed directly to the design and execution stages. Also in this stage, one may decide to postpone or abandon the project. As in the previous stage, the relevant information should be included in the BIS card.

In the **pre-feasibility stage**, the remaining project alternatives are evaluated. This requires that funds be assigned for the necessary studies. The need for this stage depends basically upon the need for additional information, in order to make an adequate decision. You should weigh the additional costs associated with the new studies and the additional benefits associated with the reduction of uncertainty. Often in this stage, it is necessary to do on-site studies to clarify in more detail the secondary information acquired in the profile stage. Both in this and the profile stage, you should always analyze the alternative of optimizing the present situation with better administrative measures. Detailed studies of supply and demand, market, etc., should be made in the pre-feasibility stage. In this stage you should make the specialized technical studies to see if alternatives are viable. You should accumulate sufficient information in this stage to permit sensitivity studies of the most relevant variables of the project. This sensitivity should at least include effects on the VPN of changes in the costs of project investment and operation, and of changes in supply and demand. Finally, you should recommend firmly the execution of only one of the alternatives. Most projects that reach this stage of pre-feasibility will pass directly to their final design and execution. However, some large projects will, because of their size, warrant further studies, which are feasibility studies. Both for pre-feasibility and feasibility studies **we recommend utilizing specialized consultants.**

In the **feasibility** stage the objective is to reduce to a minimum the uncertainty associated with projects which require large investments. In this sense, this is the final stage in the process of acquiring more information and thus less uncertainty, at the cost of more expenses in new studies. In the feasibility stage, the alternative recommended in the previous stage should be analyzed in detail, paying particular attention to the optimum size of the project, its initiation date, finance structure, administrative organization, etc.

Many pre-feasibility and feasibility studies include studies of <u>preliminary design</u>. In these, both the technical and structural aspects of the project are molded, and any required manuals are designed. In many cases, however, the <u>definitive design</u> is made only after the project is approved. In any case, the definitive design and detailed plans are on the border of the pre-investment and investment phases.

INVESTMENT PHASE

In the investment phase, also called execution or construction phase, the necessary equipment is acquired, and the project is begun. This stage lasts until the project enters into full operation. In this stage, the preparation, design, plans and earlier analyses are all tested. Almost all of the work in the previous stages is directed towards making sure that the project will be a success. The purpose of this section is to provide some hints on how to make the project successful, indicate problems that may occur and some approaches that have been developed to solve them.

The executive and coordinative capacity of the entity which carries out the project is important for those projects which must be implemented with several entities, such as rural development and rehabilitation projects. Two minimum conditions must be fulfilled: the responsibilities of each one of the participating agencies must be clearly defined, and mechanisms must be designed so that each agency may work efficiently. It is also convenient for the project supervision to be separate from the unit which carries out the project.

It is important to have instruments to judge the execution of the project, to correct shortcomings as they present themselves. Among these are the method of critical path, follow-up studies and the design of management information systems.

Finally, it is important to plan adequately so that when the project begins to operate, it has the financial and human resources necessary, so that it is not held up for lack of them.

OPERATION PHASE

The last phase of a project is that of operation. In this phase, the investments have been made and the project should begin to provide the goods and services for which it was designed. It is important in this stage to provide the funds necessary for the adequate operation of the project, since otherwise the project will not provide the expected benefits.

EX-POST PROJECT EVALUATION

Strictly speaking, the "project cycle" finishes when the project has been executed. However, there is an additional, and final, step: ex-post evaluation. This step usually occurs once the investment stage has been completed and operation begun. Since the CBIP is still being implemented, and given the scarcity of information about projects in operation, we shall not establish rules for the ex-post evaluation of projects. However, it is important to outline the principal characteristics of this process.

We must distinguish between ex-post evaluation and project follow-ups. The purpose of the latter is to help assure efficient execution, identifying and correcting problems as they occur. Ex-post evaluation examines the project from a wider perspective, and tries to determine the reasons for success or failure, with the purpose of repeating the successful experiences in the future, and avoiding detected problems. Ex-post evaluation should also provide information of each project, in fulfilling the objectives for which it was designed.

Typically, ex-post evaluation tries to answer questions such as the following:

✓ Were the objectives of the project clearly designed and feasible?
✓ Was the institutional capacity of its execution taken into account?
✓ Were the technical specifications appropriate?
✓ Was the target group of the project adequately covered?
✓ Was this coverage effective?
✓ Were the institutions associated with the project strengthened?
✓ Were there important cost overruns in the project?
✓ Was the established chronogram followed?
✓ Should the project have been carried-out in this way?

A N N E X 8

SELECTION CRITERIA FOR PROJECTS

INVESTMENT CRITERIA

INTRODUCTION

Projects are evaluated to decide if it is convenient to make the investment. For this purpose, we should not only identify, quantify and put values on its costs and benefits, but also develop comparative instruments by which to judge different projects coherently. We also require criteria by which to choose among mutually exclusive projects, and to select certain projects when not all can be funded. The theory of project evaluation (theory of investment decisions) provides a group of criteria for this type of analysis.

We note that this group of criteria may be used both for private and social evaluation of projects, since it is the form of putting values on the resources generated and used, which distinguishes private evaluation from social evaluation.

PRESENT NET VALUE (PNV)

The criterion of Present Net Value is based on the principle that a project is convenient if and when the returns of the project are at least equal to, if not greater than, the costs. Using this general criterion, it would be appropriate to invest in "project" B1, since an investment of $1.000 produces returns of $1.100; while it would be convenient to invest in "project" B2, since for an investment of $2.000 (divided into two periods) there is only $1.700 in net returns. We would say that "project" B1 has a Net Value of $100, and that B2 has a Net Value of -$300.

Project B1

Year	Cash Flow
0	-1,000
1	+ 200
2	+ 400
3	+ 500
Net Value	+ 100

Project B2

Year	Cash Flow
0	- 800
1	-1,200
2	+ 800
3	+ 500
4	+ 400
Net Value	- 300

With this type of simple analysis, the criterion to use for accepting projects would be equally simple: accept projects with a Net Value greater than or equal to 0 (since they produce returns greater than or equal to their costs), and reject all projects that have a negative Net Value. This type of general criterion is adopted when the criterion of Present Net Value is utilized. However, there is a great difference: in the previous examples, the value of the money over time is not incorporated, and it is well known that this is a central element in the criterion of **Present** Net Value.

The incorporation of the value of money over time (or cost of intertemporal opportunity of money) is introduced by "discounting" the cash flows, when this "discount" depends upon the time when the flow occurs.

The central idea of the concept of "the value of money over time" is associated with that fact that a given quantity of money has a different value, depending upon the moment in which it is acquired or spent. This has nothing to do with the concept of inflation-devaluation (we assume that neither conditions exists), but rather with the fact that a sum of money may be invested in earn interest. If someone owes you $100 and asks you to choose between immediate payment and payment (of $100) in one year, you would instinctively choose the former. This is because the $100 would be worth less to you in a year, because if you have it now, you could invest it, and at 10% interest (for example), you would have $110 after the year. If the person who owes the money offers to pay the $100 now or $110 in a year, we would effectively receive about the same amount. Thus, we may say that the $110 after one year has a **Present** Value of $100, if we use an interest rate of 10%.

The mathematical process of this concept is that of compound interest:

$$S \cdot (1 + r)^n = 100 \cdot (1 + 0.10)^1 = 100 + 10 = 110$$

Where S is the initial investment or deposit, r is the annual interest rate, and n is the number of periods (years) in which the interest is calculated.

Inverting the order of this formula, we may determine the amount that must be invested in order to receive $110 in a year:

$$110 \cdot \frac{1}{(1 + 0.10)} = \frac{110}{(1 + 0.10)} = \$100$$

Therefore, $100 is the PV of $110, that will be received in one year, and the $110 is the Future Value of $100 today. In the same way, $100 deposited for two years at 10% annual interest, will be worth:

$$100 \cdot (1 + 0.10) \cdot (1 + 0.10) = 100 \cdot (1 + 0.10)^2 = \$121$$

and the $121 received in two years is equal to:

$$121 \cdot \frac{1}{(1 + 0.10) \cdot (1 + 0.10)} = \frac{121}{(1 + 0.10)^2} = \$100 \text{ now}$$

Thus, the Future Value of $100 in two years is $121, and the Present Value of $121, to be received in two years, is $100.

In general terms, $S * (1 + r)^n$ is the future value of a sum S deposited for n periods at an interest rate of r per period. In the same way, $S * (1/(1 + r)^n$ is the present value of a sum S which is to be received in n years. Present Value is usually expressed as $S * (1 + r)^{-n}$.

The Present Net Value method expresses the flows in their equivalent present values, although they could just as well be expressed as Future Values. Returning to the example of project B1, which was calculated as the net value of the flows, now we shall first convert (discount) the cash flows to PV to incorporate the fact that money has an opportunity cost over time, and then calculate the net value in PV (PNV). For example, with an 8% interest rate, the PNV of project B1 is - $74.96.

Project B1 (cont.)

Year	Cash Flow	Present Value Factor		Cash Flow in Present Value
0	-1,000	$\cdot (1 + 0.08)^0$	=	-1,000.00
1	+ 200	$\cdot (1 + 0.08)^{-1}$	=	185.19
2	+ 400	$\cdot (1 + 0.08)^{-2}$	=	342.94
3	+ 500	$\cdot (1 + 0.08)^{-3}$	=	396.92
Net Value:	+ 100		PNV:	-74.96

We see from this analysis that even though the project initially looked attractive, when we incorporate the opportunity cost of money it is not so attractive. In order to compare flows that occur at different moments, we convert them all to a given moment, in this case, the present. Once we accept that money has an opportunity cost over time, we must accept that sums (equal or not) produced at different times are not directly comparable. For this reason, flows should be transformed (discounted) to a common moment.

In more general terms, we may express the PNV of an investment project as the sum of all its discounted cash flows:

$$PNV = \sum_{t=0}^{n} \frac{S_t}{(1 + r)^t}$$

where S_t is the cash flow of the project (positive or negative) in period t; n is the useful life of the project (or the number of relevant periods), and r is the annual rate of discount. If the PNV is greater than or equal to 0, the project is profitable and convenient, and if the PNV is less than 0, the project should not be undertaken.

The PNV criterion is an indicator of when to invest or not in a project. Returning again to project B1, we observe that it requires an initial outlay of $1.0000, and produces cash inflows for the next three years. But if we do not invest the $1.000 in the project, but instead deposit it at 8% interest, after three years we would have obtained $1.0000 * (1 + 0.08)^3 = $1.259.71.

And if we invest in our project and invest the positive cash flows at 8% interest, how much would we have after 3 years? As may be observed in the table below, we would have obtained $1.165.28.

Project B1 (cont.)

Year	Cash Flow	Future Value Factor		Cash Flow in Future Value (at the end of the third year)
1	+ 200	· $(1 + 0.08)^2$	=	233.28
2	+ 400	· $(1 + 0.08)^1$	=	432.00
3	+ 500	· $(1 + 0.08)^0$	=	500.00
		Future Value (FV):		1,165.28

As you may deduce from above, the PNV criterion evaluates projects by analyzing implicitly the alternative: investments at the current interest rate. The PNV, thus, represents the increase or decrease in capital value produced by the project.

In this development, we have assumed that cash flows in each period may be positive or negative, and that these are expressed in Present **Net** Value. The **Net** in the expression refers to the difference between revenues (or benefits) and costs. That is, we sum the benefits attributable to the project and subtract the total of project costs. In synthesis, the PNV will be:

$$PNV = \sum_{t=0}^{n} \frac{S_t}{(1 + r)^t} = \sum_{t=0}^{n} \frac{B_t - C_t}{(1 + r)^t}$$

where B_t is the inflows (or benefits) in period t, and C_t represents the costs in period t.

ANNUAL EQUIVALENT VALUE AND ANNUAL EQUIVALENT COST

As we have seen, any sequence of net benefits (benefits minus costs) may be expressed as PNV. The PNV concept automatically incorporates the value of money over time. That is, any cost or benefit occurring at any moment may be expressed in its equivalent PV. By the same token, this PNV may be expressed in uniform annual equivalents over the useful life of the project. In other words, the Annual Equivalent Value (AEV) distributes the sum of the PNV uniformly over the number of periods (years) of the useful life of the project. This indicator is useful when you wish to compare project alternatives that have different useful lives. According to this criterion, the project (or alternative) with the best AEV should be selected. The mathematical relation between PNV and AEV may be expressed as:

$$AEV = PNV \cdot \left(\frac{(1 + r)^n \cdot r}{(1 + r)^n - 1} \right)$$

where "n" is the useful life of the alternative.

To illustrate that criterion, suppose that you wish to build a highway where one alternative is to use concrete, which would have 20 years of useful life; and another is to use asphalt, which would have 10 years of useful life. In Table C1 we give the PNV for the alternatives, assuming their useful life and a discount rate (r) of 10%:

Project C1

Alternative	Useful Life	PNV	AEV
Asphalt	10 years	10,000	1,627
Concrete	20 years	12,000	1,409

We see that, the PNV of the alternative of building the highway with concrete is greater than the other alternative. However, this option has a useful life that is greater (in this case double) than the other alternative. Therefore, it requires twice the time for generating the benefits. Considering that the two alternatives have a different useful life, the PNV indicator cannot be used, because both alternatives are not directly comparable due to the bias that is introduced when the two useful lifes do not coincide. When we use the annual PNV we can see that in each year, the concrete alternative (it has a greater PNV) generates a lower annual wealth, and therefore, it is advisable to chose the alternative of asphalt highway.

The Annual Equivalent Value Cost (AEC), is similar to the Annual Equivalent Value (AEV), with the difference that only the cost of the projects are included. This indicator can be used when two alternatives of any project generate total similar benefits but have different useful lifes. According to this criterion, we should chose the alternative that has a lower AEC. Mathematically, the relation between the PNV and the AEV may be expressed as:

$$AEC = PVC \cdot \left(\frac{(1 + r)^n \cdot r}{(1 + r)^n - 1} \right)$$

where PVC is the Present Value of the Cost and "n" is the useful life of the alternative.

In order to illustrate this criterion, suppose that you wish to build a highway where one alternative is to use concrete, which would have 20 years of useful life; and another is to use asphalt, which would have 10 years of useful life. If we assume that both alternatives have the same design and if both bear the same traffic, the benefit will be identical for both alternatives. In Table C2 the values for the Present Net Cost (PVC) for both alternatives are shown, considering the useful life and a discount rate "r" of 10%.

Project C2

Alternative	Useful Life	PVC	AEV
Asphalt	10 years	1,000	162,7
Concrete	20 years	1,200	140,9

We see that, according to the PVC criterion, we should choose the alternative of asphalt, since it has a lower Cost Present Net Value (PVC). However, the two alternatives have different useful lives, so that the CPNV are not directly comparable. Using the AEC criterion, we should choose the alternative of concrete. However, note that when we use this type of criterion, we should keep in mind that we are comparing alternatives (or projects) supposing that they have equal benefits.

INTERNAL RETURN RATE

In the Present Net Value section we showed that if the PNV is positive for a given interest (discount) rate, say 8%, this means that the return rate of the project is more than 8%, and if the PNV is 0, the discount rate is equal to the return rate of the project. The Internal Return Rate (IRR) may be defined as the discount rate which, applied to the cash flows of a project produces a PNV of zero. In general terms, the IRR is the value of r that satisfies the equation:

$$PNV = \sum_{t=0}^{n} \frac{S_t}{(1 + r)^t} = \sum_{t=0}^{n} \frac{B_t - C_t}{(1 + r)^t} = 0$$

Note that the IRR is independent of the discount rate of the investor. It depends exclusively on the project. In general, if the IRR is greater than the discount rate, the project is convenient; if it is less, the project is not convenient; and if it is equal, the investor will be indifferent to the funding of the project.

To estimate the IRR of a project, we must solve a polynomial equation, which may be difficult. However, the IRR may be estimated by the method of "liner interpolation". Returning to project B1, the exact calculation of the IRR gives a value of 4.31%. The method of linear interpolation consists in approximating this value by using one discount rate which gives a positive PNV, a lower rate which produces a negative PNV, and interpolating between the two. In the table below we estimate the PNV with discount rates of 8% and 2% Using these estimations, the IRR may be approximated as:

$$IRR = R_1 + \left(\frac{PNV_1}{PNV_1 + PNV_2} \cdot (R_2 - R_1) \right)$$

where R_1 is the discount rate that gives a positive PNV, R_2 is the rate that gives a negative PNV, PNV_1 is the positive PNV, and PNV_2 is the absolute value of the negative PNV. Applying this formula to the data of the table gives:

$$IRR = 0.02 + \left(\frac{51.71}{51.71+74.96} \cdot (0.08 - 0.02) \right) = 0.0445$$

Project B1 (cont.)

Year	Cash Flow	PV Factor	Cash Flow in PV
0	-1,000	·(1 + 0.08)0 =	-1,000.00
1	+ 200	·(1 + 0.08)-1 =	185.19
2	+ 400	·(1 + 0.08)-2 =	342.94
3	+ 500	·(1 + 0.08)-3 =	396.92
		PNV:	-74.96

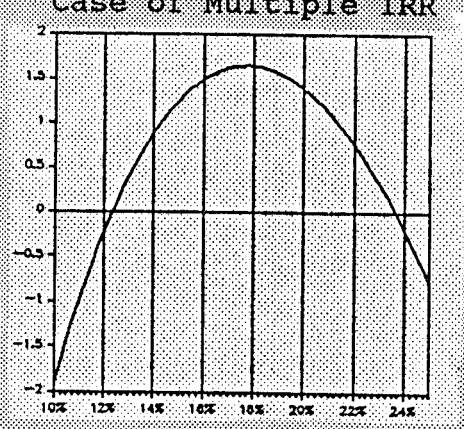
Project B1 (cont.)

Year	Cash Flow	PV Factor	Cash Flow in PV
0	-1,000	·(1 + 0.02)0 =	-1,000.00
1	+ 200	·(1 + 0.02)-1 =	196.08
2	+ 400	·(1 + 0.02)-2 =	384.47
3	+ 500	·(1 + 0.02)-3 =	471.16
		PNV:	51.71

However, the IRR criterion has serious limitations, for which it should only be used together with PNV. In the first place, since the IRR is the solution of a polynomial whose degree is equal to the useful life of the project (n), there may be more that one real solution, positive or negative, and there may be also complex solutions. Generally, if there is more than one change of sign in the flows, more than one solution may exist. In the following table we show a project (E1) that, at a discount rate of 14% is profitable, but that has two values of IRR: 12.3% and 23.6%.

Project E1

Year	Cash Flow
0	- 720
1	1,699
2	-1,000



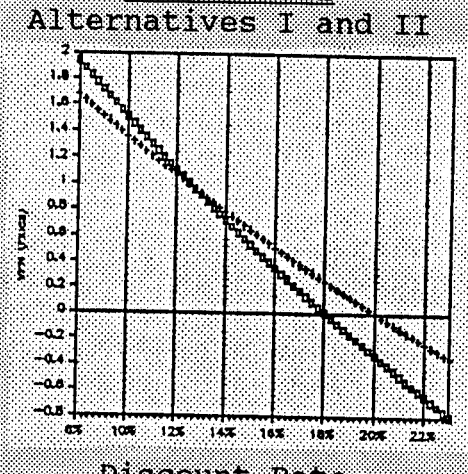
Secondly, the IRR criterion assumes that the money earned by the project are re-invested at the same rate, while it would be more logical to assume re-investment at the best rate for the investor, which is the discount rate. Finally, the use of the IRR criterion may lead to erroneous decisions, by recommending the choice of projects that at the discount rate of the investor are less attractive than the available alternatives.

Suppose that we must choose between the two investment alternatives presented in project E2. With the IRR criterion, we would choose alternative II, since it has a superior IRR value. However, if the investor has an available interest rate of 10%, the PNV of the second alternative is inferior.

Project E2

Cash Flows

Year	Altern. I	Altern. II
0	-10,000	-10,000.00
1	0	6,545.50
2	13,924	6,545.50
IRR	18%	20%
PNV (10%)	1,506	1,363



COST-BENEFIT RELATION

This relation is based upon the PNV criterion, although it may produce project rankings inconsistent with rankings produced by the PNV criterion. The relation between Benefit/Cost (B/C) is the quotient of Present Value of Income (PVI) and the Present Value of Costs (PVC):

$$(B/C) = \frac{PVI}{PVC}$$

If this relation is greater than or equal to one, the project is attractive, since the PVI is at least as great as the PVC. If it is less than one, the project will not be attractive. This criterion is useful for decision making. However, when one must choose between mutually exclusive alternatives (carrying out one project excludes the others), this criterion may lead to errors. Project F1 has two mutually exclusive alternatives. Clearly, the B/C relation indicates that we should choose alternative I, in spite of the fact that the PNV of alternative II is superior. In this Manual, we recommend the use of the PNV criterion.

	Project F1	
	Alternative I	Alternative II
PVI	50	60
PVC	40	49
B/C	1.25	1.22
PNV (10%)	10	11

THE RELATION PNV/I

In the evaluation of project, it is common to find situations where the resources are limited and the investment possibilities exceed the availability of funds. Although it is not the purpose of this Manual to provide instruments for the ranking of projects by budgets, it is useful to have a ranking criterion derived from the PNV criterion. When funds are not limiting, all the projects of table G1 would be accepted, except for project 6, that has a negative PNV.

Table G1

Project N°	Investment (I)	PNV(10%)	PNV/I	Ranking
1	- 100	+ 60	0.60	3
2	- 150	+ 58	0.39	4
3	- 60	+ 21	0.35	5
4	- 100	+ 79	0.79	2
5	- 50	+ 74	1.48	1
6	- 100	- 5	-0.05	6

We would require a total of $446 to invest in all the projects, which would produce a total PNV of $292. The capital would be increased by this $292. However, if we only have $300 to invest, we would have to choose which projects to fund The next-to-last column gives the values of the PNV/I criterion, which indicates that we should invest in project 5, 4 and 1, which together would cost $250 of our $300. In these investments we would obtain a total PNV of $213, and thus the restriction of funds would result in a loss of PNV (capital) of $79.

However, in the situation described here, the use of this criterion assures the maximum capital gains (PNV). This is because the quotients give us a criterion for ranking the projects in terms of the PNV that they generate per unit of investment.

INDICATORS OF COST-EFFICIENCY

Finally, the indicators known as "cost-efficiency" are used when the estimation of the PNV is difficult, because it is extremely complex, or because it is hard to estimate the project benefits. Cost-efficiency indicators relate an indicator of total costs (in present value or annual equivalent) to a "profile" of project benefits. We note that the cost indicator to be used should incorporate all investment and operation costs of the project. In practice, cost-efficiency indicators may be likened to unitary costs per unit of service. For example, cost per cubic meter of purified water, cost per additional connection to an aqueduct, cost per additional student served by a new school, etc.

A N N E X 9

TABLE OF INDICATORS

TABLE OF INDICATORS

The following are some examples of project indicators.

ESTIMATED ANNUAL PRODUCTION
ANNUAL PRODUCTION VALUE
INCREASE IN EMPLOYMENT
NET EXPORTATIONS PER UNIT OF INVESTMENT
NET BENEFIT PER UNIT OF INVESTMENT
EMPLOYMENT OF SKILLED LABOR
EMPLOYMENT OF UNSKILLED LABOR
ADDITIONAL AREA IRRIGATED
TEACHERS PER STUDENT
INVESTMENT PER STUDENT
TEACHERS DEFICIT
POPULATION ALLOCATED
MATERNAL MORTALITY RATE
INFANT MORTALITY RATE
LIVE BIRTHS OUTSIDE HOSPITALS
MALNUTRITION RATE
TOTAL BEDS/10.000 INHABITANTS
DOCTORS/10.000 INHABITANTS
NURSES/10.000 INHABITANTS
INVESTMENT PER HOUSE
POPULATION BENEFITTED
NUMBER OF ADDITIONAL SERVICES CONNECTION
DEFICIT OF CONNECTIONS
INVESTMENT/SERVICES CONNECTION
ENERGY GENERATED
ENERGY SOLD
INVESTMENT/POPULATION BENEFITTED
VALUE OF ADDITIONAL PRODUCTION
INCREASE IN LAND VALUE
INVESTMENT/BED
INVESTMENT/PERSON TREATED
INVESTMENT/ALLOCATED POPULATION

A N N E X 1 0

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Good reference book for project analysis. Explains the experience of the World Bank.

Fontaine, E.: **Evaluación Social de Proyectos**, 6ª Revised Edition, Ediciones Universidad Católica de Chile, Santiago, 1989.
University textbook. Recommended for advanced readers.

Gittinger, J.Price: **Análisis Económico de Proyectos Agrícolas**, Editorial Tecnos, Madrid, 1982.
Manual which concentrates agricultural projects, recommended for readers with background in micro-economy.

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A text for investment analysis from a private standpoint. Includes a Chapter on social evaluation. Highly recommended.

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A N N E X 1 1

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