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INDUSTRIALIZATION AND PRODUCTIVITY

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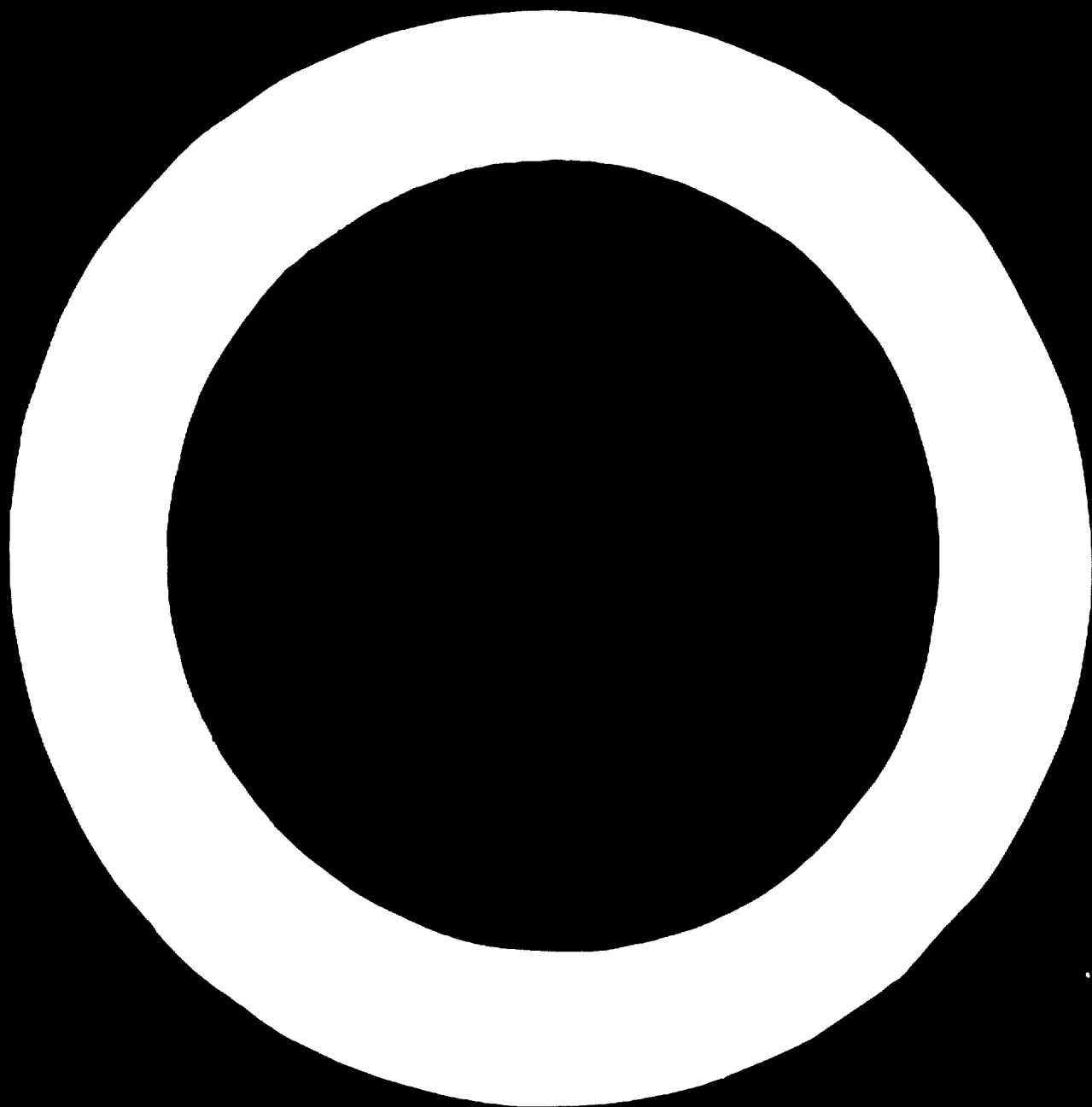BULLETIN No. 19

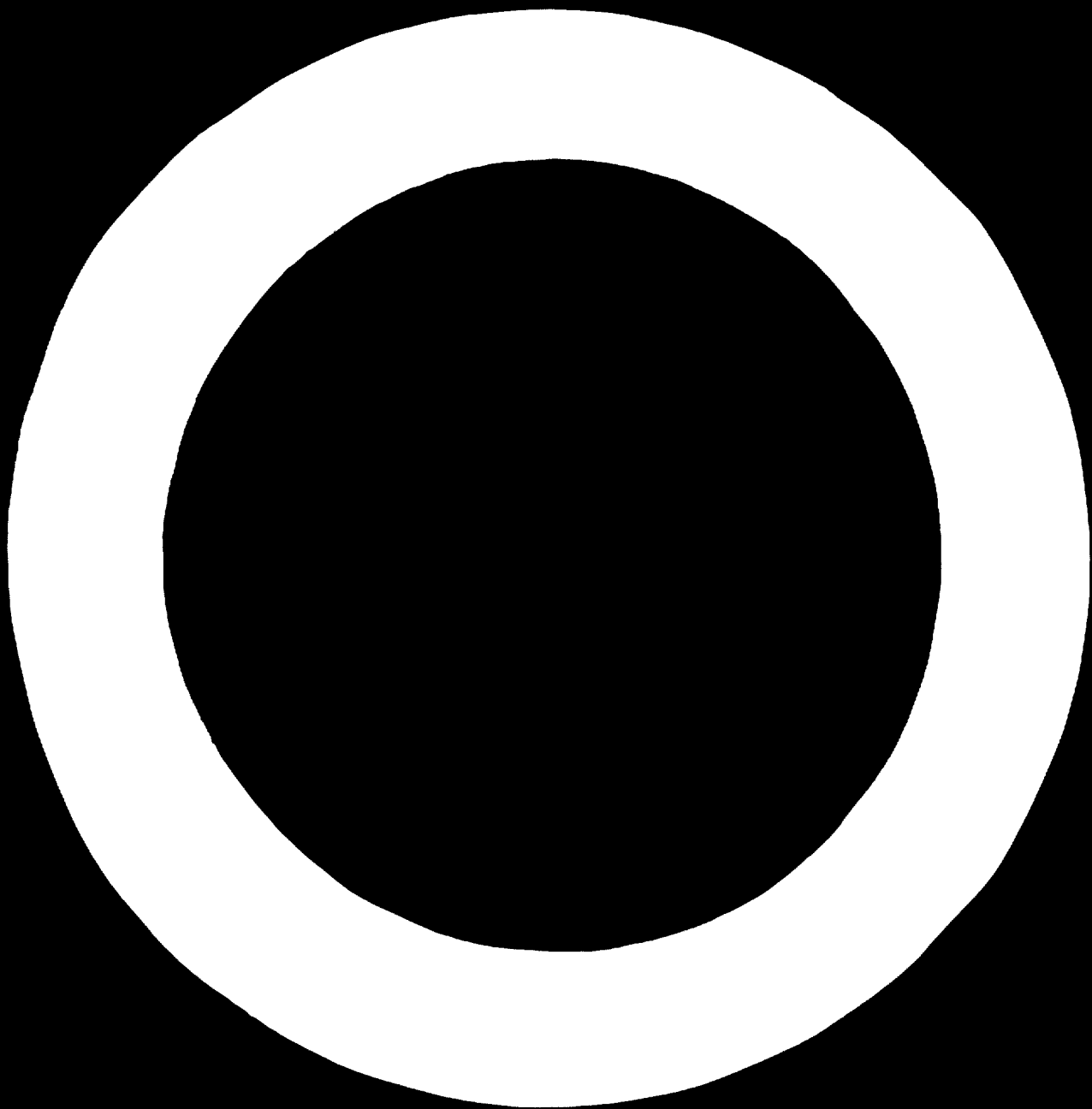UNITED NATIONS

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Preface

T HE PRESENT ISSUE of the *Industrialization and Productivity Bulletin* has been prepared in response to a number of requests received by UNIDO from French-speaking countries. We have attempted to provide articles and bibliographical commentaries which will meet the needs in question. We should like to draw the attention of our readers to the fact that this issue, number 19, appeared in French in September 1972 in order to respond to these requests as speedily as possible.

It would seem useful to review briefly our activities relating to the preparation and evaluation of projects, the subject to which the greater part of this issue is devoted. At the present time UNIDO is rendering assistance to some thirty countries in this field. The assistance is concentrated on one or several of the stages in the preparation and implementation of industrial projects described in the article prepared by UNIDO which appears in this issue (page 18). Experience has shown that there is a certain confusion regarding the terminology employed to describe the studies and documents required and regarding the order in which they should be prepared. This article attempts to introduce uniformity in the terminology and to facilitate an understanding of the whole process of preparation and implementation of projects.

The fundamental problem in the process of evaluating projects concerns the data, known as industrial programming data, required for this evaluation. The present issue contains an article prepared at UNIDO's request by Mr. J. Salmona, Director of the Observatoire économique méditerranéen of the National Institute of Statistics and Economic Studies (INSEE), at Marseille. This article describes the main elements of a data bank for planning purposes, the main stages in its creation and the way to approach the problem in a developing country. Subsequent issues of the *Industrialization and Productivity Bulletin* will deal with other aspects of the establishment of a data bank.

We should like to draw attention to the series of seminars which have been organized by UNIDO in several developing countries dealing with methods of evaluating industrial projects. The aim is to supplement the training of the technical personnel of different institutions in this field. The third article of this issue has been prepared by Mr. A. Bussery; both the paper on methodology and the case study constituted the basis for discussion at the seminar held in Tunisia in November 1971. The author proposes a method which is above all practical, although, according to him, it is not always perfect; he endeavours to remain realistic, basing himself on the resources likely to be actually available in a given country. The difficulties arise not only at the theoretical level but also and above all at the practical level, for example in connexion with the gathering of numerical data and the verification of

the hypotheses advanced. Mr. Bussery also stresses the very great importance of a profound knowledge of the general economic situation which will provide the context for a particular project. This is all the more important as it is not always easy to demonstrate that a project is worth-while from the point of view of the community; for such demonstration it is necessary to take into account the relationship between the selection of projects and general planning. In this connexion, it may be recalled that UNIDO regularly prepares systematic summaries of the industrial development plans of the developing countries. We take this opportunity to draw our readers' attention to the fact that a second volume in the series *Summaries of Industrial Development Plans* (UNIDO IPPD 54) appeared in December 1971.

We should like to announce also that the UNIDO study entitled *Guidelines for Project Evaluation* appeared initially in English in March 1972, in Spanish in December 1972; the French version will be published at a later date. Our next issue will include a summary of this study, following up the article in issue No. 15 entitled "An analysis of two approaches to project evaluation in developing countries". The latter article, by Mr. P. Dasgupta, a lecturer at the University of Cambridge, compares the approaches adopted by OECD and UNIDO.

The last part of this issue is also designed to meet the needs of a number of French-speaking developing countries. In view of the impossibility of providing articles on all aspects of industrial development, it seemed desirable to offer our readers some reviews of works recently published on industrial planning and policies. We hope that this issue will contribute towards a better understanding of the problems which have been brought to our notice or which we have encountered in the implementation of technical assistance projects. Of course, these articles cannot deal with difficulties of a specific nature; such difficulties call for a specific technical assistance project to be prepared by UNIDO in the light of the needs of the country concerned.

Main steps in the creation
of a data bank
for decision making

by JEAN V. SALMONA*

WHEN THE MANUSCRIPT *of this report was almost completed, the author received the report of the East African Working Party on Industrial Programming Data, prepared by the UNIDO secretariat independently of the present one.[1] The author gladly acknowledges the similarities between his report and that of UNIDO. Both are based on the same principles and use the same guidelines in drawing up a data-bank programme suited to the conditions generally prevalent in developing countries. Apart from style of presentation the main difference lies in that the description of the critical steps for data-bank building in this paper is not explicitly geared to the particular version known as the "industry file system" but is consciously based on the author's own experience with the INSEE Observatoire économique méditerranéen, Marseilles, France. On that score, this report deals with some elements that the UNIDO report on the industry file system ought to have covered in more analytical or clearer terms than it does.*

As in the UNIDO report, the author wishes to emphasize that a data bank does not necessarily involve sophisticated systems and big computers. The very purpose of the data bank is to make existing data from various sources more readily available to potential users.

During the past decade, several experimental data banks have been created in developed countries, mainly in Sweden, Norway, the United States, the United Kingdom of Great Britain and Northern Ireland, and France. They included: sectoral data banks for management, general data banks for national, regional and urban planning, intended for government or the benefit of private users. Some attempts failed, others succeeded. Both failures and successes facilitate conclusions as to what is to be done, and what avoided.

In relation to these attempts and conclusions, the author strove to analyse the general principles and other factors that must be taken into account when building up a data bank, and to draw up a step-by-step guide for effective action for establishment of a data bank in a developing country. The ideas expressed in this paper, as in the UNIDO report, are still of a very general nature; they must obviously be adapted to the specific need of every country, and to local conditions.

This report deals only with data banks for planning and decision making in regard to investments. The problem of information systems for management has therefore been put aside. One of the basic characteristics of information systems for making important decisions—those that form the subject of planning and are fundamentally different from management decisions—is that the information contained necessarily covers several sectors of economic activity, whereas a management information system is concerned with one sector only. For instance, the information for management of a transportation network

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* Mr. Jean V. SALMONA is the director of the Observatoire économique méditerranéen (INSEE), Marseilles, France. This paper was presented at the Expert Group Meeting on the Industry Files System and Other Data Bank Techniques for Industrial Programming, held on 16–20 November 1970 in Vienna, Austria. The ideas and opinions expressed in this report are those of the author and do not necessarily reflect the views of the UNIDO secretariat, nor those of the National Institute of Statistics and Economic Studies.

[1] The *Industry File System*. Provisional Report of the East African Working Party on Industrial Programming Data, Nairobi, Kenya, November 1969.

includes data on the existing public and private networks (daily traffic, vehicles utilized, workers employed). The information for transportation planning includes data on: population, utilization of transportation in various fields of activity and geographical zones, daily migration, etc.

The sets of data needed by various planning or decision-making centres are certainly not unrelated. Several cases may arise in a given country:

(a) An economic sector or certain body wishes to build up its own information system for decision making;

(b) The Government decides to create an information system (or network of information systems) for country-wide, regional, or urban planning;

(c) Several economic entities establish a common information system for planning.

Whichever the case may be, one can hardly overemphasize the merits of mobilizing information from different sources and creating a common information system for several sectors of economic activity and several decision-making centres. The present report deals with an information system for planning, open to any user. In some cases a partially closed system may prove useful. Although this report stresses the "needs of the users", it presupposes no particular organization of users and sources of information.

INTRODUCTION

DATA BANKS AND INFORMATION SYSTEMS

Definitions

Information system

AN INFORMATION SYSTEM is a logical organization of information elements intended to satisfy given needs. It comprises: (a) a set of information elements data concerning a person, a building, a block, an enterprise, a document, etc.; (b) the means for integration, retrieval, selection, processing and publication of this data.

An information system may be open or closed. If it is intended for the exclusive use of the bodies that created it, the system is closed (such systems are generally conceived for specific purposes: budget management, social security, taxes, etc.). If it is also available to other users, it is open.

Data bank

By definition, a data bank is an open information system. The sets of data of the data bank are known as files.[2]

A data bank is composed of the following elements:

(a) The basic files, known as data base: each file contains data on entities in the same category (persons, firms, etc.);

(b) A filing system that makes it possible to update the files, and to integrate data from different files, relative to the same entities. This involves identification of entities (e.g., industrial enterprises) by the same identification number for a given unit (e.g., firm) in all the basic cards;

(c) A data-processing system that allows users to extract relevant information from the files adopted to their needs and in a form suited to their decision patterns.

It will be seen below that these conditions generally imply the use of computers, but do not necessarily lead, at least at the beginning, to complicated and sophisticated information systems.

The data sources

Data may originate from two categories of source: (a) administrative management operations (see figure 1); statistical research operations ad hoc, such as polls and censuses.

It must be stressed that various projects put to work throughout the world have all clearly proved that a data bank for decision making must be fed information beginning with that obtained as by-product of administrative management.

In effect, administrative operations are of a repetitive and periodical nature. The data supplied as by-product are automatically and regularly updated, which is obviously not the case for a poll or a census. Moreover, it is generally exhaustive for the field to which they apply.

Further, practice shows that the cost of mobilizing managerial information for decision making is generally low and beyond all comparison with that

[2] These definitions are taken from: Regional and Urban Information Systems and Data Banks in the United States, Ferragu, Salmona, Timmell (INSEE) and Robequain (Ministry of Equipment), 1969 (France).

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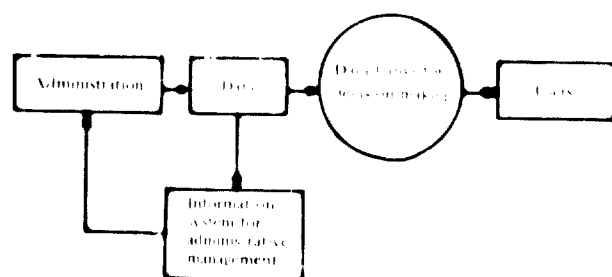
of a census or poll. Finally, administration of the law (taxes, social security, registration, etc.) ensures the desired degree of stability and regularity of record. Ad hoc inquiries should only be made when no information is available from regular administrative records.

Sectoral versus general data banks

A data bank may pertain to one given sector (e.g., industrial enterprises) or to several.

It has already been said that a management information system can be set up at sectoral level, but the data necessary for planning must cover many sectors.

Industrial planning (government or enterprise decision making) necessitates data on commerce and industry, manpower, internal market, foreign trade, etc. In fact, it requires several information systems, relating to different fields, which are necessary for decision making, though these decisions may only concern one field.

Data banks and their users

It should be always kept in mind that a data bank is not an end in itself. It is a tool, intended for certain users who are going to use it for certain purposes. This is why a data bank must be user-oriented (i.e., conceived in relation to the users' needs). This applies to the nature of the data to be collected, as well as to the systems proper.

Most failures that occurred in various countries were due to wrong initial orientation: the data bank was not adapted to the users' needs, and, consequently, the users were not served by it.

THE MAIN PHASES IN CREATING A DATA BANK

This part of the report is dedicated to technical analysis of the various phases involved in creating a data bank. Problems relating to a programme for setting up a data bank in a developing country are dealt with in the third part of this report.

The data bank must be conceived and organized in accordance with the users and uses for which it is intended. Before building up a data bank, it is therefore necessary to take stock of the users and their decisions, analyze these decisions, determine the data and conceive the systems that fit the structure of these decisions.

Inventory of potential users

Considering the economic and political structure of the country, it is first advisable to decide which of the following economic entities will be the users of the data bank:

Planners and decision makers of the central Government;

Regional and local administration (planners and decision makers);

Parliament;

State-owned enterprise;

Privately owned enterprises, both national and foreign;

Political parties;

Trade unions;

Research centres;

Universities.

For each of these groups, an inventory must be first drawn up of main types of decisions that use of a data bank may help to optimize. These decisions can be classified into categories such as:

(a) Location of a firm or cluster of firms (plant, industrial complex, commercial centre);

(b) Programming and locating public investment;

(c) Launching a new product;

(d) Defining a national education policy;

(e) General orientation of economic policy.

At this point, it is not necessary to go into details of geographic aspects of the problems, but it is essential to distinguish between different geographical strata of decisions: national, regional, communal, quarter, block level, etc. For instance, in a country where such investments are financed by Government, the decision concerning erection of a new school may involve several stages:

(a) First, at national level, definition by Government, of the priorities for various budget sectors and particularly for the different sectors of investment; specifically, determining school and university equipment budgets in accordance with the political objectives and data concerning the country as a whole;

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(b) Secondly, allocation of overall volume for investment in schools and universities by region, according to regional data (such as school-age population),

(c) Within each region, allocation of scholastic equipment by community, according to local data: school-age population, public transport network between communities, etc.

(d) Finally, in a given town, choosing the quarters and precise locations in accordance with infra-urban data

Construction of a data bank implies that the decisions, to be optimized by the data, must be ranked. The following method may be used to weight every decision.

A certain weight must be accorded each operation O_i (that can involve one or more decision makers; e.g., erection of plant generally implies at least decision of a privately owned enterprise, of central Government, and of regional administration). That weight may be ascribed either to the operation O_i as a whole, or to the decision D_{ij} of each decision maker J_i involved in operation O_i. In the latter case, a separate weighting must be assigned to the decision makers J_i on one hand, and to each decision maker J_i for each one of his decisions D_{ij} on the other.

These weights may be assigned, either technocratically by the builders of the future data bank, or by its future users themselves. In the latter case, a comparatively simple method consists of convening the users' representatives in a group and asking each and every one to assign a subjective weighting, from 0 to 10, for instance. After several successive rounds, a Delta type method will ensure convergence of the subjective weightings. As to relative weights of various decisions by a given decision maker, they may be self-determined (by representatives of the group if a group is involved by a similar method, between representatives of the same group).

If weights are thus separately assigned to the decision maker J_i (weight a_i) and by the decision maker J_i to the decision D_{ij} (weight d_{ij}), the absolute weight of decision D_{ij} for the whole is the product $a_i \cdot d_{ij} \cdot p_{ij}$.

If possible, a weight will be assigned to each decision by every decision maker (e.g., the decision of a privately owned industrial enterprise to erect a new plant). If this is not possible, a weight will be assigned at least to each operation (e.g., erection of a new plant, involving decision of privately owned enterprises, of Government, etc.).

Analysis of decisions and ranking of data

It is necessary to analyse each decision and determine what data are required for optimization.

The best method for this purpose is that of case study. Taking for each decision an actual case relating to a real decision to be taken or that has already been taken, the method consists in analysing the way the decision must be (or has been) taken and determining the information likely to optimize (or to have optimized) that decision.

The case study will be conducted for each decision with the participation of the decision maker concerned, who must be representative of the group to which he belongs.

These case studies shall then be used for purposes of response in group seminars (see page 14).

A separate list will then be prepared of the data necessary for optimization of each analysed decision (or operation). (The data are of varying importance in the weighting of decisions, e.g., knowing school age population is much more important than any other information for locating a school in a given region.) To separate the essential data from the inessential, each category is assigned a weight. Thus for a given decision D_{ij}, each fact I_k will be assigned a weight w_{ijk} that measures the importance of I_k in the optimization of D_{ij}. The product of p_{ij} times w_{ijk} gives a measure of absolute weight for datum I_k within the frame of optimization of decision D_{ij}.

The weights are, of course, to be assigned whenever given information is useful for optimizing several decisions D_{ij}. The sum $b_k = \Sigma_{ij} p_{ij} w_{ijk}$ measures the absolute weight of datum I_k for the community of users. The final result of analysis is a list of main data with a ranking by weight that measures their usefulness for all the potential users concerned.

Data to be collected and stored in the bank

The operation divides into two parts: *(a)* stock-taking of existing data and their availability; *(b)* selecting and programming, in accordance with the priorities calculated as indicated, the body of data to be fed into the bank and operations to be carried out in order to make these data useable.

Inventory of existing data

Sources of data: All available, summarised and collected elementary data are studied in this inventory. These data are of two kinds: *(a)* periodically and automatically updated data: by-products of administrative management; *(b)* data that are

not updated relating to fields where no updated datum is available: these are structural data, taken into account in the bank, if their usefulness does not decrease too fast with age (population census, transportation surveys, etc.).

The inventory for each administrative source of data will be drawn up as follows, for example:

(a) Tax administration:
  Revenues from households, balance sheets and accounts of enterprises and firms;
  Real estate data;
(b) Social security;
(c) Customs and foreign trade administration;
(d) Construction and public works administration;
(e) Administration of schools and universities;
(f) Internal trade administration;
(g) Agricultural and industrial administration;
(h) Public health;
(i) Local communities;
(j) Censuses and surveys.

If a central bureau of statistics or equivalent administration exists, the inventory must obviously begin with information already collected by that bureau.

Form of the available data. It is necessary to study the form in which every one of the inventoried facts is available: magnetic tape, punched cards, manual card files, books and reports, microfilm, etc. Attention should also be paid to potential data, i.e., data that will—or could be—produced by administrative management, but are no as yet.

Filed data. For each file, it helps to obtain:
  One copy of basic documents (if any);
  The format and layout of the record;
  The definition of the units (field);
  The codes (composition and definition);
  The geocoding: the manner in which the data are localized, postal address, block number, co-ordinates, etc.);
  Geographic levels;
  Frequency of updating;
  Accuracy: reasons for underestimation or over-estimation;
  Existing ways of processing these data (tables and lists) and frequency of processing.

Administrative forms:
  A copy of the form;
  The field;
  Geocoding;
  Geographical levels;
  Frequency;
  Accuracy.

Aggregated data
  Statistical tables: design, codes, definitions, frequency of production, etc.;
  Chronological series (e.g., production indices);
  Maps and graphs;
  Reports and other documents;
  Inventory of administrative facts that are the object of a record and might provide data.

Operations necessary for providing the required data

At this stage, the data to be stored in the bank have been chosen and provided with weights for measuring their usefulness. The inventory of existing data and their characteristics has then been drawn up. By comparison of these two lists, the operations necessary for obtaining the useful data in required form can be deduced.

In fact, the inventory of such operations may have already been made during the previous stage, but it is necessary to determine the very diverse costs of each of these operations. The cost of efforts needed for mobilizing administrative data already filed cannot be compared with that involved in obtaining new data, which entails creation of forms, and possibly a change in administrative organization. This is why it is necessary to compare efficiency of various data (measured by weighting) and the cost of action necessary for determining which data should be first mobilized.[a]

First category of preliminary operations: geographic files and registers. The data necessary for preparing a given decision will generally be obtained by statistical processing of individual data merged at the level of the individual, i.e., at the level of the basic entity (person, enterprise, premises, etc.). It will thus be necessary to merge data relating to enterprises from tax authority files, trade and customs files and other files (files if electric power companies, etc.). Integration must obviously take place at the level of the basic unit, i.e., at elementary level, even if only data aggregates are wanted from the elementary data. It is therefore very important that the basic units be common to all the files considered. (For instance, if the basic unit is an enterprise whose establishments are all in the first file, whereas the second contains only state owned establishments, no integration is possible.)

[a] Assuming c_k to be the cost of obtaining the datum I_k whose absolute weight for the users' community is h_k $(h_k = \Sigma_j p_{kj} w_{kj})$. The data are classified in the decreasing order of the $\frac{h_k}{c_k}$ ratio $I_1, I_2, \ldots I_i, \ldots$ and mobilized in this order of priority. If the total available budget for the mobilization programme is S, the data $I_1, I_2, \ldots I_i$ will be mobilized like:

$$\frac{h_1}{c_1} \quad \frac{h_2}{c_2} \quad \ldots \quad \frac{h_i}{c_i} \quad \text{and} \quad \sum_{k=1}^{k=i-1} c_k < S, \sum_{k=1}^{k=i} c_k > S.$$

All the basic entities such as establishments, enterprises, persons, premises, state-owned equipment, must bear the same identification numbers in every file (or, at least, bi-univocal corresponding identification numbers).

The preliminary operation that mobilizes data from elementary files consists of ascribing the same identification number to a given unit in all files. Such numbers are assigned at birth (or change) of the unit and recorded in a register which is a file listing at least the invariable characteristics of each unit, with its identification number and, generally, with data concerning its location. For instance:

(a) **Register of persons:**

Identification number;
Date and place of birth;
Name and identification number of parents;
Address (land registry plot number, postal address, etc.).

(b) **Register of firms:**

Identification number (which automatically indicates the enterprise to which it belongs);
Location (postal address, number of plot or district);
Type of establishment (plant, offices, etc.).

(c) **Register of blocks (in a city):**

Identification number;
Streets delimiting the block, and house numbers along each street in the block.

There are two kinds of files according to the type of entity:

(a) Economic entities (persons, firms, premises);
(b) Geographic entities (cities, quarters, blocks, plots, etc.).

The files containing geographic entities are known as geographic files. The problems of correlation between economic and geographic files, i.e., the problems of geographic location of economic units, are examined below.

Once the problem of the identification number is solved, it is advisable to choose data-storage techniques. Various operations can then prove necessary, dependent on the nature of the data:

(a) Filed elementary data:

Identification by number;
Change of format.

(b) Unfiled elementary data selection from among various filing techniques:

Card punching;
Direct recording on tapes;
Optical scanning.

(c) Collated data-selection from among various storage techniques:

Microfilm for the data not processed;
Computerization for processed data, such as that concerning all units in a region, a city, etc., that will undergo various treatment (updating, calculation, collation, etc.).

Second category of preliminary operations: administrative and periodical problems. Operations on information involve operations with information sources. It is not always easy to obtain communication of data from one administration to another. Confidential problems often provide excellent excuses for not releasing requested information. It is even more difficult to obtain a change in data characteristics, or even in administrative procedures for data production.

This problem is studied further on, along with some other political problems of a data bank (see page 16).

The operations that involve intervention of the originating administration are of several kinds:

(a) Modification of nomenclature used for classifying entities (e.g., adoption of the standard international classification for industrial establishments);

(b) Modification of existing administrative forms to obtain new data required for planning decisions of the data-bank users (e.g., modification of income tax returns in order to obtain data on household equipment);

(c) Recording of administrative operations by means of new forms that never existed before (e.g., obliging any person that leaves the country to fill in a form);

(d) Creation of a new administrative operation for recording required data (e.g., recording of sales of land and premises).

Production of additional data: censuses and surveys. Censuses and surveys must as far as possible be avoided because of high costs and lack of automatic updating. They are, however, to be resorted to in the following two cases:

(a) Important fields in which there are no available data (e.g., population and employment, if there is no population register);

(b) Elaboration of a data base in a field where administrative files provide periodic updating, but the base is missing (e.g., if administrative operations provide a monthly record of new buildings, it is necessary to make a census of the buildings that exist at a certain moment, in order to have a permanently up-to-date file of buildings).

If part of the required information pertains to one of these two cases, a census or survey should be organized and its cost evaluated:

(a) A census, if necessary to elaborate a complete base for a file system (building files, population files, etc.);

(b) A survey, if necessary only to obtain average characteristics (survey of household consumption).[4]

A survey can sometimes be conducted by partial processing of existing census data that contain the necessary information. For instance, if the population census questionnaire contains questions on household equipment, processing of a random sample will be sufficient to obtain satisfactory average data on the equipment of various household categories.

The information systems and the data bank

As we have already seen the data bank consists of information systems comprising: (a) the data; (b) the means for updating, examining, processing and publication of these data.

The systems must be able to evolve, i.e., progressively develop and become more efficient as the mass of data and the budget increase. The starting point must be neither complicated nor sophisticated, but a simple system that rapidly makes the available data usable.

The systems described below are the most general for any data bank. The various stages, which extend over several years, leading to a complete data bank will be examined in pages 15-17.

It has already been seen that data to be stored in a data bank can be classified into two categories: (a) elementary or summarized data that must be frequently processed and updated. The storage of such data must facilitate its processing: magnetic tapes or disks, even punched cards for a start; (b) other data, such as statistical tables, economic accounts, models, for which the most important problem is not processing, but retrieval (e.g., retrieval of all information relating to a given field).

These data are to be stored, if possible on microfilm; they must be described and examinable in a documentation system.

A data bank thus contains several information systems: (a) elementary information systems, from among which it is possible to distinguish between the elementary file systems and the summarized file systems; (b) collated data systems, including a documentary retrieval system.

Elementary information systems

The elementary data to be stored in the most general data bank intended for several categories of users are as follows:

(a) Data concerning persons: data on working persons, employment, available incomes, etc. can be derived from them. The data concerning households are summarized data that pertain to this category;

(b) Data concerning establishments: the data on the establishments of a given sector (sectoral data) as well as the data concerning enterprises (i.e., all the establishments of each enterprise), which are summarized data, pertain to this category;

(c) Data concerning buildings and public works: e.g., data on premises, roads, networks, etc.

Elementary files. An elementary file contains data on the indivisible element of a given category (person, firm, premises, etc.). The merit of an elementary file system lies in that it allows merging of data from different sources, relating to the same element.

It has already been said that different data concerning the same element (e.g., a firm) can only be integrated if that element is identified by the same number in the various files. It is therefore necessary to build up a register containing at least the invariable characteristics of each element and its identification number.

The various elementary files and the means of updating, retrieval and processing constitute the elementary data systems. Some of these systems can be partial, such as: information systems on students, industrial establishments, dwellings. There can be two ways of processing these files: (a) retrieval and extraction of elementary data (concerning a person or an establishment); (b) processes that provide collated data.

As a general rule, even if the laws of the country prohibit disclosure of elementary data, such files must be kept in the data bank to provide users with collated data suited to their needs, because updating is also generally done at the elementary level. If the data are classified, then only statistics are supplied to the decision makers. The problem of classification must be solved technically by provision of adequate keys to control access to elementary data. Individual liberties mainly require that repressive authorities (police and tax collection) have no access to elementary files of other authorities. Nevertheless, the co-operation of the originating administrations in the

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[4] E.g.: a survey provides data on household consumption of each product, according to the socio-professional category of the household. The population census gives the social and professional structure of the population in any zone. These two sets of data are sufficient for providing an acceptable estimate of household consumption in any zone, and certainly for studies of transportation, market, etc.

data bank can only be obtained if these are directly interested in the existence of the bank and it facilitates their management. This implies that each administration must therefore have access to individual data originating from other administrations, provided it is not classified. A data bank for decision making must therefore be accompanied by a network of unclassified individual data, at least between administrations. In addition, this organization entails an immediate advantage for those administered: this individual data communicated to all administrations could be collected just once, by that administration in the best position for so doing.

Summarized files. Elementary data can be collated into summarized data, i.e., into data concerning grouped units, such as a household file derived from the file of persons, a file of enterprises derived from the file of firms, etc. Many administrative files in fact refer to collated units: tax files on enterprises, registrar's files on households, etc.

Geographic location, correspondence files, and summarized geographic files. Geographic location is a characteristic of the units of a file. This characteristic plays an important role, mainly in so far as it concerns urban and regional programming and planning, and location problems.

It must therefore be stressed that: *(a)* any entity (establishment, person, etc.) in an elementary file must have a geographic identification (address, etc.); *(b)* it is essential to build up reference files between different geographic identifications (address, number, etc.) unless a unified method of location has been adopted by the administrative management as a whole.

The files, collated at a given geographic level (block, community, etc.), are most useful statistical files in decision making on problems of location. They are easier to handle than elementary files and raise no problems of confidentiality.

It must be noted that updating of geographic and reference files is very difficult, especially in a country where land use evolves rapidly, as is often the case in developing countries. Administrative procedures for updating geographic units must be very carefully devised. The best recommendation that can be made is to set up a geographic index of land (at the level of the plot parcellation), accompanied by a building register and to adopt the same units of address in the administrative files.

Collated data, appended file, and documentation

Collated data. These are: *(a)* statistical tables; *(b)* chronological series; *(c)* other data, such as national audits, input-output tables, maps, graphs, etc.

This information should be stored on microfilm. Each piece of information is identified by an index number. It is highly advisable to index the collated data in a system for automatic documentation processing (see "Documentation" below).

Appended file. It is essential to know the exact definition, accuracy and limits of application of each datum. The whole of this "information about information" constitutes a general appended file.

This file is composed of collections of information relating to various collated data and to elementary and summarized files in the bank. Each type of datum contained in the bank has a corresponding set of appended information: definition of terms, nomenclature used, accuracy of information, and other elements likely to be of help in intelligent use of the data. The general appendix file must also be stored on microfilm (microcards).

Documentation. Reports, maps, graphs, etc. that may be useful to the data-bank users can also be stored in the bank. Here too, microfilm is the most suitable form for these elements of information.

An automatic rather than a classical system of documentary research is strongly recommended.

Information retrieval

For classifying data stored in the bank and permitting retrieval and identification of those that are helpful in solving a given problem, a documentation system must be instituted. The documentation system is composed of the following elements:

(a) A general description file containing a description of each element of the bank:

Pattern of each elementary file;
Pattern of each summarized file;
Collated data;
Documents.

(b) The means for systematic retrieval, in the file, of the information elements relating to a given problem.

Classical manual systems should be proscribed as inefficient. The system chosen may be simple (e.g., KWIC) or sophisticated, such as the French system SPHYNX (INSEE).

These possibilities will just be mentioned here, without going into details. Actually, this system of documentation processing is not the most important part of the data bank. Obviously in a developing country, its creation cannot be envisaged during the first stages of building up a data bank.

Figure 2

ORGANIZATION OF A DATA BANK
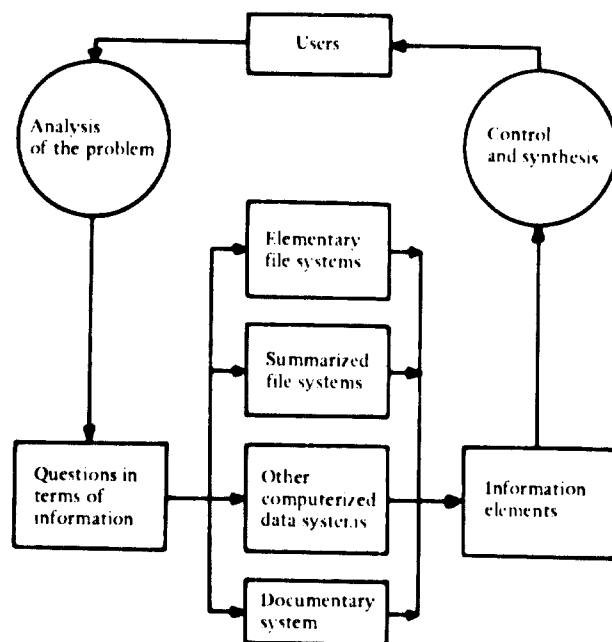
Entries in the system

The elementary and summarized files are updated by means of administrative files. The best method is to send each administration's updated files periodically to the bank. Two cases may arise: *(a)* the administrative files are readily convertible into the system's files (with a change in format, if necessary); *(b)* the data of the administrative files are used for updating the system's files. This updating involves the use of the basic records and the corresponding files.

When the bank's files are computerized and the administrative files are not, the bank must computerize the data intended for updating of its files. This calls for the devising of adequate entry procedures (by means of punched cards, data recording on tape, optical scanner, etc.).

Software

The bank's software comprises the following different modules:

(a) Updating of elementary files on the basis of administrative files, records and correspondence files (and updating of the correspondence files and records themselves);

(b) Creation of integrated files starting from two or more elementary files, on the one hand, and the correspondence files and records, on the other;

(c) Creation and updating of summarized files and most especially of summarized geographic files;

(d) Creation of derived files (e.g., a file of students starting from personal files);

(e) Examination of elementary and summarized files, and processing of their data. Corresponding publications. Many types of investigation must be possible:

(i) Retrieval of a unit in an elementary or summarized file (e.g., the characteristics of a given establishment) and computation combining these characteristics (e.g., ratio of two characteristics);

(ii) Statistical tabulation starting from an elementary file;

(iii) Retrieval, in an elementary or summarized file, of the units meeting certain requirements as to one or several characteristics;

(iv) Collation, in a summarized file, of data concerning a group of units (e.g., data on a given zone in a city, based on data on the blocks that make up that zone);

(v) Various computation and processing, such as statistical analysis, factoral analysis, classification, estimation of parameters of a model, etc.

The size and number of files, number of users, and necessity to rapidly satisfy widely different users make it impossible to have a special programme prepared in advance for each processing. This is why it is essential to resort to new techniques, by which the computer itself produces the required programme, based on simple instructions that can be combined with each other. The best solution is for the computer to write out the instructions without the aid of a programmer. This implies that the language of the instructions must be user-oriented.

(f) Publication of results in a form adapted to the users' needs involves listings, graphs and automatic mapping, and issue of results in informative forms (e.g., magnetic tapes);

(g) Finally, problems of data-bank programmes in different countries may be similar. Thus it may be possible for a country to use software written in another country.

In the field of software, there are wide possibilities for international co-operation and co-ordination, which will mainly benefit the developing countries.

Hardware

The hardware must obviously be chosen as a function of the systems. For instance, the volume of files determines the type of memories to be used. The two main factors affecting selection of hardware are: *(a)* the bank must be able to use

the administrative files; *(b)* utilization of a data bank eventually implies telemetering and installation of terminals, to facilitate direct utilization of the bank by those who are not located close to the computer. Shared time will reduce cost of management of terminals at a sophisticated stage of the data bank.

It is not absolutely necessary to have real time access to files, at least during the first stages.

Software supplied by computer manufactures seldom satisfies the needs of data banks. They are too general and too heavy. Therefore, software available from computer manufacturers should not be taken into account when selecting hardware.

Permanent connexions with users

Whether in the public or private sector, the users of a data bank are rarely in a position to use the information systems of the bank directly for the simple reason: they are not completely aware of what the bank possesses and can do. It is always necessary for a team of specialists to analyse problems raised by the user and translate in terms of questions to the data-bank systems. They must be able to help every decision maker in choosing models for preparation of decisions however simple (indicators, norms) and in determining the type of data that suits the model. It is these specialists that must therefore be familiar with information stored in the bank and with the possibilities that the bank's systems offer the users. They must be capable of using these systems themselves, without programmers. Finally, they must be capable of choosing from among the data relating to a problem and of preparing a synthesis of information elements for the decision maker.

It must be remarked that no machine can do this work, and this team is the most important human element of the data bank.

Relationships with users present two important aspects: first, the systems of the data bank must suit the needs of the users; second, economic agents, potential users who have so far never had recourse to organized data assembled explicitly for decision making, must be encouraged to call on the bank.

These two problems can be solved effectively by organizing of group seminars for each specific category of users. How to make a case study has already been shown; for every category of important decisions of each user group, an actual decision of an existing economic agent, representative of the group, is analysed and the decision model and the two corresponding situations are established. The information is extracted from the bank and combined by means of the model. The results

are discussed with the agent concerned who reaches conclusions and makes his decision. The whole constitutes the case study. A seminar can thus be organized for a group of a few decision makers having similar decision structures. The seminar has two purposes:

(a) Testing the case study by collective psychoanalysis by the participating users, assisted by the seminar leader, who react to their colleague's exposé and that of the bank team. Thus the analysis can be amended and it can be determined whether the case study can be generalized. Moreover, the reactions of participants may reveal needs for information that have not previoulsy been identified.

(b) The seminar tangibly demonstrates how the data were used for preparing decisions, and what lessons can be learnt from each example. This second purpose is very important. In fact, when the data bank begins operations, most potential users still have decision structures that prevent use of outside data. Of all possible marketing and publicity operations for the data bank, group seminars have proven the most effective.

For organizing seminars, the decision makers are divided into homogeneous groups, in so far as main decisions are concerned:

(a) Government;
(b) Regional administrations;
(c) Local communities;
(d) Parliament;
(e) Public and private enterprise:
Industry;
Distribution;
Services;
Banks;
Construction and public works;
(f) Political parties;
(g) Trade unions;
(h) Professional organizations of doctors, architects, etc.;
(i) Research centres and universities.

A case study is conducted with a representative of each group, by means of dialogue between the data-bank team and the representative. The case study comprises:

(a) Analysis of an important decision;
(b) Translation into the form of needs for data;
(c) Insertion of the data bank;
(d) Description of data to be used, and their value;
(e) Decision models to be used;
(f) Decision actually made, and its results.

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Experience teaches that such a seminar can be very effective when attended by a maximum of ten participants, for a whole day without break.

After the first seminar for a group has been held, and the validity of the corresponding case study has thus been tested, more seminars can be organized periodically, to gradually sensitize the whole group. Such seminars can be handled by a university, together with the professional organizations.

BUILDING UP A DATA BANK IN A DEVELOPING COUNTRY

General principles

Developing countries, and particularly their Governments and administrations, are in great need for economic data, more so perhaps than advanced countries. In fact, their central authorities generally have to retain much of the initiative in development matters and the cost of a bad decision is much greater than elsewhere: these countries cannot afford waste. This does not mean that every developing country should as soon as possible establish the most costly of sophisticated information systems; the starting point can be simple.

One thing is certain: all administrative-managerial operations generate data, and every country has administration (at least for collecting taxes). The by-product data of administrative management can rapidly constitute the data base for information systems open to many decision makers. No minimum development level is therefore necessary for building up a data bank for decision making in a developing country.

However, it must be stressed that the systems and structure of the bank must develop gradually and progressively. The data bank must evolve as a function of the basic economic structures (which are common in a developing country), along with the growth of available information and the changes in decision processes of the administrations concerned.

This evolution cannot be programmed. This is another reason for the data-bank systems to be operational from the outset, though the first stage may be rudimentary. The building of a bank must therefore comprise several stages, only the first of which can really be programmed. At each stage, the data bank must be usable operationally.

The organizations that are the source of data on one hand, and the users on the other, must be closely associated in the building up of the bank, from the very beginning.

As regards the source organizations, it must be stressed that legislative or regulatory measures, such as laws making communication of every administrative-management file to the bank mandatory, are not sufficient: technical competence of the source organizations and mainly their knowledge of the information that they produce and its limitations, are indispensable for operation of the bank. They must therefore be closely linked to the bank, by the detailing of members of their staff to the data-bank team.

As regards users, the need for close liaison with the bank has been sufficiently stressed above.

Finally, the data bank should not entail additional constraints on the source administration, at least during the first years. This is a prerequisite for the bank's success. It is essential that the data bank does not meet any opposition, for it can only operate in close liaison with sources and users. Therefore: (a) if confidentiality is the rule of the country, it must be guaranteed from the onset; (b) no operation that might arouse hostility of an important group or body should be launched during the first years. New forms to be completed, launching of new surveys and censuses must be avoided, as far as possible, during the initial stage. The creation of the bank must appear to generate administrative simplification (the advantages in preparation of decisions are not obvious to all economic agencies, at least during the first years).

First stage: a pilot project

A data-bank committee must be created, comprising representatives of the administration charged with planning, all the source organizations (public or other), the central bureau of statistics, and the development corporations, financial institutions, banks, etc.

The Committee must control preliminary study and see that an appropriate study team is constituted and organized. The team should include statisticians, economists, and programmers. Participation of international experts–mainly experts on data banks and developmental strategy–should be considered (if the aid of an international organization is required).

The preliminary study comprises two parts: (a) inventory of users' needs, analysis of their decisions in terms of data, and weighting of these decisions; (b) inventory of data that can be mobilized and cost of mobilization.

These operations have already been described (see page 7). At this stage, the study does not need to be a complete analysis of all decisions made by all decision makers, but only a rapid inventory of decision makers and their principal decisions.

Nevertheless, the objectives of the data bank must be clearly defined. The study must contain indications of attitude of the potential users toward the project, and on particular users who should be associated with the project from the outset.

The inventory of data sources and analysis of the information that can be mobilized have been outlined above. This study must assess actual possibilities for co-operation between existing information sources and an eventual data bank. This information will be taken into account in organizing the data bank.

Finally, a proposal for a pilot project: indication of operations to be carried out in setting up a pilot project that may help satisfy needs for information relating to preparation of decisions that have received a high weighting, by means of data that can be rapidly mobilized.

A pilot project must always precede building up of the data bank proper. This is necessary if the first stage is to be immediately operational, without too heavy a budget. The pilot project must be limited. It can take different forms, according to types of decision makers and the nature of rapidly available data.

There are two possible categories of pilot projects:

(a) A sectoral data bank: e.g., on industrial firms and investment projects (the industrial information system project proposed by UNIDO is a sectoral data-bank project); the project can even be limited within a sector: e.g., only to industrial firms with more than ten employees;

(b) A data bank for a limited geographic zone; e.g., a regional data-bank for a pilot region, the first information systems of which can be based on summarized geographic files.

Only data that can be mobilized, i.e. rendered usable without delay, should be taken into account in the pilot project.

It is possible to establish ranking of the necessary data, by its utility and the operations that make it available, as a function of cost. But it is not possible to calculate precisely the benefit accruing to the country from the use of a data bank. The profit will be shared by many users and will be more tangible over the long term than in the short term. A cost *versus* benefit analysis would therefore yield an illusory result.

Once the weights attributed to different users and the cost of mobilizing the relative information have been evaluated, the choice of the operations, in view of the given budgetary limitations, becomes automatic.

The pilot project having been launched based on rapid inventory of information effectively available and analysis of important needs of the users, it is essential for the project to become rapidly operational six months or a year after having been launched. Operation of the project makes it possible to check the analyses that have been made, the information and the decisions. It helps users of the bank and its source organizations to become acquainted with it. This bit by bit permits determination of whether it is possible to build a complete data bank in the country, and to make the stages of the second project more precise.

Various structural organizations may be envisaged for operation of the pilot project. Experience recently gained in several projects carried out (successes and failures) in developing countries leads the author to insist on an organization that is structured from the beginning, of the following type:

(a) National committee for the data bank a management council. The national committee controls the preliminary study and assumes responsibility for conclusions reached in this study. A pilot project is then launched. A law or regulation may be necessary from the pilot stage. The committee then officially becomes the management council of the bank.

(b) Association of users. The users having been divided into groups for the needs of the preliminary study (analysis of decisions), users' commissions (one for each group) are constituted from the groups involved in these analyses. A users' council is created, comprising a representative from each commission.

(c) Creation of the bank. Three solutions are possible:
i) The data bank is directly attached to a central administration that plays an important role in development (e.g., the Ministry of Planning);
ii) The data bank is a private body (e.g., a foundation);
iii) The data bank is integrated into the central bureau of statistics.

For a pilot project, the third solution may be convenient. The first would actually give precedence to governmental needs, thus leading to a practically "closed" bank. A private data bank runs the risk of not obtaining aid from the data-source administrations. The central bureau of statistics has a staff of information specialists and is already geared to respect personal secrets; all the agencies concerned will therefore trust it, in this respect.

The central bureau of statistics, which is traditionally a body for studies rather than programming of decisions, on the other hand, may lack creativeness and dynamism and require new staff to take charge of the data bank.

One risk to avoid is that of creating multiple, isolated sectoral data banks. Indeed, this solution would render co-ordination very difficult in such matters as identification numbers and selection of nomenclature. This is why the bank must be the subject of co-ordination between administrations. The management council (previously the national council of the data bank) can provide the basis for such co-ordination. Through this committee, each data source is able to control the utilization of data that it furnishes.

The staff of the data bank must include, at least: a specialist on each data source, who is familiar with the data supplied by the body to which he belongs and with the administrative operations that produced these data; economists and statisticians forming a team which analyses users' problems such as those that are posed to the bank, and conducts the case studies, if necessary; system analysts and data-bank experts, whose task is to define the bank systems; various technicians (programmers, multi-copiers, etc.); marketing specialists to promote use of the data bank; administrative personnel.

As for utilization of the computers, it has been said above that a computer is not indispensable from the very beginning. A computer can be utilized from the beginning only if the two following requirements are met: *(a)* available data to be integrated into the bank's systems have already been computerized; *(b)* computer time is available to the data bank in an administrative body. If the intention is to make the bank operational as soon as possible, a new computer cannot be used for the pilot project. If there is no computer in any administrative body, one can make do with punch-card machines for the pilot project. If a computer is utilized, only software that is readily available and functioning on that computer should be used.

After the bank has effectively functioned for six months to a year, the pilot project must be re-examined. Experience can bring alterations, and a second version of the pilot project can then be defined accordingly. The second pilot project can function for a period of one to five years.

Project No. 2

Project No. 2, which is the complete data-bank project, should be studied after several months of operation of the pilot project, by a team which worked on the pilot project. The preparatory study will cover different stages, such as those described in this report; it will include a complete inventory and analysis of all data mobilization which can be envisaged, as well as all decisions and decison programming and control actions for which the data bank will be called on for assistance.

This project will be divided into stages, according to technological and budgetary possibilities.

The conclusions of the pilot project will obviously be taken into account in the preparation of Project No. 2. Project No. 2 can start with the introduction of the primary modifications necessary in the second pilot project, followed by progressive extension of this project, in its new form, to other sectors of the economy (or to other regions, according to the type of pilot project that was chosen), so as to assure continuity of operation.

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The stages of preparation and implementation of industrial projects*

(CLASSIFICATION OF PRE-INVESTMENT STUDIES)

INTRODUCTION

PREPARATION OF A PROJECT can be seen as a series of interdependent measures in constant evolution: a process aimed at translating an idea into a collection of plans and figures, graphs and other information necessary for construction, testing and commissioning of an installation. The elaboration of a project undergoes a certain number of stages during which its various elements are prepared and examined in order to reach decisions, some of which require contractual agreements. The preparation of a project can therefore be seen as a series of activities culminating in establishment of a certain number of studies and documents which permit the taking of various decisions.

Projects are developed in a given institutional frame which determines their nature and the number of economic agencies likely to be interested in one project or another. Thus, the nature and sequence of decisions concerning viability of the project, its location and financing, approval of contracts, etc., will be determined by the policy of competent licensing authorities, the role of banks in economic life, the scope of legislative power delegated to local communities, etc.; the range and accuracy of information necessary for the taking of decisions in different stages of a project will also depend on its inherent characteristics: size, degree of complexity, sector, type of final product, etc. Therefore, any attempt to describe a typical process of project preparation comprising detailed classification of decisions to be made and thorough analysis of information required for that purpose would meet

with insurmountable difficulties. However, the process can be outlined by specifying main stages, their function, and the most common type of study (documents) used for each.

MAIN STAGES IN ELABORATION AND IMPLEMENTATION OF AN INDUSTRIAL PROJECT

The starting point of an industrial project is the setting of the objective to be attained, i.e., the belief that it is possible and desirable to manufacture a certain product or group of products, or to utilize certain resources. This belief can result from survey of existing industrial establishments, sectoral or interindustrial analyses, geological surveys, market studies, etc. It is often a response to a need that appeared within the frame of industrial development planning.

The process of preparation and execution of a project, following the determination of the objective to be attained, can be divided into stages and steps.

These steps have the following characteristics:

Preselection. A decision must be made as to whether it is advisable to conduct detailed study of the project and if so, to define the scope of subsequent studies. This requires ensuring that:

(a) The project is of sufficient interest on the technical-economic plane to justify detailed study, i.e., a feasible technical solution can be anticipated;

(b) The project conforms with the objectives of governmental strategy and plans.

The results obtained during this stage are compiled in a preliminary feasibility study. Inquiries are conducted by the investor himself or by a "fictitious investor" (promoter); the latter can be a development body, ministry, etc.

Once it has been ascertained that the project deserves study in detail, an investor must be found who is willing to carry it out (if promoter and investor are not one and the same).

Formulation. At this stage the various alternative solutions (technical, economic, financial and administrative) must be studied and the conclusions and supporting data presented in a systematic form. This is achieved by partial studies (of techniques, management, etc.) or complete studies (of technical economic feasibility) entrusted to a consulting engineering company, supplier, or potential foreign investor.

Evaluation and decision. A decision must be taken at this stage as to whether the project will be implemented, and to define its essential economic and technical characteristics. If an order of priorities exists, the project must be quantitatively assessed in terms of its ranking and priority.

Although formulation of the project already implies an assessment, the feasibility study and other preliminary investment studies must also be evaluated by the investor, or the body upon whose approval execution of the project will depend.

Contracting. At this stage, methods of implementation of the project must be defined by legal commitments (contracts). Negotiations must be conducted with several bodies to obtain official approval or conclude contractual agreements: with

banks on modes of financing, with Government on site and fiscal incentives, and with a consulting engineering company on technical supervision. The negotiations with suppliers of material and technical know how are equally important, bids must be evaluated, technical and commercial conditions fixed, and the necessary contracts signed. The signing of contracts establishes both technical procedures and the execution schedule.

Project designing, construction, and commissioning. Industrial installation must conform with technical specifications and time schedules specified in the contract. These steps comprise certain activities, such as preparation of plans and other detailed technical studies, construction drawings, site development, construction work, deliveries, erection, trials, etc. It should be noted that drawing up of contracts does not always precede preparation of plans and construction (e.g., in the case of turn key plants). In the other implementation systems, for instance open bidding for each group of machines, contracts are made in several stages. Since for reasons given below the present study does not deal with project implementation, the variety of possible systems for execution are not indicated here.

As to *investment promotion* in the strict sense of the term (i.e., activities aimed at ensuring financing of the project), these activities should follow preparation of the project and the decision to implement. Actually, it can start as soon as the interest of eventual investors can be aroused. In practice, this means activities can begin immediately after pre selection.
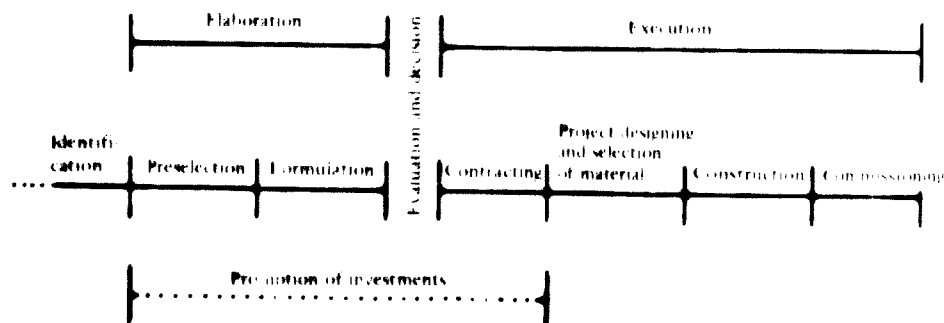
MOST COMMON TYPES OF PRE-INVESTMENT STUDIES AND INVESTMENT DOCUMENTS

It has already been said that research done for an industrial project and conclusions reached are compiled into a number of studies and documents that can be classified as follows:

(a) Pre-investment studies (elaboration stage);
(b) Documents concerning investments, execution (invitations to tender, bids, contracts, detailed

drawings, blue prints, construction plans, engineering studies, periodic work progress reports, trial reports, etc.).

In view of the fact that UNIDO assistance to developing countries is mainly given for the various stages of *project elaboration*, the present paper stresses pre-investment studies; as for execution, the paper only discusses tenders and loan application files, i.e. documents concerning the very first stages of project implementation.

PRELIMINARY FEASIBILITY STUDY

Stage: Preselection.

Expert or body to be charged with the study. An industrial economist (or engineer) with planning experience.

Object and content. The purpose of the study is to determine:

(a) Whether the objectives of the project conform with governmental policy;

(b) Whether the project, at first sight, seems to justify detailed study;

(c) What aspects of the project deserve special attention during subsequent research (market surveys, laboratory tests, etc.).

To permit decision on the merit of the project, the study must include:

(i) A description of the market (estimate of consumption, trends, present supply, price);

(ii) An outline of technological variants and information concerning availability of main production factors (mainly raw materials);

(iii) A provisional estimate (a profile) of necessary investment and cost of operation;

(iv) An approximate estimate of commercial rentability.

COMPLETE FEASIBILITY STUDY
(TECHNICAL AND ECONOMIC)

Stage: Formulation.

Expert or body to be charged with the study. A team of engineers and economists, preferably from an office for engineering studies specializing in the relevant field.

Object and content. The purpose of the study is:

(a) To assess the technical and economic viability of every project variant;

(b) To determine and evaluate in detail the optimal variant, and outline a provisional programme for implementation.

This study can be presented as follows:

(a) Specifications of the manufactured products (technical description, utility value).

(b) Market outlets and production:

Information on external and internal outlets and demand, assembled in a market study (see below).

Forecast production of the plant, itemized by year and product (or product group).

Steps to be taken to penetrate the market (price policy, sales organization, etc.).

(c) Technical data:

(i) plan of the plant:

Capacity (rated, maximum).

Technology and block diagram of operations.

Provisional arrangement of installations.

Basic equipment and machinery.

Breakdown of personnel, including management.

(ii) Operation:

Production factors (raw materials, power, water, spare parts, etc.) and their sources of supply.

Production: scope of manufacture and possibilities for diversification.

By-product utilization and waste disposal.

(iii) Construction:

Time-table of main operations and deadlines.

Personnel formulation and recruitment.

Available know-how and patents, technical assistance needs.

(d) Location:

Indication of the most important site characteristics.

Chosen location and its advantages.

Assessment of the site.

(e) Economic data (receipts and expenses in local and foreign currency, with mention of degree of accuracy wherever possible):

(i) Annual sales (on domestic market and abroad);

(ii) Annual profits and operating expenses:

Material cost.

Labour cost.

Interest.

Rent.

Indirect taxes.

Depreciation.

Administrative expense.

Profits before tax.

(iii) Equipment expenditure:

Fixed assets.

Working capital.

Miscellaneous contingencies.

(iv) Proposed financial structure:

Share capital.

Loans.

Suppliers' credit.

(v) Cash flow.

(f) Evaluation:

(i) Evaluation of commercial profitability:

Break-even point.

Amortization.

Return on total capital.

Profitability: return to share capital.

Net profit, actualized at the rate of discount prevalent in the market.

(ii) Analysis of cost and benefits of the project, in terms of the national economy:

Direct added value, and employment;

Effect on the balance of payments.

Income and expenditure effects.

Analysis of social costs and benefits (re evaluation of costs in terms of real prices).

In important projects, the general feasibility study is better preceded by separate studies of details of particular aspects. Several examples of partial studies at the stage of project elaboration are given below.

MARKET STUDY

Expert or body charged with the study. Industrial economists (or engineers) who have thorough knowledge of the product under consideration.

Object and content. Future demand for the product(s) should be assessed as accurately as possible, at least for the expected amortization period. The study must include:

(a) Analysis of past and present demand (consumption, in quantity and value, evolution of price, etc.);

(b) Analysis of sources of supply (local production, main producers, cost evolution, import, distribution channels and marketing);

(c) Estimate of future domestic demand (based on trend projections, analysis of end uses, and technical coefficients, international comparison, expected elasticity in demand, etc.) and export possibilities (information on absorptive capacity of the market of some countries; trade agreements in existence or likely to be concluded, etc.);

(d) Estimate of future production (projects in construction, projects in preparation);

(e) Projection of trends in effective demand per year (domestic and export) and an estimate of the project's share in these markets;

(f) Steps to take in order to ensure the forecast share of each market.

TECHNICAL FEASIBILITY STUDY

Expert or body to be charged with the study: A team of engineers and chemists specializing in the sector under consideration; laboratories, research institutes.

Object and content: Review of techniques (processes) that could be applied. This study involves:

(a) Description of applicable technological variants and conditions for their implementation (site, raw materials, power, water, public utilities, labour and management, patents);

(b) Study of availability of necessary production factors (physical and chemical properties of raw materials and possibility for using them in certain technological processes, availability of other essential production factors) with indication, if necessary, of location of sources of supply;

(c) Selection of technologically viable variants, including the following:

 (i) Main characteristics of the necessary equipment and machinery;

 (ii) Labour needs;

 (iii) Possible locations;

 (iv) Forecast expense on equipment for each variant.

STUDY OF THE SITE

Expert or body to be charged with the study: An industrial economist and a civil engineer.

Object and content: To evaluate comparative advantages to the investor and the national economy of the suitable sites from a technical viewpoint, and to recommend the most appropriate location. The study comprises the following:

(a) An estimate of equipment expense and operation costs entailed in the selection of certain sites (site acquisition and development, transportation of raw materials, fuel and finished products, water supply and sewage treatment, power supply, labour recruitment, etc.);

(b) For every location, an assessment of costs and advantages for the national economy. Costs: housing, expansion of tertiary sector and public services, environmental conservation. Advantages: creation of jobs, regional distribution of income.

EVALUATION REPORT AND DECISION

Stage: Evaluation.

Object and content: Conclusions of the evaluation report are sometimes presented in a written document of highly variable form, scope and content. This document can include:

(a) Remarks on questions dealt with in the pre-investment studies;

(b) Critical examination of forecast data and comments on the evaluation and recommendations contained in the pre-investment studies;

(c) A recommendation concerning the decision to be taken (or observations on the decision already taken).

INVITATION TO TENDER

Stage: Making of contracts.

Experts to be charged with the study: Consulting engineers.

Object and content: Specification of the technical and economic characteristics of the bid, as well as the form and nature of contractual commitments. The document comprises the following:

(a) Introduction (designation of investor, and consulting engineers (if any), definition of certain terms used, definition of type of contract, e.g.:

 (i) Lump-sum contract for turn-key job;

 (ii) Contract for services rendered by the home office of the contractor and material expenses, if construction costs remaining to be discussed;

 (iii) Fixed fee for services extended by the contractor's home office, the material expenses and cost of construction work remaining to be discussed;

 (iv) Cost price for services extended, plus (a) a fixed sum or (b) a certain percentage of the cost price.

(b) Description of project (extract of feasibility study):
  Production objectives;
  Technical data;
  Location;
  Economic characteristics;
  Time schedule.

(c) List of goods and services to be supplied by the contractor:
  Equipment specified in the appendix;
  Site preparation;
  Inspection of materials delivered to the site;
  Technical know-how (licences and patents to be provided, if necessary, by the supplier or contractor);
  Time schedule, specifying:
  Sanctions for delays or bonuses for work completed before deadline, duration of maintenance period following completion of work;
  Construction work (management, reports on progress of work, files for construction items, subcontracting, trials, etc.).

(d) Commercial clauses:
  Required format of contract;
  Pricing;
  Payment conditions;
  Guarantees (e.g., for design, efficiency, materials).

(e) Non-commercial clauses:
  Penalty clauses;
  Settling of disputes and recourse to arbitration;
  Applicable local laws and regulations (concerning labour, imports, etc.).

(f) Special instructions concerning bids:
  Time limits for bidding;
  Guarantee deposits, etc.
  Annexes:
  Specifications of machinery and materials;
  Physical and chemical properties of raw materials;
  Characteristics of the site;
  Construction facilities available in the country, etc.

LOAN APPLICATION FILES

Expert or body to be charged with the study: Specialist(s) in investment financing.

Object and content: To provide financial institutions with information on economic and financial viability of the project, and on the investor and his technical partners. The document normally contains the following:

(a) General information (history of the project, financial situation, reputation and competence of investors);

(c) Information of the project (extracts of the feasibility study):

Market and production;

List of applicable manufacturing methods, description of the selected procedure with detailed indication of the cost of equipment and operation expense;

Commercial profitability;

Social benefits;

Financial soundness (financial structure adopted, solvency);

(c) Miscellaneous information:

Proposals concerning guarantees to be offered to bank;

Steps taken and formalities completed toward implementation of the project;

Technical partners envisaged or selected.

FACTS CONCERNING TECHNICAL ASSISTANCE IN PROJECT PREPARATION

The purpose of this list of pre-investment studies with details of their contents, is not to provide a model that applies to every case, but rather to indicate the logical sequence of operations and provide a general idea of their nature. In practice, the studies and documents can take various forms, according to:

(a) The sectoral characteristics (technical feasibility studies are, for instance, of much more interest in the chemical sector than in metal-processing);

(b) The scale of production (for projects of limited importance, some decisions can be taken without real preliminary study);

(c) The method adopted for project preparation within a certain institutional frame.

The method of preparing projects is a function of the respective roles played in this process by various economic agencies. The most important of these agents are:

The investor;

The financier;

The public authority;

The technical partner (who supplies the equipment);

The consulting company (that provides the technical skills).

(The *promoter* plays an important role in development of some projects. Public or semi-public, national or international bodies usually assume investment promotion and take various steps to tackle and facilitate the preparation of industrial projects. They can also help in seeking other possible partners for projects. Nevertheless, they are not always directly interested in implementation of projects, nor are they bound by contract. Thus they cannot be considered as playing a functional role in the project development process.)

Knowing who will play this functional role can be very important for development of the project. If the investor is a public body, it may be tempted to by-pass the stage of project preparation, and pass directly from the stage of identification to that of invitation to tender. The type of technical partner is also very important: British and American companies prefer to respond to tenders accompanied by specifications carefully prepared by consulting engineers; some European companies are more used to studying the possibilities for project implementation themselves and submitting their bid accordingly. Other institutional factors can also influence scope and depth of project elaboration work.

In view of all this, bodies that render technical assistance in preparation and promotion of industrial projects are advised to comply with the following:

(a) Before undertaking detailed and expensive studies necessary in the formulative stage, a study of possibilities (preliminary feasibility study) should always be on hand; this study must be thorough enough to permit judicious preselection of possible projects;

(b) The stage of formulation should never be omitted; feasibility studies should never be left exclusively to an equipment supplier, unless he assumes part of the operation's risks (such as is the case in joint ventures);

(c) Detailed studies pertaining to the stage of formulation (mainly feasibility studies) should only be commissioned or undertaken if a potential investor has been found, and if the project ranks high in national development priorities. If there is no prior commitment, ordering expensive studies that are likely to be shelved should be avoided as far as possible;

(d) In investment promotion programmes, a distinction must be made between formulated projects (feasibility studies) and projects that have not been preselected (by studies of investment opportunities or preliminary implementation studies). Industrial projects for promotion are usually only elaborated in the form of a preliminary implementation study. In such cases, the promoter would not only have to find a local investor, but also assist in detailing the project, i.e., preparing the feasibility study. This assistance is not necessary if the project is to be carried jointly by local and foreign investors, as the foreign investor in this case usually desires to carry out the feasibility study himself.

Evaluation of economic viability of production projects in developing countries

by ANDRE BUSSERY*

INTRODUCTION

THE EFFECT of an industrial or agricultural project on the economy of a country is one of the most difficult factors to evaluate in a developing economy, where classical theory cannot be strictly applied for various reasons: a price system not reflecting cost, real values, economies of scale, external savings or otherwise, problems of income distribution. The methods suggested to resolve the problem are frequently not appropriate either to the statistical data or to the time granted for conduct of studies, or economic training of the persons responsible. Use of "reference prices" for better cost and profit evaluation of the project—despite progress made during recent years—faces three main obstacles:

(a) It is difficult in many cases to measure reference prices;

(b) "Decision-makers" (politicians or executives) do not easily accept vindication based on prices that differ from current prices;

(c) Reference prices do not permit measurement of all the effects of a project: in particular, this approach does not take external savings and surpluses into account.

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Therefore, the paper proposes a pragmatic approach, taking various theoretical teachings into consideration, yet remaining workable and providing a minimal evaluation of viability of the project.

This method rests on examination of the effects of the project on major enterprises located vertically forward or possibly behind, and on public finance.

Projected accounts receivable and payable for various units, based on their assumed productive capacity and cost structure, are subject to possible correction to take into consideration deviations from current prices and costs and in real benefits to the community.

Having arrived at a rate deemed reasonable, selection between variants can be made, either by considering the up-dated accrual profit or in the more probable case of financial constraints the ratio of accrual profit: investment cost, computed for the entire economic entity in question. For pro or con decision making the obtaining of a positive actualized value is sufficient to justify favourable decision.

The paper presents the various stages of computation and insists on the necessity for judicious and careful use of these methods.

Calculation of viability of an industrial or agricultural project, made from the standpoint of the private or public enterprise entrusted with implementation uses well-known methods, applicable all over the world, with the difficulty of evaluating

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certain present or future numerical values in relatively poorly known technical and economic conditions. We shall take for granted the methods of up-dating and computing the benefit-cost ratio which, for simplification, we will refer to as the financial viability of a project.[1]

Calculation of its economic viability, i.e., from the viewpoint of the economic entity into which it should integrate, is one of the most difficult problems facing the working economist.

The problem's complexity results from:

(a) *Practical considerations:* it is virtually impossible to know all the effects of a project in the economy because of statistical uncertainty of much of the data, e.g., the use made by households or the State of additional incomes generated by the project, and difficulties in forecasting future conditions in the economy;

(b) *Theoretical considerations:* judgement of a project implicitly necessitates reference to an over-all model of the economy and its aims. In addition to difficulties in formulating this over-all model, the economist faces questions of political options that are outside his sphere of competence.

Nevertheless, decisions are made every day by governments and external financial bodies. "Experts" are called in and must try to answer despite imperfections in their knowledge and methods.

More than ten years of reflection and experiences—some costly—permit a first "decanting." The modest purpose of this paper, which is followed by a simple yet concrete example of practical application, is not to suggest a new theory but only to give a "guideline" which in many cases may permit an answer that if not optimal is at least satisfactory, to the questions asked.

The paper comprises four sections:

(a) Results of classical analysis and its conditions of validity;

(b) The major difficulties in applying theory to reality;

(c) Partial solution for reference prices;

(d) Proposed practical solutions.

Bibliographical references, in some cases with comments, are appended to this paper.

This paper will not touch on problems posed by public investment, for which evaluation of receipts in monetary terms is difficult and sometimes impossible. We will also assume the future to be sufficiently well known for establishment of maturity sched-

ules for incomes and expenditures without great uncertainties.[2]

We will take the position of a "Plan Service" called upon to advise on a project presented by a public or private body which seeks, apart from possible approval, certain financial or fiscal advantages, or asks the State to accept certain additional expenses related to the project (especially in infrastructure). This situation frequently occurs in "Third World" countries that leave much to local or foreign private initiative, or to mixed or semi-public industrial development bodies.

"Industrial programming" of projects seems to be partially illusory in many countries where public powers can only play a role of encouragement. In countries where public powers directly intervene in selection and implementation of industrial projects, more elaborate methods should be applied. Although subject to debate on certain points, the possibility presented by C. Prou and M. Chervel in [5], based on systematic use of a table of industrial exchanges seems to us an interesting way.

THE RESULTS OF CLASSICAL ANALYSIS AND THE CONDITIONS OF ITS VALIDITY

Classical economists, like Pareto, built a theory in which the collective optimum correlates with simultaneous individual optima.[3]

For the enterprise this situation corresponds to profit maximalization on a front defined as the combination of factors beyond which it is impossible to increase production of one product without diminishing production of another. In the same way a consumer maximizes his function of satisfaction in an entity limited by his budgetary restrictions. Modern economist-mathematicians such as G. Debreu demonstrated that every optimum is consistent with an equilibrium in respect of a price system and that inversely, any equilibrium with regard to a price system is an optimum.

The marginalistic diagram and its recent formalizations can only be verified by means of certain hypotheses which we call:

(a) Perfect competition: cost of factors and goods are independent of the action of individuals (producers and consumers)—there is free entry into the branch. G. Debreu demonstrated that the existence of non-increasing returns and the hypothesis of free entry into the branch entail existence of constant returns.

[1] The interested reader can find descriptions in papers [1], [2], [3], of the attached list of references.

[2] The problems posed by future uncertainties and their proposed solution would be a continuation of the present description. The interested reader can refer to [4] which deals more specifically with probable uncertainties, or to some chapters of [3] which deal with the same subject.

[3] For further details on the "classical theory," refer to chapters I to IV of [3] or to the summary by J. Lesourne in [7], or to the work of P. A. Samuelson [25].

(b) The behaviour of entrepreneurs is guided by search for maximum profit (which entails for each enterprise a minimum-cost-management and a production level at which the cost of the last unit produced is equal to selling price), whereas behaviour of consumers is guided by the search for maximal satisfaction within the income at their disposal.

(c) Successive economic periods are taken into account by means of a rate of realization which is identical for all enterprises and individuals and which results from free meeting of supply and demand for capital.

(d) Income distribution is said to be "optimal", i.e., it is impossible to improve satisfaction of one individual without reducing that of another.

(e) There are no external savings or deficits (costs or profits resulting from implementation of the project for economic agencies not directly related to it). Air or water pollution can represent a cost factor to the community which will however not appear in the books of the enterprise. Conversely, an industrial enterprise can contribute to training of manpower useful in other sectors without any obvious counterpart in receipts.

In our present case, the project to be implemented does not disturb the marginal pattern, i.e., it is a marginal change in the economy which does not affect the price system.

It is obvious from mention of the above conditions that they are far from being met in real economy and still less in developing countries.

Hence, the point of view of the enterprise and the economy as a whole are no longer identical, and in each case distinct analysis of the two should be undertaken. However, before indicating methods for such an evaluation from the viewpoint of the community, we will reflect on the major sources of divergence of theory from reality, in order to submit solutions which are better adjusted to reality.

MAJOR SOURCES OF DISAGREEMENT BETWEEN THEORY AND REALITY

There are five main sources of difficulties which nevertheless are somehow interrelated:

(a) The existing price system does not reflect real cost to the economy;

(b) Introduction of structural changes by certain projects;

(c) Existence of external savings or deficits;

(d) Problems of income distribution;

(e) Taking of the time factor into account.

We will analyse these five points.

The price system does not reflect real cost

The system of real prices is not that which would result from free competition on a market with a great number of well-informed buyers and sellers, on which the State would not collect indirect taxes (but would intervene solely to ensure competition). We will analyse hereunder the major sources of divergence of certain factors of expenditure and receipts occurring in a project.

Wages

The level of wages in developing countries does not result solely from "free" play of supply and demand: generally, minimum wages were established under pressure from trade unions or by application of regulations inspired by the Western countries: conversely, some countries fixed maximum wages when this function suited the higher administrative echelons.

Now, if a worker is recruited for implementation of a project, what is the real cost to the economy? The real cost is the value to the economy of his production in his previous position.

In a market system his income (salary or entrepreneurial profit) would have been strictly equal to the value of output that he ensures and, assuming the supposed equilibrium to exist, his income in the new function will be equal to the former and thus to the value of his previous output. His wages, which appear as a cost to the enterprise that employs him are, therefore, at a cost to the community of diminished output of one product for the benefit of another.

This pattern is certainly not realistic.

Let us suppose to begin with that the new wage earner was an agricultural labourer on a family farm where manpower was superabundant. His departure will probably not entail any output reduction and, at most, his cost to the community will be equal to nil.

In fact, as will be seen, this cost is not nil, because the monetary income at his disposal in his new position will permit him to incur expenses that correspond to costs for the community.

On the other hand, if a new enterprise has to recruit a highly skilled head of the maintenance department who previously worked in another company, the cost for the community may be higher than the salary paid this specialist. *A fortiori*, in countries where an upper limit is fixed for salaries of executives, the real cost of an executive can be much higher than his nominal salary.

Taxes

The existence of taxes, and especially indirect taxes and import or export duties, falsifies the price system in differentiation between the price that the

buyer pays and the amount that the producer or seller receives.

Let us take for instance the purchase of imported goods for $ 100 of which $ 20 are various taxes. The enterprise records an entry of $ 100 as expenses, but the real cost to the economy will be: (a) the price paid abroad, e.g., $ 75; (b) the cost of forwarding services from the border to the place of use. Say $ 5 (assuming it to be a significant share of the costs).

The $ 20 of taxes are only in the nature of a transfer from the enterprise's funds to State funds and do not represent cost for the economy.

Conversely, the value to the economy of an exported product, subject to export duty, will be higher than the price paid the exporting company, because the importing country also pays a certain amount to the State.

Analogous reasoning can be applied to products solely in domestic trade.

Rate of exchange and import quotas

A great number of countries lack foreign currency and are therefore obliged to restrict imports to a minimum.

For various reasons which we do not seek to examine here, the procedure of devaluation of national currency is not always used. Very often, complex systems for quotas, import licences or multiple rates of exchange according to the nature of the transaction (import or export) are established.

Whatever the system, the price paid (or received) for import (or export) is not consistent with actual cost (or profit) for the economy, because demand cannot be met at the existing rate of exchange.

Price of public services

Because of the rigidity of any tariff system and occasional erroneous conceptions in this sphere, pricing of public services (transport, water, electricity) is often far from reflecting the real costs of the services supplied. We will illustrate this in the case of railway transport.

Generally, creation of a new industry entails backward and forward transport of raw materials or finished goods. The current tariff is applied to the enterprise. However, particularly in the case of carriage by rail, the tariff rarely reflects the real cost to the economy of supplementary transport. Railways represent an activity where infrastructure expenditure is particularly heavy, and where "productive capacity" is generally not fully utilized. The real cost of transport supported by the community will be: (a) either higher than the tariff applied to the enterprise if, for instance, a special spur was built; (b) or lower and even much lower if only a few available waggons are added to an

existent train. The expense will then solely amount to a small power outlay and to additional maintenance expense on equipment and rolling stock.

The tariff, which is relatively rigid, cannot be adjusted in all cases and will consequently result in a profit or additional cost for the railway company and, thereby, for the community.

Similar examples can be given for other public services, and especially electric power.

Price of certain production

In numerous cases certain national, agricultural or industrial products enjoy tariff protection or price support which permits sale on the domestic market at prices much higher than those of equivalent imported products.

In such cases, the question arises as to whether receipts so obtained by the enterprise actually represent total return for the community, and if so whether it would not be advisable to take into account a lower price of the real market value of the product in question.

Capital cost

The enterprise will record in its forecast operational accounts, the amount of interest to be paid its lenders.

However, as everyone knows, no perfect capital market exists, and several rates will appear for diverse local and foreign sources of financing.

The enterprise may benefit from favourable interest payments arranged by the Government for promotion of industrialization, or even from simple aid for which no cost appears.

However, whether this aid is of local origin or foreign, where the amount is limited, it represents a real cost to the community, like all other investment capital. The cost of this capital must be taken into account at a rate of interest representing its cost to the community.

One could add to the preceding remarks on the difference between observed prices and actual costs, similar remarks on the difference between the observed prices and the prices "felt" by the consumer, and based on which his purchase decisions are made. In his lecture *Economic Techniques for the Use of Developing Countries* [6], C. Pradon developed this concept and demonstrated the necessity of taking into account these "felt" prices in founding development action, especially in traditional sectors.

Introduction of structural changes by the projects. The notion of surplus

So far, we have observed that no ideal market exists for the great majority of goods and services traded in the economy, but we have not considered

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the specific problem posed by big investments which introduce structural change into the economy, in particular on the level of prices for goods and services offered.

A structural change may for example result from construction of a new road (considerable reduction of transport cost), building of a fertilizer plant (price reduction and sometimes-more fundamentally-availability of fertilizers previously impossible to obtain), a power station, etc. It must be noted that a qualified structural change at the level of a town or a small district can sometimes be considered marginal for the country as a whole (or for the enterprise which decides, if it is for example, an additional plant for a very important foreign company).

What is the specific problem posed by this kind of project, which is particularly frequent in developing countries?

To present it, we will use a graph well known by the economists (see figure 1). This graph comprises two curves. The first is that of cost of production C of product as a function of quantity produced. The curve may ascend or descend according to the location where it is placed.

Let us specify that it is not for the average cost of production of quantity Q, but the marginal cost of production, i.e., of the last unit produced (we assume for simplicity that there is only one marginal cost as a function of the level of production attained and that the curve of marginal cost is regular). The other one is the curve P of prices (or curve of demand) as a function of quantities: it decreases with quantities sold, since the price of a product must diminish to increase sale.

Figure 1
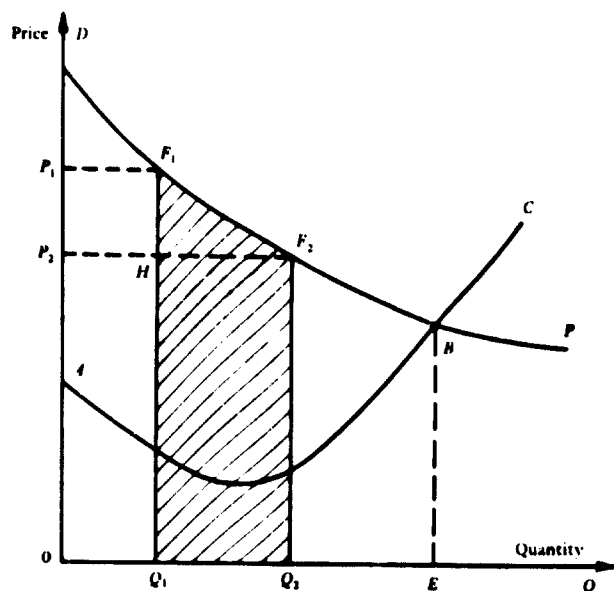
Figure 2
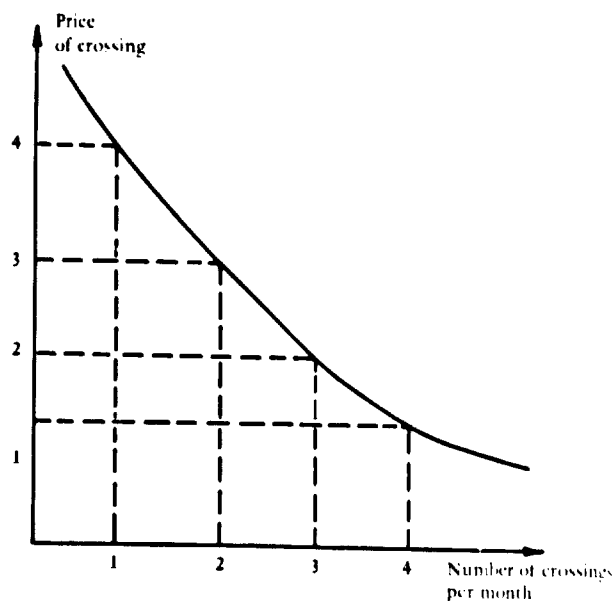
Let us make a more detailed analysis of the significance of this curve by taking a specific example. Let us consider an individual of given income, living near a river which can be crossed by ferry or toll-bridge. Let us suppose that his relatives live across the river. The number of crossings of the river per month will depend on the price for crossing. Let us suppose that we can experimentally plot his demand curve according to the table below:

Price of crossing in dollars	Crossings per month
4	1
3	2
2	3
1,5	4

Figure 2 demonstrates this table.

Practically, we can interpret it as follows: the first visit the individual pays his relatives every month procures him a satisfaction equivalent to four dollars, since he is willing to pay four dollars to perform it. The second visit gives him only a marginal satisfaction of three dollars, the third-two dollars, and the fourth-1.5 dollar only. If the price for crossing amounts to two dollars, he would take the ferry three times a month, and would pay $2 \times 3 = 6$ dollars, but his total satisfaction can be estimated at $4 + 3 + 2 = 9$ dollars.

In other words, the price paid does not always reflect the total satisfaction derived by the individual from consumption of a product or service. From the point of view of the enterprise running the ferry, its returns will show receipt of six dollars, although the service may be worth nine dollars for

the community. The difference between these two is part of the "surplus" first described in 1844 [21] by J. Dupuit, engineer of roads and bridges, and which is the subject of much dispute and debate among economists.[4]

Let us return to figure 1.

The surplus is proportional to the surface ABD encompassed by: *(a)* the surface $ODBL$ which represents the total satisfaction for users of quantity Q of the product studied (the curve DB represents satisfaction derived from consumption of an additional unit); *(b)* the surface O_vABL which represents total cost of production of the quantity Q (curve AB represents cost of production of an additional unit at each level of output).

We can envisage a project permitting production of Q_2 instead of $_vI_1$ and selling at price P_2 instead of P_1, P_2 being lower than P_1. The receipts of the enterprise will amount to $P_2 \cdot Q_2$.

But this receipt does not express total profit resulting from this investment for the community. The value corresponding to the surface F_1I_2H has to be added.

We will return to this point again, to show how to try to take this profit into account.

The external savings and deficits

Two kinds of external savings or deficits can be envisaged: *(a)* the external advantages or inconveniences not taken into consideration in market price and resulting from technological effects; *(b)* the external advantages or inconveniences reflected in modification of the price system of economic agencies not directly concerned by the project.

The advantages or inconveniences of the first kind are, for example, atmospheric or river pollution resulting from siting of a chemical plant, or conversely, the aesthetic, tourist and eventual sanitary advantages of water projects aimed at harnessing water mainly for agricultural and/or hydraulic output.

An example of external saving of the second kind is price reduction of a given product to all consumers, because a new plant will need it in great quantities. Such an increase in consumption can entail either price rise if the product is available in limited quantities, or in a favourable case, will permit installation of a new production unit which, as a consequence of economies of scale, will allow price reduction. Such an advantage will not show in the

books of the planned enterprise, but it is nevertheless real for the economy.[5]

It is often possible at least partially to attribute a value to external savings and deficits of the first type (e.g., cost of pollution prevention). However, it seems that savings and deficits of the second type are far the more important phenomena in developing countries, where economies of scale are frequent: creation of an important plant consuming electricity will justify construction of a new power station which in turn will reduce the price of electricity to all consumers. Conversely, a new clothing factory may cause partial decrease or total disappearance of activity by many craftsmen who will be deprived of their income.

We will be returning to the taking of this kind of disadvantage and advantage into account, but we note now that the price system used to judge the initial project is unable to cope with them.

Problems of income distribution

In the conditions of validity of classical theory, we indicated that income distribution should be judged as "optimal." A small project would not really make a considerable change to this distribution and the condition can be considered as met. However, most projects in developing countries will have the effect of considerably modifying income distribution within the nation. Moreover, the location of a factory in A or B will doubtlessly change certain investment and operation costs somewhat, but these costs cannot reflect the importance that public authority attaches to development of one district rather than another.

Furthermore, considerable change in income of the population may cause important modification in demand for certain goods and in their prices. Such effects are not really accounted in the forecasts of the project.

Calculation of the time factor

We indicated before the presupposition of a rate of actualization valid for the community. This simple statement raises a lot of methodological problems, even if we admit the implicit existence of a rate of actualization for a given individual in his options between consumption and saving. We briefly state some of the questions:

[4] We mention in particular Alfred Marshall [22], J. R. Hicks [23], J. Lesourne in the papers [7] and [24] and J. C. Hirschleifer, J. C. de Haven and J. W. Milliman in [16]. A good discussion is presented by Abraham and Thomas in [13], chapter VIII.

[5] This advantage, resulting from an economy of scale, is expressed in a surplus in the economy, which reduces cost of inputs of the enterprises and, in certain cases, permits other new increases in output. An example of this kind is a hydroelectric power station which supplies an alumina electrolysis plant in Ghana. Electricity available at an advantageous price made possible renewed mining of gold requiring extensive pumping and a slight reduction in electricity price for public supply.

(a) How to "collate" satisfaction and rates of actualization which naturally vary for all the individuals of a nation at a given moment?

(b) How to "collate" post-factum forecast satisfaction and behaviour with regard to rate of actualization over several years, especially accounting for changes in income distribution resulting from implementation of projects?

(c) How to take into account future preferences of future consumers?

Various theoretical solutions have been suggested, but we shall not deal with them here.[*] We will only indicate that we are on one of the borders between economy and socio-politics, in so far as degree of preference for the future, with regard to the present reflects or necessitates comprehensive political choice.

A POSSIBLE SOLUTION: THE REFERENCE PRICE. DESCRIPTION AND LIMITS

We have seen that in fact in the economy-in particular of developing countries–current prices generally do not reflect scarcity or real value of goods and services traded. Therefore, the use was tried, in the study of projects, of prices that more accurately express real costs to the community. From the preceding paragraphs, we know that it is difficult to find a price system responsive to all the required characteristics. In particular, effects of income distribution or external savings cannot be taken into account solely by modification of the price system.

In spite of these reservations, the concept of utilizing a price system that takes into account the real cost and advantages to the community can be admitted as theoretically satisfactory. These prices, albeit artificial, would therefore be more suitable than market prices for evaluation of projects. The prices have been given various names: "shadow prices", "accounting prices", "opportunity costs", "substitution prices", or "reference prices".

Quayum and Chakravarty (cf. [8] and [9]) were the first to make theoretical studies on this subject. The two authors give a theoretical justification for their use, which in their opinion, leads to effective allocation of productive factors in the sense of Pareto's application.

The first practical trials were made in Pakistan, with a very simple model and very rough determination of accounting prices (cf. Papanek and Qureshi [10]). Since then, numerous theoretical studies and various practical experiments were conducted, either *a posteriori* or to try to define

* Cf. [7] J. Lesourne, *Economic Calculus*, chapter 7.

policies (Algeria, Greece, Ivory Coast, Tunisia, Mexico, India). Volume II of the *Manual of Industrial Project Analysis in Developing Countries*, an OECD publication, by I. M. D. Little and J. A. Mirrlees, should be mentioned here: it describes, without the use of mathematical formulation, the theory of shadow prices, tries to show its operational nature, and recommends use of an international price for goods and services.

Many theoretical and practical difficulties in effect restrict the use of shadow prices.

The first difficulty is estimation with relative certainty: in effect the planner must resolve the over-all problem of optimal allocation of resources for the entire economy. Theoretically, solution could be attained by resolution of a giant programme aimed at maximization of production over a certain period, for the given available resources (human, material and financial). At the same time, solution of the programme would give the best allocation of resources and correct prices leading to this optimal allocation.

Really scarce inputs would all be utilized and would have a price determined by the programme. Superabundant production factors would not be completely used and their price would be nil. However, examination of the programme reveals an anomaly. Essentially, solution of the problem consists of trying a certain combination of projects, with a certain range of prices for production factors, selecting those that are viable and then determining which factors are superabundant and insufficient for this combination.

The prices are then high for scarce factors and low for the superabundant, and the process is repeated. At each repetition, demand for scarce inputs will be better adjusted to supply and the combination of selected projects will be closer to the optimal solution. After a sufficient number of repetitions, a list of projects will have been obtained which makes use of scarce factors precisely, and a list of factors that do not represent constraints for the economy and consequently have a "shadow price" equal to nil. Hence, if the solution provides factor prices, it also provides the selection of projects and "shadow prices" will not have played any part in the selection. They only serve to show how a solution has been reached.

Chakravarty recognizes this anomaly and suggests a search to establish some approximate values which do not require resolution of the whole programme. This can be done at a relatively high level of collation for factors such as manpower, foreign currency and capital. Estimates made in this way will be used to analyze projects. This kind of experiment was conducted for Pakistan, but it raises many problems, and there are doubts as to the merits of results

obtained by classification of projects on the basis of roughly estimated numerical values.

The papers mentioned before [11], [12], [13] written in this spirit[7] helped to considerably refine the above-mentioned ideas. They conclude by suggesting generally high rates of actualization (15 to 35%) and recommend reference prices, especially for the exchange rate or for prices of certain goods that do not differ fundamentally from the observed prices. The cost of unskilled employed labour force is generally nil, as could be expected.

A further step could be made with the opening of new possibilities by the immense computerized linear programmes. In fact, needs for, and availability of, production factors are constantly changing. Therefore it is necessary to have, not only a simple "reference price" for each factor, but also the evolution of this price over the course of time. A theoretical model of dynamic programming could be devised, taking into account a great number of periods of the economy as they correspond to the practical life of projects. Research is at present being conducted in this field. However, the results are not yet workable, because of the scope of detailed programmes without oversimplification, distortion of reality, and the "no-limit" problems posed by implementation of these programmes.

For instance, an evolutional reference price must be used for salaries of various manpower categories as a function of supply and demand (i.e., of the training and productive projects retained in the programme). A reference price can also be retained for capital and foreign currency.

Little and Mirrlees propose using international prices as reference prices, to give tangible form to reference prices used in evaluation of a project. However, this suggestion does not resolve the problems of very difficult estimation of certain products (capital goods) or services (especially pricing of public services).

Complexity of computing and elaborating underlying models, as well as the difficult estimation of certain parameters, have so far considerably restricted the use of shadow prices in developing countries.

However, the principle should not be entirely rejected. Without awaiting results of research in progress, many adjustments have already been made for observed prices in project studies. The adjustments for instance relate to manpower cost, tax and foreign currency cost as will be seen in the following section. But first, another question of principle must be raised with regard to the theory of shadow prices: the prices proposed for evaluation of projects are those which would result from free

[7] A good summary can be found in [5], pp. 108-129.

competition. The justification for this procedure lies in the fact that these are the prices which would appear in Pareto's optimal economic condition.

However, to reach a Pareto optimum all prices in the system must be competitive. What happens if, in a non optimal situation projects or even worse only certain projects are selected as a function of shadow prices, while the real prices do not reflect actual cost to the community? In particular, can we be sure that projects selected in this way will lead toward better allocation of resources, or perhaps be a step backwards?

Unfortunately the answer is negative. One can only assume that such is the case, and most authors[8] having dealt with the ticklish problem of second-rank optimums, share this opinion. But some dispute this viewpoint and quote examples to prove the contrary. It is not out of the question that systematic application of a method of project selection, as a function of community interest in these projects, based on the shadow price theory, would lead to approval of several projects that result in deficit for the enterprise. Public authority would then be forced to intervene in such a way as not to suppress, if possible, incentive for sound management.

However, it should be borne in mind that such a solution, applicable to a very small number of projects, cannot be generalized without strongly affecting public finance and even the whole economy, since fiscal policy changes optimal allocation of factors in the economy. This observation shows clearly that there is an additional restriction on systematic application of the method of reference prices.

Finally, a last comment on reference prices is necessary. The over complex method of their elaboration, assuming feasibility with sufficient certainty, complicates dialogue between economic study bodies and decision-making bodies, whether public or private. How can a political authority, or the manager of an enterprise conceive that the prices they observe must be "manipulated" in various directions in order to witness impact on their projects. According to Prou and Chervel in [5], to be possible, the dialogue between the "centre" (the Bureau of Planning) and the "periphery" (i.e., enterprises, administrations, individuals) must retain clarity. The present research on reference prices can only result in workable methods if it leads to techniques of project evaluation, simple enough to be understood and discussed.

[8] An account and a discussion on the theory of the second-rank optimum is presented in C.J. Vedel's paper "The Second-Rank Optimum" in Economic Calculus, Faculty of Law and Economic Sciences, University of Paris, Presses Universitaires de France, Paris, 1968 (with a large bibliography). Cf. also J. R. Fayette, For an Economic Calculus of the Discontinuous — The Cost Efficiency Analysis, METRA, Vol. VII, No. 4, 1968.

In the final event, the theory of reference prices supplies a useful framework of thought, likely to find practical application in well-defined cases where it will be possible (as will be seen hereafter) to determine relatively objective reference prices, without resort to too complex a model notably by use of international prices.

In many cases, application of the theory of reference prices will equate correct computation of the indirect effects of a project.* Nevertheless, this theory is unable to comprehend certain factors, such as change in income distribution resulting from the project.

More global views indicated the concept of collective utility (social welfare function) which would adequately "integrate" the satisfaction of individuals who form the economic entity, by conferring a "weight" on each. This theory, developed, *inter alia*, by J. Lesourne in [7] clearly demonstrates the importance of the hypotheses on income distribution and the nature (marginal or structural) of the change resulting from the project. It permits interesting results, when income distribution is judged "optimal", i.e., when the allocation of one additional dollar of income, no matter to which individual, increases collective utility to the same extent. Experience shows that such an hypothesis is not always realistic. Nevertheless, we shall make practical use of certain results of this approach in the following section.

PRACTICAL SOLUTIONS TO BE ADOPTED FOR PROJECT EVALUATION FROM THE COMMUNITY VIEWPOINT

In this last section, we shall try to describe in a practical manner the various stages to be followed in passing from the standpoint of the enterprise to that of the community. Naturally, the rules we will describe or suggest must be applied in identical fashion to all projects submitted for examination by public authority. We note that here we are more in the perspective of study of a project with possible multiple variants, to decide on its implementation, rather than in systematic programming of an industrial development which requires more sophisticated techniques, if applicable. The practical rules that we are going to suggest aim at obtaining as accurate as possible estimates of interest of the project, by moving gradually from the certain to the less certain. We suggest the following stages:

(a) Definition of the economic entity for which viability of the project is examined;

* To assert, for instance, that the price of a metric ton in a specific case is 6, instead of the nominal rate of 10, amounts to saying that, if the enterprise pays 10 for one metric ton, there will be an additional profit of 4 for the railway.

(b) Definition of a reference solution taken as basis of comparison, as necessary;

(c) Identification of the economic agencies concerned with the project;

(d) Calculation of direct and indirect costs and profits of the project encompassing, if necessary, modification of certain observed prices and a procedure of actualization;

(e) Estimation of possible surplus and of external savings and deficits;

(f) Quantitative estimation, in as far as possible, of effects of change in income distribution and summary computation of induced secondary effects;

(g) Research of other qualitative and quantitative effects in non-monetary terms, not previously taken into account;

(h) Decision according to criteria which express economic advantage.

Let us examine these points successively.

Definition of the economic entity for which project viability is examined

Calculation of viability within a framework exceeding that of the body called on to undertake implementation of the project, presupposes a fairly accurate definition of the frame in which the calculation is to be made. Let us specify two examples: that of a foreign industrial investment and a harbour investment.

The first case (the industrial project) can be examined from the viewpoint of the national community of the country receiving the investment, or from the larger view that takes into account, for example, the country of origin of the investment. The investment financed from abroad represents no real cost to the national community, since there is no recourse to financial resources of that community. In the second case, however, total cost of the project must be taken into consideration.

In the case of a harbour investment generally charged to the country where the harbour is located the resulting advantages may differ slightly according to whether the viewpoint is strictly national, or more general time-saving for foreign ships, for instance, which in principle will be expressed in reduction of freight rates for imported and exported products, as well as in time saving and reduction of freight rates for all other goods carried by ships calling at this harbour, coming from or going to foreign countries.

The advantage resulting from the opening of a permanent connexion over the English Channel would be measured differently from a French or British viewpoint or by both together.

Therefore, the frame for evaluation of advantage and cost should always be defined.

A project corresponds to a certain change in the allocation of resources in the economy. Therefore, the nature of the change envisaged should always be specified at the initial stage with its "natural" evolution were no project envisaged.

In the case of a mining or agricultural project, the reference solution could be "to do nothing". In an industrial project, the reference solution would be either import of the goods in question, or maintenance in working order of obsolete units with higher production costs. In both cases, implementation of the project will entail change in income for other economic entities which should be taken into account in global evaluation.

It should be noted that the reference solution does not necessarily uphold the status quo at the time of study of the project. It will often be the initial situation "adapted" to meet evolution of demand, i.e., if necessary entailing certain investment or change.

Location and classification of various economic factors concerned with the project

The next stage necessitates prior reflection on the practical method proposed, and a reminder of the complex nature of allocation of resources in the economy.

Every economic organization comprises:

(a) Enterprises which, with limited productive capacity, ensure the production functions in transforming raw materials or semi-manufactured goods into intermediate or finished products;

(b) A State with limited income, and which with this ensures certain investment and function of certain services;

(c) Individuals who, on the one hand, consume goods and services but who, on the other hand, represent the "labour force" or enterprises and administration. Here again, the number of qualified people and not only for the highest positions is limited.

Finally, these various "economic agents" make exchanges with the exterior of the economic entity in question.

These exchanges, both domestic and external, are on the basis of a price system which, as shown above, does not always reflect the real social cost of the good or service traded.

With time, a project will affect re-allocation of available resources (raw materials, equipment, manpower) in such a manner that the new allocation of resources will permit a better "yield" to the economic system as a whole.

Strictly speaking, computation of the effects of a project amounts to analysis of its impact on all economic factors.[10] This analysis is most simple in a case which postulates "full employment" of the existing means of production (i.e., equipment as well as land, manpower as well as raw materials). This is of course an extreme case, but it permits minimal evaluation of viability of a project for the entire economy. Under this hypothesis of full utilization, all enterprises make full use of their productive capacities, and there is no unemployment.

This being so, any consumption of production factors (raw materials, capital goods, manpower) for implementation of the considered project can only be at the cost of other production. The other economic agencies will be compelled either to import if technically or economically possible or to forego certain production.

In this limited case, there are no indirect or secondary effects and beyond possible change in income distribution, the only advantage of the project to the community is measured by its profit which will possibly be adjusted, as we will see hereafter, to take certain factors into account: expenses of the State, possible change in exchange rate, taking into account a possible surplus.

The real economic world, in particular in developing countries, never corresponds to this extreme hypothesis. We must enlarge it.

We will enlarge it in two stages. In the first, we will examine the effect of the project on enterprises which supply goods and services for its implementation and operation and which, without it, do not fully use their means of production. In the second stage we shall see how to deal, if necessary, with the problem of manpower (see page 35). In all cases, the effects of the project on public finance should be taken into account.

At this stage, the problem posed therefore amounts to detection of the enterprises whose activities will be influenced by the project, either during its implementation, or afterward in the course of its operation.

We then list main enterprises concerned with the project, for which the additional activity that it

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[10] Conventionally, and in accordance with terminology generally used:

(a) Primary direct effects, or simply direct effects, those which appear in accounts of the body managing the project;

(b) Primary indirect effects, or simply indirect effects, those resulting from purchase of goods or services from other enterprises;

(c) Secondary effects, those resulting from an increase in the income of various economic factors, due to direct or indirect effects;

(d) Induced effects, those which might eventually appear because of the project: subsidiary plants, possibilities of agricultural development after construction of a network of secondary roads, etc.

generates will permit better utilization of existing but unemployed productive capacity, or for which the additional activity generated entails new investment (important or not).

The list will be of more or less importance according to the nature of the project and the degree of accuracy of the desired evaluation.

Frequently three or four enterprises (or sectors) for the operating period, and one or two for the investment period suffice to provide the detailed information mentioned hereafter. Evaluation of the other sectors will be quicker, or, as a safeguard, it will be assumed that indirect effects on these enterprises are nil (i.e., their means of production are already fully utilized).

It should be noted that in certain cases an enterprise which is not a direct supplier of the project can be classified in the first category: an industry with a heavy electricity consumption may indirectly cause revaluation of heavy fuel produced by a local refinery, and used for additional electric output.

At the end of this paper we therefore give a list of enterprises (or sectors of activity) which will be the subject of more precise investigation, and a list of other sectors for which estimation will be more concise.

Calculation of the project cost and return

This entails several stages: (a) compilation of maturity schedules for receipts and expenditures of the enterprises concerned with the project and for the State; (b) possible adjustment of certain prices; (c) actualization.

We are going to examine all these stages successively with their practical problems which require resolution.

Maturity schedules of receipts and expenditures

The enterprise and the State will be analyzed successively.

(a) Enterprises

For each enterprise most directly affected by the project, its impact should be analyzed in terms of: (a) additional receipts and expenditures, resulting from production of goods or services put at the disposal of the project; (b) additional investments that may be necessary to cope with the additional demand.

In general the analysis should not be made in terms of "average cost" or "average profit". Let us for example take a new cement plant, consuming fuel and electricity. This additional electricity consumption may either permit better utilization of existing unemployed productive power (at least at some hours) resulting in important profit to the

power plant, or necessitate heavy investment in means of production and transmission, the cost of which is not always reflected in the price of electricity to the cement plant.[11] Likewise, for a refinery, according to its initial productive capacity, the nature of crudes processed, and market distribution of white and black oils in the country concerned, the additional demand may result in significant losses or profits.

Generally speaking, every time a project entails better utilization of underemployed productive capacity, the effects will be positive. But, investments however small supplying enterprises have to make to meet additional demand, must always be taken into account.

Should the price system not be subject to change, the effect of the project will equal the variation in profits of the various enterprises whose activity is affected by the project. To facilitate possible change in the price system, a precise maturity schedule of additional receipts and expenditures must be compiled for each studied enterprise, distinguishing in particular between the share of receipts and expenditures resulting from trade with the state, and the share of foreign currency (or more precisely receipts and expenditures inside and outside the economic area in question). For enterprises, activity of which is only slightly changed by the project, indirect effects will be considered as nil or, if certain productive capacities are unutilized, cautious estimate will be made. If recent tables of interindustrial exchanges exist, they can be used, or else rapid investigation can be made in the sectors in question. In such cases, an estimate of costs of corresponding investments should also not be omitted.[12]

(b) Examination of effects on the State

Implementation of the project can sometimes entail certain state expenditures (roads, schools, subsidies, etc.) and modification of certain income (taxation of imported products and profits).

Consequently, receipts and expenditures ascertained for enterprises connected with the project, should always be complemented by receipts and expenditures generated to the accounts of public authority, either by direct operation or through indirect effects of the kind described above.

[11] Strictly speaking, establishment of a cement plant may have the effect of advancing the timing of new investment in electricity production, in a country where demand is growing, and where initial output capacity is insufficient. Such an acceleration of the investment programme finds expression in the cost of actualized value which one must try to estimate.

[12] Strictly speaking, the capital requirement necessary to cope with marginal change in demand should be taken into account. In fact, these coefficients are generally not known and one has to be content with estimates worked out as well as possible.

(c) *Possible adjustment of certain prices*

We already indicated that actual prices must be modified cautiously to attempt better evaluation of the value of a project in terms of the entire economy. There are, however, certain cases in which almost all economists agree to make certain corrections. Before analyzing problems posed by various entries of receipts and expenditures, we shall deal with two specific corrections which sometimes affect almost all entries: taking into account duties, taxes and subsidies of the State and possible adjustment of the exchange rate.

(d) *Financial transactions with the State*

Every financial operation (excepting purchase of goods or services) between the State and a domestic economic agent (or the economic community, according to the point of view) is of the nature of a transfer and therefore does not create new wealth or expenditures. Consequently, it need not be taken into account from the viewpoint of the community (if, of course, the problem of income distribution be temporarily ignored).

Practically, if the State be considered an economic agency for which a maturity schedule of receipts and expenditures has been compiled, it will suffice to add the actualized balance of these transactions to the other effects of the project. If the State's role[13] is limited to collection of taxes and payment of subsidies, with no purchase of goods and services on its part (e.g., industrial project for which the State does not have to make any specific investment) there is no absolute need to identify the State as a particular economic agent, nor to modify receipts and expenditures of the enterprise to adopt the viewpoint of the whole economy by use of the following table which indicates the various possible situations.

This table should be utilized correctly. This implies simply noting the existing differences, taking into account computation of financial transactions with the State and the differences between the viewpoint of the enterprise charged with the project and that of the economy as a whole; a subsidy S for equipment is a receipt to the enterprise which, on the other hand, effects an investment I to an equivalent amount, which will appear as an expenditure in the accounts of the enterprise as well as those of the community.

In the strictest sense the above-mentioned viewpoint presupposes that problems of income distribution not be taken into account. Consequently, certain writers, such as Prou and Chervel

[13] We have in mind the State in its strict sense of the administration of national accounting. A government owned enterprise shall be considered as an enterprise if it sells goods or services (mail, telephone, water supply, etc.).

	Viewpoint of the community					
	Viewpoint of the enterprise		National enterprises		Foreign enterprises	
Nature of financial transactions with the State	Receipts	Expenditures	Receipts	Expenditures	Receipts	Expenditures
Indirect duties on inputs (T) (including import duties)		T				T
Indirect duties on outputs (T') (including export duties)		T'				T'
Direct taxes paid by the enterprise (D)		D				D
Subsidies, capital participation or loans (S)	S				S	

in the first chapter of [5], insist that the fiscal machinery of most developing countries is unable to ensure desirable redistribution and that in fact it is impossible, in evaluating a project, to dissociate its effects on production from its effects on redistribution of incomes. Therefore, they rightly warn against computation without taxes, which would not be complemented, as we recommend here, by total calculation of the project's impacts on income of the State and, further, on the income of various categories of economic agent (see page 40).

(e) *Foreign currency exchange*

If the project is in a country where currency is not freely convertible, the problem will arise of the economic value to be attributed to the rate of exchange which will be used in evaluation of goods and services, imported or exported. It is difficult to formulate a general rule, because regulations in force and economic conditions vary widely from one country to another.

We will only indicate that it will often be advisable to approximate that rate quoted on the parallel exchange market in order to evaluate real value of foreign trade; this will confer a certain coefficient on all the entries of receipts and expenditures in foreign trade, regardless of certain price adjustments which will occur later.

(f) *Evaluation of the value of the project's output*

We will distinguish between three cases:

(a) Production exported;

(b) Production destined for domestic use, but which may be used in foreign trade;

(c) Production which cannot be used in international trade.

Production exported. The retained value is, in principle, that actually collected by the national community (i.e., the enterprise and possibly the State if there is an export duty), possibly adjusted by means of a previously determined coefficient for exchange of foreign currency.

Nevertheless, there may be certain cases where different values must be taken into account. Exports within the frame of bilateral trade agreements, with the partial characteristics of barter, may lead to sale of a product at an interesting price, counterpart to which would be purchase of goods at a price higher than that at which the same goods could have been procured elsewhere. A reduced value should be retained for exports carried out under these conditions.

Production for domestic consumption only, but which may be used in international trade. Here, too, the normal rule will be to refer, in principle, to prices quoted on the world market, or more exactly, to the price at which the goods can actually be procured on the world market, taking into account transport costs and existing trade relations (and possibly adjustment of the rate of exchange).

This rule is of utmost importance, because many products enjoy protection or price support on the domestic market: one should not judge viability of a sugar plant project by the price granted the existing sugar plants, but by the price at which sugar can actually be procured abroad. The profit of the project is in fact equal to savings realized by not buying this sugar abroad.

The price supplement granted to domestic producers is, in the wider sense, a transfer from the consumer to the producers at large (the enterprise's owners, wage earners and suppliers).

Products which cannot be used in foreign trade. These are essentially services (transport, housing) or goods produced by public services (water, electricity, excepting certain cases).

The economic theory indicates that optimal allocation of resources in the economy is realized if goods and services are sold at their marginal cost, demand being then equal to supply. This poses many problems in practical application, in particular in the case of enterprises producing goods and services which require very heavy investment (railways, generation und transmission of electricity). Sale at marginal cost is not the general rule, and there is a considerable divergence sometimes (positive or negative) between the price paid by the user and the real production cost of the service considered.

Without too complex research, one should try to estimate the value of goods or services which cannot be used in international business, at production cost. However, this simplified rule cannot be

blindly applied. A great number of enterprises, selling goods or services which cannot be used internationally are in fact in a monopoly position, and retaining a value for service at equal to marginal cost could lead to justifying of aberrations in the economic field.

Consequently, having made sure that implementation of the project will be followed by a demand that effectively corresponds at a forecast price to available productive capacity, the retained value of the product will significantly balance costs over a reasonable period.

Hence, strictly speaking, a value above selling price must be taken if, for political reasons, the service in question is clearly priced below real cost. Because of scarcity of resources, this will prevent the enterprise from meeting the manifest demand, and will result in cuts in power and water supply (common in certain countries). Reciprocally, that part of the price intended for easier self financing of the enterprise in order to meet growing demand (generally the case in electricity projects) cannot be considered as a receipt to the community. This price supplement is a kind of transfer from user to enterprise owner and is facilitated by the enterprise's position of relative monopoly. It would not exist in a competitive situation with a large money market capable of easily financing forthcoming expansions. Nevertheless, one might contend that the user who agrees to pay the demanded price for the service supplied, confers on it a "value" equal to the price paid. Consequently one may retain the price entailing a margin of self financing, while being assured of market volume at the proposed price.

(g) *Evaluation of the value of consumption of goods and services by the enterprise*

Here we specify:

(a) Imported goods and services;
(b) Domestic goods and services but available on the world market;
(c) Goods and services impossible to buy on the world market;
(d) Wages;
(e) Transactions with financial bodies.

Imported goods and services. They are estimated at real cost, possibly with an adjustment coefficient for the rate of exchange. Insofar as the State account has been identified, taxes are taken into account automatically. Otherwise, the amount of taxes is to be eliminated.[14]

[14] The two methods are equivalent. In case where there is a State account, alongside that of the enterprise, the amount of the taxes paid by the enterprise appears as a receipt to the State and in collating for the whole economy, the operation is balanced out. Therefore, taking into account these purchases less tax amounts to the same thing.

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Goods and services produced locally but which could be imported. In this case we must distinguish between two hypotheses:

(a) The case where goods and services consumed are produced by enterprises working at full capacity; it is clear that the prices to be considered in this case are those of equivalent imported products.

(b) The goods and services consumed are produced by enterprises from the list of those affected by the project, for which accounts of receipts and expenditures are established. In this case the purchase price for the maturity schedule will not be amended; losses or profits resulting from additional production should appear in the books of the producing enterprise. However, a ticklish problem may arise, if the real cost of additional output (and not its selling price), is higher than the price of the equivalent imported product. This implies that production is less efficient than in other countries, and it would be advisable strictly from the economic viewpoint to stop the production. If, for reasons other than economic, this production is forced on domestic users, it seems legitimate to take it into account at the cost level, rather than to retain the price of the equivalent imported product.[15]

In principle, the reverse situation should not occur; if the cost of additional production is lower than the price of the equivalent imported product, the enterprise should export and work at full capacity and we would return to the previous case. Should this not be so (because, for example, of transport and insurance charges on export), the real cost must be retained, and not the price, less tax, of the equivalent imported product.

It should be noted that, in the case of utilization of local production at marginal real cost[16] higher than that of the equivalent imported product, the project under investigation is penalized, because of wrong previous allocation of economic resources,

or because of change in technological and commercial data.

Non-importable goods and services. In this case one should clearly distinguish between prices or rates, and real costs actually generated by the project.

It is obvious that cost of additional transport of cement or ore, by a railway not working at full capacity, will be very low by comparison with the cost of constructing a new special rail-head to service new strata. However, in both cases, one risks application of similar tariffs, the rate having a general character which does not take into account particular characteristics of each load.

In the case of enterprises included in the explicit analysis of additional receipts and expenditures resulting from the project, computation entails no special problems. However, in the case of supplying enterprises, for which no explicit analysis is made, the rates applied by the enterprises should be checked for compliance with costs, at least for certain highly valued inputs. Comments made before, (page 35) on products which cannot be subject to foreign trade, apply equally here.

Wages. Assuming full employment, wages in principle reflect the cost of manpower both to the community and the enterprise. Any new employment can be created only at the expense of other employment, and the real cost to the economy is in principle equal to the production value that the wage earner realized in the sector where he previously worked.

On the other hand, if part of the staff planned for the project was previously unemployed, creation of income resulting from the project may be taken into account in evaluation. The initial application of the reference price theory led to a nil cost for these wages. A more careful–and perhaps more cautious–analysis of the question leads to admission of a certain reduction of nominal wages, but not the acceptance of nil cost. Indeed, certain costs often correspond to input of work (recruitment, minimum training, housing), and are not nil but always registered elsewhere.

On the other hand, total unemployment over the whole year is rare (in agricultural areas there is occasional manpower scarcity for harvesting) and there might be certain production loss. Finally, monetary income thus created will be partly used for consumption of goods that are imported or contain imported elements, whereas the consumption structure was different before creation of the employment.[17]

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[15] Such a situation might result from economies of scale: the production cost of one unit in a small factory, even if well managed, is generally higher than that of a factory with greater capacity.

[16] The concept of marginal cost must be applied very cautiously. In particular, it should not be limited to short-term view. In the case of an expanding sector with temporary surplus productive capacity, the marginal cost shall take into account, as we already noted, the actualized cost realized by advancement of the date when a new production unit will be needed.

In the converse case of a regressing sector, it will not be necessary to take such a cost into account.

In the case of a technically connected "string of projects" (e. g., a power station and an aluminium plant), the marginal cost will include all investment and operating costs of these units.

[17] In the paper [14] J. M. D. Little and J. A. Mirrlees, on the basis of schematic computations, put forward the idea that reference wages represent about 80% of nominal wages in the case of a staff without employment. This calculation assumes however the possibility of transfer of the amounts paid as wages into amounts available for investments, and one could dispute this viewpoint.

A reduction of 20 to 50% of the nominal rate of these wages can therefore be accepted for the case of personnel without employment.

Moreover, it should be noted that the staff which was really unemployed before the project, only constitutes a part of the whole staff, and that staff not classified in higher categories may often be a scarce commodity in the economy.

This adjustment of wages can in practice only be done for wages paid by the enterprises linked to the project, and only by more specific investigation. Generally, wage adjustments in other enterprises will be ignored (as reflected by the taking into account of costs, slightly overstated for locally made products).

For qualified staff who are scarce in the economy, at least real wages shall be taken into account and, in the case of a country applying arbitrary limitation of wages for executive staff, it may be justified to take an accounting price that exceeds the nominal rate.

The reference price theory applied to remuneration of work input, raises problems as yet unsolved by economic theory. In certain cases, programming submitted to the constraint of full employment, can lead to negative prices for wages.

It was this dilemma which confronted L. V. Kantorovitch when he applied mathematical programming to socialist planning. The objectively defined evaluation (prices) for labour input may be without significance, from a political or social viewpoint, and its economic significance is only marginally true. However, in a liberal economy, wages do not derive solely from relations between wage earners and employers. With tax, social charges, allowances, subsidies, etc. the state completely changes this relationship, as R. Pallu de la Barrière observes in the foreword to the French edition of L. V. Kantorovitch. The socialist economist also suggests a general equalization of wages.

One may even go farther and consider introduction of a systematic distortion at the level of reference prices which can be theoretically justified when returns increase. Indeed, in the linear case, prices (dual variables) maintain a constant value up to the point where they become nil. However, in the case of growing returns, remuneration of inputs at their marginal productivity entails remuneration in excess of average productivity. The transition from underemployment (even partial) to full employment naturally implies a growing return of input, and this kind of distortion can therefore be justified.

Transactions with financial bodies. Transactions, no matter of what nature (participations, loan, loan or capital repayment, interest or dividends payment), will be classified in two categories, according to the beneficiaries:

(a) Transactions with national financial agencies, or at least bodies within the economic entity under investigation;

(b) Transactions with foreign financial bodies.

The first are simply internal transfers and therefore of no interest to us, except from the viewpoint of income distribution.

But the second must be taken into account, on their actual date of operation, with corrective coefficients as might be necessary, for all payments in foreign currency.

Actualization

We now have at our disposal maturity schedules of receipts and expenditures, possibly adjusted to take into account certain distortions of exchange rate or of particular prices for each economic agent (enterprises and State) most concerned with the project (as a result of change in their activity, in cost of their consumption or in sale of their products and consequently in their profit).

It now remains to take into account the fact that the value of 1 dollar in a year, or several years from now, is not the same as its immediate value, neither to the individual nor to all the other economic agents. The concept of actualization was therefore introduced from the viewpoint both of the enterprises and the individual. Its use in judging a project from the viewpoint of the community raises some difficult problems in the theoretical field.[18] Some dispute its use even in the case of big investments, and recommend direct consideration of the maturity schedules of receipts and expenditures.

Whichever the hypotheses considered, the authors generally agree that the community attributes more weight to consumption in the near than in the distant future. The evolution of the coefficient which balances consumption and consequently forthcoming uses is not known exactly, but it is traditional and comfortable to admit that it assumes the form:

$$\frac{1}{(1 + i)^p}$$

The rate of actualization from the community viewpoint (social time preference), would then equal *i* for all periods.

This form may, however, be criticized: in particular, the rate of actualization has no reason to be constant, and may depend on the level of consumption attained.

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[18] See a discussion on these problems in [7] of J. Lesourne, pp. 172—177, in [3] of Abraham and Thomas, or in [5] of Prou and Chervel, pp. 133 and 134.

It is nevertheless the form generally adopted. The coefficient:

$$\frac{1}{(1 + i)^p}$$

has sometimes been called the psychological discount rate (M. M. Boiteux). But, once the principle of actualization has been admitted, definition of the rate to be adopted raises many problems which have not so far been resolved satisfactorily.

Various approaches have been tried, and we shall mention three. The first accepts the idea that the financial market at least approximately reflects the future evaluations made by suppliers and recipients of capital. The rate of actualization will therefore be sought on the basis of analysis of rates actually applied to various kinds of investment, if possible distinguishing between the rate of "net" interest and the "premium" on risk of the operation financed by the loan, and on the quality of the borrower.

This pragmatic approach is nevertheless confronted by the fact that there is not one, but several financial markets, each partitioned off and subject to its own regulations. Furthermore, the market which can be included in statistical observation, often only represents a small part of total investments of the country. Finally, the rates quoted may vary by some two to three per cent on medium-term bonds issued by the State, and up to 100% on usurious loans granted at some periods of the year.

Such a situation results from partitioning of the various capital markets. Thus, it is very difficult to determine a rate that may be applied for "equilibrium".

Therefore, another approach has been suggested, close to that recommended by certain authors for an enterprise in the case of financial constraint. The central planning authority could attempt to determine various rates for projects yielding a positive actualized profit and then calculate the total capital requirements for each rate. In this way one gets (figure 3) a decreasing curve, as a function of the rate of actualization (or more exactly, a stepped curve, since the number of envisaged projects is limited). C_0 is then the total amount of available capital originating from various sources (foreign aid, budget, local savings, etc.). The rate i_0 as rate of actualization shall be so chosen that all the projects yielding a positive actualized profit at the rate i_0, can be implemented with the available funds C_0. However, this procedure can be criticized for several reasons.

First of all, in reality, it is quite difficult to grasp the notion of available funds C: what length of time is envisaged–one year or five? Are transfers

Figure 3
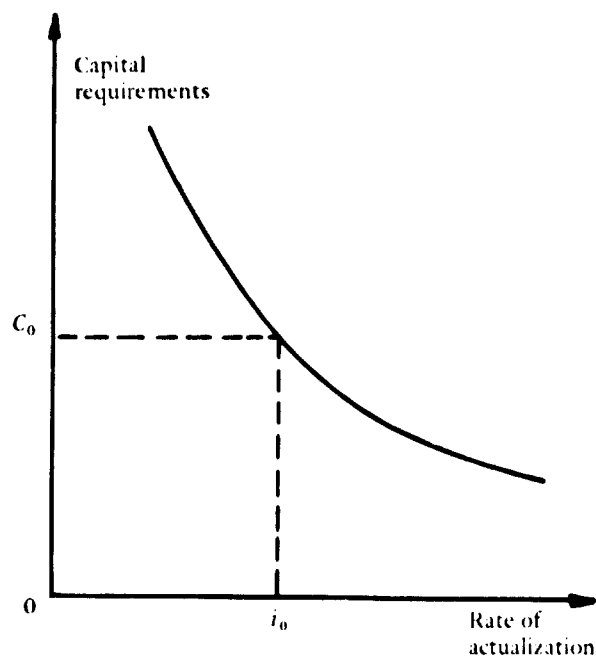
from one year to another possible? As far as projects are concerned, difficulties are also numerous. What kind of project is taken into account: public projects only or public and private ones? Is it possible to delay some projects? The interdependence of projects also entails many problems.

But, even when C_0, the sum of the capital available, and the projects are sufficiently well defined, the very principle of the method is open to question.

It would be valid within the frame of a broad capital market where an increase of interest rates would be reflected in actual increase of capital supply.

In reality, the envisaged procedure leads to adoption of very high rates (20 to 25%), when the invested funds originate either from public (hence fiscal) sources, for which it is difficult to fix an interest rate, or from external aid, the rates of which, if it is a loan, rarely exceed 6 to 9% and will never reach the rates of 20 to 25% obtained before.[19] Should the choice between projects then not be made either by real capital cost and consequent adoption of much lower rates–of 8 to 10%? The most

[19] One should mention the explanation, given by C. Abraham and A. Thomas in their work [3] (p. 318) of this difference, admitted even in developed countries for public investments. The less ing of satisfaction resulting from the payment of 1 dollar is assumed to be much greater than that resulting from an income reduction of 1 dollar, and the scarcity of public fund follows from it. The method shown in figure 3 would then be applicable, only through increasing the monetary cost of public investment by a certain amount, corresponding to the psychological cost of the tax. Abraham and Thomas suggest an increase of about 20 to 30%.

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interesting projects would then be those for which these rates generate the highest actualized income.[20]

This procedure, though not applicable on a country-wide scale, has nevertheless been employed at the level of certain services that receive capital grants yearly (Ministry of Public Works, of Energy etc.). It remains a useful palliative, and a first approximation of what might be called the rate of substitution (or opportunity cost) of capital for the country or service considered.

The rate thereby adopted would be the rate of internal viability of the first project to be renounced (or the last project implemented, if each project is sufficiently small in terms of the whole ensemble of projects). But this rate of substitution, resulting from juxtaposition of the funds available, and the "project ideas" at the time of its determination, has no reason to be equal to the coefficient of actualization which expresses the weight that the community, enterprise or individual attribute to outputs, consumption or future satisfaction.

Thus, another much more theoretical and "macro-economical" approach is necessary, but which better reflects the future factors to be taken into account.

Consideration indeed shows that:

(a) In the same proportion that the planned rate of growth is higher, the rate of actualization is probably higher; a high rate of growth requires big investments, with resultant heavy drawing on available resources. The heavier the immediate demand for sacrifice, the higher the present preference, consequently, the actualization rate will rise in consequence;

(b) As the rate of actualization is higher, so the total resources available for saving and consumption will be smaller in direct proportion.

The rate is therefore linked to the growth rate desired for the economy and its initial level. But the relationships between these various factors, and many others, such as population increase and socio-institutional aspects of the community concerned, are not rigid.

Many models of economic growth, presented by theoreticians[21] (Cobb-Douglas, A. Quayum, S. Chakravarty, J. Von Neumann, Kemeney, Morgenstern, Thompson, Solow and, recently, Malinvaud and Stoléru), connect growth rates, existant re-

sources, the interest rate, the rate of savings or investment and various other factors. Under certain conditions it can even be demonstrated that the rate of expansion and interest are identical at equilibrium.[22] Unfortunately, these models rest on complex hypotheses, some of which are apparently not fulfilled (in particular, the convexity of production function, since multiplicity of equipment decreases development cost).

Moreover, purely theoretic analysis must be complemented by:

(a) sociological analysis of actual behavior of economic agents, and the rate of savings they accept; *(b)* analysis of the role of technical progress, in all its forms, in economic growth and its relationship to the rate of savings.

Beyond these conceptual difficulties, the application of models presupposes a measuring device sufficiently precise for the parameters adopted. Such a device can only be sufficiently elaborate national accounting, which few countries at present possess. Nevertheless, it is conceivable that such an instrument will one day enable political authority to adopt an actualization rate that is more adequate from the viewpoint of the community. Such a choice would essentially reflect a choice between present and future, as to the rate of growth and the kind of development desired. On these grounds, it is a political decision to be made by the central political-economic authority of the country. Models, no doubt complicated, will one day make it possible to test the consequences of choice of a certain medium and long-term rate, taking foreseeable reactions of economic agents into consideration. The formal and mathematical developments presented by L. Stoléru[23] and relating to economic growth in France, enabled decision on a global rate of actualization of between 8 and 10%.

It follows that this rate will not vary for the various investments envisaged:[24] present satisfaction procured by forthcoming availability of a dollar cannot depend on the equipment which made this dollar possible. A unified rate will therefore be the rule.

It should also be noted that the actualization rate so defined is truly the rate which expresses the value accorded to future income, consumption and output. It does not necessarily equal the "rate of substitution" determined theoretically, by calculating the rate of internal profitability resulting from the use of fixed capital of the project for other purposes in the economy. This concept of rate of substitution

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[20] The discussion is close to that which can be held from the viewpoint of the enterprise, by comparing the criterion of rate of internal viability, and the coefficient of relative capital growth where financial constraints exist.

[21] See P. Massé in [4], p. 425 and the following citations, where description and discussion of several models is given. We should also mention Malinvaud in [15], J. C. Hirschleifer, J. C. de Haven, J. W. Milliman in [16], pp. 139—151 and 160—161, Stoléru in [17].

[22] See B. Kirchner [18].

[23] Paper mentioned [17], pp. 415—442.

[24] This point of view is especially disputed by J. Desrousseaux [19], but the author appears, in certain cases, to question the very principle of actualization.

discussed in detail by American authors–for determination of the rate of actualization on funds allocated to public investment expenditure, is difficult to grasp in terms of alternative use of the funds (private or public utilization).[25]

Finally, although generally accepting the principle of actualization, economists emphasize the difficulty in proposing tangible rates for computation from the community viewpoint. Therefore, calculations are generally made on several rates, to better check the sensitivity of projects to variations of the rate. Experience shows that a variation of a few points generally does not alter judgement, except in projects with very different capital cost and operation structures. Rates from 6 to 25% seem to represent the limit of actualization rates admissible for a community.

Besides, various models of economic programming, showing the actual capital cost, lead to rates of about this order.

Such a calculation gives: (a) minimal estimation of profit for the economic entity concerned with the project, or the variants of the project under investigation; (b) possible estimation of attraction of the project from the viewpoint of public finance and, at least partially, the influence of the project on the balance of payments.

The latter does not limit itself solely to the enterprise's foreign trade resulting from the project, but also encompasses trade of enterprises affected by the project.

Estimation of profits or losses due to considerable variation of prices and external savings or deficits

Many projects will effect considerable change in price of existing goods, either by rise (protection of a new enterprise), or reduction (considerable increase in capacity, due to scale effects). In principle, demand for the goods will vary and price alteration will find expression in additional loss or profit for the community not previously taken into account. Let us take an item imported at price P_1. First the case of a rise in price from P_1 to P_2, the quantity being sold dropping from Q_1 to Q_2 (see figure 4). As indicated, the receipts for the project from the viewpoint of the community will be the value $Q_2 \times P_1$, where the sum $(P_2 - P_1) \cdot Q_2$ has the nature of a transfer from consumers to owners and wage earners of the project enterprise.

Furthermore, there is a loss of "satisfaction" in the economy, since consumption dropped from Q_1 to Q_2. Under certain general hypotheses, it can be demonstrated that this loss is equivalent to the surface of the curvilinear triangle ABH. Likewise, in the case of price reduction from P_1 to P_3,

[25] See S. C. Smith and E. N. Castel in [20].

Figure 4
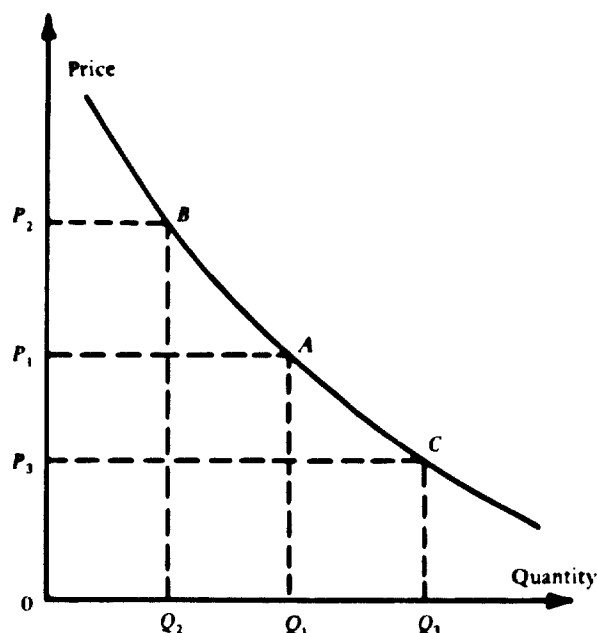
and increased consumption from Q_1 to Q_3, one must add to the profit resulting from price reduction for the past consumption [represented by the surface AP_1P_3F, i.e., $(P_1 - P_3) \times Q_1$]-the profit resulting from new consumption made possible by the project. It can also be shown as represented by curvilinear triangle ACF.

One can therefore try to estimate these benefits and profits. Practically it will often be difficult to evaluate variation in consumption due to price change. Knowledge of price elasticities is insufficient for most products. Nevertheless, one could try to make a cautious estimate and assimilate the demand curve with a straight line between the significant points for the initial and final state. The profit or the loss will then be equal to:

$$\frac{(P_1 - P_3) \times (Q_3 - Q_1)}{2} \quad \text{or} \quad \frac{(P_2 - P_1) \times (Q_1 - Q_2)}{2}$$

Similar calculations will for instance be made in the case of increased traffic because of improvement of a road (taking into account the advantage resulting from "traffic generated"). Profit calculated in this way will of course be actualized at the same rate as the other receipts and expenditures.

Likewise, attempt will be made to evaluate external savings and deficits. We have already indicated that some cannot be directly quantified. They will merely be described. For all other cases an estimation will be attempted, and especially for projects entailing considerable price variation in other products in the economy or changing activity of other economic agencies (especially

because of a substitution effect: a shoe factory will reduce activity of craftsmen in making shoes. Conversely, a plant for aluminium processing can be erected after implementation of a project to produce aluminium). These external savings and deficits will be subject to separate evaluation, from year to year, according to the previously defined rules for the project in question.

Effects of projects on income distribution and summary calculation of induced or secondary effects

We repeatedly indicated the significance of problems of income distribution. However, economic analysis conducted so far has practically ignored them, in assuming one dollar of additional income to a poor farmer to be totally equivalent to one additional dollar for the wealthy entrepreneur or the State, provided the profits be in the same community. We tried to measure growth of income resulting from the project, without giving attention to the beneficiaries. This approach has the advantage of simplifying the calculation. This procedure follows essentially from the fact that modification of income distribution should result from action of the State-fiscal and of various social institutions-rather than from choice of production projects. However, taking the significance of this problem into consideration, the main categories of beneficiaries should be distinguished for every variant of the project, and especially domestic and foreign economic agents. This distribution is not solely of political importance, but also has economic bearing insofar as it affects utilization of new resources created by the project.

The effects on income distribution must be quantified as much as possible, leaving the responsibility of decision and the weight to be accorded each category of beneficiaries to the political authority. Sometimes they can be used as a basis for the estimation of secondary effects. However, one should use secondary effects to justify a project only with the greatest caution.

When comparing two projects which are incompatible, both will have secondary effects related to income distribution modifications entailed by each. If the income distribution resulting from the two is more or less the same (which is mostly the case), it will be enough to take into account income created by each one, without multiplying it by a factor which would be nearly the same in both cases and would therefore not change the gradings of the two projects.

If two projects possess effects on income distribution that vary widely from the one to the other (capitalistic and non-capitalistic project), an estimate of resultant secondary effects can be attempted.

It should not be forgotten however, that a secondary effect is only possible if the productive capacity of the economy concerned is not fully utilized. There are many bottle-necks that prevent satisfaction of considerably growing demand, without additional investment, which should be taken into account. Without precise information on actual behaviour of beneficiaries from increased resources created by the project (households, enterprises and the State), only some summary estimates are possible. Coefficient factors with weak theoretical and statistical bases should be applied with utmost caution.

Other effects of the project

All other possible factors must be collated to complete economic evaluation of projects under consideration. One could consider implementation of projects that permit the country to acquire a certain economic independence from a sole supplier. Such a position may be justified. The additional price paid to make the project viable then becomes an insurance premium against future uncertainty. Analysis of behaviour of developed countries shows many examples of this kind of project. The purpose of economic study will then be to show the cost of this insurance or independence. A favourable decision is only made if the economy can bear the cost, taking into account the real profits anticipated. Economic independence at any price impossible to achieve in the 20th century, even for the most developed countries would be very expensive for the economy.

A criterion often considered is the number of new jobs created. However, this criterion is not sufficient in itself, since creation of jobs always corresponds to cost.

The analysis of variants will take the relatively low cost of manpower for certain projects into account, and in some cases will lead to adoption of material of lower technical performance, with a cost in foreign currency which is also less.

The value of industrial training given by the enterprise can justify, in certain cases, advantages granted by public authority. It will, however, always be difficult to estimate correctly and caution should be applied.

Project classification

Upon conclusion of the work discussed above, each project will have:

(a) An actualized balance of its direct and indirect effects, evaluated in a limited and cautious fashion;

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(b) An actualized balance of surplus, and of possible external savings or deficits related to the project;

(c) A qualitative rather than quantitative balance of its effects on income distribution, secondary, induced and other possible effects.

There will also be an evaluation of actualized cost (or profit) for public finance.

It now remains to make a decision and three cases can be distinguished:

(a) A decision of "yes" or "no", without selection of variant;

(b) An option between several technically incompatible projects;

(c) Several compatible projects (possibly with variants) for which priorities must be defined taking into account financial or other restrictions).

In these cases one does not overlook calculation of profitability of invested capital by comparison with the reference solution: e.g., in a shoe factory project, the possible loss of activity of several craftsmen.

Decision by "yes" or "no"

In this unfortunately too frequent case because it testifies to scarcity of projects for study, it is enough for the actualized profit to be positive at the rate considered normal, or what amounts to the same thing for the rate of internal viability to be higher than the minimum judged necessary.

Option between incompatible projects

In the absence of financial restriction, the variant yielding the highest actualized profit is recommended. In fact, there are almost always financial restrictions even if not explicit. In this case, the variant to be adopted can be that with the highest relative rate of capital growth, by comparison of the B/I of the variants. B would be the actualized profit from the community viewpoint (this profit may sometimes include prudent estimation of surplus) and I would be the initial capital expenditure of the community concerned, subjected to the financial constraints. It would not necessarily be the total capital cost, if part of the investment originates from foreign sources, and if there is no option of it being invested in another economic sector (e.g., the case of certain industrial or mining projects calling for foreign capital). The variant giving the highest B/I will then be adopted.

Definition of priorities among technically compatible projects

This situation has at least two aspects: (a) definition of priority among projects which are compatible and profitable, but not all realizable because of

financial restriction; (b) definition of priority among projects for which properly speaking, there are no financial restrictions their financing not being state supported, but for which some action is nevertheless required i.e., orientation given to industrial promotion on behalf of several projects).

In the first case, the criterion of the rate of relative capital growth B/I, as defined above, permits first classification which, though not perfect from certain points of view,[26] has the merit of being simple and adaptable to the conditions of many developing countries, where uncertainty of data does not always justify application of a too complex method.

In the second case, the possible uncertainty as to source of financing (foreign share in the total investment) makes the option between priorities more difficult. In fact, both criteria (actualized profit realized and relative capital growth rate at an estimated rate of financing from a domestic source) complemented by the chance of succeeding, more or less quickly, in a possible promotion, will permit practical definition of priorities.

It should be noted that we have not made use of two criteria sometimes emphatically proposed for project evaluation: added value and effect on the balance of payments. We want to specify our objections to these two criteria and demonstrate the extreme practically non-existent cases in which in our opinion they might be applied.

Evaluation of projects by added value amounts to saying that no cost is attributed to the creation of added value, which includes the profits, possible tax, wages and charges. Increased product price due to tariff protection would then be reflected in additional profit, and consequently in additional added value. In fact, added value would only be admissible if there were no bottle neck in the economic system and especially, if there were underemployment of all means of production (manpower and equipment). This case practically never exists.

The criterion of the added value is sometimes used in the form of the relation $V.A./I$, I being the initial investment. The numerator is sometimes the actualized added value, but more often the "average" added value of a normal year's operation. This criterion, to be correct, presupposes:

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[26] In fact, the criterion B/I implicitly assumes that one-time capital grants are made for implementation of a certain number of projects. In fact, there will generally be a budget of investment renewed every year, and each project may be implemented, either in the first or the second, or n^{th} year — or not all. One then is dealing with a linear programme in integer numbers which is very complicated. Capri's method makes it possible.

(a) That the concept of "average" added value makes sense, i.e., that there is actually no great difference between the first and last years of duration of the project.

(b) That the time of duration of the compared projects is identical.

(c) That, as above, there is underemployment of all production means in the economy.

This criterion, in inverse ratio to a capital co-efficient, is in some respects comparable to the "period of amortization" used by certain enterprises, the limitations of which are known. We therefore deem it impossible to use this criterion in many cases, other than for preparatory classification in an economy with great underemployment, including of qualified staff.

In general, the criteria based on added value assume a shadow price for labour equal to 0 for total manpower, and ignore the cost of consumption of certain technical inputs to the economy.

Some authors recommend that countries suffering form severe lack of foreign currency should classify projects by foreign currency contribution. This criterion must also be used with great caution, since it often amounts to an assumption that the only scarce commodity in the economy is foreign capital. It is likely that there are other scarce commodities such as qualified manpower and it would simply lead to comparison of cost of foreign currency saved or earned for each project, this would be no different from the procedure indicated before, once possible correction has been made to account for the rate of exchange, determined at a level that does not reflect scarcity of foreign currency.

GENERAL CONCLUSION

The theoretical and practical developments in evaluation of projects from the viewpoint of the entire economy show that the problem is not easily described, nor resolved, despite constant attempts to simplify it.

The practical method proposed here is/also not perfect, and only permits good evaluation in a relatively simple economy, or for projects with a limited number of inputs. But it seeks to remain realistic as to the means actually available for evaluation of project interest in many countries.

Systematic implementation of this method would doubtless have avoided many errors. This presupposes that bodies responsible for the economy would devise methodology adapted to the specific conditions of the country (e.g., as far as available production capacity is concerned), and would opt for certain identical numerical values for examination of all projects. Nevertheless, it should be noted

that many countries are making considerable progress in this direction. Certain concepts considered inadmissible some years ago, are today adopted and even recommended by certain international financial bodies. There are instances of effective utilization of reference prices for the rate of exchange, capital costs, production value or wage costs in analysis of projects which have been the subject of effective financing.

The essential difficulty results not only from theoretical problems, but also from practical problems, such as collation of data and verification of the hypotheses advanced in the theory. This data collation can be no more than approximate, and the economist must always demonstrate impeccable judgement and intellectual integrity. He must limit his investigations, because of time or financial restrictions that are imposed on him. His selection between fields to be explored more thoroughly, and matters where summary estimates will suffice, is essential in the value of the study. This choice assumes profound knowledge of the general economic conditions into which the project is integrated, and here we again deal with the problem of liaison between choice of projects and general planning. It is essential that the person responsible for the projects whether industrial or not is acquainted with the main points of this paper. Many people, and even many experts, will try to convince him of the interest of a specific project for the community. Such an interest may be real, but it should not result from summary demonstration too frequently encountered. A dishonest or badly trained economist will always be able to demonstrate to persons not familiar with economic techniques that a project is interesting for the community. The industrial economist, charged with study of projects, must always be aware of the conditions which render these demonstrations valid, and he has to verify whether all the significant effects of a project have been analysed.

The evaluation factors to be collected for various projects will be partially identical (capacity for energy production, transport, employment data, etc.). With some experience, such evaluation can be made in relatively short time for each project.

Great care must always be taken to adopt only minimal estimates of profit. In this respect, the so-called secondary effects will practically never be taken into account. Estimation of "induced" effects must be cautious and should be limited to the most certain among them. Taking into account the "consumer surplus" justified in many cases should however be prudent. Finally, cost analysis must always be meticulous, especially so in those

cases where the market price is likely to be replaced by an accounting price that better reflects the cost of a production input to the community.

The hypotheses on which computation is based will always be clearly specified. Computation of effects of a project from the community viewpoint, and selection of the project that best suits this viewpoint entails too many conceptual, methodological and statistical problems. Therefore, results should not be presented without their mode of calculation being specified, thereby permitting discussion.

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Case study

EXAMPLE OF IMPORT SUBSTITUTION:
IRONWORKS WITH AN OUTPUT OF 30,000 TONS PER YEAR
FOR THE PRODUCTION OF (CONCRETE)
REINFORCEMENT BARS FROM SCRAP IRON

by ANDRE BUSSERY

THIS CASE STUDY, *as all studies intended for teaching, simplifies reality and may seem schematic. It seeks to illustrate a practical approach to problems of economic project evaluation, taking into account the restricted research means generally available, but nevertheless conforming to the teachings of economic theory.*

This approach, without explicitly using reference prices except for capital and manpower cost is equivalent, however, to an approach of correct use of reference prices for supply of fuel, scrap iron, electricity, etc. Moreover, it identifies beneficiaries and losers in the event of implementation of the project. In other words, it permits measure of the impact of the project on income distribution among economic agents.

On the other hand, it may appear too limited to the financial effects of the project, without taking into account certain results that the project could have. The significance of these effects depends greatly on the economic conditions of the entity. Their appreciation would pass beyond the framework of this modest case study.

A. STATEMENT OF THE PROBLEM

Position of the problem

IN ITS THIRD FIVE YEAR development plan, the Government specified erection of ironworks with a capacity of 30,000 tons per annum, based on an electric scrap furnace and rolling mill.

The Department of Industrial Promotion is charged with detailed study of the project and has, for this purpose, consulted with several manufacturers of ironworks equipment and financial bodies likely to participate in the erection of the works.

After checking the expected profitability of this project the Department of Industrial Promotion was entrusted by the Minister of Planning with evaluation of all the economic effects of the project.

To evaluate the project, the Department has the following elements at its disposal:

(a) Study of the domestic market for reinforcement bars and scrap iron;

(b) Detailed technical study giving particulars of the investment and main production cost;

(c) Financing scheme prepared by the national investment bank after consultation with the main financial bodies concerned.

The principal information resulting from these documents is described below.

For timing of the project, the following premises were accepted:

Year 0: start of construction (infrastructure and civil engineering);

Year 1: erection and completion of plant;

Year 2: start of operation.

Analysis of the local market for reinforcement bars and scrap iron

Thorough investigation made it possible to specify that the present market for reinforcement bars amounts to 20,000 t/year and that past evolution of imports (the only source of supply hitherto), and the prospects of the national economy, make it reasonable to accept a growth rate of 6% per annum, at least for the forthcoming ten years.

Taking these prospects into account the promoters adopted the following programme:

	t/a
Year 2	10,000
Year 3	15,000
Year 4 to 10	20,000
Year 11 to 15	25,000
Year 16 to 21	30,000

The output of one ton of finished goods requires 1.2 t of scrap. Analysis of the domestic market showed that it could supply only one third of the needs of the works (i.e. 400 kg per ton of finished goods). The local scrap price at factory door is taken to be $20 per ton, equal to the f.o.b. price for export of this scrap. The additional scrap needed, i.e. 800 kg per ton of finished product, will be bought on the world market, at the c.i.f. price of $40 per ton, taking into account the distance of sources of supply.

Detailed investments and principal production costs

The iron mill will have an electric arc furnace with a capacity of 10 t per cast, 10 casts in 24 hours and an ordinary rolling mill processing small sized billets.

The scrap iron is melted in the electric furnace, and then cast in ingot moulds. The billets are reheated in the pusher type furnace and rolled through the bearers of the mill.

After comparative analysis of the various offers for equipment, and decision on the most advantageous solution, the investment is estimated as follows:

(a) *Detailed investment*

Total investment will be $4 million as follows:

	In dollars	Depreciation per annum In dollars
Infrastructure (feasibility, railhead, water, telephone, high tension power line, etc.) depreciated over 20 years	300,000	15,000
Buildings, depreciated over 20 years	900,000	45,000

	(In dollars)	Depreciation per annum (In dollars)
Equipment renewable every 10 years	1,500,000	150,000
Equipment renewable every 5 years	200,000	40,000
Depreciation from year 2		250,000
Initial expenses (engineering, studies, etc.) depreciated over 3 years	100,000	33,000
Amortization in the first 3 years of operation		283,000
Initial working capital 600,000 dollars of which to be used for stockpiling and 400,000 for cash requirement	1,000,000	

The schedule of expenditure looks as follows:

Maturity schedule of capital costs and renewal charges, effected by the ironworks company

(In thousands of dollars)

Year	Infra-structure	Building	Equipment renewable after:		Initial expenses and working capital	Total
			10 years	5 years		
0	250	150				400
1	50	750	1,500	200	1,100	3,600
2 to 5						
6				200		200
7 to 10						
11			1,500	200		1,700
12 to 15						
16				200		200
17 to 21						

Depreciation shall be effected in linear fashion.

(b) *Financing of investment*

The investment will be financed:

(a) By subscription to capital stock of $1.5 million divided as follows:
State: $0.9 million;
Private national groups: $0.6 million.
The company will be constituted, and the capital subscribed at the beginning of year 0;

(b) By a long-term loan of $1.5 million, granted by a foreign bank for a period of 10 years at a rate of 8%, repayable in equal annual payments from the 6th year;

(c) By a medium-term loan of $1 million, granted by a domestic bank, at the rate of 7%, for a period of 5 years, repayable in equal annual instalments.

The loans shall be available from year 1, the first maturity date of repayment and interest payment will be in year 2.

Table 1

PROVISIONAL OPERATING ACCOUNT FOR THE IRONWORKS
(In thousands of dollars)
Assumed price $160/ton

Year	2	3	4	5	6	7	8	9	10	11			
Receipts													
Sales	1,600	2,400	3,200	3,200	3,200	3,200	3,200	3,200	3,200	4,000	4,000	4,800	4,800
Expenditures													
Operating expense	1,400	1,900	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,900	2,900	3,400	3,400
Interest paid	190	178	165	151	136	120	100	78	54	28			
Depreciation	283	283	283	250	250	250	250	250	250	250	250	250	250
Total expenditure	1,873	2,361	2,848	2,801	2,786	2,770	2,750	2,728	2,704	3,178	3,150	3,650	3,650
Operating profit	273	39	352	399	414	430	450	472	496	822	850	1,150	1,150
Tax	0	0	0	0	124	129	135	142	149	247	255	345	345
Net profit	273	39	352	399	290	301	315	330	347	575	595	805	805

Table 2

PROVISIONAL OPERATING ACCOUNT FOR THE IRONWORKS
(In thousands of dollars)
Assumed price $176/ton

Year	2	3	4	5	6	7	8	9	10	11			
Receipts													
Sales	1,760	2,640	3,520	3,520	3,520	3,520	3,520	3,520	3,520	4,400	4,400	5,280	5,280
Expenditures													
Operating expense	1,400	1,900	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,900	2,900	3,400	3,400
Interest paid	190	178	165	151	136	120	100	78	54	28			
Depreciation	283	283	283	250	250	250	250	250	250	250	250	250	250
Total expenditure	1,873	2,361	2,848	2,801	2,786	2,770	2,750	2,728	2,704	3,178	3,150	3,650	3,650
Operating profit	113	279	672	719	734	750	770	792	816	1,222	1,250	1,630	1,630
Tax	0	0	0	0	220	225	231	238	245	367	375	489	489
Net profit	113	279	672	719	514	525	539	554	571	855	875	1,141	1,141

Table 3

PROVISIONAL OPERATING ACCOUNT FOR THE IRONWORKS
(In thousands of dollars)
Assumed price $144/ton

Year	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
Receipts																		
Sales	1,440	2,160	2,880	2,880	2,880	2,880	2,880	2,880	2,880	3,600	3,600	3,600	3,600	3,600	4,320	4,320		4,320
Expenditures																		
Operating expense	1,400	1,900	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,900	2,900	2,900	2,900	2,900	3,400	3,400		3,400
Interest paid	190	178	165	151	136	120	100	78	54	28	84	70	54	37	19	0		0
Depreciation	283	283	283	250	250	250	250	250	250	250	250	250	250	250	250	250		250
Total expenditure	1,873	2,361	2,848	2,801	2,786	2,770	2,750	2,728	2,704	3,178	3,234	3,220	3,204	3,187	3,669	3,650		3,650
Operating profit	433	201	32	79	94	110	130	152	176	422	366	380	396	413	651	670		670
Tax	0	0	0	0	28	33	39	46	53	127	110	114	119	124	195	201		201
Net profit	433	201	32	79	66	77	91	106	123	295	256	266	277	289	456	469		469

Table 4

FORECAST CASH FLOW FOR THE IRONWORKS

(In thousands of dollars)

(cash components of the investment costs)

Assumed price: $1600/ton

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Resources																							
Loan	1,500																						
Capital		2,500																					
Operating profit before tax			−273	38	352	399	414	438	450	488	672	486	822	888	888	888	850	850	950	1,150	1,150	1,150	1,150	1,150
Depreciation allowances			283	283	303	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Total resources	1,500	2,500	10	322	635	649	664	640	700	722	746	1,072	1,100	1,100	1,100	1,100	1,100	1,100	1,400	1,400	1,400	1,400	1,400
Employment																							
Repayment of loans (capital)			174	186	199	213	228	256	276	298	322	348											
Investments	400	2,400				200						1,700					200						
Tax for year of operation							124	129	135	142	149	247	255	255	255	255	345	345	345	345	345	345
Dividends and reimbursement of capital			20	176	200	145	151	158	165	174	805	595	595	595	595	805	805	805	805	805
Total employment	400	2,400	174	286	373	413	697	536	569	645	645	2,563	850	850	850	850	1,350	1,150	1,150	1,150	1,150	2,697
Resource utilization rate employment (1+2)	1,100	100	116	260	236	33	144	131	117	101	1,511	290	290	290	290	90	250	250	250	250	2,697
Cash position on 1/1	1,100	1,000	836	952	1,212	1,440	1,415	1,559	1,690	1,807	1,908	1,988	397	647	897	1,147	1,397	1,397	1,447	1,697	1,947	2,197	2,447	2,697
Cash position on 31/12	1,000	836	952	1,212	1,440	1,415	1,559	1,690	1,807	1,908	397	647	897	1,147	1,397	1,447	1,697	1,947	2,197	2,447	2,697	0

Table 5

FORECAST CASH FLOW FOR THE IRONWORKS

(In thousands of dollars)

Cash estimates of the ironworks

Assumed price: $176/ton

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Resources																							
Loan	1,500																						
Capital		2,500																					
Opening profit before tax			−113	279	672	719	734	750	770	792	816	1,222	1,250	1,250	1,250	1,250	1,630	1,630	1,630	1,630	1,630	1,630	
Depreciation allowance			283	283	283	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	
Total resources	1,500	2,500	170	562	955	969	984	1,000	1,020	1,042	1,066	1,472	1,500	1,500	1,500	1,500	1,880	1,880	1,880	1,880	1,880	1,880	3,997
Employment																							
Repayment of loans (capital)			174	186	199	213	228	256	276	298	322	348											
Investments	400	2,600					200					1,700											
Tax for year of operation							220	225	231	238	245	367	375	375	375	375	489	489	489	489	489	489	
Dividends and reimbursement of capital			0	140	336	359	257	263	269	277	286	428	875	875	875	875	1,141	1,141	1,141	1,141	1,141	1,141	3,997
Total employed	400	2,600	174	326	535	572	905	744	776	813	853	2,843	1,250	1,250	1,250	1,250	1,830	1,630	1,630	1,630	1,630	1,630	3,997
Resource surplus on employment (1−2)	1,100	100	4	236	420	397	79	256	244	229	213	−1,371	250	250	250	250	50	250	250	250	250	250	
Cash position on 1/1	1,100	1,100	1,000	996	1,230	1,650	2,047	2,126	2,382	2,626	2,855	3,068	1,697	1,947	2,197	2,447	2,697	2,747	2,997	3,247	3,497	3,747	
Cash position on 31/12	1,100	1,000	996	1,230	1,650	2,047	2,126	2,382	2,626	2,855	3,068	1,697	1,947	2,197	2,447	2,697	2,747	2,997	3,247	3,497	3,747	3,997	0

Table 6

FORECAST CASH FLOW FOR THE IRONWORKS
(In thousands of dollars)
Cash estimates of the ironworks
Assumed price: $144/ton

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Resources																							
Loan	1,500	2,500																					
Capital	1,500	2,500														1,200							
Operating profit before tax			433	201	32	79	94	110	130	152	176	222	366	340	346	413	651	670	670	670	670	670	
Depreciation allowance			283	283	283	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	
Total resources	1,500	2,500	150	82	315	329	344	360	380	402	426	1,672	616	640	646	663	901	920	920	920	920	920	
Employment																							
Repayment of loans (capital)	400	2,600	174	186	199	213	228	256	276	290	322	340	290	223	239	256	274						
Investments							300					1,700					210						
Tax for year of operation	0	0	0	0	0	0	26	33	39	46	53	127	110	114	119	124	195	201	201	201	201	201	
Dividends and reimbursement of capital	0	0	0	16	39	33	39	45	53	62	148	256	266	272	300	456	469	469	469	469	469		
Total employment	400	2,600	174	186	215	252	400	328	360	397	437	2,323	575	603	635	644	1,125	670	670	670	670	670	
Resource surplus or deficit (1-2)	1,100	1,100	324	100	100	77	145	32	20	5	11	651	160	27	11	6	224	250	250	250	250	250	1,298
Cash position on 1.1	1,100	1,100	1,000	676	572	672	749	644	636	656	661	650	199	240	267	278	272	48	298	548	798	1,048	1,298
Cash position on 31.12	1,100	1,000	676	572	672	749	644	636	656	661	650	199	200	267	278	272	48	298	548	798	1,048	1,298	0

50

<center>Table 7</center>

<center>ACTUALIZED PROFIT AT VARIOUS ASSUMED PRICES AND DIFFERENT ACTUALIZATION RATES</center>

<center>(In thousands of dollars)</center>

Rate of actualization percentage	144			160						
	10	15		10	15					
Value achieved from viewpoint of shareholders	278	360	923	2,349	1,063	100	4,399	2,414	754	110	846
Value in terms of cash balance of the enterprise	498	583	671	1,023	1,125	1,171	1,599	1,700	1,700	1,619	1,457
Total actualized profit, taking into account financing conditions	776	223	252	3,372	2,188	1,071	5,998	4,203	2,454	1,509	611
Present value of loans and annual repayments	85	240	617	85	214	568	85	214	568	800	1,051
Profit realized without taking financing conditions into account	861	25	869	3,457	1,974	503	6083	3,989	1,886	709	440

(c) Operating conditions

The technical file supplies a detailed statement of required personnel and the production costs. At the final stage, the staff will amount to 300.

Fixed charges (which we will, albeit irregularly, consider as totally independent of production) include:

Interests of loans;

General expenses estimated at $ 400,000.

Costs proportional to the number of tons produced amount to $ 100 per ton as follows:

$ 15 wages and charges paid locally,

$ 40 for scrap (0.4 · 20 + 0.8 · 40 · 40),

$ 20 for electric power (1,000 kW/t) at an installed rating of 10 MW,

$ 4 for fuel,

$ 21 for consumables, spare parts and maintenance.

The forecast selling price ex-works for reinforcement bars is $ 160/ton. It is equivalent to the price for imported reinforcement bars delivered at warehouse (duties and tax paid · lighterage and transit). The latter included 35%, import duty, i.e. $ 56/ton.

For simplification a constant selling price was assumed for the period, the error in relation to reality should not be too great, taking into consideration that the price of imported scrap varies in parallel to the price of reinforcement bars.

(d) Forecast tax situation of the ironworks company

The company will be exempted from profits tax during 4 years, and will then pay at the normal rate of 30%. The company will also be exempted from duties and tax on its importation (scrap iron, refractories etc.) for its own manufacturing purposes.

Allotment of dividends. In order to simplify calculation, it was assumed that half the net profit will be distributed, from year 3 until year 11, and 100%, of the profit from year 12 to year 21.[1]

Liquidation of the enterprise. At the end of operation (i.e. at the end of year 21) the enterprise will go into liquidation. It is assumed that the liquidation value is nil, since the shareholders will collect in year 22 only the cash balance, assuming that the working capital can be recovered entirely.

Analysis of financial viability of the enterprise

The forecast accounts of operation, and tables of resources and capital use were computed on the basis of three hypothetical selling prices: $ 160/ton, $ 176/ton, $ 144/ton.

For this last assumption, and to meet financial requirements for renewal of equipment in year 11, it was assumed that an additional loan of $ 1,200,000 was subscribed abroad, at a rate of 7%, for a period of 5 years, with equal annual repayment.

Results for the operations account are shown in tables 1, 2 and 3 and for resources and capital use[2] in 4, 5 and 6.

Immediate deduction was made of actualized profit (table 7) and of the rate of internal profitability (table 8), corresponding to the various hypotheses on sales price.

[1] This hypothesis, like those on financing models, does not pretend to represent optimal financial policy. It has been set up to facilitate calculation and does not represent the general rule. Moreover, it is questionable in many points.

[2] For simplification, the tables "resources" and "use" do not explicitly show stockpiling at the beginning of operation or at a high production level. The result is a high initial cash reserve and improved "made good" value for calculation of actualized profit or of the rate of internal viability, calculated for own funds invested.

(*a*) Strictly from the viewpoint of *shareholders*;

(*b*) From the viewpoint of *own invested funds* taking financing conditions into account;

(*c*) From the viewpoint of *all invested funds* without taking financing conditions into account.

Table X

RATE OF INTERNAL PROFITABILITY AT DIFFERENT ASSUMED PRICES

(*Percentage*)

	Guaranteed price in dollars per ton		
	44	50	55
Point of view of shareholders	7.8	14	19
Project as a whole, taking into account financing conditions	12	25	45
Without conditions of financing	9.8	18	25

Additional information obtained during realization of economic analysis of the project

To carry through economic analysis of the project, several additional studies were needed to evaluate the main effects foreseeable for the ironworks project. We present here the main results of these investigations.

Inquiries in building enterprises

National building enterprises do not at present work at full capacity. Certain equipment is not utilized for the time being; therefore, no equipment needs to be purchased in order to furnish demand upon erection of the factory.

However, the labour force of these enterprises is fully employed. Increased production will necessitate recruitment. The whole qualified staff and part of the nonskilled manpower (representing a third of the total wages paid) is at present working in another sector, for the same remuneration. The remaining staff to be recruited can be considered as being presently unemployed.

Analysis of the operation of building enterprises shows that 30% of additional resources would be spent on new wages, 30% of the additional resources would purchase other goods and services. The enterprises pay 30% tax on profits.

Inquiries in the national electricity administration

The local power station presently works at full capacity at peak hours. To supply the plant, it will therefore be necessary to add a 10 MW generating set and build a high tension power line between the factory and the power station. The national

administration undertakes the operation of the set, which represents an investment of one million dollars (the State, by way of industrial development aid, will finance the power line, i.e., an investment of $60,000). This investment will be carried out in the year 1, and depreciated over 20 years.

There is sufficient staff at the administration to cope with this increasing activity and no new jobs will be created.

Analysis of the administration's operation shows that 20% of the additional resources will be spent on fuel from the refinery, whereas 10% will be assigned to other purchases (abroad, etc.).

The administration pays 30% profit tax.

It is assumed that an expenditure of one million dollars on this investment expresses a real cost to the economy.

Inquiry at the refinery

The refinery processes imported crude oil. At present, because of the lack of local consumers, a great part of the fuel produced by the refinery is exported, at $0.03 kg. The output of fuel by far exceeds the foreseeable needs and there will be no increased production at the refinery.

The refinery sells the fuel on the domestic market at the price of $0.04 kg. It also pays profit tax of 30%.

Other enterprises

All other sectors of activity can be considered as working at full capacity, and compelled to select between the offered activities.

It is especially to be assumed that harbour and commercial activity resulting from the ironworks yield very much the same resources as do the import of reinforcement bars and export of scrap iron.

The State

The State is expected to carry out certain development works of the existing infrastructure (especially roads), the cost of which in year 1 amounts to $60,000, nonrenewable.

Other factors

The opportunity cost of capital is assumed to be 10%. Calculations will however be made at 7 and 15%, to test the sensitivity of the result of an error of evaluation of the actualization rate.

It is assumed that the rate of exchange in force correctly expresses the relative value of the domestic currency in terms of foreign currency.

The state of employment in the country is such that about two thirds of the wages which will be

paid by the ironworks will go to people who, without the project, would have been unemployed. This rate will grow with time, because of population increase and job creation.

Finally, it is to be assumed that the effect of the project on the entire economy is small enough to consider the change entailed as marginal.

B. SOLUTION

We will analyze effects of the project on the various economic agencies concerned with creation and running of the iron and steel industry, and will ignore effects on all other agents. We will confine ourselves to direct and indirect effects, not taking into account "secondary" effects resulting from income creation, or reduction, for certain agents (households, the State, enterprises).

Consequently, we will successively analyze:

(a) Effects on enterprises:
  Ironworks project itself and its shareholders;
  Building trade;
  Power station;
  Refinery;
  National bank;
  Buyers of reinforcement bars;
  Traders in scrap iron.

(b) Effects on the State.

(c) Effects on the households.

We assume the activity of all other enterprises to be independent of the erection of the plant. This implies that, should they receive orders connected with construction or operation of the plant, they would have to forego equivalent contracts for other customers.

The foreign currency economies of the project shall not be especially evaluated, it being assumed that the rate of exchange corresponds to true parity of the domestic and foreign currencies.

This approach doubtless gives a limited conception of the interest in the project. In particular, it neglects secondary effects which may be important in an underdeveloped economy, where certain productive capacities are not utilized, and it does not explicitly deal with certain advantages: creation of employment and training of manpower, more secure supply, psychological effects on other suppliers.

Calculations will first be made with the assumed selling price of $ 160/ton. Later we shall see the sensitivity of results to a change in assumptions.

Calculation of economic viability of the project in the frame of the initial hypotheses on prices and employment

Calculation of effects of the project on each economic agent

Effects resulting from the ironworks enterprise

The profit created by the ironworks is distributed within the State, as direct tax, to the State as shareholder, and to private shareholders of the industry considered in this case as nationals.

However, it should be noted that the yearly balance of resources and employment of the undertaking is not immediately paid as dividend to the shareholders. Therefore, there is a permanently favourable cash balance which, since the shareholders are nationals and the activity of the enterprise is mainly on the domestic market, can be considered as a benefit to the national economy, though we made no explicit hypothesis as to placement of these moneys.

Finally, for the enterprise itself we shall adopt:

(a) Distribution of dividends and reserves to the shareholders as per table 7, i.e. 6 15 of the total dividend to private shareholders and 9 15 to the State. Table 13 gives this last result (column 6);

(b) Payment of taxes is summarized in column 3 of table 13, showing effects on the State;

(c) Liquid assets, for which table 7 indicates the actualized value at the rates of 7, 10 and 15%. This cash takes into account all the payments made by the enterprise, including dividends, taxes, repayment of loans.[*]

Building trade

The erection of the works (year 0 and 1) will have a bearing on the building trade.

Table 9 permits calculation of the additional profit that the building trade will draw from this new activity, after deduction from its new resources of additional operating expenses (wages of recruited staff, purchase of consumables, etc.), and later, increased tax on profit. The erection of the plant will represent profit to the building trade which can be evaluated according to actualization rates adopted, at $ 278,000, $ 271,000 or $ 261,000.

(a) *The power station*

Erection of the ironworks requires extension of the station in year 1, in the course of which one million dollars must be invested to meet additional demand.

[*] The actualised value of this cash in hand has been estimated optimistically, considering that part of this cash is used at the initial stage of operation for stockpiling. For simplicity, this procedure has not been taken up again in the tables of "resources" and "uses".
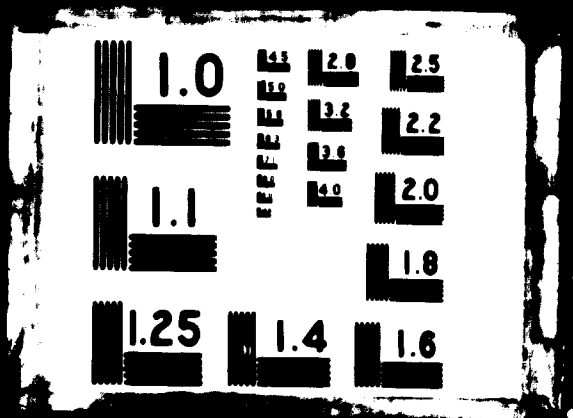
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Table 9

EFFECTS OF THE ERECTION OF THE WORKS ON THE BUILDING TRADE
(In thousands of dollars)

Year	Additional receipts	Additional expenses		Additional taxable profit	Additional tax	Net additional profit	Value actualized at the rate of		
		Wages	Purchases				7%	10%	15%
0	150	45	45	60	18	42	42	42	42
1	750	225	225	360	108	252	236	229	219
						Total	278	271	261

Table 10

EFFECTS OF THE ERECTION OF THE WORKS ON THE POWER-STATION
(In thousands of dollars)

Year	Additional receipts	Additional depreciation	Purchase of additional fuel	Other additional purchases	Profit before additional taxes	Additional tax	Additional profit	Value actualized at the rate of		
								7%	10%	15%
1							−1,000*	−935	−909	−870
2	200	50	50	20	80	24	106	92	87	80
3	300	50	75	30	145	43,5	151,5	124	114	100
4	400	50	100	40	210	63	197	150	135	113
5	400	50	100	40	210	63	197	140	122	98
6	400	50	100	40	210	63	197	131	111	85
7	400	50	100	40	210	63	197	123	101	74
8	400	50	100	40	210	63	197	115	92	64
9	400	50	100	40	210	63	197	107	84	56
10	400	50	100	40	210	63	197	100	76	49
11	500	50	125	50	275	82.5	242.5	115	85	52
12	500	50	125	50	275	82.5	242.5	108	77	45
13	500	50	125	50	275	82.5	242.5	101	70	40
14	500	50	125	50	275	82.5	242.5	94	64	34
15	500	50	125	50	275	82.5	242.5	88	58	30
16	600	50	150	60	340	102	288	98	63	31
17	600	50	150	60	340	102	288	91	57	27
18	600	50	150	60	340	102	288	85	52	23
19	600	50	150	60	340	102	288	80	47	20
20	600	50	150	60	340	102	288	74	43	17
21	600	50	150	60	340	102	288	70	39	15
22	0	0	0	0	0	0	0	0	0	0
						Total	3,577.0	1,151	668	183

* Additional investments for the new set.

During the entire operating period of the plant, the receipts to the power station will increase because of sale of energy. However, the station will have new expenses (fuel, various purchases). After computation of profit from additional operation and deduction of tax, we have the additional yearly profit for the power-station (after adding the amount for depreciation). Table 10 shows that the power-station draws a profit from erection of the plant which, at the rates adopted, equals $ 1,151,000, $ 668,000 or $ 183,000.

(b) The refinery

The refinery will have two additional resources: sales to the plant and sales to the power-station.

However, its sales abroad will decrease (by a value equal to three quarters of its new resources).

After tax deduction, we obtain the additional yearly profit of the refinery.

The profit that the refinery draws from this extension of its local market can be estimated by means of table 11; $ 333,000 at the discounted rate of 7%, $ 251,000 at 10% and $ 167,000 at 15%.

(c) The national bank

It lends one million dollars in year 1, repayable over 5 years at the rate of 7%. According to the rate adopted–7, 10 or 15%–the discounted profit will be nil (rate of 7%) or negative, as table 12 indicates. This actualized loss corresponds to the "premium"

Table 11
EFFECTS OF THE ERECTION OF THE IRONWORKS ON THE REFINERY
(In thousands of dollars)

Year	Additional receipts from sales		Loss of receipts from export	Additional profit before tax	Additional tax	Net additional profit	Actualized		
	to the iron-works	to the power station					7%	10%	15%
0	—	—	—	—	—	—			
1	—	—	—	—	—	—			
2	40	50	67.50	22.50	6.75	15.75	14	13	12
3	60	75	101.25	33.75	10.12	23.63	19	18	15
4	80	100	135	45	13.50	31.50	24	21	18
5	80	100	135	45	13.50	31.50	22	20	16
6	80	100	135	45	13.50	31.50	21	18	14
7	80	100	135	45	13.50	31.50	20	16	12
8	80	100	135	45	13.50	31.50	18	15	10
9	80	100	135	45	13.50	31.50	17	13	9
10	80	100	135	45	13.50	31.50	16	12	8
11	100	125	168.75	56.25	16.87	39.38	19	14	8
12	100	125	168.75	56.25	16.87	39.38	17	12	7
13	100	125	168.75	56.25	16.87	39.38	16	11	6
14	100	125	168.75	56.25	16.87	39.38	15	10	6
15	100	125	168.75	56.25	16.87	39.38	14	9	5
16	120	150	202.50	67.50	20.25	47.25	16	10	5
17	120	150	202.50	67.50	20.25	47.25	15	9	4
18	120	150	202.50	67.50	20.25	47.25	14	9	4
19	120	150	202.50	67.50	20.25	47.25	13	8	3
20	120	150	202.50	67.50	20.25	47.25	12	7	3
21	120	150	202.50	67.50	20.25	47.25	11	6	2
22	0	0	0	0	0	0	0	0	0
					Total	740.28	333	251	167

on industrial development, which the bank supports when it grants a loan at a rate lower than the average return on capital from the viewpoint of the national economy—estimated in the country at 10 or 15% according to the rate of actualization adopted. Possibly, this loss need not be taken into account if the bank always lends its funds at 7%, no matter for what project, or if the funds put at the disposal of the plant were denied to another project.

(d) The buyers of reinforcement bars

For the latter the situation remains unchanged. In fact, they pay the same price for the same quantity of reinforcement bars. For the community, the difference derives from the fact that the purchases are made on the domestic market and not abroad. However, this difference is taken into account in calculation, by recording in the community receipts, the total amount of sales of reinforcement bars (for the ironworks) and in expenditures, the losses resulting from cancellation of duties that the State collects on import of reinforcement bars. For the community, the profit is in fact equal to the value less tax of the reinforcement bars, which it is no longer necessary to import. The solution adopted is equivalent to the application of an international price equal to $ 104/ton of reinforcement bars.

(e) Transactions on scrap

Here we have the converse: stoppage of export of scrap represents a cost to the community, already taken into account in the operating forecast of the enterprise, which pays a price equal to the f. o. b. price. The purchases abroad were also recorded in the operating account of the iron industry.

(f) The State

The State supplies part of the capital for the enterprise in the year 0. In year 1, it also finances some infrastructure facilities. But it receives additional tax from the ironworks, building trade (table 9), power station (table 10), refinery (table 11) and its share of dividends from the works. However, primarily as a development premium, it renounces collection of duties on imported goods, for erection or operation of the plant.

As is shown by table 13, the waiver of import duties is by far the most important factor, involving a considerable actualized loss of $ 8.1 million at the rate of 7%, $ 6.6 million at the rate of 10% and $ 5.0 million at 15%.

It is, however, proven that the value of this loss decreases in parallel with the rate adopted. This is understandable, since the lost returns of the State

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Table 12

EFFECTS OF ERECTION OF THE PLANT ON THE NATIONAL BANK
(In thousands of dollars)

Year	Additional transactions	Actualized value at the rate of		
		7%	10%	15%
1	-1,000	935	909	870
2	244	213	201	184
3	244	199	183	161
4	244	186	167	139
5	244	174	152	121
6	244	163	138	105
Total	0		68	160

continue throughout the whole lifetime of the enterprise.

(g) The income of the households

Households draw their additional income from two sources: that paid by the building trade (two thirds of the new wages; the remainder being paid to personnel who had already equivalent wages), and that paid by the ironworks (also two thirds of the wages paid by the enterprise).

The benefit represented by this additional income distribution depends on the economic cost relating to use of unemployed manpower.

Without again discussing this problem, let us remember that this economic cost is at least equal to the production value previously realized by the same personnel in another economic sector. If creation of the plant eventually finds expression in decrease of working population in agriculture, the cost of manpower is equal to the marginal productivity of the agricultural labour force.

Some authors take into account the fact that part of the wages paid will be exchanged for imported consumption goods or services diverted from saving and recommend adopting for wages a reference rate higher than opportunity cost.

We shall pragmatically adopt a reference rate of 0.5 for wages paid to personnel unemployed in the absence of the project. Table 14 indicates the actualized profit of these additional wages: $ 1,148,000 at the discounted rate of 7%, $ 885,000 at 10%, and $ 614,000 at 15%. Thus the phenomenon in question is an important one, exceeding the effects on the power station and refinery.

Table 13

EFFECTS OF THE ERECTION OF THE IRONWORKS ON THE TREASURY
(In thousands of dollars)

Assumed price: $ 160/ton

Year	Infrastructure investment (1)	Ironworks tax (2)	Additional tax building (3)	Additional tax power station (4)	Additional tax refinery (5)	Return on capital (6)	Non-collected import duties (7)	Total difference (8)	7%	10%	15%
0	—	—	18	—	—	-900.0	—	-882.0	-882	-882	-882
1	-60	—	108		—			48.0	45	44	42
2				24.0	6.7		-560	-529.3	-462	-437	-400
3				43.5	10.1	12.0	-840	-774.4	-632	-582	-510
4				63.0	13.5	105.6	-1,120	-937.9	-716	-640	-536
5				63.0	13.5	120.0	-1,120	-923.5	-658	-573	-459
6		124		63.0	13.5	87.0	-1,120	-832.5	-554	-470	-360
7		129		63.0	13.5	90.6	-1,120	-823.9	-513	-423	-310
8		135		63.0	13.5	94.8	-1,120	-813.7	-473	-380	-266
9		142		63.0	13.5	99.0	-1,120	-802.5	-437	-340	-228
10		149		63.0	13.5	104.4	-1,120	-790.1	-401	-305	-195
11		247		82.5	16.9	172.8	-1,400	-880.8	-418	-308	-189
12		255		82.5	16.9	357.0	-1,400	-688.6	-306	-220	-129
13		255		82.5	16.9	357.0	-1,400	-688.6	-286	-200	-112
14		255		82.5	16.9	357.0	-1,400	-688.6	-267	181	-97
15		255		82.5	16.9	357.0	-1,400	-688.6	-249	-165	-85
16		345		102.0	20.2	483.0	-1,680	-729.8	-247	-159	-78
17		345		102.0	20.2	483.0	-1,680	-729.8	-231	-144	-68
18		345		102.0	20.2	483.0	-1,680	-729.8	-216	-131	-59
19		345		102.0	20.2	483.0	-1,680	-729.8	-202	-120	-51
20		345		102.2	20.2	483.0	-1,680	-729.8	-188	-109	-44
21		345		102.2	20.2	483.0	-1,680	-729.8	-177	-98	-39
22						1,618.2	—	1,618.2	366	199	74
Total	-60	4,016	126	1,533.0	317.0	5,930.4	-26,320	-14,457.6	-8,104	-6,624	4,981

Year	Iron works wages	Building trade and public works wages	Total additional income	Actualized value realized at the rate of		
				5%	10%	15%
0		15	15	15	15	15
1		75	75	70	68	65
2	50		50	44	41	38
3	75		75	61	56	49
4	100		100	76	68	57
5	100		100	71	62	50
6	100		100	67	56	43
7	100		100	62	51	38
8	100		100	58	47	33
9	100		100	54	42	28
10	100		100	51	39	25
11	125		125	59	44	27
12	125		125	55	40	23
13	125		125	52	36	20
14	125		125	49	33	18
15	125		125	45	30	15
16	150		150	51	33	16
17	150		150	48	30	14
18	150		150	44	27	12
19	150		150	41	25	11
20	150		150	39	22	9
21	150		150	36	20	8
Total			1,148	885	614	

Recapitulation of all the effects and value of economic viability of the project

Without at first taking into account the effects of the project on income distribution, it will suffice to add the effects of the project as felt by various economic agencies, which gives table 15.

Undoubtedly, effects other than increase of household income can be considered as practically certain. It is to be noted that in no way do they provide justification of the investment. The profit is negative for all discounted rates which corresponds to the operation being detrimental to the national economy, until year 16, when the output eventually reaches the level of 30,000 tons/year–the maximum capacity of the plant.

Considering a part of the wages paid as a profit certainly improves the over-all balance sheet, but does not make the operation profitable, when the State's immense deficit is taken into account with regard to the reference solution (import of reinforcement bars). In fact, the balance is just as detrimental for two reasons:

(a) The plant has a low production capacity and consequently does not benefit by economies of scale prevalent in competitive units abroad;

(b) Production capacity, although low, is still far in excess of market volume. The plant uses two thirds of its capacity only from the eleventh year on. The equipment renewed at this time would be only partially utilized, and it would perhaps be possible to postpone the renewal for some years. Yet, such a delay would not fundamentally change the result.

From the viewpoint of income distribution, the operation represents income distribution by the State (and incidentally, the national bank), to the benefit of households, shareholders of the works and suppliers. The study shows that the profitability, which is high from the viewpoint of the shareholders, does not justify the operation, as far as the community is concerned, within the frame of the adopted hypotheses.

Analysis of changed hypotheses on the economic viability of the project

Changed selling price of reinforcement bars on the domestic market

Without calculating, one can assert that such a change would not alter the economic viability of the project, but only the income distribution among the various economic agencies concerned. Nevertheless, we shall make the calculation for better illustration of the mechanisms. We will consider two assumptions, of $ 144/ton and $ 176/ton. We assume that the consumption of reinforcement bars is not affected by a change in price of ± 10%, though this is most probably wrong.[4] The effects already calculated for building enterprises, power station, refinery, national bank, income from wages and buyers of scrap will remain unchanged. On the other hand, the following will be subject to alteration:

(a) Profits of the iron industry and consequently, their distribution amongst the State, shareholders and cash assets of the enterprise;

(b) Income of the buyers of reinforcement bars, who will gain or lose, depending on rise or reduction of price;

(c) Finally, in the case of price reduction to a level of $ 144/ton, an additional loan is subscribed in year 11 by a foreign bank, at the rate of 7%, thus altering the value of actualized profit at the discounted rates of 10 and 15%.

We will calculate these various terms successively.

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[4] To give up this simplifying hypothesis, it would be necessary to make additional calculations. They would not involve difficulties, as long as the effect of price fluctuation on demand can be estimated.

Table 15

SUMMARY OF EFFECTS OF THE IRONWORKS PROJECT ON THE NATIONAL ECONOMY
(In thousands of dollars)

Assumed price: $ 160/ton

Actualization rate (percentage)	Building trade and public works	Power station	Refinery	National bank	Private shareholders	Ironworks liquid assets	State	Partial total	Households	Grand total
7	278	1,151	333	0	940	1,023	—8,104	—4,379	1,148	—3,231
10	271	668	251	-68	425	1,125	6,624	3,952	886	—3,066
15	261	183	167	—160	—40	1,171	4,981	—3,399	614	—2,785

Table 16

ACTUALIZED VALUE OF TAX PAID TO THE STATE
(In thousands of dollars)

	Assumed price in dollars per ton											
	160				176				144			
Year	0%	7%	10%	15%	0%	7%	10%	15%	0%	7%	10%	15%
6	124	83	70	54	220	146	124	95	28	19	16	12
7	129	80	66	48	225	140	115	85	33	21	17	12
8	135	78	63	44	231	134	108	75	39	23	18	13
9	142	77	60	40	238	129	101	68	46	25	19	13
10	149	76	57	37	245	124	94	60	53	27	20	13
11	247	117	86	53	367	174	128	79	127	60	44	27
12	255	113	81	48	375	167	120	70	110	49	35	21
13	255	106	74	42	375	156	109	61	114	47	33	18
14	255	99	67	36	375	145	99	53	119	46	31	17
15	255	92	61	31	375	136	90	46	124	45	30	15
16	345	117	75	37	489	166	107	52	195	66	43	21
17	345	109	68	32	489	155	97	45	201	64	40	19
18	345	102	62	28	489	145	88	40	201	59	36	16
19	345	96	57	24	489	135	80	34	201	56	33	14
20	345	89	51	21	489	126	73	30	201	52	30	12
21	345	83	46	18	489	118	66	26	201	49	27	11
Total		1,517	1,044	593		2,296	1,599	919		708	472	254

Table 17

ACTUALIZED INCOME OF THE STATE AT THE VARIOUS PRICES ASSUMED
(In thousands of dollars)

	Assumed price in dollars per ton								
	160			176			144		
Actualization rate (percentage)	Dividends	Taxes	Total*	Dividends	Taxes	Total*	Dividends	Taxes	Total*
7	1,409	1,517	-8,104	2,639	2,296	—6,095	167	708	—10,153
10	638	1,044	6,624	1,496	1,599	—5,211	—216	472	— 8,050
15	—60	593	-4,981	452	919	—4,143	—554	254	— 5,814

* Total, taking into account other income and charges, not altered by a change in the selling price of reinforcement bars.

The income of private shareholders is equal to 40% of the total income of shareholders, as already calculated in table 7.

The actualized value of cash fluctuation of the enterprise is also indicated in table 7.

The actualized value of dividends collected by the State is equal to 60% of the total income of the shareholders (table 7).

The actualized value of tax paid by the enterprise is calculated in table 16.

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Table 18

ACTUALIZED VALUE OF A CHANGE OF $ 16/TON IN PRICE OF REINFORCEMENT BARS

(In thousands of dollars)

Year	0%	7%	10%	15%
2	160	140	132	121
3	240	196	180	158
4	320	244	219	183
5	320	228	199	159
6	320	213	180	138
7	320	199	164	120
8	320	186	149	105
9	320	174	136	91
10	320	163	123	79
11	400	190	140	86
12	400	178	128	75
13	400	166	116	65
14	400	155	105	56
15	400	145	96	49
16	480	163	105	51
17	480	152	95	45
18	480	142	86	39
19	480	133	79	34
20	480	124	72	29
21	480	116	65	25
Total	3,407	2,569		1,708

Table 19

BENEFIT RESULTING FROM LOAN OF YEAR 11

(In thousands of dollars)

Year	Cash fluctuation	Actualized value at the discounted rate of 7%	10%	15%
11	1,200	570	420	258
12	-293	—130	-- 93	— 55
13	—293	—121	- 85	- 48
14	-293	—114	—77	- 41
15	- 293	--106	—70	—36
16	—293	— 99	—64	- 31
Total	0	31		47

Table 17 indicates total income of the State at price levels of $ 144/ton, $ 160/ton and $ 176/ton.

Table 18 gives the actualized value of profits or losses, for consumers of reinforcement bars.

Table 19 indicates the actualized value of profit represented by the loan of $ 1,200,000 contracted in the year 11.

Tables 20 and 21 summarize these various factors to devise from them the economic value of the project. As foreseen, the over-all economic balance remains the same as that obtained in table 15, apart from the case of $ 144/ton, where the loan from abroad at a rate of 7% slightly improves this table.

If the assumption of demand being independent of price is abandoned, one could doubtless recommend a solution which would slightly reduce the sales price in order to obtain an increase in demand, which would thus lead to higher income.

Change in price of electricity and fuel

The conclusions reached will be the same as in the previous case.

In fact, if there is increase in price of electricity, the power-station will receive additional resources from the ironworks and other domestic consumers. It will also pay additional tax. The ironworks profits will decrease as will the tax and dividends it pays (a rise in price of electricity does not endanger the financial equilibrium of the plant).

All these operations take place within the community (between domestic consumers, State, power-station, ironworks, private national shareholders). They end in internal redistribution of resources, and not in alteration of actualized profit (or loss).

In the case of price reduction of fuel, the operating profit of the refinery will also decrease. It will pay less tax. The power-station augments its operating profit and will pay more tax. The ironworks will have increased profit, will pay more taxes and distribute higher dividends to its shareholders. All these operations are internal redistributions which do not affect the profit of the community, but only income distribution.

Rise in world price of reinforcement bars

In this case, the profit resulting from the project changes considerably, since the reference price, i.e. the price of reinforcement bars delivered, at border, is higher. Erection of the plant makes it possible to avoid suffering the consequences of this increase. For instance, an increase of $ 8 in the price per ton, less custom duties (i.e. a change of about 5% in the selling price) improves the actualized balance of the project by $ 1.7 million at the discounted rate of 7%, $ 1,285,000 at 10% and $ 0.85 million at 15%, assuming the planned production (cf. table 18).

Building of the plant therefore grants some protection against rise in world prices of reinforcement bars. However, this is not sufficient to justify the plant from the economic viewpoint. In fact, the consequences of the envisaged increase of $ 8 would compensate for only about a third to a half of the discounted loss as previously calculated. Equilibrium would be achieved only by an increase of about $ 16 to $ 25 per ton from the year 0, and that without parallel change in world price of imported scrap iron. In the case of a change in price over a

Table 20

ECONOMIC EFFECTS OF THE IRONWORKS PROJECT
(In thousands of dollars)

Assumed price $ 176/ton

Actualization rate (percentage)	Building trade and public works	Power-station	Refinery	National bank	Total incomes not affected by price fluctuation	Private shareholders	Ironworks liquid assets	State	Consumers of reinforcement bars	Partial total	Households	Grand total
7	278	1,151	333	0	1,762	1,760	1,599	-6,095	-3,407	-4,381	1,148	-3,233
10	271	668	251	68	1,122	998	1,709	-5,211	-2,569	-3,951	886	-3,065
15	261	183	167	-160	451	302	1,700	-4,143	-1,708	-3,398	614	-2,784

Table 21

ECONOMIC EFFECTS OF THE IRONWORKS PROJECT
(In thousands of dollars)

Assumed price $ 144/ton

Actualization rate (percentage)	Total of enterprises not affected by price fluctuation	Private shareholders	Ironworks liquid assets	State	Consumers of reinforcement bars	Partial total	Households	Grand total	Profit from loan	Total to be compared to the assumed price of $ 160
7	1,762	111	498	-10,155	3,407	-4,377	1,148	-3,229	0	-3,229
10	1,122	144	593	-8,050	2,569	-3,920	886	-3,034	31	-3,003
15	451	-369	671	-5,814	1,708	-3,353	614	-2,739	47	-2,692

span of 10 years, the actualization effects would lead to even higher increases being necessary to achieve equilibrium.

It must be added that a change in the world price of reinforcement bars would involve change in price of scrap and consequently, the profit envisaged.

Hypothesis of private foreign shareholders

Assuming that the private shareholders would be foreign, and would repatriate their profits, the actualized amount of these shareholders' income must be deducted from the profits previously calculated. The interest of the project for the national community would be lessened accordingly. It is also probable that the part of the profit measured in liquid assets of the enterprise must also be subtracted, if there is free transfer of funds to abroad.

In this new situation, it appears that change in selling price of reinforcement bars would alter the value of the project for the national economy: a rise in price, whether through increased protection or fixing of quotas, would find expression in higher profits paid to foreign shareholders, who could transfer them abroad. There would be no more neutral prices. This situation quite often corresponds in reality to many industrial projects with foreign investors, who benefit from high protection on the domestic market, and repatriate their profits.

Hypothesis of greater underemployment

This hypothesis, presupposing a reference price of 0.33 for the total amount of wages paid, leads to the results indicated in table 22.

Even taking this advantage into account, on the assumption of domestic shareholders, the project would not be justified.

Even a reference price nil for the labour force would not be sufficient to justify the project.

Table 22

ACTUALIZED PROFIT OF THE PROJECT ASSUMING VERY HIGH UNDEREMPLOYMENT
(In thousands of dollars)

Actualization (percentage)	Profit of the project without the advantage of manpower	Wages paid to unemployed personnel	Total profit of the project
7	-4,379	2,296	-2,083
10	-3,952	1,732	-2,220
15	-3,399	1,228	-2,171

The envisaged project taking into account the narrowness of the market, does not allow production of reinforcement bars under economically satisfactory conditions.

A new analysis of the project on the technical plane would perhaps permit reduction of certain initial investments, or delayed renewal of under-utilized equipment in the first ten years. But the improvements to be expected are minor.

Export sales hardly seem possible. In fact, the marginal cost of production is at least equal to $ 100 per ton, whereas the price less customs duties amounts to $ 160 — $ 56 = $ 104. Taking into account the cost of transport, export sales could only be done at loss, except to countries located on the continent, where the market is very limited.

Therefore, it appears that the project in its present form must be abandoned as long as the domestic market has not reached a volume sufficient to make better use of productive capacity from the start. A delay of about 10 years seems necessary, according to the market analysis.

Except for some slight nuances, the method used here is equivalent to that of "reference" price and cost which is often recommended and which adopts:

(a) For labour force–its cost to the national economy: therefore, the wages and charges of ironworks personnel should be reduced by one third, to adopt an assumption consistent with that made here;

(b) For goods and services subject to international trade (in this case reinforcement bars, scrap iron, fuel, etc.): their world price delivered at national border;

(c) For other goods and services (in this case electric power, certain general expenses, etc.); the cost of inputs contributed to their production, as previously calculated.

	Current price ($/ton)	Reference price ($/ton)	Of which foreign currency ($/ton)
Receipts:	160	104	104
Expenditures:			
Wages and charges	15	10	—
Scrap iron	40	40	40
Electric power	20	10	10
Fuel	4	3	3
Other expenses	21	20	12
General expenses	20	20	11
Interest	5	5	5
Depreciation	12,5	12	9
Tax	6,8	—	—
Total expense	144,3	120	90
Profit:	15,7	—16	14

We are going to summarily illustrate the approach with reference prices, not in consideration of detailed accounts and total actualized values, but of values relevant to a ton of reinforcement bars. Taking the representative values for the years 6 to 10, with some additional assumptions on certain expense items, one obtains the foregoing table.

At the reference prices, the receipts therefore amount to $ 104/ton and expense to $ 120/ton ,which implies a loss to the national community of $ 16/ton of reinforcement bars. This loss corresponds to the following breakdown:

For the profit of the ironworks shareholders	+15.7
To the detriment of the treasury for loss on import duties alone: 104 — 160	— 56.0
For the profit of other economic agencies: 144.3 — 120 =	+24.3
Total	— 16.0

The above-mentioned distortions between observed price and reference price are deemed to express transfers of income to various domestic economic agents. Except for the differences in evaluation of these distortions, on the one hand, and transfers on the other hand, it therefore amounts to the same thing to estimate viability for the economy by using reference price or by computing differences in income of the economic agencies with the income of the enterprise (at observed prices).

The loss of $ 16/ton to the economy is broken down another way to cost in national currency of $ 120 — $ 90 = $ 30/ton and profit in foreign currency of $ 14/ton, assuming reference price to be equal to observed price for import and export.

It was in fact assumed that the current rate of exchange corresponds exactly to the relative value of the domestic currency in terms of foreign currency. For instance, if we suppose that the national currency is overrated by 20%, the value of import substitution would need to be increased by 20% from the economic viewpoint. Likewise, 20% should be added to the economic cost of direct and indirect import for the project, as well as to export not performed, because of the implementation of the project (local scrap, fuel). Calculation of detailed accounts and actualized values could be easily made. Briefly, one can see that each reference price of the previous table would be subject to an increase equal to 20% of its foreign currency component (figure in the last column at the right). The loss to the national economy which previously amounted to $ 16/ton would be reduced by 20% of $ 14, i.e. by $ 2.8, which finally amounts to a loss to the economy of $ 13.2/ton. Thus it

appears that in this case, the result is little sensitive to the reference price of foreign currency. An over-evaluation of more than 100% of national currency would be necessary, in order to dispute the above conclusions.

In conclusion, the ironworks project would remain very disadvantageous to the national economy, even when adopting relatively optimistic assumptions for:

World price of reinforcement bars and scrap;
Employment level;
Currency parity.

Nevertheless, this project, as we have seen, is:

Greatly profitable intrinsically — profitability rate: 25%;
Greatly profitable for its shareholders;
Greatly profitable for the balance of payments;
Creates employment for about 300 persons under optimal working conditions with an initial investment of $ 4 million and $ 5 million including the power station extension.

The last two criteria, frequently used to judge the national interest of a project, should never be allowed to cloud the fact that corresponding costs must be taken into account. In the case under investigation, implementation of the project means:

(a) To earn one dollar in foreign currency, the economy spends about two dollars (profit in foreign currency amounting to $ 14/ton, against an expense in national currency of $ 30/ton;

(b) To ensure employment, the economy spends $ 10,000 in present value (at a rate of 10%), or in other words–to pay one dollar of additional wages, the national economy spends $ 2.2 (ratio between $ 1,770,000 for additional wages and the loss of $ 3,952,000 discounted at the rate of 10%).

Consequently, this example shows how carefully simple criteria (effect on the balance of payments and on employment) are to be used.

Book reviews

THE INDUSTRIAL ECONOMY

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INDUSTRIAL DEVELOPMENT

THE IMPORTANT ROLE OF INDUSTRY "transformation of one product into another" in economic development explains the prestige attached to industrial development by the developing countries. Several factors explain this motive action of industry: less elasticity in consumption of agricultural products than in manufactured products; more abundant self-financing in industry than in agriculture, since the former is free of climatic hazards and shows evidence of a creative dynamism in constantly renewed innovations. It is in the nature of industry that it supplies work to itself (intermediary consumption) as much as and more than for final consumption, which conveys the picture of inter-industrial exchanges. However, the alternative of industry or agriculture is a false choice, because the two sectors are in fact obliged to sustain each other.

Any industrial enterprise results from the union of four factors:

(a) A solvent demand since production is useless if it is not consumed; moreover, the bond between the two terms has a double sense, for if demand evidently stimulates production, then vice versa, industry stimulates demand by its distribution of revenues, its intermediary consumption and its equipment requirements;

(b) A technique of transformation, whence the importance of the phenomena of techno-logical evolution and of obsolescence and applied research;

(c) Means of production:

   (i) A tool for production, maintenance and management, hence resources capital for its acquisition;

   (ii) Manpower of diverse levels a professional cadre and influx from outside (migration, with all the problems it poses);

   (iii) Materials to be transformed;

   (iv) Other production factors, the principal being energy;

(d) Rentability, which results from the exploitation of the other three factors, and which must be appreciated at the levels of the entre-preneur and of the community.

Products, just like living creatures, are born, live for a certain length of time, and die; four successive phases can be discerned in the evolution of an industrial branch: growth (more than 10%), rapid expansion (from 7 to 10%), normal expansion (at the rate of the general economy), decline. According to the phase, the number of enterprises, professional organization, management, importance of invest-ment and of amortization, cost and sales prices vary considerably. In terms of their place in the different phases, industries can be classified as spear-head (enthusiastic), modern (plodding) and traditional (aging). Technical progress acts con-tinuously to supply new means and products, by way of "innovation" and in particular "major innovation", which upsets the production structure by making it pass from an age of development to a new age. A new "pole of development" is char-acterized by a major innovation and the motive units issuing directly from it.

The elements of the strategy

The problems confronting those responsible for the industrial spurt are: how to invest (high or low capital intensity investments)? in which sectors (basic or consumer industries)? and following what time schedule? while taking into account the fact that industrialization is not a simple juxtaposition of industries, but the birth of complementaries that bring about a cumulative movement.

Generally, industries manufacturing intermediate products and equipment necessary for their production become the motive element in industrialization. Their realization often conforms to an audacious forecast and runs foul of difficulties in implementation; their advantages are no less considerable, the principal one being inherent in their great possibilities for capital accumulation.

For there to be an industry, a technique is necessary; the choice of technique, if such a choice is possible, is multiple (but in all cases it must be adapted to local factors of production):

(a) Utilization of a known material and much labour? or modern materials and little manpower?

(b) Specialization by the country in certain branches? Attempts to make a little of everything?

In practice, states can be classed in three categories: those having a limited industrial vocation; those having some industrial vocation, and those having a large industrial potential, each of which calls for different conclusions in the choice of technology. This choice cannot limit itself solely to the industry, but must take into account the necessary infrastructure.

The continual growth of industry is manifest starting from a certain size and diversity of the sector, by the interplay of the "multiplicator" and "accelerator" which involve a cumulative process of income, saving and investment, by "external economies" which are created when the profits of one producer are affected by another, and by "economies of scale" which lower the production cost per unit as the enterprise grows.

Possible strategies

"Industrialization by substitution of imports" is based on the idea that the process of industrialization can only begin with the sectors which sell to the end user, since the market for intermediate goods is non-existent; it will then continue gradually to intermediate products which are less and less elaborate. In practice, this type of industrialization

encounters certain restraints and rapidly finds its limits.

"Industrialization by exploitation of local resources" admits the fact that, since a market for intermediate goods does not exist, it is worth while to seek it abroad, that is to export, on condition that those industries be favoured which are effective in internal liaison, and not those whose activities are "closed". Such a policy does not always give the anticipated results.

In examining the picture of intersectoral exchanges, we perceive that the degree of interdependence of the various industries varies strongly, whence the notion of "key industries" which maximize these effects of liaison. The strategy adopted is, then, that of industrializing industries which always necessitates some conditions of adaptation to the socio-political environment and to the size of the country (or regional economic policy).

"Transfers of industries" are envisaged by those who believe that the industrial countries will progressively abandon certain parts of their traditional industrial activities, or that certain industries can only function on the planetary scale. In both cases the decision centres of several types of industries will have the opportunity of locating themselves in the developing countries if the necessary measures are taken progressively (subcontracting, participation in decisions, etc.)

Recourse to "spearhead industries", with the technological jump that this entails, seeks participation in the unleashing of new technologies, instead of pursuing the difficult course of catching up with technologies already in industrial use. The systematic use of this method, while being capable of achieving fruitful results, incurs the risk of grave miscalculation, psychological trauma, economic dislocation and financial and social burdens.

Industrialization based on the "small and medium enterprises" is a part of the premise that such enterprises play a considerable role throughout the world. Their development calls for very adaptable economic policy and support by means of which promising results may be achieved. Recourse to crafts and cottage industries also appears to offer real, but limited possibilities. In fact, such a policy should not exclude large unit industrialization, since the manufacturing development of a country calls for factories of all sizes, interconnected by complementary relations.

The spatial aspect

Geographical space not being homogeneous, since the distribution of population, potentialities and limitations reveals strong and weak points,

industrial enterprises must take into account a certain number of more or less limiting factors of location (transport, availability of production factors, various facilities). Certain units are bound to fixed sites, others are completely free, and still others can be located by optimization of factor costs. Two policies of "adaptation of territory" may be pursued: based on strong geographic points, which is development by "poles of growth"; or favouring of weak points in order to overcome their backwardness, which is "harmonized regional development" with economic and human consequences diverging because of the different effects of an enterprise resulting from its location. In a number of cases, it will also be convenient to take into account the narrowness of national frameworks, and envisage co-operation between neighbouring states.

INDUSTRIAL PROGRAMMING

Outline of an adapted strategy

Each country constitutes a specific case which varies with time; the strategy to be adopted should therefore not be singular, chosen as a function of theoretical options, but composite, based on the given needs of a given moment. The implantation of industries is not an end in itself but a means of raising the standard of living and changing the quality of life. It must therefore be integrated into "industrial programming" which takes into account not only the industry, but also its environment (education, technical training, housing, etc.) in a "global planning" which will emphasize the effects of choices taken and ensure the coherence of the objectives pursued. In elaborating the strategy and implementation of planning which will translate it into practice, the design of a long-term "growth model" constitutes the first stage: that which defines the economic, social and political structures necessary for a general process of growth to become possible, and which will permit orientation, co-ordination and ranking of public and private operational programmes. Starting from the growth model, the second stage consists in the elaboration of a more detailed and precise medium-term development plan. The third stage then constitutes implementation of the industrialization programme which will incorporate the objectives determined by the general plan, and the means chosen as a function of the adopted industrialization strategy.

The investment project

The realization of the strategy and policy of industrialization by means of the industrialization programme and its objectives is assured by the execution of projects. The projects may be defined as a group of means implemented in a co-ordinated fashion in order to pursue a development objective, such as a group of technical, economic, financial and human studies which define what each must do in order to attain the determined goal. Three problems emerge from a study of the projects: evaluation—because the effort demanded from the realizer must be inferior to the result obtained (validity of a project); a choice between incompatible projects, to retain the most advantageous variant; priority between compatible projects if the financial means are insufficient to ensure realization of all of them. To be sure that the project has been studied in all its aspects, and to co-ordinate execution by the different responsible bodies and control the results obtained, it is necessary to prepare a file of the project according to a sufficiently precise and complete scheme.

Project evaluation methods

Viewpoints differ as to whether it is the entrepeneur who is interested in the validity and must make a choice, or whether it is the community, which must equally take priorities into account.

The economic calculation in the enterprise begins by evaluation of the project, based on its financial equilibrium, on results obtainable at maximum capacity and on the cost price per unit in comparison with the competition. To take into account the different periods at which expenditures are made and incomes received, one proceeds to "actualization" which gives the "present value" calculated according to a "time-adjusted rate." Such actualization permits comparison between projects, allowing a choice according to concepts such as:

- "Duration of amortization"—the number of years at the end of which the sum of receipts at the present value becomes greater than the sum of expenditures; "recuperation period" is an identical concept but without actualization;
- "Relative profit at present value"–which for each independent project is the ratio between the "actualized" gross profit and the initial expenditure;
- "Rate of rentability"–which is the rate of actualization at which the actualized profit becomes nil.

From the point of view of the community, it is a matter of choosing between variants and then determining the date of realization, taking into account existing limitations (capital, labour, etc.) while attempting to maximize certain functions which express the collective satisfaction (and which cannot be reduced to monetary gain). The effects

of an investment differ according to the environment; its efficacy is yielded not only by the direct primary effects-direct contribution of the project to national income, but also by its primary indirect effects-growth of income in sectors directly limited to this sector by direct technological ties, and finally, secondary effects which result from the use of additional income thus generated. These mechanical effects are completed by price acceleration, training, nuisance and non-commercial effects (health, time-saving, psychological effects). Although theoretically it may seem simple to judge these effects by referring to a collective optimum, in practice no method permits the calculation of such an optimum and one is forced to reconcile one by one the effects of an investment with the objectives which the nation has assigned itself. The choice will then fall according to a certain number of criteria which may be divided into two categories:

(a) Those relative to the specific project: financial rentability, costs, social return, etc.;

(b) Those relative to the allocation of resources: capital per production unit, marginal rate of re-investment *per capita*, marginal contribution to growth, marginal social productivity, etc.

REALIZATION OF INDUSTRIAL PROJECTS

Industrial promotion

The process of industrialization corresponds to the realization of a series of industrial projects: their promotion will differ according to whether they are state-owned and controlled or whether they are of private persons or enterprises:

(a) For state-owned projects, promotion boils down to defining a method adapted to the identification, elaboration and implementation of the project, the value of which will depend on the quality of the instruments and regularity of state functions (finance, industrial policy, etc.);

(b) For privately owned projects, a whole series of measures are necessary to select the investors, who may be foreign or national industrialists, local holders of capital or artisans: pre-investment, protection, financing, formation, etc. A number of systems exist: industrial development centre, investment promotion centre, assistance at the pre-investment level, search for investors, etc.

The action of industrial promotion takes on a national character but this does not imply that the administration must be in sole charge of it. It is often advantageous to separate the role of choice

and decision (normative aspect = organization and surveillance) from the role which gathers the elements of choice and action which prolong decisions (preparation and exploitation aspect = promotion and stimulation). A more or less autonomous promotional body presents numerous advantages to encourage new or to improve existing enterprises, but poses two series of problems: the degree of subordination to the ministry responsible for the industry; the degree of freedom which it leaves to the different specialized cells it will create to ensure the diverse industrial services expected of it.

The industrial services

No industrial enterprise, even in developed countries, is completely self-sufficient, but is obliged to call on external aid (financing, technical studies, etc.). This dependence appears even more marked in developing countries which must have a complete range of industrial services, the creation of which cannot be left to chance, but must form part of the industrial development plan:

Institute of Technology;
Bureau of Standards, Measures and Quality Control;
Industrial Information Centre;
Industrial Advisory Services;
Protection of industrial property;
Industrial co-operative associations;
Fairs and exhibitions;
Industrial estates.

If the Government is called upon to play a decisive role in the creation of industrial services it must retain sufficient flexibility to allow the participation of the private sector concerned.

Financing

Financing relies on both internal and external sources. The latter cannot assure industrial development by themselves: the correlation between the two sources does not limit itself solely to investment, but extends equally to the function and results which have repercussions on the balance of payments.

Internal financing relies on household savings, which is best channelled to financial institutions, company savings, where reinvestment on the spot should be encouraged, and public savings, which plays a decisive role. Various techniques facilitate mobilization of internal resources: institutions specializing in industrial financing (investment societies, development banks), commercial banks, other financial institutions (savings funds, etc.), stock exchange, etc.

External financing complements internal savings and brings in foreign currency for investment and operation: flow of private foreign capital which relies on the existence of healthy projects recognized by the financiers, on a policy of stimulation, and on the guarantees given by the receiving state; public bilateral or multilateral financial assistance.

Financing of small industry demands specific solutions. It is one aspect of the group of problems posed by the creation, modernization or growth of modest-sized enterprises, and financial measures must be integrated into an over-all programme of aid.

Public power and industrialization

Industrialization brings together three partners: the State, with a double role (decision and control on the one hand, assistance and encouragement on the other), the public sector and the private sector. It follows that there must be co-ordinati n of activities, all the more so since each partner comprises smaller units with varying reactions, which calls for internal co-ordination.

The State, as guardian of the national interest, determines the rules, defines the nature and importance of the measures to be taken and verifies their implementation. It is therefore of benefit for the State to unify the policy of its different services, to ensure that current decisions do not contravene it, and to remember that its very function introduces disturbing elements.

The State is capable of assisting industrial development in addition to promotion and industrial services—by granting fiscal, legislative and economic advantages, protecting infant industries and by industrial legislation.

The public industrial sector is created to favour the application of industrial policy; but while remaining true to this mission, it must retain its own will and act so as to limit its appropriations from public budgets, and preferably to operate profitably. It would be desirable for all developing States to establish a well-conceived policy for public enterprise.

MANAGEMENT OF INVESTMENT

Once industrial investment is realized, matters must not be left there: evaluation of results and their comparison with the forecasts will offer the possibility of eventually taking desirable corrective measures and constitute a source of guidance for future investments. The results are traditionally diagnosed according to the duly corrected accounts—notably the balance sheet and the profit and loss account. Capital investment and cash flow already give useful indications on management. The diagnosis of management depends on the analysis of the general policy of the enterprise, products, type of production, conditions of exploitation of the market, distribution of investments and personnel policy.

QUANTITATIVE PLANNING TECHNIQUES

by Roland OLIVIER

Published by the State Secretariat for Foreign Affairs, Paris, 1970 (480 pages)

THIS WORK WAS PREPARED at the request of the State Secretariat for Foreign Affairs, for use in developing countries. Its aim being essentially practical, it presents general planning techniques and the most widespread programming, voluntarily leaving aside certain other techniques which are sometimes used by the Bureau of Planning, but which, in numerous cases, and in particular in developing countries, are more applicable to problems of the enterprise than of the nation.

Divided into a brief description of the Plan's logic, a presentation of the technique of understanding and economic selection of projects, this manual of general planning is composed of three parts:

FIRST PART:
THE LOGICAL PROCESS OF PLANNING

The general targets of development can be classified very simply under three headings (leaving aside aspects of security, prestige, etc.):

Search for greater independence;
Search for better distribution;
Search for better living.

It is in the light of these general targets and the various existing constraints that the projects must be started. In developed countries, projects, always numerous, are initiated by two categories of agent:

(a) entrepreneurs for projects of the private sector; *(b)* technical ministries for public investment projects. On the other hand, in developing countries, projects are often few, due to the weakness of the private sector or a certain lack of highly qualified personnel in the technical ministries. If the Bureau of Planning wishes to have projects at its disposal to build up a programme, it must assist the entrepreneurs and ministries in preparation of the projects, or even take this preparation upon itself.

The planner must therefore first verify the existence both of a series of medium- and long-term coherent objectives and of a list of projects which in principle will be integrated into these objectives, some of which will be studied in detail and presented in the form of operation files. In case this is insufficient, he must attempt to define objectives and conceive the projects.

It then remains for the planner to combine the different projects into a short-term programme, say of two or three years, while respecting budgetary equilibrium and the objectives of the Plan.

It goes without saying that the economic agents must be pushed toward the realization of determined objectives by a certain number of executive measures which pose difficult problems of choice. Such measures may be of information, incentive, or authority and assistance.

Finally, the planner will have to evaluate the deviations in relation to the determined objectives, analyze them, draw conclusions and adjust later programmes and their related measures, in the light of the experience thus acquired.

SECOND PART:
FORECASTING AND PROJECTION TECHNIQUES

In this second part, essentially technical, a large section is devoted to mathematical demonstration. It begins by a general study of the different empirical and mathematical methods used in forecasting and projection. Although it is always possible to envisage the future in the light of laws deriving from past experience, forecasts and projections (forecasts in which the intervention of man is more "voluntary") must take into account the context and conditions for which these laws are true.

All economic and social planning begins by a serious demographic analysis, and continues by long-very long-term projection. An important chapter here deals with demographic forecasting which permits conclusions to be drawn that have particular bearing on the various future needs of the population (food, housing, education, health, employment, etc.).

The demographic statistics, tables and graphs serving as illustrations are taken from the economies of both developed and developing countries, and attempt to bring out the various correlations between economic situations and the demographic behaviour of populations.

These first provisions having been established, it is legitimate to give priority to purely economic dimensions, such as volume of production and consumption, in order to measure the values of production or consumption *per capita*, which in turn express the productivity or average standard of living of the population.

The economic dimensions are presented in the classic forms of national accounting, in tables of "balance of resources-uses" and in tables of "intersectoral exchange". An original demonstration, starting from a spatial-economic table leads, by projection of the table's elements on one or two planes, to the table of resources-uses or to that of plotted exchange between agents.

But the economic dimensions are not only linked by balanced accounting relations. There are also relations of interdependence, statistically more or less true, which are used precisely in carrying out the provisos and projections. To quote:

The case of enterprises:
Intermediary consumption is proportional to production (purchasing coefficient).

The case of households:
The consumption of households is a linear function of household income (marginal propensity to consume).

Practical tables promote, better than formulas, the understanding of the usefulness of these coefficients, which link dimensions to each other.

Economic projections which are based on an analysis of the past and on demographic forecast must therefore describe coherent future situations, starting from certain political objectives.

It is evident that the calculations must rely as much a possible on concrete fact in order to have the largest number of local possibilities and targets. The Planning Bureau must also establish its "development objectives" in liaison with the technical services, while endeavouring to adjust the results obtained against international comparisons, which may in certain cases serve as general rules for development.

In practice, the projection of revenue, even if only rough, is essential for establishing more detailed projections later on; in actual fact, supply will depend on demand, itself closely linked to income.

- An example of French perspective for 1965, made in about 1955–56, illustrates a realistic approach to the problem. Easily conceivable in a full-employment economy, this method is nevertheless hard to apply in developing countries.

- The 1970 forecasts of the Tunisian economy, made in about 1958–59, present the second –normative-mode of apporach: out of sixteen dimensions chosen, four were introduced voluntarily. These four dimensions constitute the objectives to be attained and determine, by means of a simple model, the situation desired for the Plan's horizon year.

This gross evaluation of income makes it possible to push the other projections forward, notably that of demand and supply.

(a) Demand is obtained directly from incomes, since it is linked to them by relations of interdependence. Here we see, by concrete examples of food, housing and education demand, how varied the projection techniques can be: in other words, the use of these techniques must be adapted to the specific circumstances.

(b) Once the medium-term objectives of final use have been determined, it is possible to evaluate production objectives. Here, the techniques of use of the table of intersectoral exchanges are studied. The "Input-Output" model calls on technical-economic coefficients which are presented in as general a manner as possible. Certain applications of the model, eventually useful for the planner, are given as an example (work value or amount of energy contained in a product).

Since the medium-term projections are not the only ones used, the Planning Bureau often being led, for multiple reasons, to build macromodels of growth, certain formal types of growth models are examined in the work.

It was also interesting to present retrospective models of the American and Japanese economies ¯ce the end of the 19th century. The interest of ese examples lies in that they show, in two cases of success, that long-term evolutions are generally very slow. A growth rate in production and consumption of 2–3% *per capita* per annum in fact leads, over a period of 50 years, to quasi-explosive results.

The techniques of economic selection of a project are studied in detail according to the two classical perspectives of project evaluation: the perspective of the enterprise and the perspective of society (community).

The economic criteria for choice, from the perspective of the enterprise, are primarily economic-financial, such as profits realized, realization of investment and the rate of internal profitability; on the other hand, the criteria of society often take many forms: they take into account the effect of the project on national independence, on redistribution (between individuals or between regions) and on production.

The effects on production are measured by means of the same economic-financial indicators as those of the enterprise, but in this calculation it is preferable to take into account the context and the effect of the project on different economic agents.

In particular, the mechanical effects of the project on the economy as a whole should be analysed in a very systematic fashion, by distinguishing the effects bound to expenditure on equipment from those bound to utilization of labour, and by distinguishing the effects on other economic activities brought about by technological liaisons and on household incomes. In many cases it will also be necessary to measure the effects of the project in a system of prices different from that existing on the market: some examples of such systems are indicated in the text.

After some theoretical reminders which constitute three chapters of the work, a series of examples is given:

- First, choice between variants of an identical project in relation to the best venture to be retained (improvement of rural production), the best technique (choice between communication routes), the best location (*case of a cement plant), the best schedule of realization (the scheduling of several stages within a period of time).

- Then, on the actual evaluation of the project from the standpoint of society: analysis of the effects of a project, calculation of the rentability of an investment from the point of view of financing, and finally the influence of public aid measures on the rentability of a project.

INDUSTRY AND COMMERCE IN SOME DEVELOPING COUNTRIES — A COMPARATIVE STUDY

by Ian LITTLE, Tibor SCITOVSKI and Maurice SCOTT

THIS BOOK IS OF CONSIDERABLE IMPORTANCE in that it contains an interesting analysis of the policies followed during the last twenty years to promote and organize industrialization in certain developing countries. It suggests alternative policies for the coming decade and examines possible obstacles to their implementation.

The authors base themselves on empirical studies of the industrialization of Brazil, India, Mexico, Pakistan, the Philippines and Taiwan, written by other specialists[1] and already published separately.

The work analyzed is therefore the fruit of the reflections of nine specialists who worked for the Development Centre of the OECD between 1965 and 1969.

It maintains that the economic and commercial policies pursued by the six countries under consideration, between 1950 and 1970, have stimulated the production of manufactured goods more than agriculture, and production for the home market more than for export. The imbalance to the detriment of agriculture has been partially corrected by improved yields and a more energetic application of agricultural development policies. The imbalance to the detriment of exports persisted longer, and the currency devaluations finally accepted were too weak and too tardy. Since 1960, the countries in question have been obliged to recourse to a policy of import control which has aggravated the already excessive protection of industry.

The fact that production of manufactured goods increased rapidly in these countries between 1950 and 1970 (and, consequently, all is well) is of no value in the authors' eyes. They declare that in all the countries analyzed, an industrial sector was created composed of numerous small enterprises with high production costs and constituting a mediocre spring board from which to challenge international competition on the export markets.

The principal reason for this is that industry has enjoyed excessive protection against foreign compe-

tition. The level of custom duties has varied considerably from one product to another. The procedures used to protect numerous industries have consisted in imposing quotas rather than high custom duties. The levels of effective protection (that which relates to the part of the manufacturing process performed inside the country) are estimated at approximately 200% for India and Pakistan, 100% for Argentina and Brazil, 50% for the Philippines and 33% for Taiwan. Under these conditions, internal competition has generally been unable to satisfactorily replace foreign manufactures.

Since industry is protected by quotas or by high and unequal custom duties the choice of products to be manufactured in the country has not always conformed to the choice to be made according to the principle of comparative advantage. Numerous industries with high production costs have been created; the excessive protection has enabled many factories to attain the threshold of rentability, while using only a small part of their capacity; there has therefore been a tendency to create excess production capacity that is incapable of supplying export markets.

In a number of countries the investment demand and foreign currency needs have taken on an excessive dimension which has led to the imposition of a system of administrative control to brake them. These controls and the protectionist policy have had the aggravating result of encouraging industrial enterprises to rely more on the privileges granted by the Government to ensure their profitability than on their own ability to organize efficient production units and reduce their cost price. Generally, industrial growth has therefore been the act of a small number of large, well established firms which, under these conditions, proved better able to prosper than the small companies of recent creation.

Passing on to the 1970s, the authors find no justification for the pessimism shown by a large number of developing countries during the 1960s regarding the possibilities of increasing their exports of manufactured goods. They note that: *(a)* certain Asian countries have obtained good results in this field; *(b)* export of manufactured goods from developing countries today holds only a very insignificant place in world trade of these products;

[1] Brazil: *Industrialization and Trade Policies*, by Joel Bergsman. Mexico: *Industrialization and Trade Policies since 1940*, by Timothy King. India: *Planning for Industrialization*, by Jagdish N. Bhagwati and Padma Desai. Pakistan: *Industrialization and Trade Policies*, by Stephen R. Lewis, Jr. Taiwan and Philippines: *Industrialization and Trade Policies*, by Mo Huan Hsing, John Power and Gerardo P. Sicat. All published by Oxford University Press, 1970.

(c) manufactured goods at present represent only 12% of the total exports of developing countries. They therefore judge it possible, during this decade, to augment sales to industrial countries by a higher annual rate than the 9% realized in recent years. Furthermore, they consider that an even higher rate of increase during the same period will probably not disrupt the markets and will not create employment problems in the industrialized countries.

The authors therefore recommend that during the 1970s policies be initiated which will avoid excessive protection of the industry, stimulate export of manufactured goods and encourage greater use of manpower in manufacturing industries. The rate of exchange must be fixed at a level which will permit the abolition of quantitative restriction of imports, leaving custom duties as the sole form of protection. A radically different policy must be adopted that will replace protection by promotion based on subsidies and measures for encouragement. Two connected reforms should allow this to be achieved. Firstly, in every case possible from the administrative point of view, it will be expedient to impose a sales tax which will affect both domestic and imported goods; its application is preferable to custom duties, the level of which must finally be reduced and made uniform (the authors suggest a 10% rate). Secondly, it will be necessary to subsidize local industries and grant them facilities, in order to permit them to lower their production costs on the one hand, and thus compete with foreign products, and on the other improve their exports; to replace traditional encouragement of investment, such as tax exemptions, the authors propose payment of a regular subsidy per person employed, amounting to between 10 and 50% of the wages of a worker in a manufacturing industry.

The authors recognize that such significant modifications in policy will be difficult to implement. For this reason the last chapter deals with problems which will probably arise from the transition from present policies to new ones, based on the principles that they have defined. In their opinion, each Government must begin by choosing the policy toward which it wishes to orient itself and, over a number of years proceed, by successive reform, to its complete implementation. When the industrialists realize the direction chosen, they will think and act in a manner to adapt themselves to the new economic conditions which the Government is attempting to create and which will be marked by more vigorous competition, an activity based more on exports, as well as a larger place given to employment problems.

Like some other works which have profoundly stamped the evolution of economic thought and government policies, this book makes difficult reading. It is repetitious, and certain subjects (for example, the theory and practice of protectionism) are developed at great length, while other, perhaps more important and related problems (such as the determination of the best adapted rate of exchange) are treated cursorily and in a relatively dogmatic manner.

Throughout the work, the authors have a tendency to stress the need for a better allocation of resources; this may be explained by the fact that two of them have contributed to the elaboration of the theory of "the economy of well-being." This objective may be justified in the eyes of theoreticians, but the book does not present proof that progress in the standard of living deriving from better allocation of resources will not be counterbalanced and, even more, by recession in the rate of industrial growth, deriving from the implementation of the more prudent and selective policy necessary to realize this better allocation.

The value of the thesis proclaimed by the authors lies therefore more in concrete viewpoints converging on the idea that for developing countries it is essential to produce at costs closer to those observed in industrialized countries. The work shows that the considerable disparities are due to policies followed in the past; unless their present policies are modified, the six countries studied (and other countries less advanced from the point of view of industrial development, but which apply the same methods) will continue to create industries where the costs of production are not competitive on the world market for manufactured products.

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