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PROJECT RANKING AND LOGICAL DESIGN OF AN INVESTMENT PROGRAMMING SUPPORT SYSTEM*

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CONTENTS

PROLOGUE

In order to support the Latin American and Caribbean governments in their basic tasks related with investment programming, ILPES, through its Area of Advisory Services Programmes has been working systematically and gradually in the development of viable and operative methodologies and instruments for improving the allocation of financial resources.

Starting from the logical structure of the Project Banks, which is based on the project cycle, an effort has been made to broaden the concepts of preinvestment and, with the support of computers, make it possible for planning offices to achieve two fundamental functions. First, to objectively rank projects, especially those smaller and domestically financed. Second, to prepare an investment programme consistent with budgetary limitations, within national, sectoral, or regional objectives, and according to the contribution of each project to national welfare and product. The intention is to make the microeconomic aspects of the projects compatible with the macroeconomic impact of the investment programme.

The present document, prepared by the ILPES expert, Eduardo Aldunate, is another contribution to clarifying and responding to these themes. It has been enriched by both the internal discussions with the ILPES technical team and also, fundamentally, by the input received from the works in progress in the different countries by the interchange of experiences with public employees where the Institute provides advisory services.

Simultaneously with providing alternative methods for the administration of public investment, we wish to take advantage of this opportunity to invite all interested parties to express their opinions and commentaries. ILPES will be pleased to receive all kinds of suggestions and reactions.

Edgar Ortegón
Co-ordinator, Area of Advisory Services Programmes Area

Chapter 1

INTRODUCTION

One of the crucial aspects for achieving an optimum allocation of investment resources is the development of public investment programmes. In fact, all the work of identifying, formulating and evaluating projects ends in this step, at which, based on the development objectives, a decision is made about the appropriateness of carrying out each project.1/

However, in spite of the progress made in the development of instruments for supporting the administration of public investment so advanced and complete as the project banks, similar development has not been made in support instruments for elaborating investment programmes.

The complex task of elaborating investment programmes continues to be carried out without the support of computerized methodologies and programmes designed specifically for this purpose. This severely restricts the capacity for elaborating and analyzing alternative programmes, since elaborating more than one programme seriously strains the capacity of the responsible institutions.

This work offers the bases for the development of a support system for elaborating investment programmes and facilitating this job through the use of modern computer technology. Moreover, given that to elaborate an investment programme, projects awaiting financing must be ranked, this problem is also dealt with in detail and a simple system is proposed which can be used when sufficient information is not available for applying other more elaborate procedures.

1/ The document, "Public Investment and the Project Cycle", published in October 1988 by the ILPES, Area of Advisory Services Programmes, presents a detailed analysis of the importance of investment programming.
A complete discussion of investment programming can be found in chapter 5 of the World Bank's World Development Report 1988.

The proposed system is part of the ILPES effort to develop a set of congruent and co-ordinated instruments for supporting the administration of public sector investment.2/ It is therefore intimately related to project banks and macroeconomic projection models.

Chapter 2

BACKGROUND

A. PROJECT BANKS

The elaboration of investment programmes is usually carried out, as has been indicated, without the support of computer instruments developed expressly for this purpose. This means a long and tedious procedure of collecting and analyzing information. Moreover, the necessary information is often not available or, if it is, must be completed and standardized.

A first step towards solving this type of problem is the installation of project banks. These are designed to permit following up the projects over their life cycle, collecting all the relevant information for decision-making. Given that the proposed system is intimately tied to the project banks, some of their main characteristics should be described.3/

Project banks were developed as an information system on public investment projects whose purpose was to organize and standardize the relevant information for their control and for decision-making. Later, with the advent of computers, and considering the great volume of information to be managed, computer systems were developed for facilitating the management of available information.

2/ See the document, "Methodological and Operational Bases for Public Investment Management", ILPES, June 1988.

3/ Detailed information on the structure and functioning of project banks can be found in the following documents: "Una propuesta de organización y funcionamiento del sistema nacional de programación de inversiones públicas", Technical Cooperation Agreement IDB/SEGEPLAN/ILPES, Guatemala, July 1988. Project Bank User's Manual, Ministry of Economic Development of Belize, ILPES, Belize, April 1988. "Sistema de información e inventario de proyectos", volumes 1, 2, and 3, Technical Cooperation Agreement IDB/ONAPLAN/ILPES, Dominican Republic, March 1988.
"Banco integrado de proyectos del sector público -B.I.P. Conceptos, métodos y técnicas", ODEPLAN/UNDP/DTCD, Santiago, Chile, January 1985.

Project Banks however, are by no means simply software. In fact, their operation needs methodologies, procedures, and skilled personnel.

The methodologies are necessary so that the information collected about the various investment possibilities be comparable, at least at the sectoral level, so that projects can be ranked on a uniform scale of measure.

For the efficient collecting of information, it is necessary to define procedures for sending and analyzing information and establishing the roles of the different institutions. This guarantees that the information managed by the system will be sufficiently up to date to be a reliable basis for the adoption of control measures or for planning future activities.

Lastly, the training of personnel in the use of the methodologies and the system procedures must be taken into account. This is basic to guaranteeing the fluid operation of a project bank and the quality of the information managed.

The logical structure of the projects bank is based fundamentally on the project cycle.4/ The system registers the most important information about each project at each step of its life cycle. As it passes from one stage to another, the information corresponding to the finished step is filed in the project bank and the information generated in the new stage of the project begins to be registered. The quantity of information increases as the project progresses over its life cycle.

In the stages of idea, profile, prefeasibility, feasibility and design, the information registered will be basically that describing the main characteristics of the project, indicators for its ranking and decisions about the following steps.

In the execution stage, on the other hand, the information registered will refer mainly to the physical and financial control of the progress of the works. Usually the volume of this information will be considerably greater than that of the preceding steps. Moreover, its frecuency of reception is also greater.

4/ A detailed account of the project cycle can be found in the document,"Manual for the Appraisal and Monitoring of Projects", prepared by ILPES, Area of Advisory Services Programmes for the Ministry of Economic Development of Belize, Belmopan, April 1988.
See also the document "Preparación y presentación de proyectos de inversión", ODEPLAN, Santiago, Chile, September 1985.

Thanks to the availability of this type of system it is possible to have the necessary information for developing more elaborate instruments for investment programming. Information relative to projects in the execution stage is fundamental for programming financial commitments for the finishing of these projects. Also, information relative to projects awaiting financing is necessary for selecting new projects to be incorporated in the investment programme. However, until now, project banks have usually been limited to following up projects and have been used only partially for planning preinvestment and estimating the aggregate impact of investment programmes.5/ Instruments have not been developed allowing the ready use of the great collection of information which these contain in the elaboration of investment programmes.

Ranking the projects which need financing is indispensable for the elaboration of investment programmes. Therefore, before proposing a methodology for investment programming, we will briefly analyze different methods for selecting, evaluating, and ranking projects.

B. METHODS FOR RANKING PROJECTS

Both the movement of projects from one stage to another over their life cycle, and the elaboration of investment programmes require previous selection and ranking of the projects awaiting financing, in order to determine which will be financed and when. To develop this process different procedures can be used, each one of which presents certain advantages and limitations.

The following pages describe and briefly analyze some methods for selecting, evaluating and ranking projects, showing their characteristics, advantages and disadvantages.

5/ An application of a project bank to estimating the aggregate impact of an investment program is described in the document, "El sistema nacional de proyectos de República Dominicana: una herramienta para la programación de inversiones públicas", IDB/ONAPLAN/ILPES Agreement, Dominican Republic, May 1988.

i) VERIFICATION LISTS

This procedure allows determining simply and rapidly if a project meets or not the objectives fixed by the country or the institution. Its application requires a clear definition of the objectives by which the project will be judged. A scale is established for each objective for classifying the project. Each scale fixes minimum levels which the project must meet in order to be selected.

The main advantage of this procedure is that it is simple. However, it is not possible to use it for ranking projects, since it provides no way to know whether not meeting one criterion can be offset by meeting other criteria well (see example project C). Therefore, the method only serves for rapidly discarding projects which do not meet certain minimal conditions.

Example:

VERIFICATION LIST FOR THREE PROJECTS

PROJECT EVALUATED	Meeting the criterion * 1	2	3	4	5
PROJECT A					
Generating employment		x			
Saving foreign exchange					x
Supporting poorest sectors	x				
PROJECT B					
Generating employment				x	
Saving foreign exchange				x	
Supporting poorest sectors			x		
PROJECT C					
Generation of employment					x
Saving foreign exchange					x
Supporting poorest sectors	x				

Minimum acceptable

* 1 = Very bad 2 = Bad 3 = Adequate 4 = Good 5 = Excellent

ii) SCORING MODELS

This type of model is basically an extension of the previous model, but with weightings established for each objective. Using these weightings and the score obtained by the project for each objective, a weighted score can be determined for each project. For this purpose additive or multiplicative models or other mathematical functions can be used. An example of an additive model is:

$$P_j = \sum_i (W_i * S_{ij})$$

where: P_j = score of project j

W_i = weighting of the objective i

S_ij = score of project j with respect to objective i

These models have the advantage of allowing the ranking of projects according to their contribution to pre-established objectives. In the case of the example given, the first priority would correspond to project C, the second to project B and the third to project A. It can be appreciated that the low yield of project C with respect to the objective of supporting the poorest sectors is offset by an excellent score with respect to the other two objectives.

However, unless the weightings and the scoring scales are designed and applied to meet the characteristics of a ratio scale, it is impossible to claim that a project is better or worse than another in a specific degree. This method is eminently practical and simple to use but the previous limitation must be remembered.

Example:

SCORING MODEL FOR THREE PROJECTS

PROJECT EVALUATED	Score *	Objective Weigh	Weighted Score
PROJECT A			
Generation of employment	30	0.3	9
Saving of foreign exchange	90	0.3	27
Support to poorest sectors	10	0.4	4
Total score of the project			40
PROJECT B			
Generation of employment	50	0.3	15
Saving of foreign exchange	60	0.3	18
Support to poorest sectors	40	0.4	16
Total score of the project			49
PROJECT C			
Generation of employment	100	0.3	30
Saving of foreign exchange	80	0.3	24
Support to poorest sectors	10	0.4	4
Total score of the project			58

* Scoring range from 0 to 100 with 0 = makes no contributions to the objective and 100 = excellent contribution to the objective.

iii) ECONOMIC INDICATORS

The use of economic indicators is one of the most common methods of selecting and determining project priorities. Indicators of this type are for example, the net present value (NPV), the internal rate return (IRR), the benefit/cost ratio, the capital recovery rate, etc.6/

Although indicators of this type are best for assuring maximum efficiency in the use of resources, usually sufficient information is not available for their reliable calculation. Moreover, for many types of projects, methodologies permiting the determination of economic indicators are not available. Therefore, the application of these indicators is limited to only certain types of projects. They also have the disadvantage of excluding all those criteria which cannot be expressed in monetary terms.

A good application of them consists in fixing minimum levels which all projects (for which they can be calculated) should achieve to be acceptable (for example IRR greater than the cost of capital). Next using another method, a ranking is made of those which meet the minimum requirements.

iv) MODELS FOR DETERMINING PREDOMINANCE AMONG PROJECTS

This type of model is applied in uncertain conditions and is for determining dominance among projects from the point of view of the expected results.7/ That is to say, it analyzes the possible results of the project in different settings, the probability of each result, and compares these results with those of other projects.

6/ Detailed analyses of these methods can be found in any finance book, as for example, in "Managerial Finance", Weston and Brigham. Their application to public sector projects (social evaluation of projects) can be studied in publications such as: "Evaluación social de proyectos, Ernesto Fontaine, Instituto Económico, Pontificia Universidad Católica de Chile, December 1981.
"Evaluación de proyectos sociales", Ernesto Cohen and Rolando Franco, GEL, Buenos Aires, 1988.

7/ More detailed information can be found in the book "Decision-Making Under Uncertainty. Models and Choices". Charles A. Halloway, Prentice Hall, 1979.

If in any possible setting the worst result of project A is equal to or better than the best result of project B, there will be absolute dominance of A over B and project A will be recommended.

There will be a probabilistic dominance of project A over project B when, for any possible setting, the probability of obtaining a certain result (desirable) is greater for project A than for project B.

The application of this type of model is useful for determining the optimum alternative for a specific project or for selecting alternative projects in uncertain conditions. Its use for selecting a project to include in an investment programme is limited, because for projects in different sectors it will be very difficult to establish whether a determined result of one of them is more or less desirable than the result of the other project in the same setting.

Moreover, its use is complicated by the difficulty of reliably estimating the probability associated with each possible result of the project.

v) MODELS BASED ON CONTRIBUTION TO GOALS

These models are for measuring the contribution of a project to determined goals. Unlike the method based on scores according to the agreement of the project with the objective, in this case an effort is made to obtain an estimate of the percentage of progress towards the achievement of the determined goal as a result of carrying out the project.

For example, if the goal is to provide dignified dwellings to 1 000 poor families and the project is for the construction of 100 houses, the percentage of contribution to the goal will be 10%.

After estimating the percentage of contribution the project makes to each goal proposed, these values are added up, eventually weighted according to the importance of the goal. Thus an indicator is obtained of the general contribution of the project to the achievement of national goals.

Although this method appears very logical, its practical application is almost impossible. In fact, it will rarely be possible to find clearly defined goals against which the contribution of the projects can be measured. Moreover, even if these goals were known, it would be very difficult to estimate the effective contribution of each project to the different goals.

vi) PORTFOLIO MODELS

This type of model is for determining the marginal contribution of a new project when included in a set of already selected projects. For this, factors must be taken into account such as the profitability of each project and the spreading of risk which it introduces to the portfolio.8/

Portfolio models have a solid conceptual base and, in theory, are the ideal instruments for selecting project packages. However, the volume and type of information required for their application makes their use impractical in the elaboration of investment programmes.

vii) MODELS BASED ON LINEAR PROGRAMMING

To meet the problem of trying to achieve multiple objectives with limited resources subject to various restrictions, an effort has been made to apply linear programming models to the selection of project packages.9/

The objective function selected is usually to maximize the sum of the net present social value of the projects included in the investment programme. The limitations reflect resource restrictions (basically money), limits to investment by sector, region and/or institution and dependency, complementarity or exclusivity relationships among projects.10/

However, the application of this method requires the availability of a social evaluation of each project claiming inclusion in the investment programme. This seriously limits the model since in practice this type of evaluation is only available for a few projects in sectors such as energy and transport. Moreover, the problem rapidly becomes so complex that it is impossible to find a solution by simple procedures.

In fact, the indivisibility of the projects obliges the use of interger programming. Moreover, the relationships among projects and the limitations

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8/ For an analysis of these methods see: "Financial Theory and Corporate Policy", Copeland and Weston, Adison Westley, 1983.

9/ Detailed information on this method can be found in "Mathematical Programming and the Analysis of Capital Budgeting Problems". Weingartner, Prentice Hall, 1963.

10/ An example of an application of this type can be found in the document: "El análisis de proyecto en el contexto de la planificación", Glen D. Westley. Monograph on project analysis No. 14, IDB, August 1983.

in availability of funds and their sectoral and spatial distribution, create a large number of restrictions.

Lastly, the number of projects and project alternatives to be taken into consideration makes the problem even more complex and difficult to solve.

Therefore, although recognizing the potential of this type of instrument, it is impossible to consider their use for determining investment programmes when they include a large number of small projects for which information or methodologies are not available for calculating their NPV. The collecting and preparation of information, the construction of the model and its solution could easily take much more time than elaborating the investment programme by hand.

viii) NOMINAL INTERACTION AND Q-SORTING

This procedure for ranking projects is based on the systematized work of a group of evaluators as a result of which a classification of the projects is obtained according to their contributions to the objectives of the organization. The procedure combines individual work stages with group work stages.

The procedure is begun by asking each evaluator to classify the projects by priority. For this, a Q-sorting procedure can be applied consisting in a set of steps for facilitating the classification of projects in various categories according to the priorities attributed to them by the evaluator.

Each evaluator receives a set of cards, each one representing a project. His job is to classify them in two groups, one of high priority and the other of low priority projects. In the following step he is asked to separate out from the group of low priority projects those of intermediate priority and those of very low priority. He should also separate out from the high priority projects those of intermediate priority and those of very high priority. Thus a classification of projects is obtained in five categories according to the level of priority attributed to them by the evaluator.

Next follows a stage of nominal interaction in which the results obtained by each one of the evaluators are presented in a group session, without identifying who has provided each classification. The method of presentation consists in indicating how many "votes" each project received in each category. These results are discussed by the group in order to increase

coherence of opinions in the case of projects widely dispersed over the various categories.

Next, individually, a second round of Q-sorting is carried out. Its results are once again presented to the group and discussed. The procedure is repeated until an adequate level of coherence is reached about the priority of each one of the projects.

ix) ELECTRE METHODS

Electre methods (Elimination Et Choix Traduisant la Realité),11/ developed by Bernard Roy, are decision-making methods with multiple objectives based on the exploitation of binary relationships. They use the concepts of concordance and discordance to generate, starting from the binary relationships, an ordering of a set of alternatives.

The stages of these methods are:

Stage 1: The construction of one or various outranking relations which express to what extent it can be affirmed for each pair of actions (a,b), that action "a" is preferable to action "b".

Stage 2: The generation, on the basis of the outranking relations, of two orderings of the actions, one descending and the other ascending.

Stage 3: The construction of a "pre-order intersection".

These methods, which have a solid conceptual basis and have been developed in computer programmes are, unfortunately, complicated to apply. In fact, the need to indicate for each possible pair of actions which is preferred with respect to each criterion, implies excessive evaluator time, especially when the number of projects is more than a couple of dozens. For example, if 100 actions (projects) and four criteria are considered, it will be necessary to make 100*9*4 = 3 200 comparisons. This demand makes these methods impractical for ranking public sector investment projects which can reach several hundred.

11/ Detailed information on these methods can be found in: "Multiobjective Decision-Making. Theory and Methodology". Chanking and Haimes, North-Holland, 1983.

Chapter 3

PROPOSED METHODOLOGY

The elaboration of investment programmes is a complex process involving macroeconomic, financial, and public-sector policy aspects. As with every complex problem it is not easy to find the optimum solution. Therefore, it is necessary to use methodological instruments which simplify the work to be carried out. The objective of this chapter is to present the methodology suggested for ranking projects and the procedure selected for preparing investment programmes, indicating which aspects could be supported by a programme designed specifically for this purpose.

First, it must be pointed out that the procedure proposed for ranking projects and preparing investment programmes is based on the principle of dividing complex decisions into a series of simpler decisions, and then combining these decisions to arrive at a solution to the original problem.

There are four elements which can generate sufficient complexity to make the use of appropriate analysis instruments attractive. These are:

- A large number of factors.
- More than one person involved in decision-making.
- Multiple characteristics to be considered.
- Uncertainty about the results of the decision.

All these elements are present in the preparation of an investment programme. Political, economic, social, and geographical factors must be considered. The decision to select a specific investment programme generally involves a large number of public-sector employees. The development objectives of a country are always multiple and the projects will support each one of them to a different extent. Lastly, there will never be certainty about the results to be obtained from each project and even less from a set of projects.

Following the principle of dividing complex decisions into a series of simpler decisions, the preparation of investment programmes has been separated into four related stages. These stages are:

- Determining the availability of money for public investment and eventually distributing it by sector, geographical area and institution.
- Identifying, formulating and evaluating projects.

- Selecting and ranking projects awaiting financing.
- Allocating financing to the projects.

The first and second stages should be carried out before the third stage, since their results will be the main inputs to the third. Also, the third stage will be necessary for developing the fourth.

To obtain the budgetary framework by sector it is necessary to resort to instruments such as macroeconomic models for predicting the impact of redistributing spending among sectors.12/ This decision will also be strongly influenced by historic spending levels in each institution since the management capacity of these is usually a function of the investment which they have managed in recent years.

There is also the alternative of fixing, a priori, a specific geographical distribution of resources.13/ If this alternative is chosen, the investment programme could be prepared by region or at the national level respecting regional investment limits.

It is necessary to keep in mind that a system such as this, if it is to function efficiently, requires the existence of an adequate quantity of projects duly evaluated on the basis of previously established methodologies, as well as sufficient projects in the pre-investment life cycle stages (idea, profile, prefeasibility, and feasibility).

The project banks provide the support for identifying, formulating, and evaluating the projects waiting to be integrated to the investment programme. However, if the quality of the information received is poor, the results obtained from its use will also be poor. Therefore, the existence of a solid and well-structured pre-investment process constitutes a basic

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12/ ILPES has worked in various countries developing macroeconomic models for projecting the availability of resources. See, for example, the documents: "Sistema de información y predicción macroeconómica para la planificación", ILPES, Santiago, Chile, 1988. "Estimación econométrica de las funciones para modelo macroeconómico de Paraguay", work document No.6, Project PAR/87/003. Asunción, September 1988.

13/ A methodology for supporting regional and sectoral distribution of resources was proposed in the ILPES document: "Banco de proyectos gubernamentales de Colombia: una metodología de priorización de proyectos municipales". August 1988.

pre-requisite for the preparation of investment programmes following the methodology proposed.

Specifically, the methodology is for choosing the projects which will be included in the investment programme, ranking them, assigning them financing, and studying the impact of this package of projects on selected macroeconomic variables. In this process an effort should be made to make the maximum possible use of the facilities offered by a project bank.

To develop the system and, following the above-mentioned principle of dividing complex decisions into a series of simpler decisions, a procedure with the following stages is proposed:

- Selection and ranking of the projects seeking financing.
- Allocation of financing to the projects according to their priorities and limitations by financing source, sector, region, and/or institution.
- Preparation of reports and assessments of the aggregate impact of the investment programme.

A. SELECTING AND RANKING PROJECTS

For selecting and ranking projects it is possible to use any one of the above-described procedures. For example, if it is possible to calculate the NPV of all the projects, these can be ranked in descending order according to NPV, IRR or according to the NPV/Investment ratio.

However, considering the advantages and disadvantages of each method described, as well as the experience of the Institute with respect to the availability of information on projects in the various countries, a flexible methodology for selecting and ranking projects is proposed. This is based on indicators and/or subjective assessments of the user with respect to the contribution made by each project to the national and/or sectoral objectives.

In the scheme proposed, a project bank would provide the codes and indicators available for all the projects in the base and would offer the user the possibility of ranking them according to one or more indicators.14/ Alternatively, the indicator could be presented to the evaluator in such a

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14/ A detailed treatment of possible indicators can be found in the document: "Guide for Ranking Project Profiles", elaborated by ILPES for the Ministry of Economic Development, Belize (November 1988).

way that he classifies the contribution of the project to the objective according to the value of the indicator. Whichever method is selected, the final ranking of the projects would be by a system of weighted scores.

For parametres such as the NPV or cost per unit produced --physical or service-- it should be possible to fix minimum acceptable values. This would allow, for example, preselecting only projects with positive NPV.

Moreover, restrictions could be stipulated on the total amount of resources available for each sector and the resources available or required by fund or financial source could be indicated. Lastly, if desirable and information is available, it should be possible to feed into the system a ranked list of projects and use only the module for investment programming.

The approach proposed is general and not subject to the need of having very elaborate indicators and, therefore, seems the most suitable to develop. In fact, it allows including in the analysis institutional, policy and subjective aspects, impossible to quantify. Moreover, it can be used both where there is little information and where reliable socioeconomic evaluations are available for all projects. It also assures a better relationship of the selected projects with the national and sectoral policies and objectives.

To develop a ranking method based on this scheme and following the above-mentioned principle of dividing complex decisions into a series of simpler decisions, a project ranking procedure with the following stages is proposed:

- Identifying the development objectives which it is wished to support through the investment programme. These objectives should be fixed by the higher authorities in accordance with current policies. It is better that the number of objectives not be very high, since if it is high, the procedure of allocating scores to projects will be long and tedious.
- Weighting, by the evaluators, of the relative importance of the different objectives. These weightings should add up to one, obliging those who define them to analyze carefully the relative importance of each one of the objectives. It is fundamental that the weightings assigned be agreed to by all the evaluators. That is to say, they should be consensus values. Otherwise, the score obtained by a project based on partial scores assigned by one evaluator may not be in agreement with

the general importance which the evaluator assigns to the project. Ideally, this decision should also be taken at a higher level.

- Identifying the projects awaiting financing, and, eventually, rejecting those which do not satisfy certain specific criteria (for example, those with IRR less than 12% or those pertaining to other regions if the investment programme is developed at the regional level).
- Selecting the indicators directly related with the objectives or which best reflect the contribution of the project to each objective.
- Calculation, by the system, of the indicators required on the basis of the information supplied by a project bank and ranking of the projects according to each indicator when this method of operation has been selected.
- Alternatively or complementarily, estimation by the evaluators of the contribution that each project awaiting financing (preselected) will make to achieving the development objectives. This estimate would be supported through the presentation of the value of the indicators selected and the decile at which the project is classified according to each indicator. The judgement of the evaluator would be expressed in a score for each project with respect to each objective.
- Calculating the total score obtained by each project. For this, the average score obtained by a project with respect to each objective would be multiplied by the corresponding weighting of the objective, then these partial scores would be added up to obtain the total score.
- Ranking of the projects in descending order according to score.

Consider, for example, the projects indicated in the following table:

Project	Investment	Employment generated	Foreign exchange saved	Employment generated/ investment	Foreign exchange saved/ investment
Project A	US$100 000	80	120000	0.00080	1.2
Project B	US$150 000	36	200000	0.00024	1.3
Project C	US$ 30 000	10	-40000	0.00033	-1.3
Project D	US$ 20 000	18	0	0.00090	0.0
Project E	US$400 000	150	0	0.00038	0.0
Project F	US$250 000	130	700000	0.00052	2.8
Project G	US$300 000	20	1000000	0.00007	3.3

The indicators calculated for each project are employment generated/investment and foreign exchange saved/investment. Suppose further that a weight of 60% has been given to the objective employment generation and 40% to the objective saving foreign exchange.

If the projects are ranked by directly employing the indicators these values must be put on a common scale. A scale of 1 to 100 can be used, assigning an arbitrary value to the minimum and maximum values of each scale and calculating the remaining values by linear interpolation.15/ Applying this procedure the following values are obtained:

15/ Alternatively, the values of each scale can be normalized as suggested in document "Banco de proyectos gubernamentales de Colombia: elementos para una metodología de priorización de proyectos municipales". ILPES, August 1988. However, the implied assumption of normality can be excessive for many indicators.

Project	Employment generated/ investment		Foreign exchange/ investment		Weighted Scoring	Ranking
	Original Value	Transformed Value	Original Value	Transf Value		
PROJECT A	0.00080	80	1.2	30	60	1
PROJECT B	0.00024	24	1.3	33	28	5
PROJECT C	0.00033	33	-1.3	-33	7	7
PROJECT D	0.00090	90	0.0	0	54	3
PROJECT E	0.00038	38	0.0	0	23	6
PROJECT F	0.00052	52	2.8	70	59	2
PROJECT G	0.00007	7	3.3	83	37	4

It can be seen that for the employment generated/investment indicator a zero was assigned on the transformed scale to the same original value of the indicator and 100 to 0.00100. For the foreign exchange saved/investment indicator, zero was once again chosen for the value 0.0 and 100 was assigned to value 4.0 of the indicator. In this last case it was preferred to assign zero to 0.0 and not to -1.3 in order to reflect the information supplied by the value of the indicator as faithfully as possible on the transformed scale. That is to say, 0.0 means no support to the objective and -1.3 means it goes against the objective.16/

As an example of the alternative procedure proposed, suppose that an evaluator has given these projects the scores indicated in columns 2 and 3 of the following table according to their contribution to the objectives, generating employment and saving foreign exchange.

16/ The points (0) and (4) define the equation of a line with slope 100/4=25 and intercept zero. Then the transformed value (TV) of the indicator is calculated as:

TV = 25 * OV + 0 (OV = original value).

For example, a transformed value of 30 will correspond to the original value 1.2 of the indicator (1.2 *25+0 = 30).

Project	Employment generated objective (W=60%)	Objective foreign saving (W=40%)	Weighted score of the project	Ranking
PROJECT A	80	50	68	1
PROJECT B	25	50	35	5
PROJECT C	30	0	18	7
PROJECT D	100	0	60	3
PROJECT E	40	0	24	6
PROJECT F	50	80	62	2
PROJECT G	10	100	46	4

The weighted scores included in the fourth column of the table has been calculated on the basis of this information.17/ These scores determine the order of the projects indicated in the last column.

In this example the same order has been obtained as with the previous method. This will not always be the case but, generally, both procedures should provide similar results.

Although the first method proposed appears to be more objective, it also includes a good dose of subjectivity in choosing the scales to be used. The second procedure suggested has the advantage that the evaluator can incorporate in his decision not only the information provided by the indicator, but also subjective information which is not reflected by the value of the indicator. Therefore, the second procedure proposed is suggested when available information is not sufficient for applying other ranking procedures.

It should be kept in mind that one of the key aspects of the recommended procedure is estimating the score assigned to a project in respect to certain objective. In fact, starting from these values, which have their basis in the good judgement of the evaluator, the scores of the projects are

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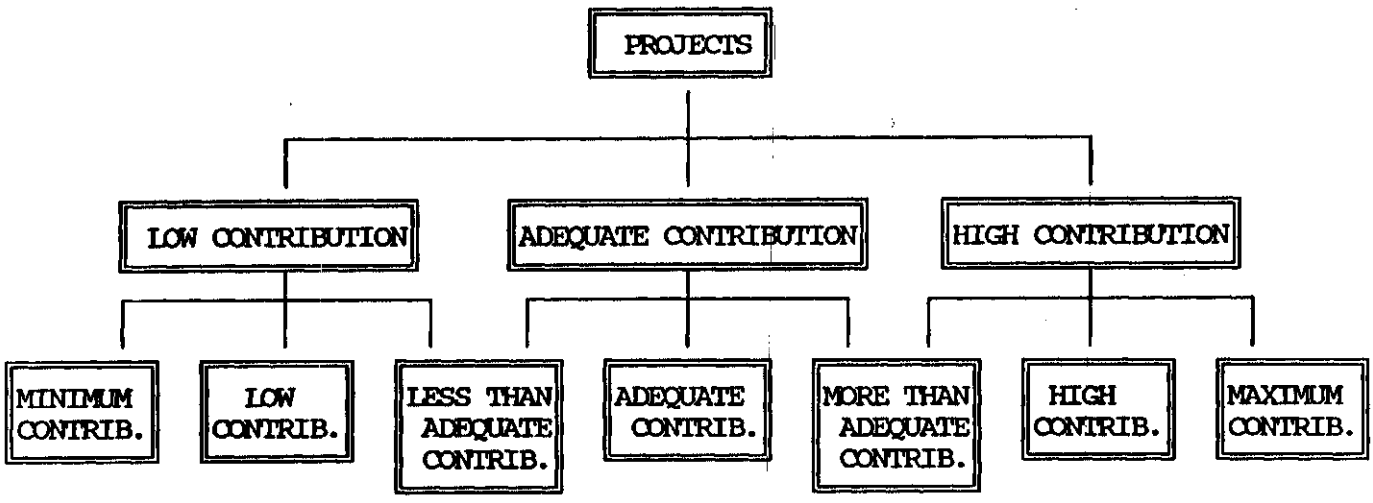
17/ For example, for project A weighted score is calculated as:
80 * 0.6 + 50 * 0.4 = 68.

calculated and the projects are put in order. It is especially important to adopt measures so that these scores, subjective by nature, are allocated in the most objective form possible.

It is necessary, then, to define a structured procedure for obtaining the scores of the projects which permits decreasing the level of subjectivity in judging the contribution of each one of them to the objectives. For this, and to transform complex decisions into a series of simpler decisions, the use of a process similar to Q-sorting, as described above, is proposed.

This procedure consists in presenting a project to the user and asking him to classify it according to its contribution to a specific objective in the categories, "low contribution", "adequate contribution", and "high contribution". After having been classified in one of these categories, the projects will once again be presented to the evaluator asking him to sharpen the classification obtained. He would then reclassify the projects in more specific categories which depend on the initially elected categories. When this process is finished, he should examine the classification obtained in order to make any necessary changes. Finally, each category is transformed into a score for the project.

This procedure is shown in the following figure:



That is to say, the classification of the project will be made in two steps and the categories valid in the second step will depend on the category chosen in the first step. This is reflected in the following table:

If the contribution to the project was considered:	The contribution could be classified in this stage as:	An it would obtain:
HIGH	MAXIMUM HIGH MORE THAN ADEQUATE	95 points 80 points 65 points
ADEQUATE	MORE THAN ADEQUATE ADEQUATE LESS THAN ADEQUATE	65 points 50 points 35 points
LOW	LESS THAN ADEQUATE LOW MINIMUM	35 points 20 points 5 points

It must be kept in mind that the application of a methodology of this type should include the active participation of those who make the investment decisions in order that the projects be selected on the basis of their opinions and not those of subordinate employees. This is especially important for determining the weightings assigned to each objective.

It should be pointed out here that an analysis could be made of the consistency of the classification given to a project by the different evaluators with respect to an objective. This can be achieved by a statistical test.18/

18/ For example, the Kolmogorov-Smirnov test can be used to dismiss the hypothesis that the distribution of the classification of a project with respect to an objective is equal to a uniform rectangular distribution. Complementarily, it can be insisted upon that a certain percentage of the "votes" of the evaluators are grouped in one category, or in two or three adjacent categories.

Another aspect necessary to consider in the allocation of scores is related to the project investment. In judging the contribution of a project to a specific objective, the evaluator should keep in mind the cost such contribution implies. Otherwise, large projects would obtain higher scores. As an example, consider the following projects:

Project	Investment	Employment generated
A	10	10
B	100	20

In this case, if the evaluator only observes the variable employment generated, he could give project B a higher score than project A with respect to this objective. However, it is clear that in proportion to the resources used, project A contributes more to the objective. In fact, project A generates one job per investment unit while project B requires five investment units to generate one job.

Consequently, and to guarantee the validity of the scores obtained, the evaluator should have indicators which relate the contribution of a project to an objective with the cost which this contribution represents. This information should be given to the evaluator during the Q-sorting process. Alternatively, before beginning the process of allocating the projects to categories according to the contribution to objectives, each evaluator could be provided with lists of the projects awaiting financing, ordered according to each indicator related with these objectives. This information would help to increase objectivity in classifying projects.

B. ALLOCATING FINANCING TO PROJECTS

The second stage of the proposed methodology is for allocating available resources to projects seeking financing. This requires the following steps:

- Feeding into the system information about available resources by budgetary period and tentative distribution by sector, region, and/or institution.

- Allocating financing to projects and studies being carried out which will continue requiring resources in the following budgetary periods, on the assumption they will not be discontinued.
- Allocating financing to new projects and studies, beginning with that with the highest score, until available financing for each budgetary period is used up, always respecting the limits established to investment by sector, region, and/or institution.

For the first of these tasks, the information should be obtained from macroeconomic projection models as has been indicated. The spatial, institutional, and/or sectoral distribution of the resources can also be carried out using appropriate methodologies. Alternatively, the system should allow working without prefixing a distribution of resources such as indicated. This would make it possible to study which distribution of resources allows undertaking the highest priority projects.

In the development of the second step proposed a project bank would perform a basic role. In fact, since it shows the actual degree of progress and the real disbursements and financial commitments for all the studies and projects being carried out, it can supply all the necessary information for discounting from the available resources those required for finishing projects and studies in progress. Therefore, if a project bank is available and operating satisfactorily, this step can be completely automatic. It will only be necessary to leave open the possibility of eliminating those projects which it has been decided to discontinue.

The third task would be allocating financing to new projects and studies proposed for the investment programme. For this the system would use the information registered in the proposed financing calendar for each project on the assumption that this calendar has been fixed by technical studies carried out by the institution supporting the project. Moreover, it is assumed that the institution presenting it asks for financing from specific sources and in predetermined amounts for each year of the executing period.

Following the order established for projects in the ranking procedure, the system would proceed to assign financing until available resources in each budgetary period are exhausted. In this process a prefixed spatial,

sectoral, and/or institutional distribution could be considered. This would be expressed as investment limits in each region, sector, and institution. In the case of a project which cannot be begun in the proposed period, either for lack of resources or because it exceeds one of the prefixed limits, the system should assign it to the following period and register the cause of its postponement.

C. GENERATION OF REPORTS AND ESTIMATION OF IMPACT

The third and final stage of the proposed procedure includes the preparation of reports and estimation of the impact of the investment programme. This task would be carried out using the information registered in the project bank.

The lists and reports prepared should provide all the interesting information on programme objectives, projects seeking financing, availability and distribution of resources, resulting investment programme, projects without financing, etc.

The estimate of the aggregate impact of the investment programme would be made by using the information available in the project bank. It is obvious that the aggregate impact can only be measured on the basis of parameters for which sufficient, reliable, and up-to-date information is available. Examples of aggregate impact which could be estimated if the information corresponding to each project is available are:

- Employment generated by qualification level.
- Use, saving, and generation of foreign exchange.
- Increase in service coverage.
- Increase in health and education coverage.
- Aggregate value.
- Demand for materials and other inputs.

This information can serve as input to a macroeconomic projection model which reestimates the availability of resources for investment. 19/ This

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19/ See: "Sistema de información y predicción macroeconómico para la planificación", ILPES, September 1988.

begins a repetitive process which, properly carried out, would lead to an investment programme duly adjusted to the availability of resources and making the maximum contribution to development objectives.

Chapter 4

GLOBAL LOGICAL DESIGN

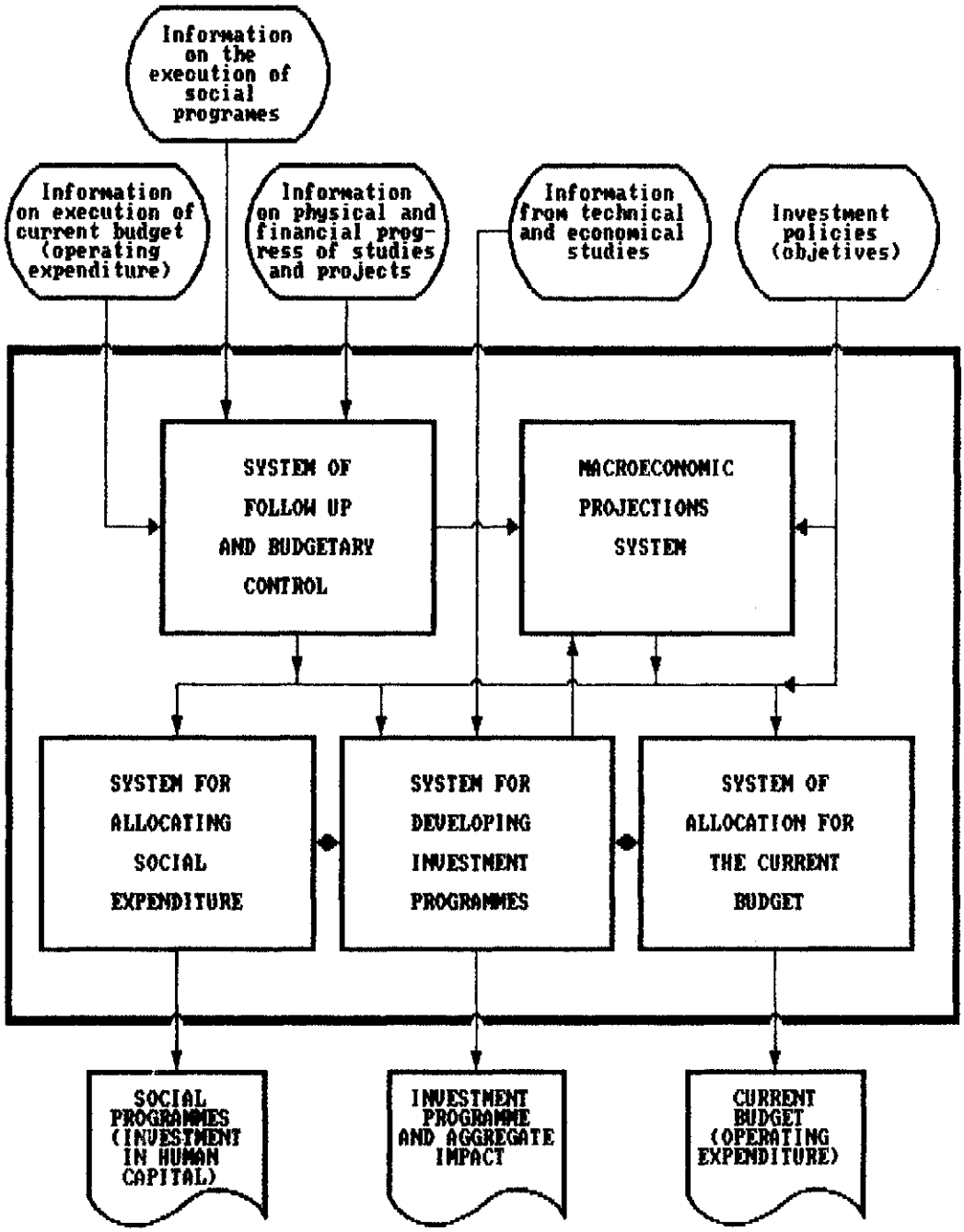
Having described the methodology for preparing investment programmes the basic characteristics of the information system to be developed for this job can be defined. For this, figure 1 which represents the systems which make up the administrative function of public investment should be analyzed.20/ This function represents all the procedures associated with the administration and control of public investment. That is to say, it includes the collection of information, its processing and analysis and the taking of decisions associated with planning and controlling public investment.

The five systems which make up this function are: the follow-up and budgetary control system, the macroeconomic projections system, the system for allocating the current budget, the system for allocating social expenditure and the system for developing investment programmes.

20/ This concept is presented and discussed in the document "Methodological and Operational Bases for Public Investment Management". ILPES, Area of Advisory Services Programmes, Santiago, May 1988.

FIGURE 1

RELATION OF THE SYSTEM FOR DEVELOPING INVESTMENT PROGRAMMES WITH THE OTHER SYSTEMS MAKING UP THE FUNCTION OF PUBLIC INVESTMENT MANAGEMENT



These systems receive the information external to the administrative function and process it, providing a decision on the allocation of resources. This decision can be separated into a current budget, social programmes, and an investment programme.

The current budget indicates to each one of the public sector institutions the amount of funds they can use during the budgetary period for each item outlined in it, such as wages, fuel, materials, etc.

The social programmes outline the different actions which the government will undertake in the areas of health, education, nutrition, or social rehabilitation. These budgets should include all the expenses associated with a specific action, such as wages, materials, etc.

The investment programme outlines all and each one of the studies and projects which the government will continue developing or begin in the budgetary period, indicating the resources allocated to each one of them. This programme should be closely related with the social programmes and current spending, since it provides the infrastructure necessary for the social programmes and generates demand for resources to operate the finished projects.

We move now to analyze the system for elaborating investment programmes. As can be appreciated in figure 1, this system is related to the other systems which make up the function. As indicated in discussing the methodology to be used and also in the quoted document, the system for preparing investment programmes receives the budgetary framework determined by the system for macroeconomic projections, information from the technico-economic studies generated by the preinvestment process and information from the follow-up system (works and studies being carried out and which require financing for the next budgetary period).

It can be clearly seen that there is a marked relationship between the system for macroeconomic projections and the system for preparing investment programmes. A repetitive process of preparing investment programmes which feed the system for macroeconomic projections and budgetary frameworks feeding the system for the preparation of investment programmes is needed to obtain the definitive projections and the investment programme.

Figure 2 presents a scheme of the inputs and outputs of the system for preparing investment programmes. Two of the required inputs, qualified personnel and methodologies, procedures and programmes, are not part of the computer system to be developed. Therefore, they were not considered in the design.

The other inputs will be required by the information system. The development objectives should be fed into the system since the projects are ranked according to their contribution to these. Each one of them will have a percentage attached representing the level of importance given to the objective.

At the same time, information about investment committed to studies and projects in progress is indispensable for purposes of knowing, by subtracting from total resources available, the resources which can be allocated to new studies and projects. This information will come from the follow-up and budgetary control system through a project bank.

Information on sectoral, regional, and/or institutional budgetary frameworks generated by the system for macroeconomic projections should be directly fed in by the users of the system. On the other hand, information regarding indicators, costs and project classification, generated by technico-economic studies, will be obtained from a project bank. If there is no project bank, it could be fed in directly by the user.

On the basis of the methodology proposed in the previous chapter, three subsystems can be identified in the system for preparing investment programmes. Figure 3 shows the breakdown of the system into these subsystems.

The system for evaluating the contribution of the projects to objectives and for ranking projects will serve for the following tasks:

- Obtaining a definition of the objectives used for ranking projects and their respective weightings.
- Developing a Q-sorting type process for obtaining the scores of the projects with respect to the objectives.
- Calculating total score of each project and ranking them on this basis.

FIGURE 2

INPUTS AND OUTPUTS OF THE SYSTEM FOR
DEVELOPING INVESTMENT PROGRAMMES

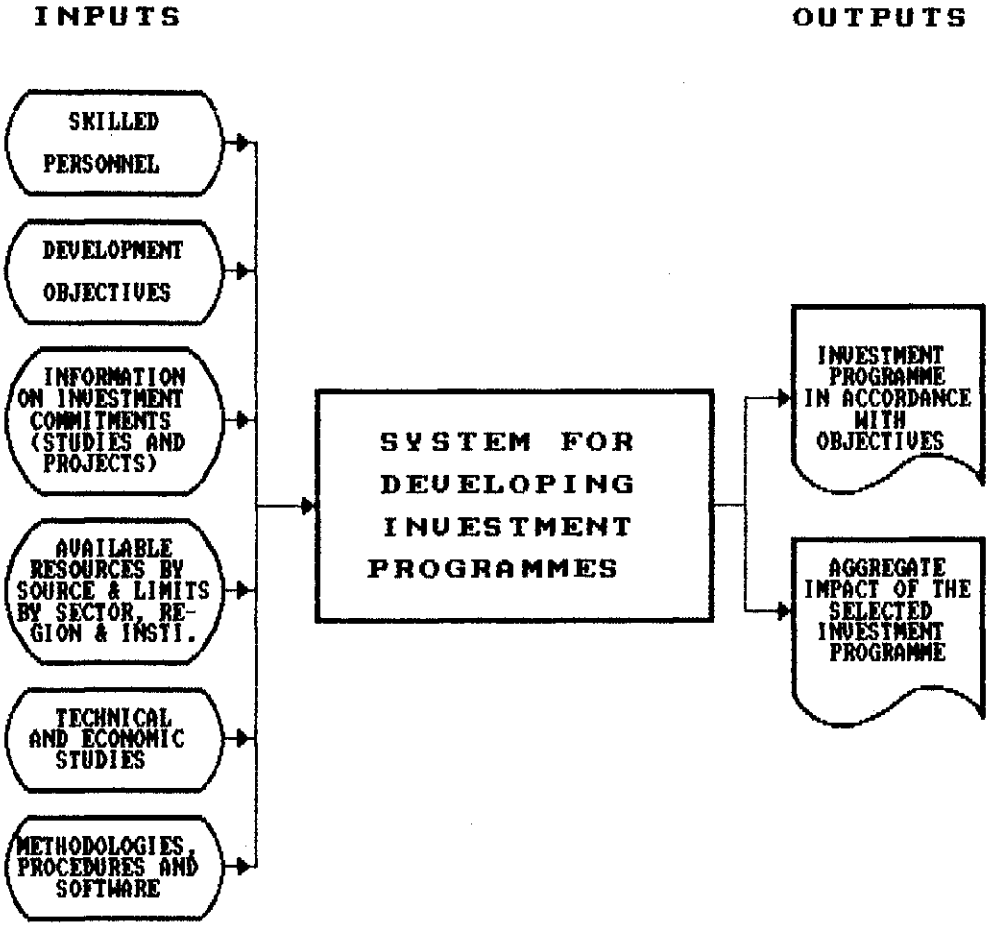
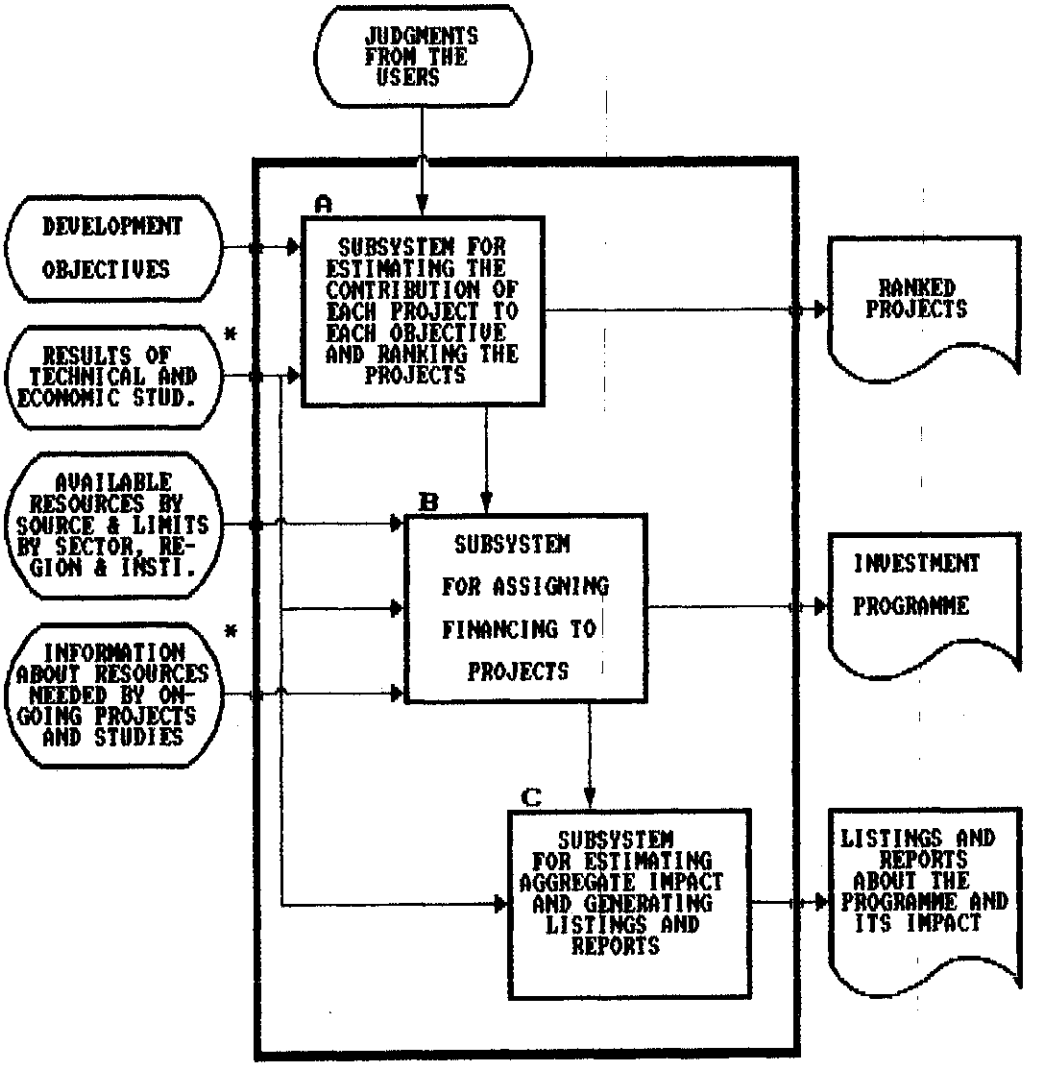


FIGURE 3

SUBSYSTEMS WHICH MAKE UP THE
SYSTEM FOR DEVELOPING INVESTMENT PROGRAMMES



* = This information would be obtained from a Project Bank

To carry out these tasks, the subsystem will need the information provided by the users on the objectives of the investment programme and information on the projects awaiting financing generated by technico-economic studies and obtained from a project bank (figure 4). The result will be a list of the projects awaiting financing ranked according to score.

The subsystem for allocating financing to projects will serve for the following tasks:

- Feeding in information about sectoral, regional, institutional, and total budgetary frameworks, as well as about the availability of financing through existing funds and the limitations of each fund on the type of project which it can finance.
- Calculating available resources for financing new projects (by substracting from the budgetary frameworks the financing required for projects in progress).
- Allocating financing to new projects.

To carry out these tasks the system needs information about both the budgetary frameworks and the ranking of the projects generated by the previous subsystem.21/ It will obtain from a project bank the financing calendar of new projects and studies and the investment committed to projects and studies in progress. The result is an investment programme (see figure 4).

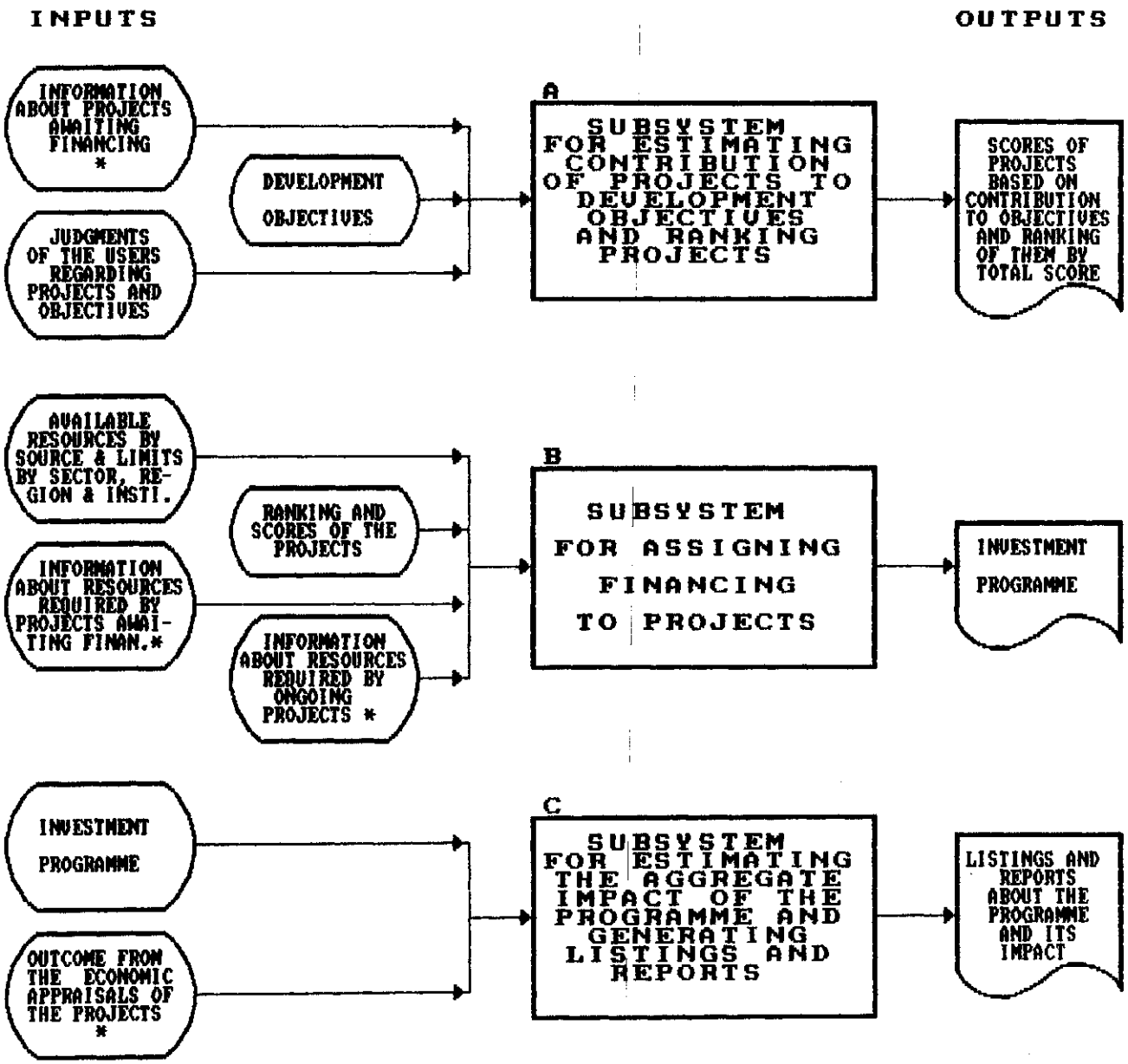
Lastly, the third subsystem, identified in figure 3, is for estimating the impacts of the programme and the preparation of lists and reports. It needs the investment programme generated by the previous subsystem and information about the impact of each one of the projects included in the programme. As output, this subsystem provides reports reflecting the aggregate impact of the programme on variables selected by the user.

If the first subsystem (figure 5), is analyzed in detail, four different functions can be identified which result in software modules to be developed.

21/ Or, alternatively, an ordering of the projects obtained by any other method and directly fed into the system.

FIGURE 4

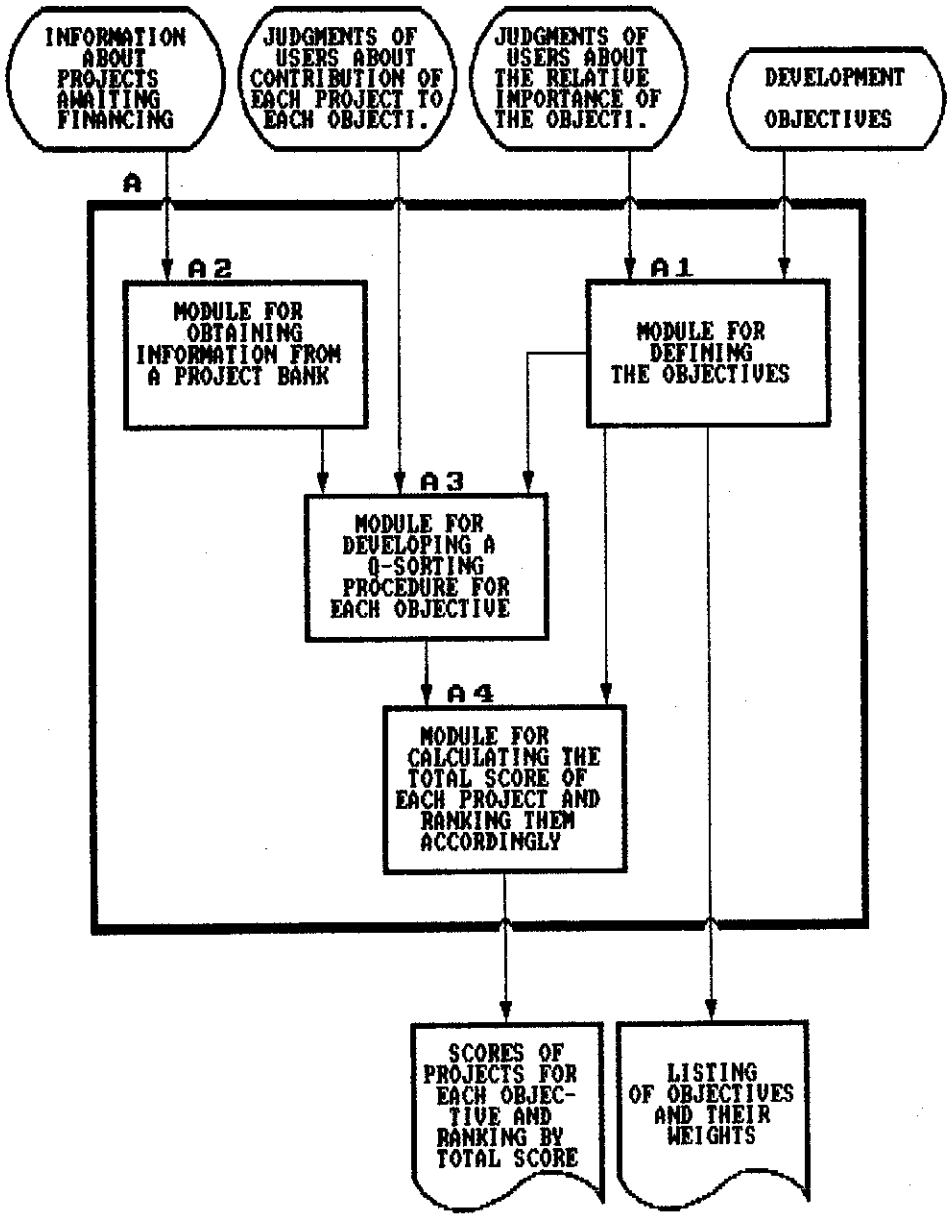
INPUTS AND OUTPUTS OF THE SUBSYSTEMS WHICH MAKE UP THE SYSTEM FOR DEVELOPING INVESTMENT PROGRAMMES



* = Information obtained from a project bank and generated by the technical and economic studies and by the system of follow-up and budgetary control.

FIGURE 5

SUBSYSTEM FOR ESTIMATING THE CONTRIBUTION OF THE PROJECTS TO THE OBJECTIVES



First, it is necessary to have a module charged with obtaining from the user of the system the definition of the development objectives to be used for judging the contribution of the project (A1). This module also obtains the weightings assigned to each objective. The description of the objectives is fed into module A3 and their weightings to module A4. Moreover, the programme provides a list with the description of the objectives and the weightings assigned to them.

The main function of the second module is to obtain from a project bank information about the projects awaiting financing. This includes the data necessary for the evaluator to identify the project, its objectives, justification and impacts. This information will be fed into module A3. If there is no project bank to provide the data, this module will serve for the direct feeding in on the part of the user of the basic information on the projects and assigning a code to each one.

The third module (A3) is for obtaining from the user the classification of the projects according to their contribution to each one of the development objectives. This task will be carried out through a Q-sorting type process as described in analyzing the methodology to be used. This will require information about the projects awaiting financing provided by module A2 and the description of the objectives provided by module A1. As a result it provides module A4 with a file containing, for each project awaiting financing, the category in which it was classified with respect to each objective.

Finally, module A4 calculates the total score of each project on the basis of the information generated by module A3 and the weighting of the objectives provided by module A1. Using this score it ranks the projects as indicated in the description of the methodology. The final result of this module is the generation of a file with the projects ranked according to total score obtained, indicating, as well, their scores with respect to each objective.

As for the second subsystem, a detailed analysis makes it possible to differentiate four independent functions as represented in the four modules in figure 6.

FIGURE 6

SUBSYSTEM FOR ASSIGNING FINANCING TO PROJECTS

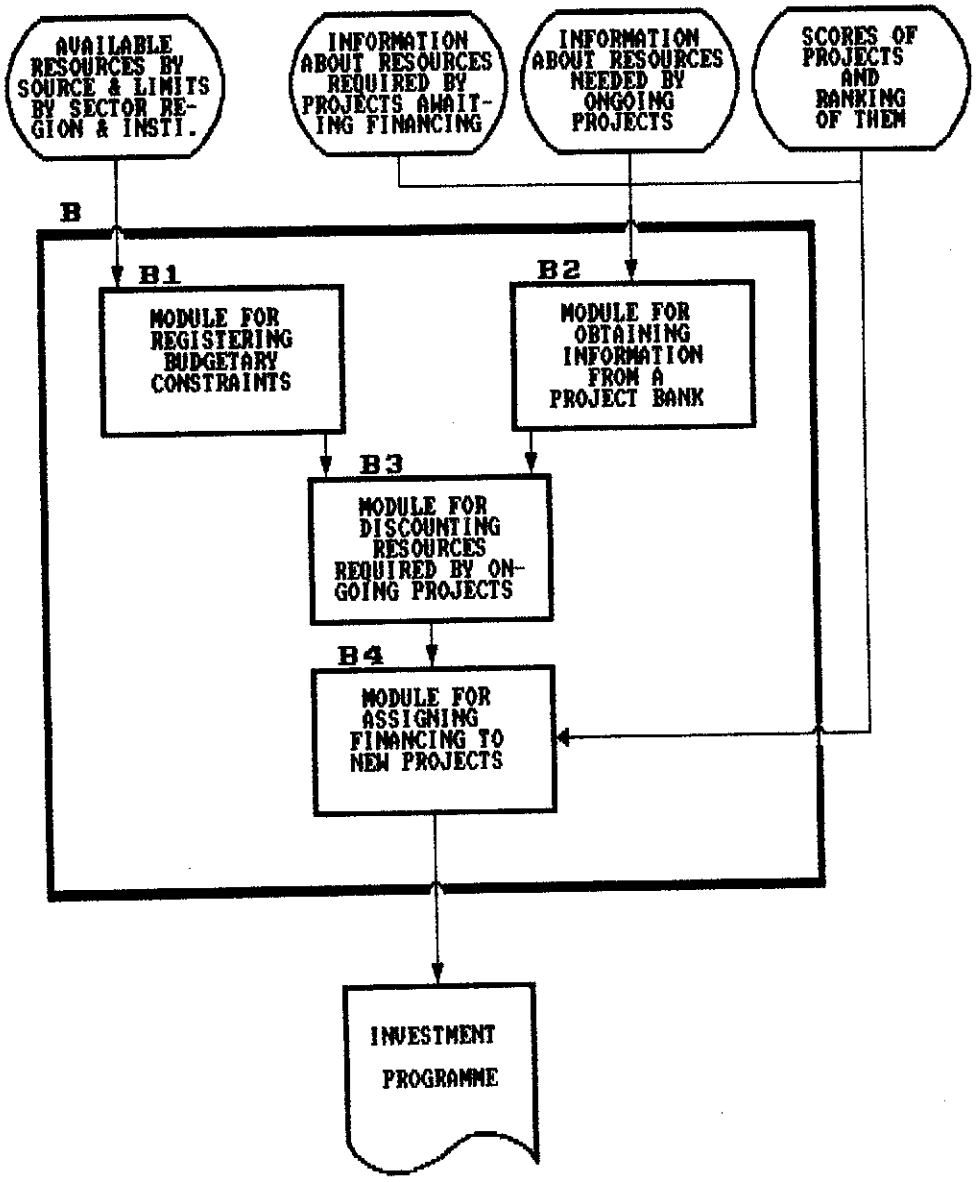
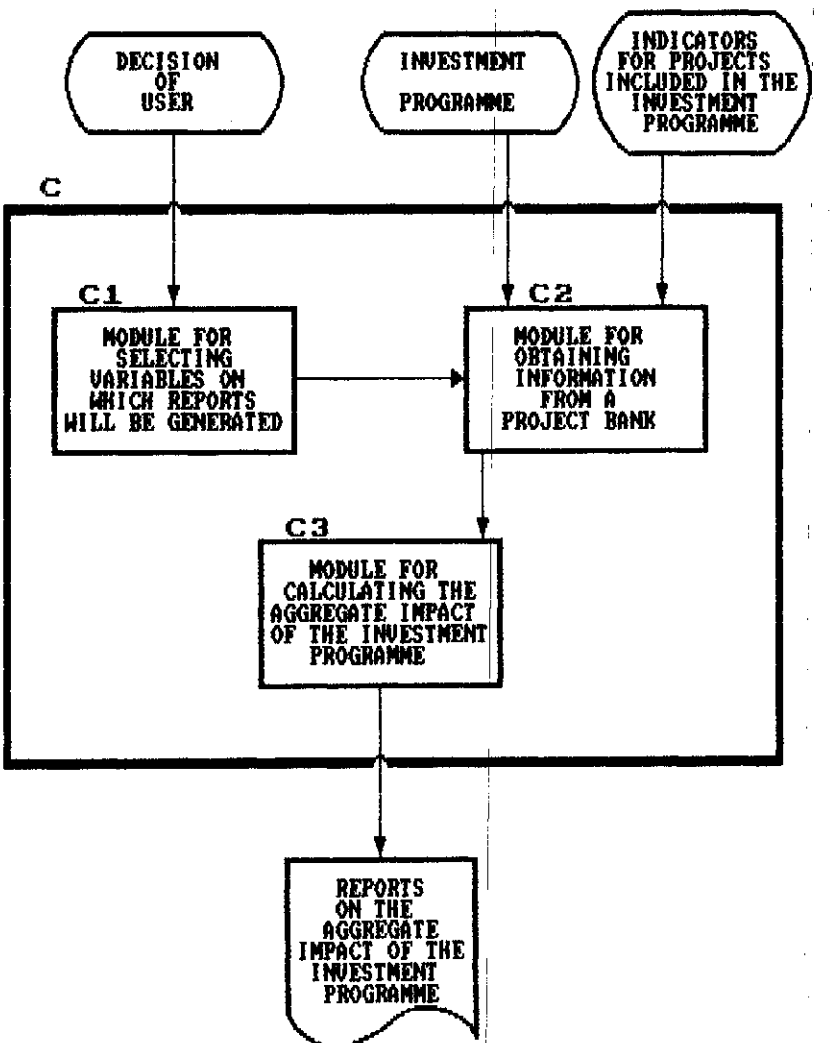


FIGURE 7

SUBSYSTEM FOR ESTIMATING AGREGATE IMPACTS AND GENERATING LISTINGS AND REPORTS



The first of these modules (B1) will serve for obtaining the budgetary limitations conditioning the preparation of the investment programme. These will consist in the maximum and minimum investment levels by sector, institution and geographical area. As well, it obtains information about the funds available in each one of the existing sources of financing and the limitations of these with respect to the type of projects which they finance. This information is fed into module B3 in the form of a computer file.

The second module (B2) is, as in the previous case, for obtaining information from a project bank (or, in its absence, permit the feeding in of information by the user). Specifically, it obtains information about the investment committed to projects and studies in progress and the financing calendar of these included in the ranked list of projects and studies awaiting financing. This information is fed in in the form of computer files to modules B3 and B4.

The third module (B3) discounts from the regional, sectoral and institutional budgetary frameworks and from the funds available in financing sources, the resources required for financing the finishing of projects and studies in progress. The corrected frameworks and the real availability of funds, as well as the list of projects on progress, is then fed into module B4 in the form of computer files.

This last module allocates financing to new projects and studies, observing the budgetary limitations and the ordering according to score. The procedure to follow is that described in chapter 3. The final result is an investment programme.

In the last subsystem identified, three interrelated modules can be distinguished (figure 7). The first of these (C1) is for the user to choose the variables on which he wishes to estimate the macroeconomic impact of the investment programme. This selection is used by module C2 jointly with the list of projects included in the investment programme for obtaining the indicators for the analysis from a project bank. All this information is fed into module C3 which estimates the impact of the investment programme and prepares reports on this.

Chapter 5

DETAILED LOGICAL DESIGN

This chapter will consider in detail the main characteristics of the software needed for a system for preparing investment programmes.

The main operational characteristics and the results of the system have already been indicated in the previous chapter. On this basis the characteristics of the programmes to be developed can be determined.

A. SYSTEM OPERATION

Figures 8, 9 and 10 show a flow diagram of the procedures the proposed system would follow. In this diagram three main blocks can be distinguished, one in each figure, corresponding to the subsystems detailed in the previous chapter. Dotted lines indicate which parts of these diagrams correspond to the modules identified for each subsystem.

The first block (figure 8) allows the definition of the objectives to be taken into account and their weightings, as well as the allocation of scores to the projects awaiting financing and their ranking by total score.

The second block (figure 9) details the steps to follow for feeding in information about budgetary frameworks and limitations and the allocation of financing to projects according to their priority in the ranking.

Lastly, the third block (figure 10) shows the procedures for estimating the impact of the investment programme.

In the remainder of the present chapter these procedures will be analyzed in detail and the entries to and withdrawals from the system will be defined.

First we shall study the flow diagram corresponding to subsystem A identified in the previous chapter.

The operation of the subsystem begins with the preparation of the files to be used (A1). This requires asking the user to indicate the number of objectives to be considered in the evaluation process. At least one objective should be defined and it is recommended that not more than five be considered.

FIGURE 8

FLOW DIAGRAM OF THE OPERATION OF THE SYSTEM FOR DEVELOPING INVESTMENT PROGRAMMES

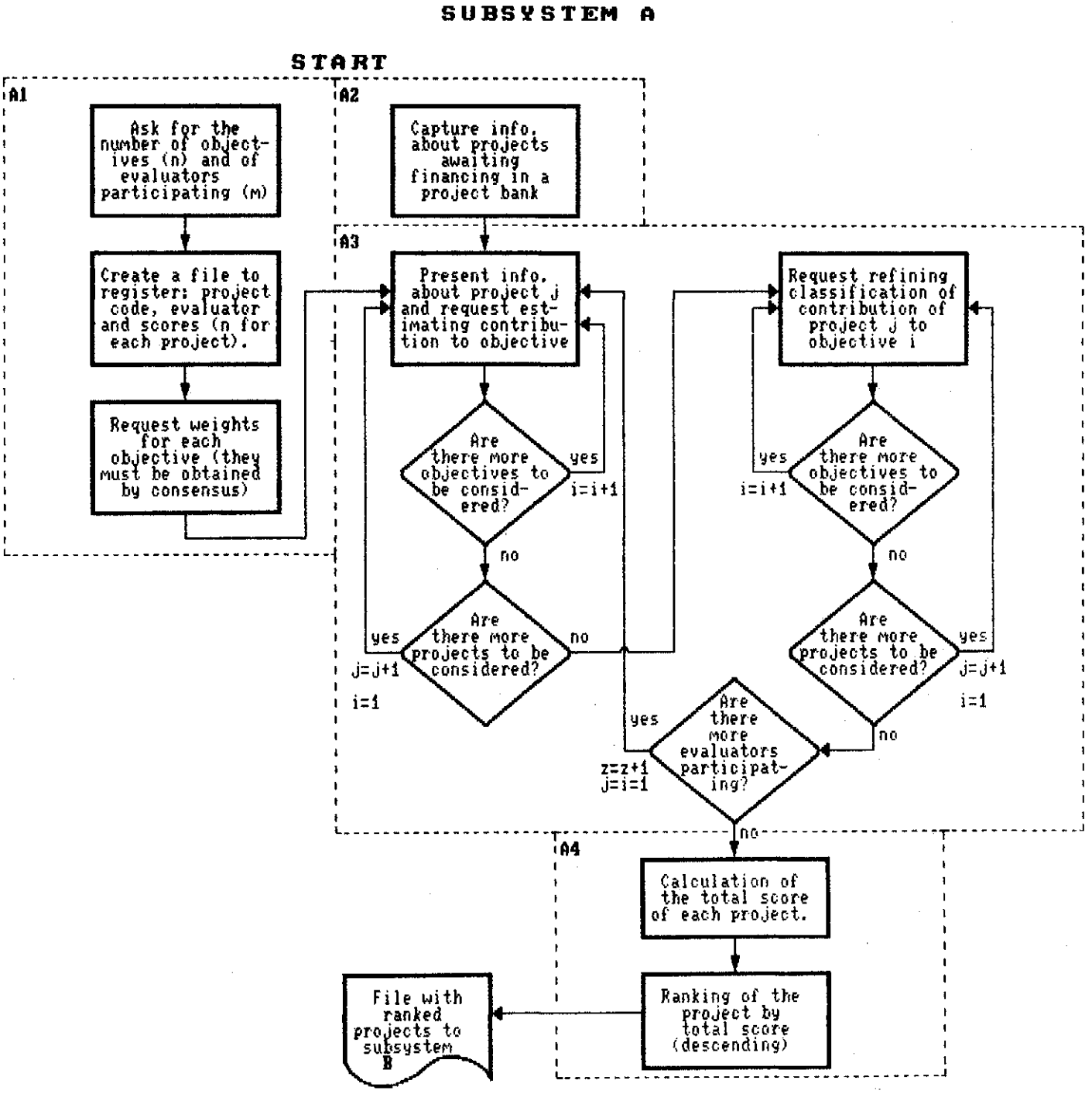


FIGURE 9

FLOW DIAGRAM OF THE OPERATION OF THE SYSTEM FOR DEVELOPING INVESTMENT PROGRAMMES

SUBSYSTEM B

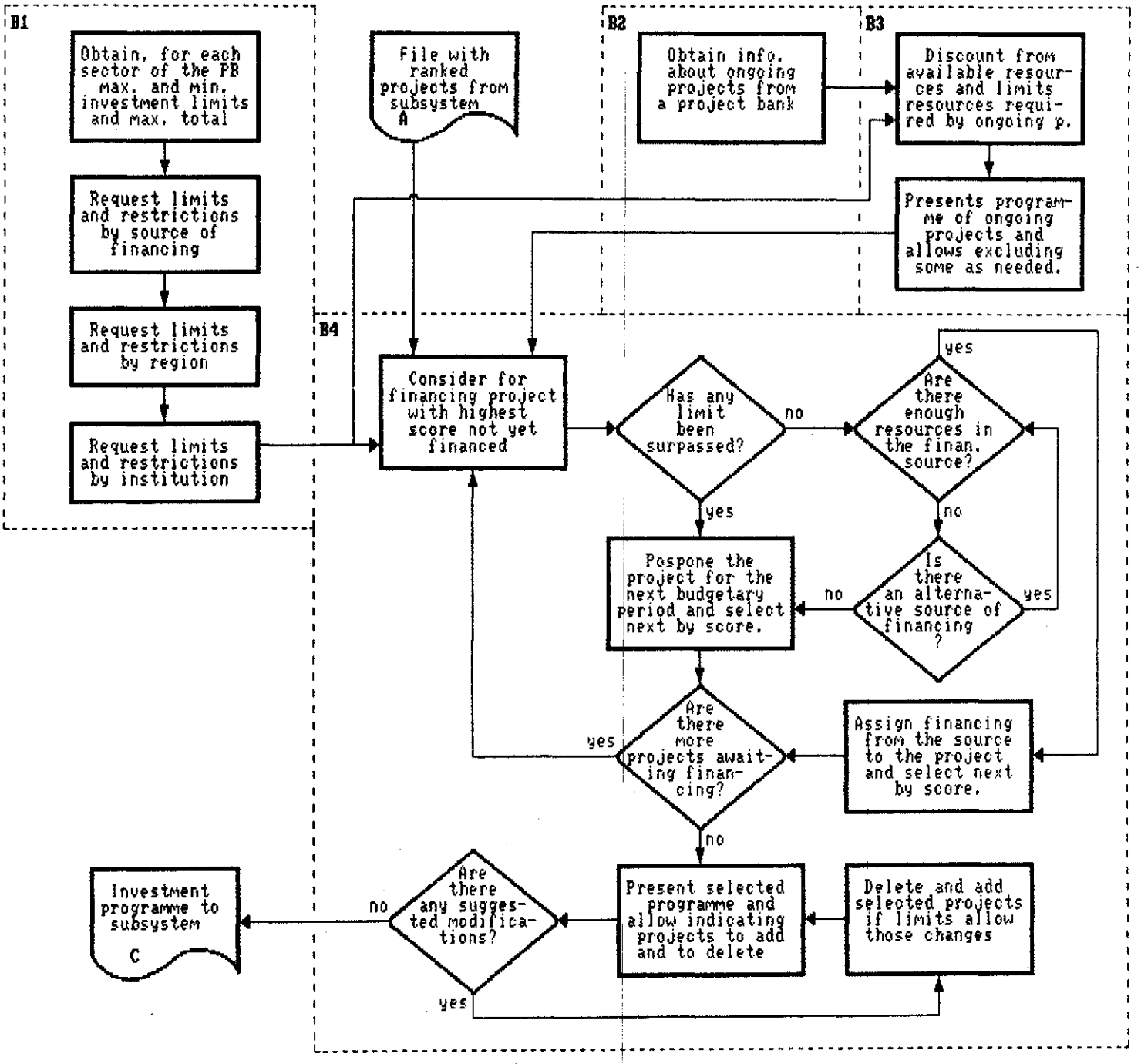
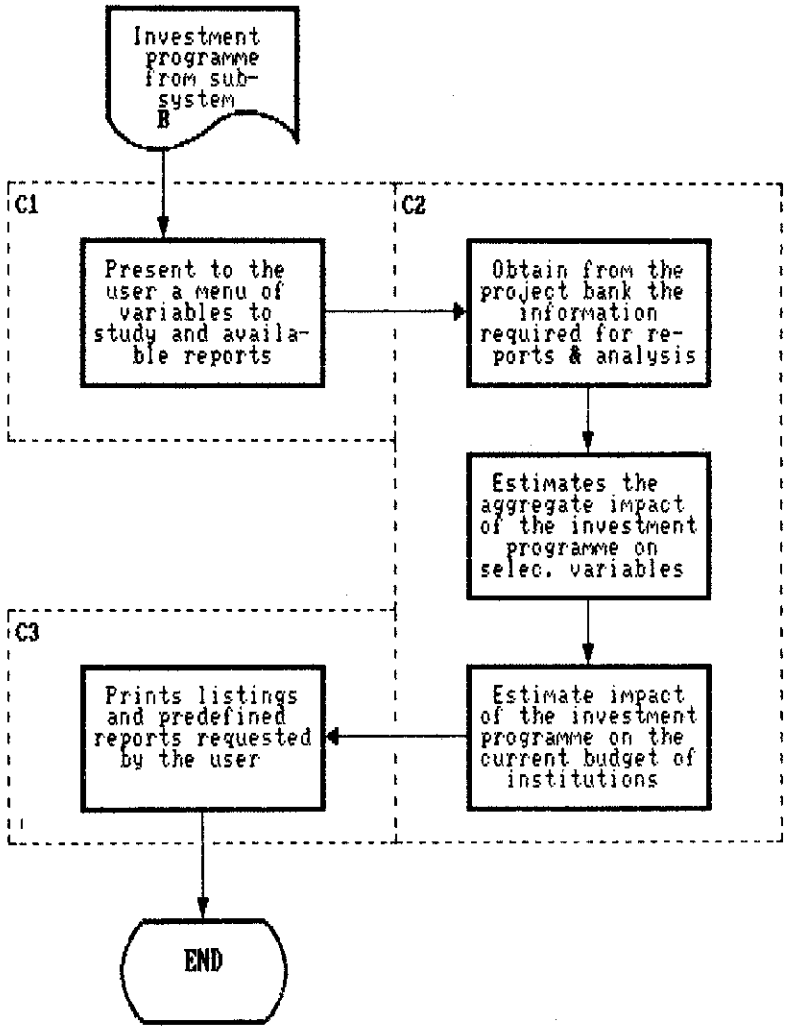


FIGURE 10

FLOW DIAGRAM OF THE OPERATION OF THE SYSTEM FOR DEVELOPING INVESTMENT PROGRAMMES



The system also requires information about the number of evaluators participating in the preparation of the investment programme. This information is for creating the files for registering the scores given by each evaluator to each project with respect to each objective.

Once the files are created , the system requests the definition of each one of the objectives and the allocation of weightings to them, which should add up to one. Once this step is finished, it obtains from the project bank information relevant to the projects which are awaiting financing (A2). This information basically includes:

- Title.
- Description and justification.
- Estimated cost.
- Financing calendar.
- Sector and subsector to which it belongs.
- Financial institution responsible.
- Indicators such as employment generated, NPV, IRR, etc.
- Geographical location.

Part of this information will be used in the following stages. The rest, which is optional informs the user about the basic characteristics of each of the projects to be evaluated. Undoubtedly, such information constitutes only a memory aid, since the evaluator needs a much fuller knowledge of the projects.

Once this initial stage of preparing the system is finished, the stage of allocating scores to the projects (A3) follows. For this, the system presents the evaluator with a project and an objective, asking him to indicate if the contribution of the project to achieving the objective is low, adequate or high. Once this task is achieved, it presents the second objective and thus, successively, until the project is classified according to its contribution to each one of the objectives of the investment programme. The second project awaiting financing will be considered in the same way and thus, successively, until all the projects have received a preliminary classification.

The next task of the evaluator is to fine tune the previous classification. For this, following the same order described above, the

evaluator classifies the projects in new categories which depend on the classification given to each project in the first round (see scheme on page 21).

Once this stage is finished, the system generates a file with the classifications obtained and gives the user the possibility of making any adjustments he considers necessary.

Thus it is clear that the number of objectives considered should not be large, since each step would become extremely tedious, compromising the quality of the information obtained.

In the case of several evaluators, the procedure is repeated for each one of them.

Once the system has all the information above indicated, it proceeds, at the request of the user, to calculate the score obtained by each project (A4). This requires, as indicated in the discussion of the methodology to be used, that each of the categories be given a specific value.

The average weighted score of each project is calculated by multiplying the score with respect to each objective by the weighting of the objective and then adding these partial scores. When more than one evaluator participates, the scores assigned to each project by each one of the evaluators are added and divided by the number of evaluators participating in the process. On the basis of this final score, the projects are ranked in descending order.

When this process is finished, the stage begins of determining an investment programme which is based on this ordering and takes into account the sectoral and financial limitations. The repetitive process followed is detailed in figure 9 which shows in the operation of subsystem B described above.

The first step (B1) consists in registering the various budgetary limitations. The user is asked to indicate the maximum investment limits for each sector of the economy defined in the project bank and for the different geographical areas and investing institutions. Moreover, the system must know the limitations of the different available financial sources with respect both to the total amount of resources and the type of projects which each source finances.

The following step consist in obtaining information from the project bank about those projects which are in progress and represent financial commitments for the following budgetary period (B2). This must be done before beginning the selection of new projects to be included in the investment programme since it is necessary to discount the resources required for finishing the projects in progress from the resources available for the following budgetary periods (B3). In any case, the system should show the user the investment commitment programme, so that a discontinued project can be withdrawn.

The next step consists in allocating financing to the projects (B4). The process begins by taking the project with the highest score. The system identifies the sector to which the project belongs, its geographical location and responsible institution. On the basis of these characteristics it verifies that financing is available and that none of the pre-established limits has been exceeded. If this is so, it assigns financing to it and includes it in the investment programme. Next it increases the amounts assigned to the sector of the project, to the region in which it will be carried out, to the institution which will finance it and the total amount of resources employed.

If the financial source selected in the first event does not have sufficient resources for the project, the system identifies alternative sources. If there is no alternative source from which the project can be financed in the present budgetary period, it is postponed and becomes a candidate for financing in the following period.

Also, if it surpasses the limit of resources allocated to the sector, the region or the institution, the project is postponed for a future budgetary period and the procedure continues with the following project.

The procedure continues until all the projects processed which seek financing for the next budgetary period have been processed. Then it is repeated for the following budgetary period with those projects which were postponed, as well as those which are expected to apply for financing in the following year. The process ends when programming has been completed for the years desired or when there are no more projects to programme.

When the allocation of projects to the various sources of financing is completed, a tentative investment programme exists. This is presented to the

user through lists which indicate the projects included in the investment programme with their corresponding execution and expenditure calendar indicating financial source. The system also provides the investment totals by institution, sector, and geographical region, as well as estimates of the macroeconomic impact of the investment programme. On the basis of this information the user can study possible modifications to the investment programme. In the event there are modifications, the system allows indicating which project should be entered to the programme and which withdrawn.

Once the desired corrections are made, the system generates a second investment programme. This procedure is repeated as many times as necessary until a definitive investment programme is obtained.

B. INFORMATION TO BE REGISTERED IN THE SYSTEM

With respect to the files required for managing the information it can be indicated that a file is needed which contains the basic information on the projects seeking financing. The variables to include in this file are:

- Project code.
- Project name.
- Description and justification.
- Financing calendar.
- Geographical location.
- Sector and subsector.
- Institutions responsible for the project (financial, technical, etc.)

Also, for the preparation of reports on the impact of the investment programme, it is necessary to add to the file the main indicators of the projects such as:

- Employment generated, by qualification level and year.
- Saving/generation of foreign exchange by year.
- NPV.
- IRR.
- Population benefitted.

This information could be presented to the user to help in allocating scores. It can also be used for establishing cut-off points or minimum levels

which the projects should achieve to be acceptable. The information can be entered directly to a file or, alternatively, obtained from a project bank. If a high integration of the software to be developed with the project bank can be achieved, the need could be eliminated for a file such as described, the necessary information coming directly from the data base of the project bank.

A second file is required for registering the scores assigned to each project with respect to the various objectives. This file should include the following variables:

- Project code.
- Name or code of the evaluator.
- Score of the project with respect to each one of the objectives.
- Total score of each project.

A prerequisite for completing this file is the definition of the objectives and their weightings. This information is registered in a file which contains:

- Name of the objective.
- Description of the objective.
- Weighting assigned to the objective.

Information will also be necessary about the restrictions on resource allocation. This could be by geographical area, by institution, by sector, or by availability of funds by financial source. To register and use this information four files will be necessary, registering:

1. - Financial source.
   - Budgetary period.
   - Available resources.
   - Resources assigned to projects.
   - Stages in the cycle of projects financed by the source.
   - Sectors in which the source finances projects.
2. - Region.
   - Budgetary period.
   - Investment limit for the region.
   - Investment allocated to the region.

3. - Institution.
   - Budgetary period.
   - Investment limit of the institution.
   - Investment assigned to the institution.
4. - Sector (or subsector).
   - Budgetary period.
   - Investment limit for the sector or subsector.
   - Investment allocated to the sector or subsector.

On the basis of this information a file is prepared describing the investment programme obtained, including the following information:

- Project code.
- Financial source.
- Budgetary period.
- Amount to be invested.

In the case of projects which receive financing from various sources, there will be a register for each financial source.

Finally, it is necessary to have a file which details the projects which did not receive financing and the reason for this. The variables required are:

- Project code.
- Financing required.
- Limit surpassed.
- State of the limiting variable when the project was considered.

C. INPUTS AND OUTPUTS

Having defined the basic files of the system, we can define the screens for capturing information and consulting it and the lists and reports generated.

For the capture of information the following screens can be defined:

Screen 1: This screen asks the user to define the objectives. Therefore it presents a number for the objective and the user indicates its name, description weighting.

Screen 2: This screen is for capturing information relevant to the financial limitations to the investment programme. It will serve for specifying the investments limits by institution, sector (or

subsector), region, and financing source. It includes fields for the name of the region, sector, institution, and source, for the budgetary period to which the limit refers and for the maximum and minimum amounts of the limit.

Screen 3: The purpose of this screen is to provide the user with the basic information about each project and request the classification of the project with respect to a specific objective. It presents the name of the project and the description of the objective. It could also make available, at the request of the user, the description of the project and eventually a screen with its main indicators. It also includes a field for registering the classification given by the user.

As for the output of the system, the main lists and reports which it provides are:

- A list of objectives considered including their descriptions and weightings.
- A report on limits fixed by sector, region, institution, and financial source.
- A list of projects included in the investment programme classified by institution, sector, and region.
- An investment calendar of the programme broken down at the project level.
- A list of projects considered indicating the score obtained by each one.
- A report which indicates the "shadow prices" in terms of project scores, of each of the limitations imposed on the preparation of the programme.
- A report on the aggregate impact of the investment programme on selected variables.

Chapter 6

FINAL COMMENTS

The design presented here is a new contribution of the Institute to the development of support instruments for the work of planning offices at the national, regional, departmental and municipal levels. It also contributes to

the goal of the Area of Advisory Services Programme of developing the theme of fiscal resource allocation.

However, this design is only an intermediate step. The ILPES Area of Advisory Services Programmes intents to use it as a basis for the development of software for ranking projects and investment programming. This software will be developed in successive stages. In the first phase, software will be developed for testing the viability of the methodology and making the adjustments suggested by its practical application. This first version will not necessarily perform all the functions and facilities suggested in the design. It will include only central aspects necessary for studying its viability.

If the pilot experience is positive, the software will continue to be developed, successively and more thoroughly designing the functions and analysis instruments. This will be done without loosing the simplicity of operation and the flexibility of adaptation to the availability of information.

Work will continue on the conceptual development and the practical application of the methodology for ranking projects. An effort will be made to improve the identification of relevant indicators for each type of project and the determination of the weightings of each one of those to guarantee an efficient ranking of the projects according to their socio-economic returns.

On the other hand, methodologies for decision-making on the sectoral and spatial distribution of investment resources will continue being developed. Software will be created to facilitate this task by using statistical information and considering the goals fixed by the government.

At the same time the integration of this system with that of macroeconomic projections will continue to be improved. This will result in a better relationship between microeconomic and macroeconomic aspects and investment programmes. It is hoped to be able to measure more precisely not only the aggregated impact of an investment programme, but also its effect on macroeconomic variables.

It should be pointed out that this ILPES effort at methodological development is for the sole purpose of better servicing the member countries. Therefore, all the methodologies and software developed will be

available to the countries which ask for them. Moreover, the Institute can provide specific advice on the theme to interested governments.

Lastly, it must be pointed out that good methodologies and useful and practical software cannot be developed without the contribution of those in each country who work on project ranking and investment programming. Their practical experience is an invaluable completment to the Institute's experience. Therefore, commentaries and suggestions on this document and those produced by the Institute and cited in this are strongly requested. Please direct all correspondence to:

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