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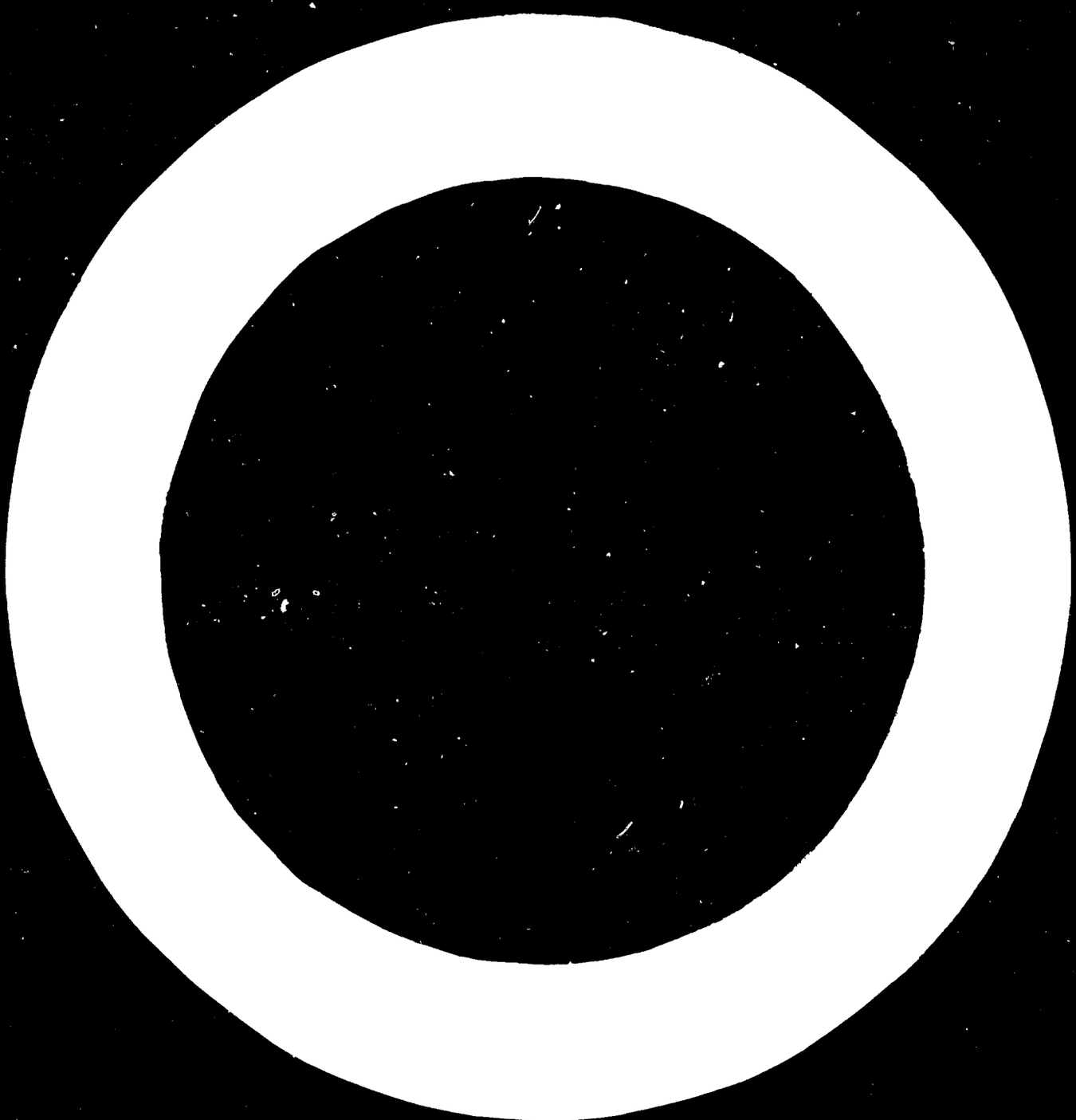
# INDUSTRIALIZATION AND PRODUCTIVITY



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# INDUSTRIALIZATION AND PRODUCTIVITY

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# *Preface*

The present issue of the *Industrialization and Productivity Bulletin* reproduces part of the documents submitted to the two seminars organized by UNIDO in Lomé and Tangier on methods of evaluating industrial projects. To date UNIDO has held nine seminars on this subject: Mexico City (Mexico, June 1966), Colombo (Sri Lanka, December 1966), New Delhi (India, January 1967), Teheran (Iran, February 1969), Tunis (Tunisia, November 1971), Lomé (Togo, September 1972), Cairo (Egypt, December 1972), Tangier (Morocco, January 1973), and Sana (Yemen, June 1973). They were held in English, French or Spanish, according to the needs of each country. These seminars, which may be organized in connexion with consultative missions or related to current technical assistance projects, are aimed at giving civil servants in the participating countries a better knowledge of modern methodology and practice in industrial project evaluation. The evaluation in question basically consists of a cost-benefit analysis in order to determine the real contribution that the industrial projects under consideration can make to the development of the national economy.

It will be recalled that the previous issue of this *Bulletin* contained two articles by André Bussery (pages 23 to 62), one on the methodology of evaluation and the other on a small steelworks project, which were based in part on the basic working documents of the Tunis seminar.

A special feature of the Lomé seminar, organized for the benefit of the Entente countries (Dahomey, Ivory Coast, Niger, Togo, Upper Volta) was that it was held in association with the French Technical Co-operation services. As a result, two methods of industrial project evaluation were discussed, the one contained in the *Guidelines*[1] and the so-called "effects" method, developed in France by Charles Prou and Marc Chervel.[2] The *Guidelines* method, like that of the OECD *Manual*,[3] is based on shadow (accounting) prices. The effects method, on the other hand, is based on market prices. It is the subject of the first three articles in the present *Bulletin*, which are taken from the working documents distributed to the participants in the Lomé seminar. The opening article sets forth the principles of the effects method of project evaluation in developing countries. The second article is an exercise in the application of the method and shows in particular the practical use of input-output tables for calculating the effects of a project. The third article is a complete case study dealing with an industrial fishing complex in an African port. The study permits an evaluation to be made of the financial profitability and economic profitability of the project, and on that basis enables the most suitable economic policy decisions to be taken in the interests of the national economy.

The Tangier seminar, organized in connexion with the technical assistance project at the Centre of Industrial Studies for the Maghreb, laid special emphasis on the evaluation of multinational industrial projects, that is to say, industrial projects involving several countries. Such projects may consist of a single industrial establishment or a complex of such establishments, the costs and benefits of which are shared by several countries. The three articles by Claude Sicard, which make up the fourth, fifth and sixth articles of the present *Bulletin*, are drawn from the working documents prepared for that seminar. The fourth article deals with the "critical mass" of production, the constant rise in which has repercussions on the development of world trade and on the structure of industry in national economies. The fifth article shows the advantage of multinational industrial projects and their economic justification by the "critical mass" criterion. The sixth and last article shows the application, in a case of current interest, of the principles defined in the two preceding articles. It examines the practical possibilities for co-operation in the field of the motor industry between the three countries of the Maghreb (Algeria, Morocco and Tunisia) and arrives at interesting conclusions regarding the benefits each of the participants might gain from a complex multinational project for the manufacture of motor vehicles in the Maghreb.

If they wish, readers may send their observations and comments to the Industrial Policies and Programming Division, UNIDO, P.O. Box 707, A-1011 Vienna, Austria.

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[1] *Guidelines for Project Evaluation* (United Nations publication, Sales No. 72.II.B.11).

[2] Charles Prou and Marc Chervel, *Etablissement des programmes en économie sous-développée, Vol. 3: L'Etude des grappes de projets* (Paris, Dunod, 1970).

[3] Ian M. D. Little and James A. Mirrlees, *Manual of Industrial Project Analysis in Developing Countries: Vol. II, Social Cost-Benefit Analysis,* (Paris, OECD Development Centre, 1969).

For a comparison of these two methods see: Partha Dasgupta, "An analysis of two approaches to project evaluation in developing countries", *Industrialization and Productivity Bulletin* No. 15, 1972.

# *Project evaluation by the "effects" method in developing countries*

Marc CHERVEL*

## INTRODUCTION

Developing countries have seen a considerable growth in the importance and number of development projects financed by assistance from outside the country, and this has led the financing bodies, particularly in recent years, to ponder and study methods of evaluating projects from the standpoint of society in the recipient countries as a whole.

A number of attempts to codify these evaluation methods have been made or are now being undertaken by various bodies concerned with international or bilateral aid.

Some evaluation methods, based on international shadow prices, seem suitable for international or foreign organizations, which have to evaluate and choose between different projects in different countries.

Economists in developing countries, for their part, feeling that this problem of evaluation and selection is of the greatest concern to them, want to find their bearings among all these methods and especially to see how they relate to the procedures followed in drawing up their own development plans.

Project evaluation by the effects method is based on the procedures followed by the planners, and that is what gives it its specific character. It has been worked out for the purpose of throwing light on the problem of development project selection by a central planning body in a developing country.

This method has been conceived for application at a certain stage in the planning progress when the planners have at their disposal:

*(a)* An over-all forecast for the economy;

*(b)* A knowledge of the various constraints (relating, for instance, to investment financing, the trade balance etc.);

*(c)* General guide-lines fixed by the policy-makers (for the growth of the gross domestic product, the creation of additional revenue etc.).

They then seek to make the best possible selection of projects in order to achieve, or attempt to achieve, the goals set.

More precisely, this stage of project selection is reached at the moment when, after the various decentralized planning boards (sectoral and regional) have handed in their reports proposing various development projects and activities, the central planning team makes its first attempt to work these elements into a whole and bring the various activities contemplated into line with the constraints of the economy and the goals that have been set.

From this brief background, it follows that in project evaluation the analysis is made:

*(a)* Within a system of constant prices (initial market prices, on the basis of which the over-all forecast is calculated);[1]

*(b)* For a future domestic demand as given in the forecast especially with regard to household consumption.

In broad terms the selection procedure thus means arriving at a combination of projects which matches the constraints and the domestic demand forecast (in respect of price and volume), in order to attempt to achieve the development goals set by the policy-makers.

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[1] This assumption can be waived; see "Determination of the effects of the project", page 8.

All this procedure is, of course, iterative, as is the planning process itself, and it is only at the end of direct discussions between the three levels:

Policy-makers

Central planners

Planning boards

which may involve reconsideration of certain initial goals, that the selection of the projects is actually made.

Although this effects method may thus appear at first sight to be an integral part of the planning process and very different from the methods based on shadow prices referred to above, it can in fact be applied without difficulty to an isolated project, granted assumptions that can be carefully spelt out.

The following account describes the basic principles of this effects method; it will of course be necessary to specify, on many points, the limits within which the method is valid, the calculations than can be made, and the assumptions underlying the calculations or procedures used.[2]

## DESCRIPTION OF THE METHOD

The effects method involves the following procedure:

Analysing the project in detail;

Analysing the country's economy in detail;

Introducing the project into the economy by putting the two analyses together (economy with project);

Studying the alternative situation (economy without project);

Determining, by a comparison of the two situations, the effects of the project on the economy;

Working out a procedure or a criterion for selecting projects by a comparison of their costs and benefits.

This method may easily be applied to the whole range of projects for the production of goods and services (agriculture, industry, mines, transport, tourism), but it is more difficult to apply to projects of the "social" type (education, health etc.).

### Analysis of the project

To simplify this description, we shall consider an industrial-type project and its operating account for one year of normal production.

A similar analysis could also be made for the investment.

The essential information is contained in the estimated operating account, at market prices. This account is broken down into:

Domestic inputs, by product;

Imported inputs, by product (taxes are shown separately);

Value added, mainly wages and social security contributions (by category);

Taxes and duties;

Gross income of the entrepreneur (broken down if necessary).

The total constitutes the estimated turnover.

### Analysis of the economy

The analysis is carried out in such a way as to take into account, as fully as possible, the structural features of developing economies—mainly, that is to say:

Dependence on outside resources;

Dualism (a modern sector and a traditional sector).

The data required on the country's economy vary according as the problem is:

*(a)* To formulate a general plan, i.e. to select a whole set of projects;

*(b)* To study a particular project in a given country.

In the more general case of formulating a plan, the analysis consists of a detailed study of an input-output table in which:

The activities of the traditional sector are dealt with separately;

Domestic production and imports cif (cost, insurance, freight) are broken down by user;

The value added of each branch is broken down into:

Wages and social security contributions (by category);

Duties and taxes;

Income of the entrepreneurs.

From this detailed input-output table it is easy to derive the unit technical coefficient matrix for domestic production, which gives for each unit of goods or services considered (output) the intermediate consumption (input) of domestic goods and services required.

The inversion of the complementary technical coefficient matrix for domestic production gives the production per branch necessary in order to provide the economy with an additional unit of each product (assuming average coefficients are constant).

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[2] Charles Prou and Marc Chervel, *Etablissement des programmes en économie sous-développée, Vol. 3: L'Etude des grappes de projets* (Paris, Dunod, 1970).

Multiplying this inverse matrix by the row vectors–direct imports and direct values added of the unit matrix–we obtain a breakdown of the value of each good and service produced domestically into:

*(a)* Imports (cif) included (import content);

*(b)* Value added included, comprising:

Wages included;
Taxes included;
Entrepreneurs' income included.

In order to study a particular project in a given country, it is not essential to have at one's disposal the whole range of data set forth in these detailed input-output tables. It is enough to have a good knowledge of the main branches of the economy which are going to be involved in the project.

Apart from being useful in connexion with the appraisal of projects–which is to be described below–a knowledge of the various rates for components of value included proves to be extremely helpful in the examination of various problems relating to the economies of developing countries.

In the first place, the rates for value added included show the national contribution to the value of the product under consideration. The rates for imports included, which are complementary to the value added rates, show the extent to which the various branches are dependent on the outside world (dependence rates).

Similar calculations based on the consumption patterns of the various categories of households give the rate of imports included for those categories, that is to say, the total imports necessary (directly or indirectly) for one unit of consumption.

A whole series of problems can then be tackled, of the following type:

Effect on domestic prices of a devaluation, or an increase in the price of a specific good, or of an increase in wages;

Effect on the standard of living of the various household categories of a devaluation or a change in one tax or another.

It is thus possible to study, for instance, with regard to the country's income distribution objectives, such matters as:

A price policy, or
A tax reform.

### Introduction of the project into the economy

*(Economy with project)*

It is advisable to carry out this process in two stages:

Study of the set of projects linked to the project under consideration;
Study of the set of activities.

If the project under consideration is linked to another project or projects, that is to say, if one cannot be carried out without the others, this set of projects must be studied as a whole. A consolidated account is then established for the set of projects (e.g. mine, mine railway, mine port).

This question of whether one project involves another is essential; depending on whether such a connexion is assumed to exist or not, the evaluator will deal with the set of projects as a whole or with the individual project in isolation.

Thus, in particular, the downstream implications of the project will have to be analysed in order to determine whether they need to be taken into account (a good example is the iron and steel industry).

The set of activities brought about by putting the project or set of projects into operation results from the stimulus given to the various branches of the economy by the additional intermediate demand created.

In the general case where a plan is being drawn up, this set of activities may be estimated by applying to the domestic inputs the average rates included that have been calculated previously.

Of course, if more information is available, an attempt will be made to obtain the marginal output coefficients, at least for the main inputs. Lastly, in cases where some domestic production units are working at full capacity, provision must be made for further investment, to be added to the project investment.

In the particular case where an individual project is being studied, if no input-output analysis is available, the same calculation can be effected by retracing, one by one, the chains of domestic production which the project calls upon for its intermediate inputs (the convergence is very rapid).

Whatever calculating procedure may be used (simultaneous or iterative), the real impact on the economy[3] of carrying out the project will thus have been described, the project being characterized by:

Imports included;
Value added included (itself broken down into its components);
Total turnover.

The corresponding investment to be taken into account comprises:

Investment in the project proper;

Plus investment in projects linked with the project (the two together giving the total investment in the set of projects);

Plus further investment that may be necessary in other branches of production in order to satisfy the intermediate requirements of the project.

### Study of the alternative situation

*(Economy without project)*

The alternative to the project, within the framework of the initial assumption regarding future domestic

[3] Primary effects only, excluding secondary effects or income expenditure effects.

demand, may be of three types, to which correspond three types of projects:

(1) The alternative is to import: the project is then an import substitution one;

(2) The alternative is an old-fashioned or small-scale technique: the project is then a modernization one;

(3) The alternative is to do nothing: the project is then an export one (or a project for adding value to goods formerly exported unprocessed).

For each of these types of alternative solution an analysis can be made similar to that carried out for the project. In general, the alternative is characterized (for the same production value) by:

Imports included;

Value added included (itself broken down by agent).

It should be noted that it is necessary to take account, in the alternative situation, of production that may be eliminated through the implementation of the project, because the project will pre-empt certain factors. For example, the traditional production of wheat may be discontinued:

*(a)* Because the project uses agricultural labour (a theoretical case, it would seem, in many developing countries where there is abundant manpower); or

*(b)* Because the project uses land (irrigation and drainage project).

Discontinued production of this kind has the effect of either reducing exports or increasing imports as compared with the "economy with project" situation.

## Determination of the effects of the project

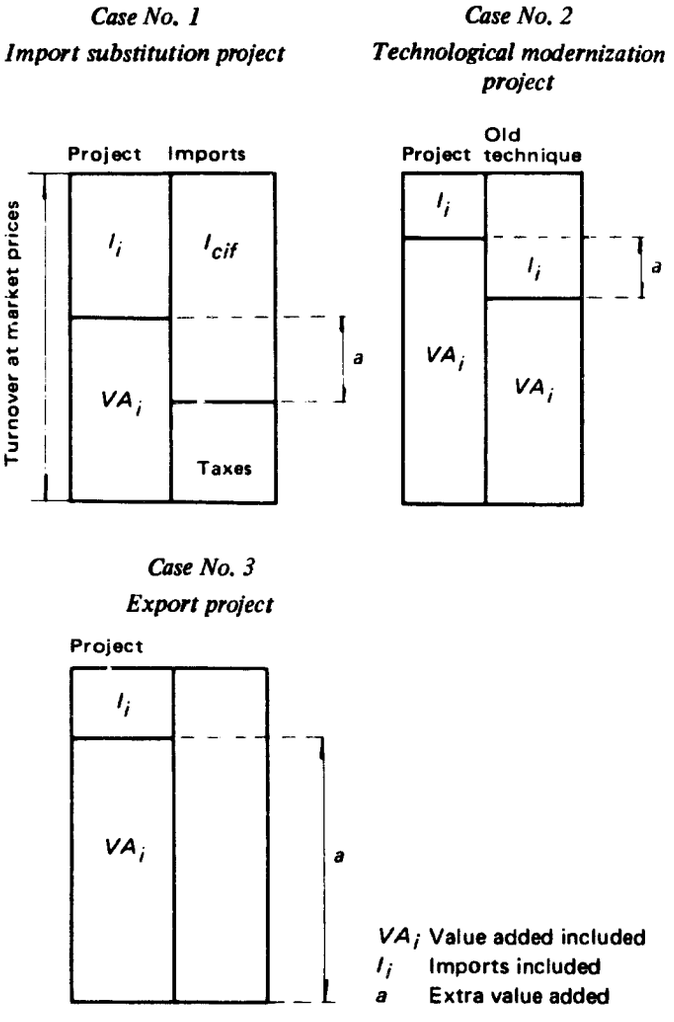
### *Total effect of the project on the economy*

A comparison of the two alternatives (economy with and without project) enables the total (primary) effect of the project upon the economy to be estimated.

This total effect is equal, in all cases, to the extra value added brought into the economy by the implementation of the project; this extra value added (primary effect) is equal to the gain in foreign exchange.

This reasoning applies in a system of constant prices. Thus, for instance, the value added of the alternative solution in case No. 1 is made up of the customs duties that the State levies, or could have levied, by placing the same product on the domestic market at the same price.

When all is said and done, the level of market prices (for a given demand) matters little; an inflation of the value added of the project, as a result, for instance, of the employment of excessive manpower is, it is true, reflected in an increase in the rate of value added included; but the extra value added created (equal to the gain in foreign exchange) remains constant; in other words the State agrees to lose, if the project is carried out, the difference between the market price and the cif price.




These arguments are valid for the three types of projects.

Case No. 2 covers projects such as:

Modernization of the transport infrastructure (former technique–earth road; project technique–paved road);

Industries which take the place of traditional production (food industries, textiles, various).

Finally, it is only in case No. 3, when the price is the fob price, that the value added included of the project equals the extra value added created.

### *Effects by category of agents*

A comparison of the two situations, with and without project, can give much more detailed information since there is available the breakdown of value added by category of agents. Thus the extra value added can be broken down by category of agents who benefit, and the project can be characterized by the plus or minus supplements of income it enables to be distributed to employees[4] (who may be foreigners, nationals in the modern sector, or nationals in the traditional sector), to the State and to entrepreneurs (who may be nationals or foreigners).

[4] It is also possible to calculate, on the basis of the rates of average and marginal employment, by branch, the direct and indirect employment created by the project.

The composition of the value added thus created differs considerably according to the case, e.g.:

Projects of the first type (import substitution projects) may involve a considerable loss of revenue for the State (as in the case of highly protected assembly industries).

Similarly, projects of the second type (technological modernization) may involve considerable losses of income for traditional small producers (as in the case of an industrial oil-mill whose output replaces traditional types of production).

Export projects, on the other hand, may lead to a greater or lesser amount of additional income for the various categories of domestic agents.

Finally, it may seem wise to adopt a "national" rather than a "domestic" approach and to try to measure the extra value added going to nationals: this can be done simply by subtracting from the domestic extra value added the income going to foreigners in the form of wages or profits (which amounts to considering these jobs as imports).

## Formulating a procedure or criterion for project selection

The problem of project evaluation and preparation for selection takes on a different aspect according as the aim is to formulate a plan or only to estimate the benefit of one particular project.

### *Project selection in the planning process*

The problem of the choice of projects is inseparable from the actual formulation of the plan.

The central planning body has at its disposal the following information:

The growth objectives of the economy;

The constraints with regard to financing, foreign trade etc.;

Data on the behaviour of agents (e.g. consumption patterns and rates of saving in the various categories of households);

Income distribution objectives etc.

The role of the project economist is to set forth in the clearest possible way the implications of the possible choices, in the light of the objectives and constraints.

The process of project selection therefore depends more on a procedure of discussion with the policy-makers than upon the over-all results of simultaneous calculations which, of necessity, implicitly include political choices.

This discussion procedure could be prepared for by:

Classifying projects in major, more or less homogeneous groups and submitting corresponding schedules of investment costs, value added, and income by agent (particularly the State, but also social categories, regions etc.);

Preparing several alternative solutions corresponding to different development policies;

Checking them against the initial objectives.

Discussion could then be started with the policy-makers, who, having all the necessary information, could gradually be brought to fix on the various objectives (growth, income distribution etc.), and the economists would make these choices explicit by progressively drawing up the corresponding list of projects.

### *Economic evaluation of a project*

There is nothing to prevent the adoption of more than one over-all selection criterion—and the approaches taken in working out different criteria are by no means mutually exclusive.

The mass of analytical data collected allows great freedom in this respect.

To stick to the procedures normally used, one might take, for instance:

*As the benefit variable:* The extra value added created, weighted if necessary by category of agent. These weightings could take into account, in particular:

Income distribution goals (by nationality, social category, region etc.);

Propensity to save of the various agents;

Multiplier effect of the expenditure of the various categories of wage-earners (secondary effects);

The State's need to balance its budget.

*As the cost variable:* Investment cost, or cost without taxes, or the foreign exchange component of the investment cost.

*As the calculating procedure:* Discounting, either by using a discount rate[5] for calculating present value, or by using an internal rate of return.

More precisely, one might propose:

(1) The simplest over-all selection criterion:

$$\frac{a}{I}$$

where

$a$ is the extra value added created by the project (equal to the gain in foreign exchange in the primary phase);

$I$ is the investment cost, taxes included.

This selection criterion is obviously suitable for choosing between projects having a more or less constant production schedule and more or less the same duration.

(2) The general criterion which is nearest to those normally used, that is to say, the internal rate of return, $r$, solution of the equation:

$$-I + \sum_{1}^{n} \frac{a_t}{(1+r)^t} = 0$$

where

$a_t$ is the extra value added (domestic or national) created;

$I$ is the cost of investment (without taxes, or including taxes);

$n$ is the duration of the project.

[5] It is, however, idle to hope that this rate can be given in any meaningful way by the policy-makers or by simultaneous calculation.

Each of the criteria chosen involves a body of assumptions concerning:

*(a)* Income distribution (considered optimal, for instance, when a general benefit like *a* is obtained);

*(b)* The progressive distortion of the economy caused by assuming the discount rate to be constant over a period of time (changes in the rate of development in fact lead to variations in this rate).

Whatever over-all criterion may be chosen, it appears, reasonably enough, that it cannot faithfully reflect the whole range of objectives and constraints in the economy.

It therefore seems essential to give individually, for each project, the main economic variables which it has been possible to calculate, such as extra value added, the impact on income of the various agents, or the employment (direct and indirect) created.

## CONCLUSION

It may seem disappointing that this effects method does not lead to a very well-defined selection criterion.

More closely examined, the procedure followed in this method can be seen to include two distinct phases:

(1) An analytical phase in which the project is checked against the economy and an attempt is made to measure its impact and effect on the economy;

(2) A policy phase in which, using the material produced by the preceding analysis, an effort is made to combine the various elements in such a way as to match as closely as possible the constraints on the economy and the goals established by the policy-makers.

The variety of criteria to which the effects method leads is thus seen to be a faithful reflection of the variety of situations in different developing countries and of the variety of development choices that can be taken by the policy-makers in those countries.

# *Exercise in the application of the effects method*

Marc CHERVEL*

## INTRODUCTION

This exercise in the application of the effects method and the case study which follows were submitted after the account of the effects method given to the Seminar on the Evaluation of Industrial Projects.[1] This exercise sets forth, in outline, the calculations which can serve as a starting-point for a process of discussion with the policy-makers when a plan is being drawn up.

The data concerning the economic coefficients and the projects have been taken from studies carried out in Morocco at the time when the first and second five-year plans were being prepared.

The problem is the evaluation of production projects by a central planning office, from the standpoint of the national economy, and their preparation for selection. The method of analysis used is the effects method. In order to apply this method it is necessary to have:

*(a)* A sound knowledge of the economy;

*(b)* Detailed information about the projects studied;

*(c)* Detailed information about alternative techniques by which the market can be supplied at the same prices.

## NATURE OF THE CASE

### Data on the economy

Knowledge is assumed of the various production/operating accounts of the branches and sub-branches of production existing in the economy and of the links these branches have with the outside (input-output table with import content).

More precisely, it is assumed that on the basis of this input-output table (with import content) the various rates for components of value included in domestic production (taxes, wages, gross income of the entrepreneur, imports) have been calculated[2] (table 1).

In addition, production/operating accounts are available for some sub-branches (electricity) and also for some accounting items (maintenance, overheads) (table 2).

### Data on the projects

The following details are available on the projects:

Production/operating accounts, drawn up by the national accounting method, and specifying the origin of the products;

The investment required.

In the case under study, in order to simplify the calculations, three industrial projects have been taken (manufacture of pneumatic tires, an industrial flour-mill, and a citrus juice factory), for which it has been assumed that:

A normal production level is rapidly achieved and is maintained throughout the life of the projects;

The investment in each case has the same life-span (see tables 3, 4 and 5).

### Alternatives

*(Economy without project)*

For the "tire manufacture" project, the alternative means by which the market can be supplied at the same price is cif importing with customs duties of 50 per cent.

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[1] UNIDO and the Secretariat of State for Foreign Affairs, France, Seminar on the Evaluation of Industrial Projects, Lomé, Togo, 1972.

[2] Charles Prou and Marc Chervel, *Etablissement des programmes en économie sous-développée, Vol. 3: L'Etude des grappes de projets* (Paris, Dunod, 1970), "Calculs effectués sur le TEI du Maroc 1958".

TABLE 1. RATES OF VALUE ADDED INCLUDED AND IMPORTS INCLUDED IN THE VARIOUS BRANCHES OF THE ECONOMY

(‰)

| *Branch classification* | *Rate of taxes included* | *Rate of wages and Social Security contributions included*[a] | *Rate of gross income of entrepreneur included* | *Total rate of value added included* | *Rate of imports included* |
|---|---|---|---|---|---|
| 1. Agriculture, fishing, forests | 35 | 830 | 101 | 966 | 34 |
| 2. Sugar, coffee | 271 | 162 | 138 | 571 | 429 |
| 3. Preserved food, cold | 85 | 517 | 220 | 822 | 178 |
| 4. Fats, milk | 139 | 342 | 117 | 598 | 402 |
| 5. Grain and flour | 66 | 701 | 170 | 937 | 63 |
| 6. Beverages and tobacco | 231 | 273 | 385 | 889 | 111 |
| 7. Power | 103 | 421 | 360 | 884 | 116 |
| 8. Phosphates | 143 | 313 | 423 | 879 | 121 |
| 9. Mines | 140 | 399 | 363 | 902 | 98 |
| 10. Building materials | 141 | 457 | 228 | 826 | 174 |
| 11. Building | 106 | 564 | 145 | 815 | 185 |
| 12. Public works | 121 | 539 | 188 | 848 | 152 |
| 13. Iron and steel, metallurgy | 124 | 340 | 419 | 883 | 117 |
| 14. Equipment, semi-finished products | 128 | 398 | 107 | 633 | 367 |
| 15. Automobiles, aircraft, cycles | 130 | 404 | 216 | 750 | 250 |
| 16. Metals, consumption | 125 | 396 | 140 | 661 | 339 |
| 17. Textiles, spinning, weaving | 120 | 351 | 211 | 682 | 318 |
| 18. Textile clothing | 165 | 358 | 195 | 718 | 282 |
| 19. Textiles, handcrafted | 100 | 679 | 78 | 857 | 143 |
| 20. Leather | 107 | 615 | 131 | 853 | 147 |
| 21. Footwear | 129 | 559 | 142 | 830 | 170 |
| 22. Chemical industries | 169 | 342 | 269 | 780 | 220 |
| 23. Parachemistry, pharmacy | 169 | 326 | 176 | 671 | 329 |
| 24. Rubber | 135 | 431 | 141 | 707 | 293 |
| 25. Printing and kindred trades | 126 | 397 | 151 | 674 | 326 |
| 26. Wood and miscellaneous | 123 | 440 | 140 | 703 | 297 |
| 27. Pottery, glass | 100 | 601 | 123 | 824 | 176 |
| 28. Transport | 117 | 574 | 197 | 888 | 112 |
| 29. Services | 69 | 590 | 281 | 940 | 60 |
| 30. Housing | 11 | 14 | 968 | 993 | 7 |
| 31. Trade in imports | 79 | 418 | 449 | 946 | 54 |
| 32. Domestic trade | 142 | 497 | 295 | 934 | 66 |

[a]Including income of agricultural small holders.

TABLE 2. PRODUCTION/OPERATING ACCOUNTS OF SOME SUB-BRANCHES OR ACCOUNTING ITEMS

| *Maintenance* | *(%)* |
|---|---|
| Domestic products | |
| Metal parts | 20 |
| Maintenance equipment | 10 |
| Imported parts | 36 |
| Wages paid | 29 |
| Taxes | 5 |
| Total | 100 |
| *Overhead expenses* | |
| Local services | 95 |
| Wages | 5 |
| Total | 100 |

| *Electricity* | *(‰)* |
|---|---|
| Coal | 40 |
| Petroleum products (imported) | 18 |
| Engineering parts, local | 28 |
| Imported parts | 70 |
| Maintenance | 14 |
| Overheads | 40 |
| Sub-total | 210 |
| Wages | 260 |
| Taxes | 70 |
| Gross income of the entrepreneur | 460 |
| Total | 1,000 |

TABLE 3. FIRST PROJECT: TIRE MANUFACTURE

*Estimated operating account (estimated turnover: 7,000 MF)*[a]

*(‰)*

| *Products* | *Technical coefficients* | *Domestic production* | *Imports cif* | *Customs and imports taxes* |
|---|---|---|---|---|
| Petroleum products | 15 | | 6 | 9 |
| Electricity | 40 | 40 | | |
| Metal products | 20 | | 15 | 5 |
| Canvas | 180 | | 170 | 10 |
| Chemical products | 90 | | 77 | 13 |
| Synthetic rubber | 150 | | 140 | 10 |
| Natural rubber | 100 | | 93 | 7 |
| Transport | 5 | 5 | | |
| Maintenance | 10 | 10 | | |
| Overheads | 40 | 40 | | |
| Total intermediate inputs | 650 | 95 | 501 | 54 |
| Wages | 190 | | | |
| Taxes | 67 | | | |
| Gross income of the entrepreneur | 93 | | | |
| Total value added | 350 | | | |
| Total | 1,000 | | | |

Investment: Total investment: 4,400 MF;
Rate of imports included in the investment: 65%;
Life span: 12 years

[a]MF: millions of old French francs.

TABLE 4. SECOND PROJECT: INDUSTRIAL FLOUR MILL

*Estimated operating account (estimated turnover: 4,000 MF)*

*(‰)*

| *Products* | *Technical coefficients* | *Domestic production* | *Imports cif* | *Customs and taxes* |
|---|---|---|---|---|
| Wheat | 650 | 650 | | |
| Electricity | 20 | 20 | | |
| Metal parts | 10 | | 7 | 3 |
| Transport | 20 | 20 | | |
| Overheads | 50 | 50 | | |
| Total | 750 | 740 | 7 | 3 |
| Wages | 110 | | | |
| Taxes | 40 | | | |
| Gross income of the entrepreneur | 100 | | | |
| Total value added | 250 | | | |
| Grand total | 1,000 | | | |

Investment: Total investment: 2,400 MF;
Rate of imports included in the investment: 71%;
Life span: 12 years.

TABLE 5. THIRD PROJECT: CITRUS JUICE FACTORY

*Estimated operating account (estimated turnover: 3,000 MF)*

*(‰)*

| *Products* | *Technical coefficients* | *Domestic production* | *Imports cif* | *Customs and taxes* |
|---|---|---|---|---|
| Citrus fruits | 315 | 315 | | |
| Sugar | 20 | 20 | | |
| Petroleum products | 10 | | 4 | 6 |
| Electricity | 10 | 10 | | |
| Water | 10 | 10 | | |
| Metal cans | 260 | | 220 | 40 |
| Transport | 5 | 5 | | |
| Cardboard boxes | 30 | 30 | | |
| Maintenance | 15 | 15 | | |
| Overheads | 40 | 40 | | |
| Total intermediate inputs | 715 | 445 | 224 | 46 |
| Wages | 140 | | | |
| Taxes | 40 | | | |
| Gross income of the entrepreneur | 105 | | | |
| Total value added | 285 | | | |
| Total | 1,000 | | | |

Investment: Total investment: 2,100 MF;
Rate of imports included in the investment: 68%;
Life span: 12 years

For the "industrial flour mill" project, the alternative is the former technique, that is to say, the traditional technique.

The evaluation is made on two different assumptions:

*Assumption (1)*

That from a given quantity of wheat, the same quantity of flour can be produced by the traditional technique as by the modern technique.

The production/operating account of the traditional flour mill is as follows (in per mille):

| | *Technical coefficients* |
|---|---|
| Wheat | 650 |
| Overheads | 30 |
| Wages | 320 |
| Total | 1,000 |

*Assumption (2)*

That from a given quantity of wheat, only 90 per cent of the flour produced by the modern technique can be produced by the traditional technique.

Thus 650 of wheat gives 900 of flour, as follows (in per mille):

| | *Technical coefficients* |
|---|---|
| Wheat | 650 |
| Overheads | 30 |
| Wages | 220 |
| Total | 900 |

For the "citrus juice factory" project, the output of which is designed for export, the evaluation is also made on two different assumptions:

Assumption (1): That the citrus fruit consumed by the factory is what has been rejected during the sorting process, which, in the alternative situation, simply goes to waste.

Assumption (2): That in the alternative situation, of the citrus fruit rejected in the sorting process:

*(a)* 20 per cent simply goes to waste;

*(b)* 80 per cent is marketed at a price 30 per cent below the price at which it would be sold to the citrus juice factory.

## PROBLEM: EVALUATION AND COMPARISON OF THE PROJECTS

What is required is to evaluate the benefit to the national economy of implementing each of these projects, in such a way as to facilitate the problem of selection.

The approach will be as follows:

### Introduction of the projects into the economy

*(Economy with project)*

For the output of each of these projects, the following variables are calculated:

*(a)* Value added included (broken down into its components);

*(b)* Imports included.

Before this is done, it is necessary to make a similar calculation for the sub-branches and items in table 2.

### Calculation of the effects of the projects on the economy

The effects are calculated by comparing the previous analysis (economy with project) with a similar analysis of the alternative situation (economy without project).

In this way, we determine (in the primary phase[3]):

*(a)* The extra value added created by each of the projects (broken down into extra income by category of agents (state, employees, entrepreneurs);

*(b)* The gain in foreign exchange.

### Comparison of the various projects

The comparison of the various projects is carried out on the basis of the previous calculations. Any necessary comments and observations are made and a conclusion is reached regarding the comparative benefits of the projects and the consequent decision to be taken.

[3] Without taking into account the effects of the expenditure in the economy of the extra income thus created.

## SOLUTION

### Introduction of the projects into the economy

TABLE 6. CALCULATION OF VALUE ADDED INCLUDED (BROKEN DOWN) AND IMPORTS INCLUDED OF THE SUB-BRANCHES AND ITEMS IN TABLE 2

| *Classification* | | *Technical coefficients* | *Domestic production* | *Imports cif* | *Customs and taxes* | *Rate of value added included* | *Rate of wages included* | *Rate of taxes included* | *Rate of imports included* | *Value added included* | *Wages included* | *Taxes included* | *Imports included* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Maintenance* | | | | | | | |
| 14 | Metal parts | 20 | 20 | | | 0.63 | 0.40 | 0.13 | 0.37 | 13 | 8 | 3 | 7 |
| 23 | Maintenance goods | 10 | 10 | | | 0.67 | 0.33 | 0.17 | 0.33 | 7 | 3 | 2 | 3 |
| | Imported parts | 36 | | 36 | | | | | | | | | |
| | Total intermediate inputs | 66 | 30 | 36 | | | | | | 20 | 11 | 5 | 10 |
| | Wages paid | 29 | | | | | | | | | 29 | | |
| | Taxes | 5 | | | | | | | | | | 5 | |
| | Total value added | 34 | | | | | | | | 34 | | | |
| | Total | 100 | | 36 | | | | | | 54 | 40 | 10 | 10 |
| | *Maintenance:* Imports included | | | | | | | 46 | | | | | |
| | Value added included | | | | | | | 54 | | | | | |
| | of which: Wages included | | | | | | | | 40 | | | | |
| | Taxes included | | | | | | | | 10 | | | | |
| | Gross income of the entrepreneur included[a] | | | | | | | | 4 | | | | |
| | | | | | | *Electricity* | | | | | | | |
| 7 | Coal | 40 | 40 | | | 0.88 | 0.42 | 0.10 | 0.12 | 35 | 17 | 4 | 5 |
| | Petroleum products | 18 | | 18 | | | | | | | | | |
| 14 | Engineering parts | 28 | 28 | | | 0.63 | 0.40 | 0.13 | 0.37 | 18 | 11 | 4 | 10 |
| | Imported parts | 70 | | 70 | | | | | | | | | |
| | Maintenance | 14 | 14 | | | 0.54 | 0.40 | 0.10 | 0.46 | 8 | 6 | 1 | 6 |
| | Overheads | 40 | 40 | | | 0.94 | 0.61 | 0.07 | 0.06 | 38 | 24 | 3 | 2 |
| | Total intermediate inputs | 210 | 122 | 88 | | | | | | 99 | 58 | 12 | 23 |
| | Wages | 260 | | | | | | | | | 260 | | |
| | Taxes | 70 | | | | | | | | | | 70 | |
| | Gross income of the entrepreneur | 460 | | | | | | | | | | | |
| | Total value added | 790 | | | | | | | | 790 | 318 | 82 | 23 |
| | Total | 1,000 | | 88 | | | | | | 889 | 318 | 82 | 23 |
| | *Overheads:* Imports included | | | | | | | 111 | | | | | |
| | Value added included | | | | | | | 889 | | | | | |
| | of which: Wages included | | | | | | | | 318 | | | | |
| | Taxes included | | | | | | | | 82 | | | | |
| | Gross income of the entrepreneur included[a] | | | | | | | | 489 | | | | |

TABLE 6 *(continued)*

| Classification | | Technical coefficients | Domestic production | Imports cif | Customs and taxes | Rate of value added included | Rate of wages included | Rate of taxes included | Rate of imports included | Value added included | Wages included | Taxes included | Imports included |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Overheads* | | | | | | | | |
| 29 | Services | 95 | 95 | | | 0.94 | 0.59 | 0.07 | 0.06 | 89 | 56 | 7 | 6 |
| | Wages | 5 | | | | | | | | 5 | 5 | | |
| | Total | 100 | | | | | | | | 94 | 61 | 7 | 6 |
| | | *Overheads:* | Imports included | | | | | 6 | | | | | |
| | | | Value added included | | | | | 94 | | | | | |
| | | | of which: Wages included | | | | | | 61 | | | | |
| | | | Taxes included | | | | | | 7 | | | | |
| | | | Gross income of the entrepreneur included[a] | | | | | | 26 | | | | |

[a]The gross income of the entrepreneur included is obtained by calculating the difference between the value added included and the sum of wages included plus taxes included.

TABLE 7. CALCULATION OF VALUE ADDED INCLUDED (BROKEN DOWN) AND IMPORTS INCLUDED IN THE VARIOUS PROJECTS

| Classification | | Technical coefficients | Domestic production | Imports cif | Customs and taxes | Rate of value added included | Rate of wages included | Rate of taxes included | Rate of imports included | Value added included | Wages included | Taxes included | Imports included |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Project: Tire manufacture* | | | | | | | | |
| | Petroleum products | 15 | | 6 | 9 | | | | | | | | |
| | Electricity | 40 | 40 | | | 0.89 | 0.32 | 0.08 | 0.11 | 36 | 13 | 3 | 4 |
| | Metal goods | 20 | | 15 | 5 | | | | | | | | |
| | Canvas | 180 | | 170 | 10 | | | | | | | | |
| | Chemical products | 90 | | 77 | 13 | | | | | | | | |
| | Synthetic rubber | 150 | | 140 | 10 | | | | | | | | |
| | Natural rubber | 100 | | 93 | 7 | | | | | | | | |
| 28 | Transport | 5 | 5 | | | 0.89 | 0.57 | 0.20 | 0.11 | 4 | 3 | 1 | 1 |
| | Maintenance | 10 | 10 | | | 0.54 | 0.40 | 0.10 | 0.46 | 5 | 4 | 1 | 5 |
| | Overheads | 40 | 40 | | | 0.94 | 0.61 | 0.07 | 0.06 | 38 | 24 | 3 | 2 |
| | Total intermediate inputs | 650 | 95 | 501 | 54 | | | | | 83 | 44 | 8 | 12 |
| | Wages | 190 | | | | | | | | | 190 | | |
| | Taxes | 67 | | | | | | | | | | 67 | |
| | Gross income of the entrepreneur | 93 | | | | | | | | | | | |
| | Total value added | 350 | | | | | | | | 350 | | | |
| | Total | 1,000 | | 501 | 54 | | | | | 433 | 234 | 75 | 12 |
| | | *Tires:* Imports included | | | | | 513 | | | | | | |
| | | Value added included | | | | | 487 | | | | | | |
| | | of which: Wages included | | | | | | 234 | | | | | |
| | | Taxes included | | | | | | 129 | | | | | |
| | | Gross income of the entrepreneur included | | | | | | 124 | | | | | |

| Classification | | Technical coefficients | Domestic production | Imports cif | Customs and taxes | Rate of value added included | Rate of wages included | Rate of taxes included | Rate of imports included | Value added included | Wages included | Taxes included | Imports included |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Project: Industrial flour mill* | | | | | | | |
| 1 | Wheat | 650 | 650 | | | 0.966 | 0.830 | 0.035 | 0.034 | 628 | 540 | 23 | 22 |
| | Electricity | 20 | 20 | | | 0.89 | 0.32 | 0.08 | 0.11 | 18 | 6 | 2 | 2 |
| | Metal parts | 10 | | 7 | 3 | | | | | | | | |
| 28 | Transport | 20 | 20 | | | 0.89 | 0.57 | 0.20 | 0.11 | 18 | 11 | 4 | 2 |
| | Overheads | 50 | 50 | | | 0.94 | 0.61 | 0.07 | 0.06 | 47 | 30 | 3 | 3 |
| | Total intermediate inputs | 750 | 740 | 7 | 3 | | | | | 711 | 587 | 32 | 29 |
| | Wages | 110 | | | | | | | | | 110 | | |
| | Taxes | 40 | | | | | | | | | | 40 | |
| | Gross income of the entrepreneur | 100 | | | | | | | | | | | |
| | Total value added | 250 | | | | | | | | 250 | | | |
| | Total | 1,000 | | 7 | 3 | | | | | 961 | 697 | 72 | 29 |

*Industrial flour mill:*

| | | |
|---|---|---|
| Imports included | 36 | |
| Value added included | 964 | |
| of which: Wages included | | 697 |
| Taxes included | | 75 |
| Gross income of the entrepreneur included | | 192 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Project: Citrus juice factory* | | | | | | | |
| 1 | Citrus fruit | 315 | 315 | | | 0.966 | 0.830 | 0.035 | 0.034 | 304 | 262 | 11 | 11 |
| 2 | Sugar | 20 | 20 | | | 0.57 | 0.16 | 0.27 | 0.43 | 11 | 3 | 5 | 9 |
| | Petroleum products | 10 | | 4 | 6 | | | | | | | | |
| | Electricity | 10 | 10 | | | 0.89 | 0.32 | 0.08 | 0.11 | 9 | 3 | 1 | 1 |
| 7 | Water | 10 | 10 | | | 0.88 | 0.42 | 0.10 | 0.12 | 9 | 4 | 1 | 1 |
| | Metal cans | 260 | | 220 | 40 | | | | | | | | |
| 28 | Transport | 5 | 5 | | | 0.89 | 0.57 | 0.20 | 0.11 | 4 | 3 | 1 | 1 |
| 25 | Cardboard boxes | 30 | 30 | | | 0.67 | 0.40 | 0.13 | 0.33 | 20 | 12 | 4 | 10 |
| | Maintenance | 15 | 15 | | | 0.54 | 0.40 | 0.10 | 0.46 | 8 | 6 | 1 | 7 |
| | Overheads | 40 | 40 | | | 0.94 | 0.61 | 0.07 | 0.06 | 38 | 24 | 3 | 2 |
| | Total intermediate inputs | 715 | 445 | 224 | 46 | | | | | 403 | 317 | 27 | 42 |
| | Wages | 140 | | | | | | | | | 140 | | |
| | Taxes | 40 | | | | | | | | | | 40 | |
| | Gross income of the entrepreneur | 105 | | | | | | | | | | | |
| | Total value added | 285 | | | | | | | | 285 | | | |
| | Total | 1,000 | | 224 | 46 | | | | | 688 | 457 | 67 | 42 |

*Citrus juice:*

| | | |
|---|---|---|
| Imports included | 266 | |
| Added value included | 734 | |
| of which: Wages included | | 457 |
| Taxes included | | 113 |
| Gross income of the entrepreneur included | | 164 |

TABLE 8. SUMMARY

(‰)

| Project | Rate of imports included | Rate of value added included | Rate of wages included | Rate of imports included | Rate of gross income of entrepreneur included |
|---|---|---|---|---|---|
| Tire manufacture | 513 | 487 | 234 | 129 | 124 |
| Industrial flour mill | 36 | 964 | 697 | 75 | 192 |
| Citrus juice factory | 266 | 734 | 457 | 113 | 164 |

## Calculation of the effects on the economy

*Study of alternatives*

***Project: Tire manufacture***

The alternative is competitive importing carrying a customs duty of 50 per cent, thus:

| | |
|---|---|
| Imports | 667 |
| Value added (taxes) | 333 |
| Total | 1,000 |

***Project: Industrial flour mill***

The alternative is the traditional flour mill.

*Assumption (1)*

The traditional flour mill requires:

| | | |
|---|---|---|
| Imports included | 24 | |
| Value added included | 976 | |
| of which: Wages included | | 878 |
| Taxes included | | 25 |
| Gross income of the entrepreneur included | | 73 |

Details are given in the table below.

| Classification | | Technical coefficients | Domestic production | Imports cif. | Customs and taxes | Rate of value added included | Rate of wages included | Rate of taxes included | Rate of imports included | Value added included | Wages included | Taxes included | Imports included |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wheat | 650 | 650 | | | 0.966 | 0.830 | 0.035 | 0.034 | 628 | 540 | 23 | 22 |
| | Overheads | 30 | 30 | | | 0.94 | 0.61 | 0.07 | 0.06 | 28 | 18 | 2 | 2 |
| | Wages | 320 | | | | | | | | 320 | 320 | | |
| | Total | 1,000 | | | | | | | | 976 | 878 | 25 | 24 |

*Assumption (2)*

From the same quantity of wheat (650), the traditional flour mill produces only 900 of flour as against 1,000 in the case of the industrial flour mill.

With the traditional flour mill, therefore, the country has to import an extra 100 of flour (or export 100 less flour).

For the same quantity of flour (1,000) on the domestic market, the traditional flour mill needs altogether:

| | | |
|---|---|---|
| Imports included | 124 (24 + 100 of flour) | |
| Value added included | 876 | |
| of which: Wages included | | 778 |
| Imports included | | 25 |
| Gross income of the entrepreneur included | | 73 |

***Project: Citrus juice factory***

*Assumption (1)*

The alternative situation is nil: it consists in doing nothing. The extra value added created by the project is thus equal to the value added included of the project.

*Assumption (2)*

The alternative situation consists in placing on the market citrus fruit to the value of:

80% X 70% X 315 = 176

corresponding to:

| | |
|---|---|
| Imports included | 0.034 X 176 = 6 |
| Value added included | 0.966 X 176 = 170 |
| of which: Wages included | 0.830 X 176 = 146 |
| Taxes included | 0.035 X 176 = 6 |
| Gross income of the entrepreneur included | 0.101 X 176 = 18 |

The extra value added created by the project is thus equal to the value added included of the project (734), less the value added included of the alternative (170).

*Calculation of the effects on the economy*

The effects on the economy are calculated by comparing:

The analysis made of the projects introduced into the economy (economy with project);

with

The analysis of the alternative situations.

The results are shown in table 9:

By proportion per thousand (‰) of the turnover:
By value, on the basis of the estimated turnover;
By composition, as a percentage of the extra value added created.

TABLE 9. EFFECTS ON THE ECONOMY OF IMPLEMENTING THE PROJECTS

*(Extra income created)*

| | *Imports included* | *Value added included* | *Wages included* | *Taxes included* | *Gross income of the entrepreneur included* | *Total* |
|---|---|---|---|---|---|---|
| *Tire manufacture* | | | | | | |
| Production | 513 | 487 | 234 | 129 | 124 | 1,000 |
| Imports | 667 | 333 | | 333 | | 1,000 |
| Differential: | | | | | | |
| Extra value added (per 1,000 of production) | - 154 | + 154 | + 234 | - 204 | + 124 | 1,000 |
| Extra value added (MF) | -1,078 | + 1,078 | + 1,638 | -1,428 | + 868 | 7,000 |
| Composition of extra value added (%) | - 100 | + 100 | + 152 | - 132 | + 80 | (100) |
| *Flour mill* (assumption 1) | | | | | | |
| Industrial | 36 | 964 | 697 | 75 | 192 | 1,000 |
| Traditional | 24 | 976 | 878 | 25 | 73 | 1,000 |
| Differential: | | | | | | |
| Extra value added (per 1,000 of production) | + 12 | - 12 | - 181 | + 50 | + 119 | 1,000 |
| Extra value added (MF) | + 48 | - 48 | - 724 | + 200 | + 476 | 4,000 |
| *Flour mill* (assumption 2) | | | | | | |
| Industrial | 36 | 964 | 697 | 75 | 192 | 1,000 |
| Traditional | 124 | 876 | 778 | 25 | 73 | 1,000 |
| Differential: | | | | | | |
| Extra value added (per 1,000 of production) | - 88 | + 88 | - 81 | + 50 | + 119 | 1,000 |
| Extra value added (MF) | - 352 | + 352 | - 324 | + 200 | + 476 | 4,000 |
| Composition of extra value added (%) | - 100 | + 100 | - 92 | + 57 | + 135 | (100) |
| *Citrus juice factory* (assumption 1) | | | | | | |
| Extra value added (per 1,000 of production) | - 734 | + 734 | + 457 | + 113 | + 164 | 1,000 |
| Extra value added (MF) | -2,202 | + 2,202 | + 1,371 | + 339 | + 492 | 3,000 |
| Composition of extra value added (%) | - 100 | + 100 | + 62 | + 15 | + 23 | (100) |
| *Citrus juice factory* (assumption 2) | | | | | | |
| Production | - 734 | + 734 | + 457 | + 113 | + 164 | 1,000 |
| Previous production | | + 170 | + 146 | + 6 | + 18 | |
| Differential: | | | | | | |
| Extra value added (per 1,000 of production) | - 564 | + 564 | + 311 | + 3,107 | + 146 | 1,000 |
| Extra value added (MF) | -1,692 | + 1,692 | + 933 | + 321 | + 438 | 3,000 |
| Composition of extra value added (%) | - 100 | + 100 | + 55 | + 19 | + 26 | (100) |

## Comparison of the various projects

*Summary table*

Table 10 recapitulates the main variables of the three projects studied (direct variables, variables included, effects). On the basis of these variables selection criteria can be worked out. All that has to be done is to determine in respect of these projects:

*(a)* What are to be regarded as benefits;

*(b)* What are to be regarded as costs;

*(c)* A calculating procedure for comparing costs and benefits.

In the case studied, since the projects have constant production schedules and the same life span, the annual cost-benefit ratio may be used as the calculating procedure.

*Criteria for direct variables*

Only direct benefits accruing from the project are considered. The criterion adopted[4] is: the ratio of direct value added created to investment.

[4] This criterion is near to the one very frequently quoted: direct employment created per million invested (or vice versa).

*Criteria for variables included*

The benefits considered include direct and indirect benefits up-stream. The following may be adopted as criteria:

*(a)* The rate of value added included in production[5] (national value added);

*(b)* The ratio of value added included to investment.

*Criteria for effects*

Benefits are represented solely by the extra income produced by implementing the project. The criteria adopted may be:

*(a)* The ratio of extra value added created to investment;

*(b)* The ratio of extra value added created to imports included in the investment (or the reciprocal, representing the time taken for the pay-back of foreign exchange–in the primary phase).

The extra income created, broken down by recipient (employee, State, entrepreneur), enables a better appraisal to be made of the project (for instance, its effect on public finance–in the primary phase).

[5] It would then be more accurate to break down depreciation (direct and indirect) into its components: value added included and imports included.

TABLE 10. MAIN VARIABLES OF THE THREE PROJECTS STUDIED

| | *Tire manufacture* | *Industrial flour mill* | | *Citrus juice factory* | |
|---|---|---|---|---|---|
| | | *Assumption 1* | *Assumption 2* | *Assumption 1* | *Assumption 2* |
| *Direct variables* | | | | | |
| Turnover (MF) | 7,000 | 4,000 | 4,000 | 3,000 | 3,000 |
| Direct value added (MF) | 2,450 | 1,000 | 1,000 | 850 | 850 |
| Investment (MF) | 4,400 | 2,400 | 2,400 | 2,100 | 2,100 |
| *Criterion for direct variables* | | | | | |
| Direct value added/investment | 55% | 42% | 42% | 40% | 40% |
| *Criteria for variables included* | | | | | |
| Rate of value added included | 49% | 96% | 96% | 73% | 73% |
| Ratio of value added included/investment | 78% | 161% | 161% | 105% | 105% |
| *Effects on the economy* | | | | | |
| $V$ = Extra value added created (MF) | +1,080 | −50 | +350 | +2,200 | +1,690 |
| Extra wages (MF) | +1,640 | −720 | −320 | +1,370 | +930 |
| Extra taxes (MF) | −1,430 | +200 | +200 | +340 | +320 |
| Extra gross income of the entrepreneur (MF) | +870 | +470 | +470 | +490 | +440 |
| *Criteria* | | | | | |
| $\Delta V/I$ | 25% | −2% | 15% | 105% | 81% |
| $Im/I$ | 65% | 71% | 71% | 68% | 68% |
| $\Delta V/Im$ | 38% | −3% | 21% | 155% | 119% |
| Time needed for pay-back of foreign exchange $Im/\Delta V$ | 3 years | – | 5 years | 0.6 yr. | 0.8 yr. |

*Note:* $\Delta V$ Extra value added created; $I$ Investment; $Im$ Imports included in investment.

## CONCLUSIONS

The ratings of the projects in accordance with the various criteria—direct, included, or by effects—are quite different (no matter which assumptions are adopted for the flour mill and the citrus juice projects).

*Ratings*

| | *Tire manufacture* | *Industrial flour mill* | *Citrus juice factory* |
|---|---|---|---|
| Direct criteria | 1 | 2 | 3 |
| Included criteria | 3 | 1 | 2 |
| Effects on the economy criteria | 2 | 3 | 1 |
| Impact on public finance | 3 | 2 | 1 |

That clearly shows the inadequacy of direct criteria, such as employment created per million invested, or criteria of benefits included such as the rate of national value added.

The citrus juice project seems distinctly the best, both by the over-all criteria and as regards the distribution of the income created.

It is worth noting that, although the industrial flour mill project is of little benefit to the economy (particularly on the first assumption), its impact on public finance is considerable; the first two projects rate differently with regard to the economy and to the State.

Without going back to the assumptions underlying the calculation (under-utilization of production capacity,[6] much unemployment, the use of average rather than marginal coefficients etc.), the study carried out enables a certain number of key points to be established for the calculation of effects.

These points mainly concern the study of the alternative situation or technique: the results can in fact be considerably modified according to the assumptions made.

First, from an over-all point of view (extra value added created):

For import substitution projects it is necessary to determine accurately the import price cif of the equivalent product.

Technical modernization projects will appear worth while only if they lead to better use of the raw material or permit exploitation of the by-products.

A detailed study of the alternative situation for export projects (export of raw products) also appears very necessary.

From the standpoint of income distribution, a study of the alternatives seems altogether essential: it reveals the full extent of the problems raised:

By some import substitution projects which involve considerable losses for public finance;

By some technological modernization projects which may entail considerable losses of income for the traditional sector,[7] whereas profitability if ensured for the entrepreneur and the State can collect substantial revenues.

[6] When production capacity is saturated, the supplementary investment required up-stream should be added to the project investment.

[7] It would obviously have been very useful to have a more detailed breakdown of the income created, into "modern" and "traditional" sectors. It would likewise have been helpful to have a breakdown of income created (employees, entrepreneurs) as between domestic and foreign recipients. These data have not been given, in order to keep the study simple.

# *Case study: Industrial fishing complex in an African port*

Marc CHERVEL
in collaboration with Marie-Thérèse COUREL and Dominique PERREAU*

## NATURE OF THE CASE: DESCRIPTION OF THE PROJECT

### Terms of reference of the study

This case study shows how the effects method can be used for evaluating the benefit that would accrue to the economy from a particular project.[1]

In 1967 an expert mission was given the task of:

Examining the economic importance of sea fish in the domestic market;
Examining the conditions for carrying out a general development programme for marine fishing;
Determining the best possible conditions for setting up an industrial fishing complex.

As regards the third item of the mission's task, a preliminary plan for a fishing project had already been prepared. It is on the basis of this preliminary plan that the case study has been carried out.

The preliminary plan provided for:

Production capacity consisting of a trawler for large-scale industrial fishing, three tunny boats and two sardine boats;
An industrial processing capacity designed for the production of frozen fillets, frozen whole fish, tinned tunny fish, tinned sardines, fish meal;
Communal equipment.

### Technical particulars of fishing

These particulars include the catches of the fishing craft, i.e., their expected yield, the investment costs and the annual operating costs (these last are set forth in the section on operating data).

*Catches of the fishing craft*

*Trawler*

The expected yield of a trawler for the whole of the fishing seasons throughout the year is 3,200 tons[2] of hake and 800 tons of pilchards for canning. Freezing is done on board.

The entire catch is stocked on land, in cold storage, before being used. When the hake comes out of cold storage, 1,000 tons are processed into fillets, and then all the hake is sent for export.

*Tunny boat*

The catch of a tunny boat is 1,200 tons of tunny fish; freezing is done on board; 55.5 per cent of the catch is intended for canning; the rest is sold directly on the domestic market after being kept in cold storage.

*Sardine boat*

The catch of a sardine boat is 1,000 tons of sardines and 750 tons of pilchards. The entire catch is chilled on board. The sardines, after being frozen and put in cold storage on land, are sold directly on the domestic market. The pilchards go direct to the cannery.

*Investment costs*[a]
*(in millions of CFA francs)*

| | *Cost per unit* | |
|---|---|---|
| | *Fishing craft cif (without equipment)* | *Fishing gear* |
| Trawler | 460 | 25 |
| Tunny boat | 160 | 15 |
| Sardine boat | 42 | 17 |

[a] For the life expectation of the equipment, see below.

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[1] This study has been drawn from a report written by Mr. Moal, Chief, Department of Fisheries and Mr. Le Noan, Expert, SCET-International.

[2] Throughout this publication, reference to "tons" indicates "metric tons".

## Technical particulars of the factory

### *Description*

The factory includes:

A canning unit for tunny fish and pilchards;
A freezing and cold storage unit;
A unit for the manufacture of fish meal from offal.

### *Manufacturing process*

*Tinned tunny fish*

The offal amounts to 60 per cent. Each "¼ tin" contains 160 g of flesh (drained). A case contains 100 "¼ tins".

*Tinned pilchards*

The offal amounts to 50 per cent. Each "oval ½ tin" contains 250 g of flesh (drained). A case contains 100 "½ tins".

*Hake fillets*

Offal from filleting amounts to 50 per cent.

*Meal*

1 kg of meal is obtained from 5 kg of offal.

### *Cost of initial investment*

| | *Millions of CFA francs* |
|---|---|
| Canning unit | 229 |
| Freezing and storing unit | 132 |
| Meal manufacturing unit | 20 |
| General equipment | 90 |

Preparatory studies estimated at 8 per cent of the above investment.

Working capital: 4 months' operation of fishing craft and factories (without taxes).

## Operating data

### *Annual cost of operating the fishing craft, per unit*

*(in millions of CFA francs)*

| | *Trawler* | *Tunny boat* | *Sardine boat* | *Source of goods and services consumed* |
|---|---|---|---|---|
| Fuel and lubricants | 18 | 7 | 3 | Imported (taxes 60% of cif value) |
| Food for crew | 8 | 4 | 2 | Local |
| Electronic parts | 2 | 2 | 1 | Imported (taxes 30% of cif value) |
| Maintenance | 17 | 15 | 7 | 50% imported (taxes 30%) 50% local labour |
| Insurance | 7 | 4 | 2 | 50% imported cif (without taxes) |
| Air transport | 8 | 3 | 1 | 40% local 10% taxes |
| Wages and social security contributions: | | | | |
| Foreign workers | 25 | 12 | 5 | |
| Local workers | 17 | 9 | 4 | |
| Taxes and licenses | 4 | 2 | 1 | |
| Miscellaneous | 4 | 2 | 1 | 25% imported cif (without taxes) 65% local 10% taxes |
| Total | 110 | 60 | 27 | |

### *Operating cost of the factory*

### *Manufacturing costs*

*Tinned tunny fish (in CFA francs per case)*

| | | |
|---|---|---|
| Packaging | 600 | Imported (taxes 30% on cif value) |
| Oil | 400 | Domestic production[a] |
| Salt, ingredients | 60 | Imported (taxes 20% on cif value) |
| Energy | 60 | Domestic production[a] |
| Wages | 240 | Local labour |
| Total | 1,360 | |

*Tinned pilchards (in CFA francs per case)*

| | | |
|---|---|---|
| Packaging | 800 | Imported (taxes 30% on cif value) |
| Oil | 50 | Domestic production |
| Tomato concentrate | 300 | Imported (taxes 40% on cif value) |
| Salt, ingredients | 90 | Imported (taxes 20%) |
| Energy | 90 | Domestic production |
| Wages | 320 | Local labour |
| Total | 1,650 | |

*Filleting (in CFA francs per kg of fillet)*

| | | |
|---|---|---|
| Packaging | 5 | Imported (taxes 30%) |
| Energy | 1 | Domestic production |
| Total | 6 | |

*Freezing on land (in CFA francs per kg)*

| | | |
|---|---|---|
| Packaging | 1.5 | Imported (taxes 30%) |
| Energy | 2 | Domestic production |
| Total | 3.5 | |

*Manufacture of meal (in CFA francs per kg of meal)*

| | | |
|---|---|---|
| Packaging | 1.8 | Imported (taxes 30%) |
| Energy | 5.1 | Domestic production |
| Total | 6.9 | |

*Cold storage*
*(on the average, in CFA francs per kg stored)*

| | | |
|---|---|---|
| Energy | 1 | Domestic production |

[a]See "Composition of domestic production", below.

*General services (management, technical services, general services, in millions of CFA francs per annum)*

| | | |
|---|---|---|
| Local staff | 14 | including permanent technical staff |
| Foreign staff | 16 | |
| Maintenance and overheads | 12 | 50% imported (taxes 30% on the cif value)<br>50% local labour |
| Insurance | 4 | 50% imported cif<br>40% domestic<br>10% taxes |
| Total | 46 | |

*Composition of domestic production*

*(in percentages)*

| | | |
|---|---|---|
| Energy account: | Imported cif | 20 |
| | Value added without taxes | 70 |
| | Taxes | 10 |
| | Total | 100 |
| Oil: | Value added without taxes | 90 |
| | Taxes | 10 |
| | Total | 100 |

**Economic data**

*Sales prices (including turnover tax of 8.4%)*

| | *Unit* | *Price in CFA francs per unit* |
|---|---|---|
| Hake fillet | kg | 82 |
| Frozen hake | kg | 65 |
| Frozen sardines | kg | 25 |
| Frozen tunny fish | kg | 80 |
| Tinned tunny fish | case | 5,500 |
| Tinned sardines | case | 3,500 |
| Meal | kg | 30 |

*Manufacturing time and life span of equipment*

| | *Manufacturing time (months)* | *Life span (years)* |
|---|---|---|
| Fishing craft | 12 | 15 |
| Fishing gear | – | 5 |
| Factory | 12 | 15 |

It is assumed that the equipment is in service on 1 January of year 1, and that its residual value at the end of year 15 is nil. It is also assumed that year 1 allows a normal production equal to that of the normal producing year.

**Financial data**

*It is assumed that:*

Two-thirds of the non-equipped boats are to be paid for in year zero.
The rest of the equipment is to be paid for in year 1.
Renewals of fishing year are to be paid for in years 5 and 10.

*Depreciation*

In calculating profits, technical depreciation is taken as constant throughout the life span, from year 1.

*Taxes*

The direct tax rate is 30 per cent of the operating profits.

*Financing*

Capital: 557 million CFA francs, paid up in year zero.

All the capital is contributed by a foreign investor. Not more than 40 per cent of profits may be exported.

*Loans*

From the National Development Bank (year zero): 300 million CFA francs at 3 per cent over 15 years, repayable in regular yearly instalments.

Bank credit (year 1): 966 million CFA francs granted by foreign banks at 7 per cent over 7 years, repayable in regular yearly instalments.

**Introduction of the project into the economy**

The sales of sardines and tunny fish on the domestic market will take the place of sales by traditional fishermen; they will also mean less custom for the old cold storage plant, in which the catches of sardines and tunny fish are stored and frozen.

The sales prices of these frozen fish on the domestic market are as forecast above.

The total turnover of traditional fishermen plus the old cold storage plant is 203 million CFA francs, broken down as follows:

| | *Tons* | *Price per ton (in thousands of CFA francs)* | *Turnover (in millions of CFA francs)* |
|---|---|---|---|
| Frozen tunny fish | 1,600 | 80 | 128 |
| Frozen sardines | 3,000 | 25 | 75 |
| Total | | | 203 |

The operating account of the traditional fishing is as follows (in millions of CFA francs):

| | *Total cost* | *Imports* | *Taxes* | *Domestic value added without tax* |
|---|---|---|---|---|
| Intermediate inputs | 33 | 3 | 5 | 25 |
| Direct value added | 170 | – | 15 | 155 |
| Total | 203 | 3 | 20 | 180 |

## PROBLEM: EVALUATION OF THE PROJECT

**Operational aspects**

The following points will be studied in succession:

Total catches of the fishing craft, general production plan;

Turnover, operating costs, investment;

Estimated operating account;

Estimated cash account.

**Calculation of financial profitability**

The intrinsic profitability of the project, not taking into account financing terms or direct taxes on profits. This means–except for direct taxation–the profitability for the financial partners as a whole. Profitability for the entrepreneur.

**Economic profitability**

Calculation of the effects of the project on the economy in general:

Domestic value added: extra income for all agents (State, national agents and foreign agents);

National value added: the above value added less wages of foreigners and foreign profits (up to 40 per cent of profits may be transferred abroad);

Extra revenue for the State.

The investment is broken down in the knowledge that:

The fishing craft have been built abroad (taxes 10 per cent cif);

The factories are 35 per cent of domestic origin and 65 per cent of foreign origin (taxes 10 per cent cif);

The fishing gear is manufactured locally.

Calculation of economic profitability (domestic, national) by comparing the present value of value added with the present value of the investment:

It is assumed, in the first place, that the whole of the catch is intended for export and that there is no sale on the domestic market;

It is further assumed that the industry thus created will take the place of the traditional fishing industry described above.

**Proposals for government assistance**

In order to increase the profitability of the project for the entrepreneur, the Government has decided to apply two clauses of the Investment Code:

"Tax exemption on industrial and commercial profits up to the end of the eighth financial year following the year during which the first operation likely to bring a profit is carried out" (remission of taxes for nine financial years).

"Exemption from the turnover tax payable on the running of the enterprise up to the end of the fifth year following the year during which the first operation likely to bring a profit is carried out" (remission of taxes for six financial years).

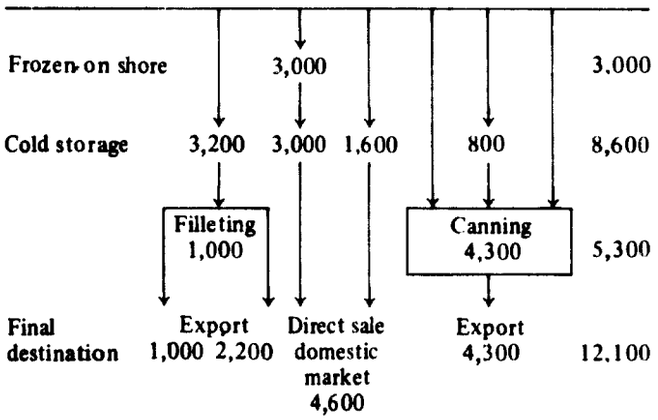
It will be necessary to consider the effect of these measures, if necessary propose other measures and, lastly, draw conclusions.

## SOLUTION

### Operational aspects

*Catches of fishing craft–General production plan*

| Fish | Frozen hake | Sardines | Tunny fish | Pilchards | Total |
|---|---|---|---|---|---|
| | tons, live-weight equivalent | | | | |
| 1 trawler (frozen on board) | 3,200 | | | 800 | 4,000 |
| 3 tunny fish boats (frozen on board) | | | 3,600 | | 3,600 |
| 2 sardine boats (chilled on board) | | 3,000 | | 1,500 | 4,500 |
| Total catches | 3,200 | 3,000 | 1,600+2,000 | 800+1,500 | 12,100 |




*Tinned tunny fish*

2,000 tons of tunny fish yield:

40% X 2,000 t = 800 t of drained tunny fish
60% X 2,000 t = 1,200 t of offal

Annual production of tinned tunny fish:

$\frac{800\text{ t}}{160\text{ g}}$ = 5 million ¼ tins = 50,000 cases.

*Pilchards*

2,300 tons of pilchards yield:

50% X 2,300 t = 1,150 t of drained pilchards
50% X 2,300 t = 1,150 t of offal

Annual production of pilchards:

$\frac{1{,}150\text{ t}}{250\text{ g}}$ = 4.6 million ½ oval tins = 46,000 cases.

*Turnover of the complex*

| | Live weight equivalent (tons) | Production (tons) | Unit price in CFA francs (all taxes included) | Turnover (millions of CFA francs) |
|---|---|---|---|---|
| Hake fillet | 1,000 | 500 | 82 | 41 |
| Hake for export | 2,200 | 2,200 | 65 | 143 |
| Frozen sardines | 3,000 | 3,000 | 25 | 75 |
| Frozen tunny fish | 1,600 | 1,600 | 80 | 128 |
| Tinned tunny fish | 2,000 | 50,000 cases | 5,500 | 275 |
| Tinned sardines | 2,300 | 46,000 cases | 3,500 | 161 |
| Sub-total | 12,100 | | | |
| Meal | (2,850) | 570 t | 30 | 17 |
| Total | 12,100 | | | 840 |

It is understood that these prices include turnover tax (8.4%).

This turnover tax, to be added to the operating costs, therefore amounts to:

$$840 \times \frac{8.4}{108.4} = 65 \text{ million CFA francs.}$$

*Operating costs of the fishing craft*

| | Operating costs (in millions of CFA francs) |
|---|---|
| Fuel and lubricants | 45 |
| Food for crews | 24 |
| Electronics | 10 |
| Maintenance | 76 |
| Insurance | 23 |
| Air transport | 19 |
| Wages and social security contributions: | |
| Foreign staff | 71 |
| Local staff | 52 |
| Taxes and licences | 12 |
| Sub-total | 332 |
| Miscellaneous | 12 |
| Total | 344 |

*Operating costs of shore equipment*

*(in millions of CFA francs)*

| | *Tinned tunny fish (50,000 cases)* | *Tinned sardines (46,000 cases)* | *Filleting (500 tons)* | *Freezing (3,000 tons)* | *Meal (570 tons)* | *Cold storage (8,600 tons)* | *General services* | *Total cost* |
|---|---|---|---|---|---|---|---|---|
| Packaging | 30 | 37 | 2.5 | 4.5 | 1 | | | 75 |
| Oil | 20 | 2 | | | | | | 22 |
| Tomato concentrate | | 14 | | | | | | 14 |
| Salt, ingredients | 3 | 4 | | | | | | 7 |
| Energy | 3 | 4 | 0.5 | 6 | 2.9 | 8.6 | | 25 |
| Wages: | | | | | | | | |
| Foreign staff | | | | | | | 16 | 16 |
| Local staff | 12 | 15 | | | | | 14 | 41 |
| Maintenance and overheads | | | | | | | 12 | 12 |
| Insurance | | | | | | | 4 | 4 |
| Total | 68 | 76 | 3 | 10.5 | 3.9 | 8.6 | 46 | 216 |

*Summary of operating costs*

| *Operating costs* | *Millions of CFA francs* |
|---|---|
| Fishing craft | 344 |
| Shore equipment | 216 |
| Operating costs (without taxes) | 560 |
| Turnover tax | 65 |
| Operating costs (all taxes included) | 625 |

*Summary of investment*

| | *Millions of CFA francs* |
|---|---|
| Fleet: | |
| Fishing craft | 1,024 |
| Fishing gear | 104 |
| Total | 1,128 |
| Factory: | |
| Canning | 229 |
| Meal | 20 |
| Freezing | 132 |
| General equipment | 90 |
| Total | 471 |
| Studies and research (8%) | 38 |
| Total | 509 |

| | *Millions of CFA francs* |
|---|---|
| Working capital: | |
| 4 months' operation of fishing craft and factories, i.e. $\frac{4}{12}$ X (625 – 65) | 186 |
| Grand total | 1,823 |

*Calculation of technical depreciation*

| *Depreciation* | *Cost (millions of CFA francs)* | *Life span (years)* | *Yearly payments (in millions of CFA francs)* |
|---|---|---|---|
| Fishing craft | 1,024 | 15 | 68 |
| Equipment | 104 | 5 | 21 |
| Factory | 509 | 15 | 34 |
| Total | | | 123 |

It is assumed that the capital is paid up in year zero, as also the loan from the Development Bank; the whole of the banking credit will be available in year 1, and charges will begin in year 2. Normal production equal to that of a normal producing year can be achieved in year 1.

*Calculation of interest paid and repayment of loan capital*

*(in millions of CFA francs)*

| *Year* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Development Bank loan* | | | | | | | | | | | | | | | | | |
| Yearly instalment | | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | |
| Interest | | 9 | 8 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 4 | 3 | 3 | 2 | 1 | 1 | |
| Repayment of capital | | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 24 | 24 | 300 |
| Cumulative repayment | | | 33 | 50 | 68 | 86 | 105 | 124 | 144 | 164 | 185 | 207 | 229 | 252 | 276 | 300 | |
| *Bank credit* | | | | | | | | | | | | | | | | | |
| Yearly instalment | | | 179 | 179 | 179 | 179 | 179 | 179 | 179 | | | | | | | | |
| Interest | | | 67 | 59 | 51 | 42 | 33 | 23 | 12 | | | | | | | | |
| Repayment of capital | | | 112 | 120 | 128 | 137 | 146 | 156 | 167 | | | | | | | | 966 |
| Cumulative repayment | | | | 232 | 360 | 497 | 643 | 799 | 966 | | | | | | | | |
| Total interest | | 9 | 75 | 67 | 58 | 49 | 39 | 29 | 17 | 5 | 4 | 3 | 3 | 2 | 1 | 1 | |
| Total repayment of capital | | 16 | 129 | 137 | 146 | 155 | 165 | 175 | 187 | 20 | 21 | 22 | 22 | 23 | 24 | 24 | |

*Estimated operating account*

*(in millions of CFA francs)*

| *Year* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Receipts* | | | | | | | | | | | | | | | | |
| Sales | | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 |
| *Expenditure* | | | | | | | | | | | | | | | | |
| Operating costs | | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 |
| Interest paid | | 9 | 75 | 67 | 58 | 49 | 39 | 29 | 17 | 5 | 4 | 3 | 3 | 2 | 1 | 1 |
| Depreciation | | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 |
| Total | | 757 | 823 | 815 | 806 | 797 | 787 | 777 | 765 | 753 | 752 | 751 | 751 | 750 | 749 | 749 |
| Operating profits | | 83 | 17 | 25 | 34 | 43 | 53 | 63 | 75 | 87 | 88 | 89 | 89 | 90 | 91 | 91 |
| Profit tax (30%) | | 25 | 5 | 8 | 10 | 13 | 16 | 19 | 23 | 26 | 26 | 27 | 27 | 27 | 27 | 27 |
| Net profit after taxation | | 58 | 12 | 17 | 24 | 30 | 37 | 44 | 52 | 61 | 62 | 62 | 62 | 63 | 64 | 64 |

*Estimated cash account*

*(in millions of CFA francs)*

| *Year* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Resources* | | | | | | | | | | | | | | | | |
| Capital | 557 | | | | | | | | | | | | | | | |
| Loans | 300 | 966 | | | | | | | | | | | | | | |
| Net profit after taxation | | 58 | 12 | 17 | 24 | 30 | 37 | 44 | 52 | 61 | 62 | 62 | 62 | 63 | 64 | 64 |
| Depreciation allowance | | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 |
| Total | 857 | 1,147 | 135 | 140 | 147 | 153 | 160 | 167 | 175 | 184 | 185 | 185 | 185 | 186 | 187 | 187 |
| *Uses* | | | | | | | | | | | | | | | | |
| Repayment of capital | | 16 | 129 | 137 | 146 | 155 | 165 | 175 | 187 | 20 | 21 | 22 | 22 | 23 | 24 | 24 |
| Investment | 682 | 1,141 | | | | 104 | | | | | 104 | | | | | |
| Total | | 1,157 | 129 | 137 | 146 | 259 | 165 | 175 | 187 | 20 | 125 | 22 | 22 | 23 | 24 | 24 |
| Surplus | +175 | −10 | +6 | +3 | +1 | −106 | −5 | −8 | −12 | +164 | +60 | +163 | +163 | +163 | +163 | +163 |
| Cash at 1 January | 0 | +175 | +165 | +171 | +174 | +175 | +69 | +64 | +56 | +44 | +208 | +268 | +431 | +594 | +757 | +920 |
| Cash at 31 December | +175 | +165 | +171 | +174 | +175 | +69 | +64 | +56 | +44 | +208 | +268 | +431 | +594 | +757 | +920 | +1,083 |

*Comments*

It is assumed that all investments are made in year zero and that normal production is achieved from the beginning of year 1. Those are, of course, assumptions designed to simplify calculations.

The cash balance, in the current operating year, is obtained by subtracting from the receipts of the enterprise expenditure actually incurred.

Taking the net profit after taxation, one therefore has to:

Add the depreciation allowance (this allowance is merely a book-keeping entry);

Subtract repayments of capital on loans (interest paid having been already subtracted from receipts in the calculation of profits, expenditure then shows the total of loan repayment instalments).

The estimated cash balance looks too large from year zero onwards; the proposed loans therefore seem too high. At all events, the cash situation must be followed closely (from month to month for the first years, and not simply per annum).

## Financial profitability

### *Intrinsic financial profitability*

Here we calculate the intrinsic financial profitability of the project, whatever the terms of financing (or of taxation of profits). This profitability may be considered as the profitability for the financial partners as a whole (direct taxation excepted). The flow of receipts and expenditure of the project includes:

*(a)* Receipts: the value of the output (taxes included);

*(b)* Expenditure: investment costs and operating costs of the fishing craft and the factory (including turnover tax).

Present value of profits ($\bar{B}$) is obtained on the basis of the table of net receipts (receipts minus expenditure).

($i$ = discount rate)

$$\bar{B} = -682 - \frac{1{,}037}{1+i} - \frac{104}{1+i} - \frac{104}{(1+i)^5} - \frac{104}{(1+i)^{10}} + \frac{215}{1+i} + \frac{215}{(1+i)^2} + \frac{215}{(1+i)^3} + \frac{215}{(1+i)^4} + \frac{215}{(1+i)^5} + \frac{215}{(1+i)^6} + \frac{215}{(1+i)^7} + \frac{215}{(1+i)^8} + \frac{215}{(1+i)^9} + \frac{215}{(1+i)^{10}} + \frac{215}{(1+i)^{11}} + \frac{215}{(1+i)^{12}} + \frac{215}{(1+i)^{13}} + \frac{215}{(1+i)^{14}} + \frac{215}{(1+i)^{15}}$$

$$\bar{B} = -682 - \frac{1{,}141}{1+i} - \frac{104}{(1+i)^5} - \frac{104}{(1+i)^{10}} + 215\,\frac{(1+i)^{15}-1}{i(1+i)^{15}}$$

| $i$ | 0% | 10% | 7% | 8% |
|---|---|---|---|---|
| $\bar{B}$ | 1,194 | − 189 | +82 | − 17 |

The intrinsic financial profitability of the project is therefore about 7.5 per cent.

*Financial profitability for the entrepreneur*

It is assumed that the capital is contributed by the entrepreneur alone. No distribution of dividends has therefore to be made outside the enterprise. The entire net profit after taxation is allocated to the cash account of the project.

From the point of view of the entrepreneur, present value of profits is expressed as follows:

$\bar{B}$ = − capital + present value of the cash balance, thus:

$$\bar{B} = -557 + 175 - \frac{10}{1+i} + \frac{6}{(1+i)^2} + \frac{3}{(1+i)^3} + \frac{1}{(1+i)^4} - \frac{106}{(1+i)^5} - \frac{5}{(1+i)^6} - \frac{8}{(1+i)^7} - \frac{12}{(1+i)^8} + \frac{164}{(1+i)^9} + \frac{60}{(1+i)^{10}} + \frac{163}{(1+i)^{11}} + \frac{163}{(1+i)^{12}} + \frac{163}{(1+i)^{13}} + \frac{163}{(1+i)^{14}} + \frac{163}{(1+i)^{15}}$$

Whence the table of $\bar{B}$ as a function of $i$:

| $i$ | 0% | 5% | 6% | 6,5% | 7% |
|---|---|---|---|---|---|
| $\bar{B}$ | +522 | +87 | +30 | +4 | − 20 |

*Calculation of intrinsic financial profitability*

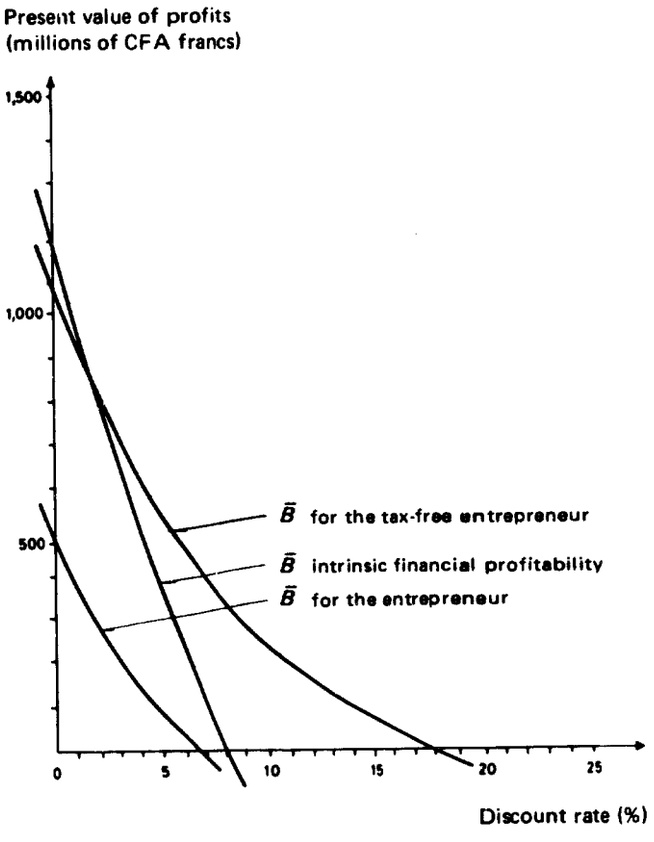
*(in millions of CFA francs)*

| *Year* | *Receipts* | *Operating costs* | *Gross receipts* | *Investment without fishing gear* | *Fishing gear* | *Total receipts minus expenditure* |
|---|---|---|---|---|---|---|
| 0 | | | | 682 | | −682 |
| 1 | 840 | 625 | 215 | 1,037 | 104 | −926 |
| 2 | 840 | 625 | 215 | | | 215 |
| 3 | 840 | 625 | 215 | | | 215 |
| 4 | 840 | 625 | 215 | | | 215 |
| 5 | 840 | 625 | 215 | | 104 | 111 |
| 6 | 840 | 625 | 215 | | | 215 |
| 7 | 840 | 625 | 215 | | | 215 |
| 8 | 840 | 625 | 215 | | | 215 |
| 9 | 840 | 625 | 215 | | | 215 |
| 10 | 840 | 625 | 215 | | 104 | 111 |
| 11 | 840 | 625 | 215 | | | 215 |
| 12 | 840 | 625 | 215 | | | 215 |
| 13 | 840 | 625 | 215 | | | 215 |
| 14 | 840 | 625 | 215 | | | 215 |
| 15 | 840 | 625 | 215 | | | 215 |

The rate of intrinsic financial profitability for the entrepreneur is therefore about 6.5 per cent.

Figure I shows the present valuc of profits as a function of the discount rate.

*Figure I. Financial profitability*




*Comments*

The intrinsic financial profitability is calculated at the aggregate level of all the parties who have a share in financing the enterprise. It is therefore obtained by comparing the cost of investment with the net operating receipts (receipts less operating costs).

This intrinsic financial profitability, calculated before the financing plan is available, gives a first idea of the enterprise's profitability. At this stage, however, it is not possible to calculate the total direct taxation (this varies in accordance with the loans contracted, which, through the interest paid, alter the operating profits).

The financial profitability for the entrepreneur, amounting to 6.5 per cent, seems inadequate, particularly since:

There has been no allowance for unforeseen expenditure, either in the operating costs or in the investment costs (such expenditure is often reckoned at 5 to 10 per cent of the identified costs);

In order to simplify calculation, it has been assumed that year 1 was a year of normal operation, which is clearly unrealistic, since it will take some time for the project to get going.

## Economic profitability

### *Calculation of the effects of the project–value added included*

At a normal production level (years 1–15), the operating account may be broken down as follows:

*Operating account*

*(in millions of CFA francs)*

| *Intermediate inputs* | *Costs* | *Imports* | *Taxes* | *Value added included, without taxes* |
|---|---|---|---|---|
| *Fishing craft* | | | | |
| Fuel, lubricants | 45 | 28 | 17 | |
| Electronic parts | 10 | 8 | 2 | |
| Food for crews | 24 | | | 24 |
| Air transport | 19 | 10 | 2 | 7 |
| Maintenance | 76 | 29 | 9 | 38 |
| Insurance | 23 | 11 | 2 | 10 |
| Miscellaneous | 12 | 3 | 1 | 8 |
| | 209 | 89 | 33 | 87 |
| *Factories* | | | | |
| Energy | 25 | 5 | 3 | 17 |
| Oil | 22 | | 2 | 20 |
| Tomato concentrate | 14 | 10 | 4 | |
| Salt, ingredients | 7 | 6 | 1 | |
| Packaging | 75 | 58 | 17 | |
| Maintenance | 12 | 5 | 1 | 6 |
| Insurance | 4 | 2 | | 2 |
| | 159 | 86 | 28 | 45 |
| Total | 368 | 175 | 61 | 132 |

*Summary table of annual operation account*

*(in millions of CFA francs)*

| *Year* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Direct value addcd* | | | | | | | | | | | | | | | |
| Local wages | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 |
| Wages to foreigners | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 |
| Taxes and licences | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| Gross income of entrepreneur: | | | | | | | | | | | | | | | |
| Depreciation | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 |
| Financial charges | 9 | 75 | 67 | 58 | 49 | 39 | 29 | 17 | 5 | 4 | 3 | 3 | 2 | 1 | 1 |
| Direct taxation | 25 | 5 | 8 | 10 | 13 | 16 | 19 | 23 | 26 | 26 | 27 | 27 | 27 | 27 | 27 |
| Domestic profits | 35 | 7 | 10 | 14 | 18 | 22 | 26 | 31 | 37 | 37 | 37 | 37 | 38 | 38 | 38 |
| Foreign profits | 23 | 5 | 7 | 10 | 12 | 15 | 18 | 21 | 24 | 25 | 25 | 25 | 25 | 26 | 26 |
| Total | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 |
| Total direct value added | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 | 472 |
| *Value added included* | | | | | | | | | | | | | | | |
| Taxes included in intermediate inputs | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 |
| Value added (without taxes) included in intermediate inputs | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 |
| Total domestic value added included | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 | 665 |
| Total national value added included | 555 | 573 | 571 | 568 | 566 | 563 | 560 | 557 | 554 | 553 | 553 | 553 | 553 | 552 | 552 |
| of which: | | | | | | | | | | | | | | | |
| Taxes and duties (agent – the State) | 163 | 143 | 146 | 148 | 151 | 154 | 157 | 161 | 164 | 164 | 165 | 165 | 165 | 165 | 165 |

From the above table, we can add up the direct value added, year by year, from wages and taxes and from gross operating income, including:

Depreciation;

Financial charges;

Direct taxation;

Net profits (60% domestic, 40% foreign).

The domestic value added included of the project is equal to the sum of:

The direct value added;

The value added included in the intermediate inputs.

The national value added included is obtained from the domestic by subtracting foreign wages and profits.

Investment may then be broken down in the same way:

Fishing craft: 100% foreign origin
Taxes: 10% on cif value

Factories: 35% domestic origin
65% foreign origin
Taxes: 10% on cif value

Equipment: Manufactured locally

Thus:

| | *Total cost* | *Imports* | *Taxes* | *Value added (without taxes)* |
|---|---|---|---|---|
| Fishing craft | 1,024 | 931 | 93 | |
| Factories | 509 | 301 | 30 | 178 |
| Equipment | 104 | | | 104 |
| Total | 1,637 | 1,232 | 123 | 282 |

*Calculation of economic profitability*

All the fishery production is intended for export. The present value of domestic profits is obtained by comparing the present value of domestic value added with the present value of investment. A similar calculation is made for the present value of national profits.

$$\bar{B}\ \text{domestic} = -682 - \frac{1{,}141}{1+i} - \frac{104}{(1+i)^5} - \frac{104}{(1+i)^{10}} + 665\left(\frac{1}{1+i} + \ldots + \frac{1}{(1+i)^{15}}\right)$$

$$-682 - \frac{1{,}141}{1+i} - \frac{104}{(1+i)^5} - \frac{104}{(1+i)^{10}} + 665\,\frac{(1+i)^{15}-1}{i(1+i)}$$

$$\bar{B}\ \text{national} = -682 - \frac{1{,}141}{1+i} - \frac{104}{(1+i)^5} - \frac{104}{(1+i)^{10}} + \frac{555}{1+i} + \frac{573}{(1+i)^2} + \frac{571}{(1+i)^3} + \frac{568}{(1+i)^4} + \frac{566}{(1+i)^5} + \frac{563}{(1+i)^6} + \frac{560}{(1+i)^7} + \frac{557}{(1+i)^8} + \frac{554}{(1+i)^9} + \frac{553}{(1+i)^{10}} + \frac{553}{(1+i)^{11}} + \frac{553}{(1+i)^{12}} + \frac{553}{(1+i)^{13}} + \frac{552}{(1+i)^{14}} + \frac{552}{(1+i)^{15}}$$

| *Rates* | *30%* | *35%* | *36%* | *40%* | *44%* | *45%* |
|---|---|---|---|---|---|---|
| Present value of investment | 1,595 | 1,555 | 1,547 | 1,519 | 1,493 | 1,488 |
| Present value of domestic value added | 2,173 | 1,878 | – | 1,652 | 1,505 | 1,472 |
| Present value of national value added | 1,841 | 1,591 | 1,550 | – | – | – |

The following rates are thus obtained:

Domestic economic profitability: 44%
National economic profitability: 36%

The project is to take the place of a traditional activity which produced a domestic and national value added of 180 + 20 = 200 million CFA francs.

The schedule of national and domestic value added is reduced by $\sum_{n=1}^{15} \frac{200}{(1+i)^n}$

| *Rates* | *15%* | *20%* | *21%* | *25%* | *30%* |
|---|---|---|---|---|---|
| $\sum_{n=1}^{15} \frac{200}{(1+i)^n}$ | 1,169 | 935 | 898 | 772 | 654 |

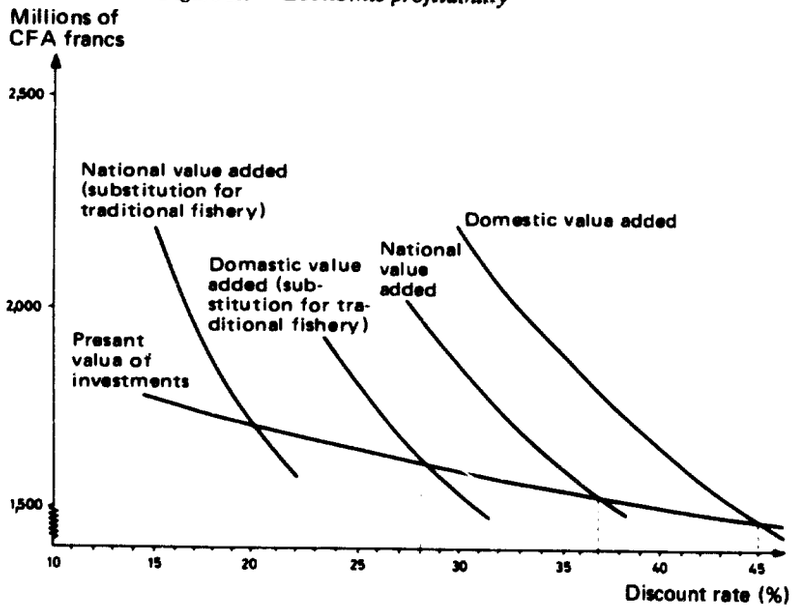
| *Rates* | *15%* | *20%* | *21%* | *25%* | *28%* | *30%* |
|---|---|---|---|---|---|---|
| Present value of investment | 1,752 | 1,691 | 1,680 | 1,640 | 1,631 | 1,595 |
| Present value of domestic value added | – | – | – | 1,794 | 1,733 | 1,519 |
| Present value of national value added | 2,116 | 1,695 | 1,628 | – | – | – |

The new rates of economic profitability are obtained:

Domestic economic profitability: 28%
National economic profitability: 20%

Figure II shows value added and the present value of investment as a function of the discount rate.

*Figure II. Economic profitability*




*Comments*

Iterative calculation is made simultaneously (value added included, imports included) for the various intermediate inputs; since no foreign wages or profits are identified, the value added included in the intermediate inputs is the same whether it is calculated from the domestic standpoint or from the national standpoint.

In order to simplify the data, no tax has been shown on equipment produced locally.

The calculations carried out above compare the total cost of investment with the extra value added (domestic or national) created by the implementation of the project; these calculations closely resemble those usually made.[3]

It may therefore seem illogical not to include as well, in year zero and year 1, the value added created in the phase of equipping the project; that would amount to taking into account only the imported component of the investment costs.

The schedule of extra value added created by the project (in the primary phase) may also be broken down as a schedule of foreign exchange gains (in the primary phase). A comparison of this schedule and the imported component of the investment therefore gives the time taken for the pay-back of the foreign exchange invested.

In the case studied, this time is about two years if the traditional activity is not eliminated and about three years if it is.

### Proposals for government assistance

*Measures likely to increase profitability for the entrepreneur*

We consider the impact on the profitability for the entrepreneur of the following two measures, taken together:

(1) Exemption from profits tax until the end of the ninth year of operation;

(2) Exemption from turnover tax until the end of the sixth year of operation.

A new estimated operating account and a new estimated cash account are obtained.

Present value for the entrepreneur:

$\bar{B}$ = – capital + present value of the cash balance

$$\bar{B} = -557 + 175 + \frac{80}{1+i} + \frac{76}{(1+i)^2} + \frac{76}{(1+i)^3} + \frac{76}{(1+i)^4} - \frac{28}{(1+i)^5} + \frac{76}{(1+i)^6} + \frac{11}{(1+i)^7} + \frac{11}{(1+i)^8} + \frac{190}{(1+i)^9} + \frac{60}{(1+i)^{10}} + \frac{163}{(1+i)^{11}} + \frac{163}{(1+i)^{12}} + \frac{163}{(1+i)^{13}} + \frac{163}{(1+i)^{14}} + \frac{163}{(1+i)^{15}}$$

| *Rates* | *0%* | *10%* | *15%* | *17%* | *18%* | *20%* |
|---|---|---|---|---|---|---|
| $\bar{B}$ | 1,061 | 240 | 69 | 20 | 0 | – 37 |

Whence a new financial profitability for the entrepreneur: 18 per cent.

[3] Frequently, however, the investment costs taken are the costs without taxes.

*New estimated operating account*

*(in millions of CFA francs)*

| *Year* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Receipts | – | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 | 840 |
| Expenditure | | | | | | | | | | | | | | | | |
| Operating costs | | 560 | 560 | 560 | 560 | 560 | 560 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 |
| Interest paid | | 9 | 75 | 67 | 58 | 49 | 39 | 29 | 17 | 5 | 4 | 3 | 3 | 2 | 1 | 1 |
| Depreciation | | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 |
| Total expenditures | | 692 | 758 | 750 | 741 | 732 | 722 | 777 | 765 | 753 | 752 | 751 | 751 | 750 | 749 | 749 |
| Operating profits | | 148 | 82 | 90 | 99 | 108 | 118 | 63 | 75 | 87 | 88 | 89 | 89 | 90 | 91 | 91 |
| Direct taxation on profits | | – | – | – | – | – | – | – | – | – | 26 | 27 | 27 | 27 | 27 | 27 |
| Net profits after taxation | | 148 | 82 | 90 | 99 | 108 | 118 | 63 | 75 | 87 | 62 | 62 | 62 | 63 | 64 | 64 |

*New estimated cash account*

*(in millions of CFA francs)*

| *Year* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Resources* | | | | | | | | | | | | | | | | |
| Capital | 557 | | | | | | | | | | | | | | | |
| Loans | 300 | 966 | | | | | | | | | | | | | | |
| Depreciation allowance | | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 | 123 |
| Net profits | | 148 | 82 | 90 | 99 | 108 | 118 | 63 | 75 | 87 | 62 | 62 | 62 | 63 | 64 | 64 |
| Total resources | 857 | 1,237 | 205 | 213 | 222 | 231 | 241 | 186 | 198 | 210 | 185 | 185 | 185 | 186 | 187 | 187 |
| *Uses* | | | | | | | | | | | | | | | | |
| Repayment of capital | | 16 | 129 | 137 | 146 | 155 | 165 | 175 | 187 | 20 | 21 | 22 | 22 | 23 | 24 | 24 |
| Investment | 682 | 1,141 | | | | 104 | | | | | 104 | | | | | |
| Total uses | 682 | 1,157 | 129 | 137 | 146 | 259 | 165 | 175 | 187 | 20 | 125 | 22 | 22 | 23 | 24 | 24 |
| Balance | +175 | +80 | +76 | +76 | +76 | −28 | +76 | +11 | +11 | +190 | +60 | +163 | +163 | +163 | +163 | +163 |
| Cash as at 1 January | 0 | 175 | 255 | 331 | 407 | 483 | 455 | 531 | 542 | 553 | 643 | 703 | 866 | 1,029 | 1,192 | 1,355 |
| Cash as at 1 December | +175 | 255 | 331 | 407 | 483 | 455 | 531 | 542 | 553 | 643 | 703 | 866 | 1,029 | 1,192 | 1,355 | 1,518 |

*Comments*

In the last analysis, the project is thus seen to be:

Not very profitable for the entrepreneur;

Beneficial to the community (especially if the traditional activity is not eliminated).

The problem then arises of encouraging the entrepreneur to carry out this project, by means of tax exemption measures. Under the approach adopted, these measures are to be analysed as transfers of revenue between the State and the entrepreneur.

At the aggregate level of all the agents concerned, over-all profitability:

Does not change from the domestic standpoint: these measures simply modify the distribution of the extra income created among the various agents of the economy;

Is slightly reduced from the national standpoint, since the entrepreneur will transfer abroad some part of the extra profits he will receive as a result of these exemptions.

In a similar manner, other incentives will be considered as, for instance, operating subsidies, interest rebates (transfers between the banks and the entrepreneur), and grants for equipment.

# *The steady rise in the "critical mass" of production: its effects on world trade and the structure of industry*

Claude SICARD*

## INTRODUCTION

Modern technological progress is reflected in most cases in a steady process known as the rise in "critical mass", particularly the "critical mass" of production.

To avoid the effects of competition, growing ever more intensive in the modern world, businessmen have to choose one or the other of the following broad policies:

(1) Either make constant changes in their products and get the consumer to accept these continuous changes as new advantages, a policy which is well known to call for very heavy advertising expenditure; or

(2) Constantly increase productivity so as to produce goods more cheaply than their competitors can.

The rising critical mass phenomenon has to do with the latter process. The basic idea behind technical progress in this instance is to increase the scale of production in order to cut down unit costs. This trend is evident in all sectors of production: in chemicals and engineering and in processing industries of the most diverse kinds. It is likewise evident in transport (e.g. supertankers, giant aircraft like the Boeing 747), marketing (e.g. supermarkets) and even in some services (e.g. banking and insurance).

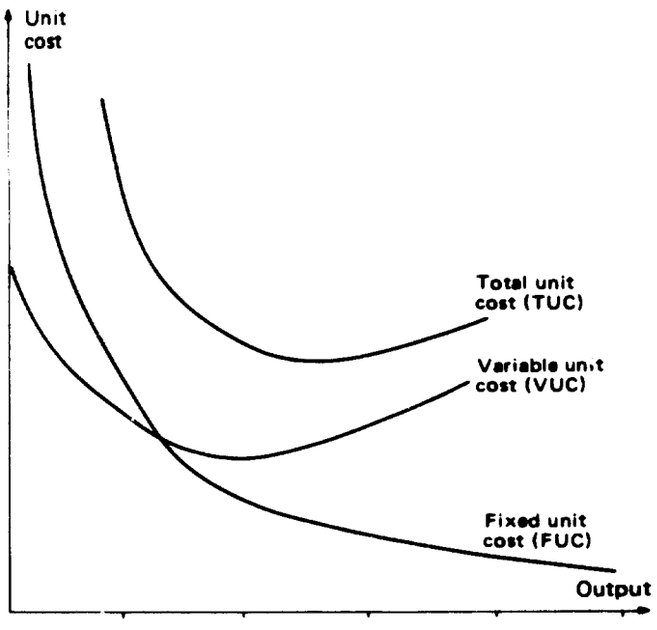
## DEFINITION OF THE CONCEPT OF CRITICAL MASS

In any micro-economic analysis of the way in which the scale of output influences unit production costs, in a given set-up, a distinction is traditionally made between fixed and variable costs; these costs, in unit terms, are theoretically as shown in figure I.

The total unit cost (TUC) curve is U-shaped. However, a correction can be made to the shape of the curve as given by economic theory; actual observation shows that in point of fact the variable unit cost (VUC) curve does not slope downwards at first, but remains more or less level up to the point where normal plant capacity is reached. In practice, therefore, the curves are more usually as shown in figure II.

This analysis of cost patterns in a given set-up may be extended to different set-ups in which the scale of output is progressively increased. In such cases, production techniques vary according to the amount to be produced and become steadily more capital-intensive, since increased productivity is mainly achieved by

*Figure I. Unit cost in relation to output – theoretical*

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introducing more and more mechanical means of production of a more and more advanced kind. Production inputs therefore shift towards capital, reducing labour's share of direct costs to a bare minimum. Thus, for different scales of production, the TUC curves will be as shown in figure III.

Each one of these curves represents a different scale of production, because obviously no one firm has a wide enough range of plant and machinery to match its capacity exactly to any and every level of output. The transition to ever-increasing scales of production is reflected in the scalloped curve ABCDE, assuming that there are only four types of plant to choose from, depending on the output to be produced.

At any given time the state of production technology will be such that there is no choice of plant which will enable a firm to achieve a more satisfactory curve than the $TUC_4$ one. It can then be said that plant No. 4 represents the *critical* level of capacity in the type of production in question. Firms unable to attain this production "mass" are then in a critical position, unless of course they can take advantage either of the distance, or of the availability of production inputs at exceptionally low unit cost, or of some other possibility of offsetting their relative disadvantage of scale.

It can happen that plants in developing countries are protected by distance, which, when it comes to supplying the local market, usually shields them against competition from the larger-sized plants of developed countries. It has thus been possible to set up many manufacturing industries in developing countries (import-substitution industries, as they are known), the degree of protection afforded by distance often amounting to 15 to 25 per cent, and even 30 per cent in some instances.

On the other hand, it may happen that producers in developed countries sell at marginal prices in developing countries, which their own local markets enable them to do fairly frequently at no great loss to themselves, and this adds to the difficulty of setting up industries in developing countries.

*Figure II. Unit cost in relation to output – practical*

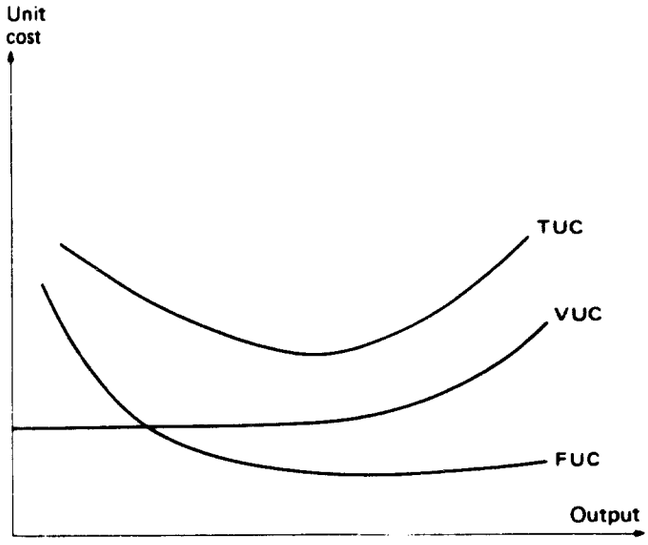
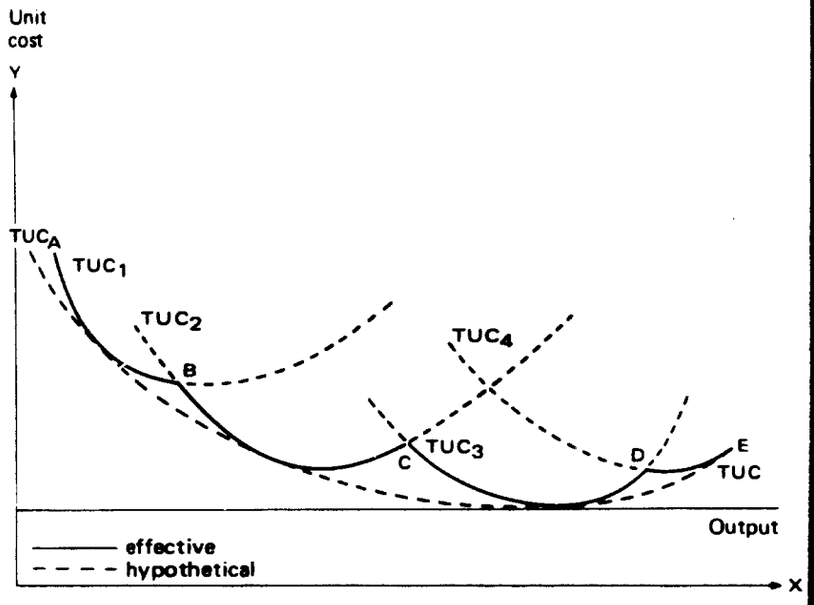



*Figure III. Unit cost in relation to output for four possible choices of plant (1–4)*




## EFFECTS ON WORLD TRADE

The history of world trade shows that trade tends to grow faster than production, and trade between the developed countries themselves has increased particularly quickly in recent decades.

Taken as a whole, international trade has grown only slightly faster than production; trade in manufactures, however, has grown much more rapidly than that in so-called "commodities". Thus, with 1938 as base year (1938 = 100), the index for the volume of trade had risen by 1959 to 149 for commodities and 262 for manufactures. Over the same period, the world population index rose from 100 to 133.

| | *1938* | *1959* |
|---|---|---|
| *Population* | 100 | 133 |
| *Production* | | |
| Foodstuffs and raw materials | 100 | 140 |
| Manufactures | 100 | 259 |
| (Total) | (100) | (190) |
| *Exports* | | |
| Commodities | 100 | 149 |
| Manufacturing industries | 100 | 242 |

On the other hand, it can be seen that trade among the most highly developed countries continues to account for by far the largest share of the total. Table 1 gives figures for the period 1928–1957.

TABLE 1. DEVELOPMENT OF INTERNATIONAL TRADE

| | *In millions of US dollars* | | *Growth factor* |
|---|---|---|---|
| | *1928* | *1957* | *1957/1928* |
| *North America* | | | |
| *Trade with developed countries* | | | |
| North America | 1,459 | 6,969 | 4.75 |
| European sterling area | | | |
| Exports | 1,320 | 1,911 | 1.45 |
| Imports | 526 | 1,307 | 2.50 |
| European Economic Community | | | |
| Exports | 1,292 | 3,570 | 2.75 |
| Imports | 548 | 1,724 | 3.15 |
| *Trade with developing countries* | | | |
| Latin America | | | |
| Exports | 872 | 4,724 | 5.45 |
| Imports | 1,048 | 3,916 | 3.80 |
| *European Economic Community* | | | |
| *Trade with developed countries* | | | |
| European Economic Community | 2,270 | 7,165 | 3.15 |
| European sterling area | | | |
| Exports | 1,005 | 1,350 | 1.35 |
| Imports | 901 | 1,450 | 1.60 |
| North America | | | |
| Exports | 548 | 1,724 | 3.15 |
| Imports | 1,292 | 3,570 | 2.75 |
| *Trade with developing countries* | | | |
| Developing countries (former overseas territories) | | | |
| Exports | 406 | 2,297 | 5.65 |
| Imports | 375 | 1,780 | 4.90 |
| Latin America | | | |
| Exports | 484 | 1,446 | 3.00 |
| Imports | 910 | 1,425 | 1.55 |
| Sterling area | | | |
| Exports | 293 | 1,656 | 5.50 |
| Imports | 850 | 2,175 | 2.55 |

The above table shows that the largest share of international trade has been between the main groups of industrialized countries, i.e. between countries on the North American continent and those of the European Economic Community (EEC).

On the other hand, trade between developed and developing countries has grown steadily, with exports showing a marked tendency to rise faster than imports. For example, between 1928 and 1957 exports from the North American region to non-industrialized countries went up by a factor of 5.45, and its imports by only 3.80; over the same period exports from EEC countries to the developing countries listed in table 1 went up by a factor of 5.65, 3.0 and 5.50 respectively, and their imports by only 4.90, 1.55 and 2.55 respectively.

It is clear that on the whole trade between developed countries continues to be very brisk; trade between industrialized and developing countries is tending to grow, but mainly to the advantage of developed countries; finally, trade between developing countries is still very limited, as can be seen from the trade figures for Latin American countries given in table 2.

TABLE 2. TRADE OF LATIN AMERICAN COUNTRIES
*(in millions of US dollars)*

| | *1928* | *1957* | *Growth factor 1957/1928* |
|---|---|---|---|
| Trade among Latin American countries | 218 | 758 | 3.5 |
| Trade among Latin American countries and developing countries of the sterling area | | | |
| Exports | 459 | 1,779 | 3.9 |
| Imports | 65 | 246 | 3.8 |

## Recent trends in international trade

The United Nations Conference on Trade and Development held at New Delhi in 1968 identified the trends in international trade over the period 1955–1965. The main findings of this Conference confirm the above remarks:

> "In the period 1955–1965, world trade in manufactures and semi-manufactures grew almost twice as fast as that in primary commodities. Whereas trade in primary commodities grew at an average annual rate of 4.8 per cent, that in manufactures and semi-manufactures grew at a rate of 9.2 per cent.
>
> "The developed market-economy countries continued to be the main exporters of manufactures and semi-manufactures, accounting for 82.1 per cent of world exports of these products in 1965. The share of the developing countries, which declined from 6.6 per cent to 5.0 per cent during the period 1955–1958, improved to 5.8 per cent in 1965.
>
> "The expansion of exports of manufactures and semi-manufactures from the developing to the developed market-economy countries during the period 1961 to 1965 was confined to a small number of countries...."

"The composition of the trade in manufactures and semi-manufactures among developing countries strikingly resembles that of their total exports of these products. Although a certain diversification is taking place, the principal exports still consist of a limited range of products, mostly textiles and other light manufactures. However, while these two groups accounted in 1955 for more than 80 per cent of the trade in manufactures and semi-manufactures among the developing countries, in 1965 their share in this trade had declined to about 65 per cent. This fall is an indication of the process of the substitution of domestic products in the developing countries, in particular of textile and clothing products, for imported products.

"The remaining exports in the trade of manufactures and semi-manufactures of developing countries, comprising chemicals, machinery and transport equipment, registered the highest rates of increase during the period 1955 to 1965. The result was a considerable rise in the share of these goods in the total trade of manufactures and semi-manufactures among the developing countries.

"A striking characteristic of the trade in manufactures and semi-manufactures among developing countries is the heavy regional concentration of this trade, in terms of the origin and destination of the products. For example, of Asia's total exports of manufactures and semi-manufactures to the developing countries in 1965, 75 per cent was shipped to countries within the region. The corresponding proportion for Africa (and islands) was 85.5 per cent, and for Latin America as high as 94 per cent."[1]

### The role of innovation and scientific know-how

It should be noted that the traditional theory of trade according to compartive advantage is now being somewhat discredited. Robert Erbes, in his study on international economic integration,[2] explains very well the key role of innovation and scientific know-how in determining the trend of international specialization. He points out that

"it can no longer be argued that industrialized countries, even 'small' ones, are 'tied' to certain kinds of output. More likely, the truth is that industrialized countries are diversifying more and more. The essential thing for firms is not so much to cut down costs–and improve existing production methods as to find new products and new processes in order to produce new goods. Technical progress is not so much a matter of 'technological change' as of technological expansion and industrial diversification.

"As for non-industrialized countries . . . they too are not tied to specializing in those products for which nature has endowed them with a comparative advantage . . . The present pattern of specialization is therefore primarily governed by a distribution of production based on the 'location', and above all on the concentration of industrial inventiveness, of research and innovation potential. The important thing about inventiveness is the possibility it provides of continuously diversifying the industrial structure, from the standpoint of both production and organization."

In actual fact, therefore, growth in exports from developing to developed countries is slow. The way is barred by advances in technology which continue to give the most developed countries very real and specific advantages. Thus there would seem to be a need to reorganize trade between these countries on a more rational basis, as the best way of helping each developing country to increase its exports to the developed countries, which provide a huge market and are the main centres of technical innovation.

The world trade pattern shows that some countries–especially small ones–do tend to specialize in particular sectors of production. For example, Switzerland is well known for specializing in certain technical fields, in which it has acquired a world-wide reputation, such as precision engineering and watchmaking.

The economist Samuelson[3] has provided an excellent illustration of the theory of trade according to comparative advantage. He imagines the following two situations: the United States of America and Europe each produce nothing but food and clothing, at different costs, the cost ratios being as follows:

United States: 10 units of food to 3 of clothing
Europe: 10 units of food to 8 of clothing

with the various total production possibilities being, say, as follows:

| | (Units) | | | | |
|---|---|---|---|---|---|
| *United States* | | | | | |
| Food | 100 | 40 | 30 | 20 | 0 |
| Clothing | – | 18 | 21 | 24 | 30 |
| *Europe* | | | | | |
| Food | 150 | 100 | 50 | – | |
| Clothing | 0 | 40 | 80 | 120 | |

Samuelson then assumes that in each case the equilibrium position would be as given in table 3, with each region being economically self-sufficient. Total

[1] *Proceedings of the United Nations Conference on Trade and Development*, Second Session, vol. III, *Problems and policies of trade in manufactures and semi-manufactures*. Miscellaneous studies: document TD/10/Supp.1 (Review of the trade in manufactures and semi-manufactures), paragraphs 3, 4, 7, 10, 11 and 12 (United Nations publication, Sales No. 68.II.D.16).

[2] Robert Erbes, *L'Intégration économique internationale*, Collection Etudes économiques internationales (Paris, Presses Universitaires de France, 1966).

[3] Paul Samuelson, *L'Economique: techniques modernes de l'analyse économique* (Paris, Librairie Armand Colin, 1953), pp. 755 ff.

production by the United States and Europe, taking into account the cost ratios, would be as follows:

TABLE 3. PRODUCTION BEFORE TRADE

| | *Cost ratio* | *Food production* | *Food consumption* | *Exports or imports* | *Clothing production* | *Clothing consumption* | *Exports or imports* |
|---|---|---|---|---|---|---|---|
| United States | 10/3 | 30 | 30 | | 21 | 21 | |
| Europe | 10/8 | 50 | 50 | | 80 | 80 | |
| Total | | 80 | 80 | | 101 | 101 | |

The United States and Europe then undertake to trade together, at an exchange ratio of between 10/3 and 10/8, closer to one figure or another according to the strength of demand for either food or clothing. This would lead to an increase in over-all production.

Assume that an exchange ratio of 10/6 is arrived at, as being profitable to both countries. The production potential of the United States is 100 units for food and Europe's 120 for clothing. The situation, after trade, would then be as shown in table 4.

TABLE 4. PRODUCTION AFTER TRADE

| | *Cost ratio* | *Food production* | *Food consumption* | *Exports or imports* | *Clothing production* | *Clothing consumption* | *Exports or imports* |
|---|---|---|---|---|---|---|---|
| United States | 10/6 | 100 | 40 | +60 | – | 36 | –36 |
| Europe | 10/6 | – | 60 | –60 | 120 | 84 | +36 |
| Total | | 100 | 100 | | 120 | 120 | |
| Gains from trade | | +20 | +20 | | +19 | +19 | |

For the purposes of the above table it has been assumed that the United States is concentrating entirely on the production of food and Europe entirely on clothing, and that for the 60 units of food exported to Europe the United States would obtain 36 units of clothing.

Food consumption would then rise by 10 points in the United States and by 10 points in Europe; clothing consumption would go up by 15 points in the United States and by 4 in Europe. Thus the over-all result would be that both partners would benefit from their trade.

However, developing countries reject this kind of argument, since they find that the technological capacity of industrialized countries is such that industries which start out labour-intensive gradually become capital-intensive, owing to advances in technology, so that the scope for industrialization left to developing countries is shrinking every day.

It is certain that in industrialized countries manufacturing industries have in many cases become capital-intensive as a result of their desire to replace men by machines in order to offset rising wage costs.

There are many examples of labour-intensive industries set up in developing countries later being faced with competition from industrialized countries with plants using new labour-saving techniques: such is the case with textiled industries, which have in fact developed considerably in developing countries but which now face competition from plants in industrialized countries which have been automated–or are sure to be automated in years to come–by the introduction of new manufacturing techniques borrowed from the paper-making industry.

Similarly, if the automobile industry had not progressed as it has done, it would indubitably now be a labour-intensive industry consuming a great deal of wood; this, precisely, is an example of the process of development based on advances in technology. Automobile technology has developed by cutting down labour costs and increasing capital expenditure.

Developing countries therefore fear that they will lose out if they confine themselves to labour-intensive industries, so that it is as it were with energy born of despair that they are now embarking on industries which they believe to be those of the future.

Developing countries are now more and more frequently rejecting the traditional theory of comparative advantage and are trying to compete against developed countries in the economic field by using the same weapons as the latter.

## EFFECTS ON INTERNATIONAL INVESTMENT

The growth in trade between developed countries has been matched, particularly during the last decade, by an increase in the flow of international investment in industry. The United States has expanded its industrial position in Europe, and European countries are constantly endeavouring to develop theirs in the United States; both on the North American continent and in the EEC countries it is now increasingly common for firms to develop branches in neighbouring countries. Sample figures below show the extent and direction of this trend.

**United States**

*Foreign investments*
*(Accumulated assets)*
*(in thousands of millions of US dollars)*

| | *1960* | *1965* | *1970* |
|---|---|---|---|
| Canada | 11.2 | 15.2 | 22.8 |
| Europe | 6.7 | 14.0 | 24.5 |
| Japan | 0.3 | 0.7 | 1.5 |
| Australia, New Zealand, South Africa | 1.2 | 2.3 | 4.3 |
| Total | 19.4 | 32.2 | 53.1 |

| | 1960 | 1965 | 1970 |
|---|---|---|---|
| Latin America | 8.4 | 10.9 | 14.7 |
| Africa | ... | 1.4 | 2.6 |
| Middle East | ... | 1.5 | 1.6 |
| Asia and the Pacific | 4.2 | 1.4 | 2.5 |
| | | 15.2 | 21.4 |
| Unallocated | ... | 2.0 | 3.6 |
| Total | 32.0 | 49.3 | 78.1 |

*Source:* U.S. Dept. of Commerce, *Survey of Current Business.*

Over a ten-year period United States investments abroad rose slightly more than twofold in Canada and nearly fourfold in Europe; the growth rate of investments in developing countries has been considerably slower, and the investment itself is frequently of a very different kind. Whereas investment in developed countries has been mainly in industry, a large proportion of investment in developing countries has been in petroleum and raw materials.

### United Kingdom of Great Britain and Northern Ireland

The pattern of United Kingdom investment has been as follows:

*United Kingdom investments*
*(Accumulated assets)*
*(in millions of pounds sterling)*

| | 1962 | 1966 | 1970 |
|---|---|---|---|
| Direct investments | | | |
| Industry and services | 3,770 | 4,785 | 7,050 |
| Petroleum and other sectors | 1,100 | 1,500 | 1,900 |
| Holdings | 3,200 | 3,650 | 5,450 |
| Total | 8,070 | 9,935 | 14,400 |

United Kingdom investment in industry and services may be broken down as follows:

*(in millions of pounds sterling)*

| | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|
| Developed countries | 214 | 215 | 218 | 343 | 433 | 384 |
| Developing countries | 95 | 61 | 63 | 66 | 116 | 124 |
| Total | 309 | 276 | 281 | 410 | 549 | 508 |

Total United Kingdom investment in industry and trade over the six-year period was thus.

£1,807 million in developed countries;
£ 525 million in developing countries.

### Federal Republic of Germany

The Federal Republic of Germany has likewise very much increased its investments abroad: in cumulative value its investments went up from DM3,838 million at the end of 1961 to DM20,608 million at the end of 1971. However, it appears to be somewhat difficult to assess from the Federal Republic of Germany's statistics what proportion went to developed and to developing countries.

### France

The annual flow of French investment abroad is somewhere in the region of 2,500 million francs (in direct investment). France continues to be a country which invests to a relatively large extent in developing countries, as can be seen from the following breakdown for 1970, the last year for which figures are available:

*Direct French investment abroad in 1970*

| | (%) |
|---|---|
| European Economic Community | 14.8 |
| United States of America | 5.2 |
| Canada | 3.2 |
| Other countries members of the Organization for Economic Co-operation and Development (OECD) | 29.1 |
| Total OECD | 52.3 |
| Developing countries | 47.7 |
| Total | 100.0 |

Turning to foreign investment in the United States, we find that foreign assets went up from some 5,000 million dollars in 1960 to 13,200 million dollars at the end of 1970, with Europe accounting for 9,500 million, and Canada for 3,100 million of this total.

It is clear from the foregoing figures that developed countries have a marked tendency to invest a great deal more in other developed countries than in developing ones. This is particularly true if we leave out of account investment in prospecting for and exploiting of sources of energy and raw materials.

There is a growing tendency, therefore, for firms in developed countries to establish production capacity in other developed countries.

A matter for further investigation is the relationships that may exist between the various industrial plants established by a given firm in different developed countries: Do the plants all produce the same range of goods, or are they specialized and therefore complementary? The answer to this question is somewhat hard to find owing to the lack of studies in this field; everything depends, it would seem, on the type of industry concerned and the strategy adopted by each multinational firm.

## EFFECTS ON THE STRUCTURE OF INDUSTRY

In industrialized countries, the rise in critical mass also leads to an increasing concentration in the structure of industry.

A convincing proof of this can be obtained either by examining the tendency for a country's industry to become more concentrated as its technology gets more advanced, or by comparing the industrial structures of countries which are at present at different levels of industrial development.

Taking France as an example, the figures below show how the number of people working in industrial establishments employing more than 10 workers has changed over the years, as a percentage of the total number of workers in industry:

| *1906* | *1926* | *1936* | *1954* | *1966* |
|---|---|---|---|---|
| 42 | 59 | 61 | 75 | 80 |

This does not mean, however, that only large firms can survive in the future: in France, firms employing more than 500 workers account for only 26.8 per cent of the total number of wage-earners in industry, whereas those employing between 50 and 500 workers account for 36.8 per cent of the same total.

This trend can be seen more clearly by comparing a cross-section of industrial structures in countries at different levels of economic development.

Table 5 compares the industrial structure of several countries with that of the United States around 1962–1963.

The table would seem to confirm that as a country's economy develops, its industrial structure becomes more concentrated; thus, establishments employing over 500 workers account for the following percentages of the total number of industrial wage earners in the following countries:

| | *(%)* |
|---|---|
| United States of America | 42.9 |
| Federal Republic of Germany | 38.8 |
| France | 26.8 |
| Italy | 21.4 |

The percentages for establishments employing 50–500 workers are:

| | *(%)* |
|---|---|
| Italy | 51.7 |
| France | 36.8 |
| Federal Republic of Germany | 34.1 |
| United States of America | 40.7 |

Finally, the number of establishments with less than 50 workers has a marked tendency to decline in developed economies, as can be seen from the following percentages:

| | *(%)* |
|---|---|
| United States of America | 16.4 |
| Federal Republic of Germany | 37.5 |
| France | 36.4 |
| Italy | 46.9 |

TABLE 5. INTERNATIONAL COMPARISON OF DEGREE OF CONCENTRATION

| | *United States (1963)* | *Federal Republic of Germany (1961)* | *Netherlands (1962)* | *Belgium (1963)* | *Italy (1961)* | *France (1962)* | *Japan (1963)* |
|---|---|---|---|---|---|---|---|
| Number of establishments | 306,617 | 553,035 | 44,888 | 39,291 | 608,976 | 498,839 | 619.403 |
| Total number of workers | 16,234,506 | 9,489,927 | 1,197,741 | 1,062,652 | 4,495,563 | 5,274,723 | 10,415,178 |
| Average number of workers per establishment | 53 | 17 | 27 | 27 | 7 | 11 | 17 |
| *Average number of workers per establishment employing:* | | | | | | | |
| Over 50 workers | 263 | 265 | 254 | 240 | 198 | 215 | 192 |
| Over 1,000 workers | 2,580 | 2,680 | 2,519 | 2,331 | 2,245 | 2,311 | 2,266 |
| *Percentage distribution in establishments employing:* | | | | | | | |
| Over 500 workers | 42.9 | 38.7 | 40.5 | 37.7 | 21.4 | 26.8 | 24.3 |
| 50–500 workers | 40.7 | 34.0 | 35.7 | 38.5 | 31.7 | 36.8 | 33.1 |
| 10–50 workers | 13.1 | 13.8 | 15.9 | 16.4 | 18.9 | 17.2 | 27.2 |
| 1–10 workers | 3.3 | 13.5 | 7.9 | 7.4 | 28.0 | 19.2 | 15.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

These various analyses thus show that small establishments tend to disappear as economic and technical progress takes effect. That is precisely a reflection of the phenomenon of rising critical mass in industry.

Whether this trend will continue indefinitely is, of course, debatable. Clearly, concentration is heavier in long-established industries; in new industries, on the other hand, there are a great many small firms, which is due to the fact that innovation is not necessarily confined to large firms and that many small firms come into being specifically for the purpose of exploiting some innovation. This suggests that industries are widely scattered in their initial stages but become more concentrated with the passage of time, generally ending up with the market divided among a few quasi-monopolistic concerns which have managed to absorb their competitors along the way, either because those competitors were less fortunate in their development or because they preferred to convert to other activities which they regarded as having greater growth and profit potential.

# *Multinational industrial projects: economic advantages and justification*

Claude SICARD*

## INTRODUCTION

An examination of data on the development of trade and international industrial investment, particularly over the last ten years, shows that the most highly developed countries appear to be moving gradually towards ever-greater economic integration.

It is between the industrialized countries that trade, particularly if one considers trade in manufactured goods alone, is developing most rapidly and most of the investments made by multinational corporations involved in activities other than the production of raw materials or sources of energy are being channelled towards the industrialized countries.

One of the fundamental causes of this development lies in what has been termed in the preceding article the rise in the "critical mass" of both production and research marketing. It is, indeed, effects of scale which make it possible to produce at more competitive prices, to maintain large research laboratories which supply the firms to which they belong with innovations enabling them to increase their advantages over their competitors, and, again, to reduce distribution costs. And naturally, it happens that firms manage to accumulate a number of advantages accruing from their large size which operate in a whole range of activities–thus they can benefit in the areas of production, research and distribution all at once.

The problem, viewed in terms of competitiveness, is thus that of the struggle which medium-sized firms have to wage against larger firms within an expanding economic environment, where the barriers traditionally formed by the political frontiers which hitherto divided States are tending to be reduced (establishment of Benelux, the European Economic Community (EEC), and later the Kennedy Round aimed at the reduction of tariff barriers between the EEC and the United States of America).

For many firms which have endeavoured to use their ever-increasing size to gain a decisive edge over competitors, the first step towards the internationalization of their activities has been the establishment in their country of origin of industrial units with capacities well in excess of the absorption capacity of the domestic market; exports have enabled them to reduce prime costs on their own domestic market and thus become more competitive.

This is in particular currently the case with very many European and Japanese firms; an example which may be cited is that of French car manufacturers who export half of their output.

In the second stage, it would appear that firms tend, particularly in any industry where the final product is composed of various subassemblies, to establish industrial units specializing in the production of certain parts or components; these units may all be established in one country, or, on the other hand, distributed judiciously within a larger economic grouping, which is when firms become truly international.

We are now witnessing, within the framework of the Common Market, the emergence of strategies aimed at the specialization of the various industrial units forming a group, this type of strategy often being adopted by multi-national corporations of American origin. Thus, we see a manufacturer of electrical household appliances with each of his plants specializing in the production of one of the appliances which make up his range; again, we see the manufacturers of vehicles with factories specializing in the production of certain components (engines, gear boxes, transmission etc.) or aircraft manufacturers allocating tasks among themselves, within Europe, whenever the construction of a new machine is undertaken. It should also be noted that some manufacturers turn over to other producers (who then become their suppliers) the responsibility for producing certain parts or elements. The latter can produce such parts in larger quantities and more efficiently and economically, since they will then be supplying different makes. Thus, the plants of a French automobile concern which used to manufacture practically all the elements and parts required for their vehicles, now get 50 per cent of these items from specialized outside contractors, such

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as manufacturers of electrical equipment, dashboard equipment, tires, glass, cardboard etc.

Another French firm, renowned for its dynamism and success in aeronautics is, first and foremost, an enormous planning organization whose industrial activities are confined, to put it very simply, to the final assembly of aircraft, the production of the various elements and components being turned over to highly specialized firms which are by no means necessarily French.

One is thus quite naturally led to conclude that when, as a result of technological progress, a manufactured item has a critical mass of production which exceeds the absorption capacity of the domestic market of a country, this country should seek co-operation with one or more other countries to ensure that a production unit with the appropriate "critical mass" can be established (cf. the definition of the "critical mass" concept in the preceding article). Otherwise, the prime costs obtained will be higher than those of units which have reached the critical mass.

In an open economy, a unit of subcritical size cannot sustain competition for long and will thus go out of business; in a closed economy, punishment will not be meted out so brutally but the adverse effects on consumers will be no less marked.

This is, then, the problem to be examined here in its various economic aspects; we shall thus consider the point of view of the entrepreneur and of the national economies concerned.

## POINT OF VIEW OF THE ENTREPRENEUR

For an entrepreneur interested in markets A and B in two neighbouring countries, the problem which arises is whether it is preferable to establish two separate manufacturing units, one located in market A and one in market B, or on the other hand, a single unit with a capacity large enough to supply markets A + B.

### Advantages of the concentration of production in one unit

The main advantages of the concentration of production in one unit are the following.

*(a) Savings in investment*

It is generally true in industry that the capacity of a plant can be doubled without a proportionate increase in investment. This phenomenon is known as the "scale-up factor", and it is in the chemical and petrochemical industries that scale-up factors have been very clearly in evidence.

The general formula used is of the following type:

$$\frac{I_i}{I_0} = \left(\frac{C_i}{C_0}\right)^{\alpha}$$

where: $I_0$ is the cost of installing the initial plant with capacity $C_0$

$I_i$ is the cost of installing plant with capacity $C_i$

$\alpha$ denoting the "scale-up factor" is always less than 1 (otherwise the entrepreneur would increase the volume of production simply by multiplying the number of machines).

In the chemical and petrochemical industries the coefficient $\alpha$ is frequently around 0.6 since it is more or less the area-volume relationship[1] and it can easily be shown by elementary geometry that the ratio of areas is equal to the ratio of volumes to the power of 2/3.

[1] A cube with edge 5 metres has a total surface of 150 $m^2$ and a volume of 125 $m^3$, while a cube with edge 10 metres has a surface of 600 $m^2$ and a volume of 1,000 $m^3$. Thus, when the surface is multipled by 4 (surface of sheet metal, for example) the volume is multipled by 8 and the coefficient $\alpha$ is 0.5.

As an illustration, we give here the value of the coefficient for various chemical or petrochemical processes:

| | ($\alpha$) |
|---|---|
| Sulphuric acid (contact process) | 0.73 |
| Sulphur (from $H_2S$) | 0.64 |
| Nitric acid | 0.93 |
| Oxygen | 0.65 |
| Styrene | 0.65 |
| GR-S (synthetic rubber) | 0.63 |
| Ethylene | 0.86 |
| Catalytic cracking | 0.62 |
| Petroleum refining | 0.67 |

The numerous studies carried out in the automobile industry sector have made it possible to determine the scale-up factors for the main production processes.

With a production of between 25,000 and 100,000 vehicles per year, for example, the following figures are obtained.

| | *Scale-up factor* |
|---|---|
| Machining of mechanical parts | 0.40 |
| Pressing of bodywork | 0.27 |
| Smelting | 0.60 |
| Forging | 0.58 |
| Final assembly | 0.60 |

*Note:* These figures are obviously only rough indications, since the various subcategories should be distinguished for each type of process.

Thus, for example, a bodywork pressing unit with an annual capacity of 100,000 vehicles would in 1968 have required an investment of 230 million French francs, while a unit with twice the capacity would have required only 270 million French francs (scale-up factor = 0.23 within the range 100,000–300,000 vehicles).

Thus, an entrepreneur having to produce bodywork for 200,000 vehicles per year would have had to invest 460 million francs in 1968 if he had been obliged to set up two separate factories and only 270 million if he had been able to concentrate all his production in a single unit.

In the example selected, the savings in investment would have been particularly large; it is not, of course,

always so pronounced, since frequently the scale-up factor is in the order of only 0.6; in the example cited above, doubling the capacity of the plant rather than building two plants would make it possible to save 190 million francs, while with a scale-up factor of 0.6, the saving would be only 139 million francs.

It can, nevertheless, be seen that with a scale-up factor of approximately 0.6 which is very common very substantial savings in investment are realized if the size of the installation is increased. This holds true until the "critical mass" is reached.

*(b) Reduction of unit production costs*

The plant depreciation charges per unit of output will be less in the case of large units than for smaller ones. This is the logical conclusion of the arguments developed above. Other overheads, such as staffing costs, administrative expenses, general services etc., which also do not increase proportionately to the capacity installed, will be spread over a larger number of units produced and the burden on each unit manufactured will therefore be less.

It should, moreover, be noted that effects of scale can also reduce supply costs, since it is generally true that the larger the quantities involved, the better the purchasing terms obtained will be.

As an illustration, and still dealing with the automobile industry where the relationship between cost and output is very pronounced, we give below an indication of the way in which the production costs of passenger cars develop in relation to output, taking as the base 100 a production of 300,000 vehicles per year.

| *Annual production of vehicles* | *Unit production cost index* |
|---|---|
| 300,000 | 100 |
| 100,000 | 120 |
| 50,000 | 148 |
| 25,000 | 188 |
| 12,500 | 280 |

The difference is considerable, even though the assumptions made about the cost of supplies and the productivity of labour in the case of small plants are optimistic.

To return to the alternative envisaged above, we can take it that if the enterprise were obliged to establish two automobile bodywork plants rather than having the option of concentrating its production in one unit, its production costs would increase by approximately 30 per cent, the relationship between cost and output being even more marked in this type of production than it is for the various branches of automobile manufacture as a whole.

In conclusion, the option for an entrepreneur to concentrate all his production in one plant represents economic advantages which may be very substantial, at least so long as the volumes of production involved are below the "critical mass". The investment to be financed is smaller and production costs are reduced; as a result, market penetration will be increased and will be greater the more elastic demand is with respect to price.

**Disadvantages of the concentration of production in a single unit**

The drawbacks which should be examined are basically the following:

*(a) Increased transport costs*

From the economic point of view, the main drawback to the consolidation of production in a single plant is the increase in the transport costs of the unit. The plant will generally be located as near as possible to the point where over-all transport costs can be kept to a minimum, in other words, near supply sources if the industries in question are located mainly on the basis of inputs, or near consumption points if their location is more output-based.

So far as our subject – namely, concentration in a single unit or division of production between two separate units – is concerned, a calculation has to be made to ascertain whether the savings which can be effected as a result of effects of scale are cancelled out by increased transport costs. In the example selected above, the effects of scale are so marked that it seems unlikely that the benefits of concentration could be outweighed by increased transport costs: assuming that transport costs represent 3 per cent of the cost of vehicles "ex works", a doubling of transport costs – which would in any event affect only those items which had to be transported to markets at some distance from the plant – could add 2 or 3 points to the total, while the economy of scale would represent around 15 - 16 points.

It is, moreover, precisely because there are two trends at the same time, i.e. the steady rise, in almost all cases, of the critical mass of production and the gradual and steady reduction of transport costs, that the process of industrial concentration and specialization referred to in the introduction is taking place.

*(b) Increased stocks of finished products*

It may be feared that the concentration of production in a single unit, which puts the plant at a distance from a part of the consumer market, will result in the piling up of stocks of finished products. This may in fact be the case, but on the other hand, stocks of materials and products undergoing processing are reduced through concentration in a single unit. The fact that it is obviously more expensive to store finished products than production materials and other items tips the scales slightly against concentration. The relative disadvantage is, however, very small in most cases and is largely dependent on the speed and flexibility of transport systems. When transport is by road, as is increasingly often the case, products can be moved very rapidly. It is thus essentially a question of organizing production programming efficiently.

*Note.* Only the economic aspects of the problem of the diffusion or concentration of production have been dealt with in the present case. Naturally, other aspects, which are not necessarily of lesser importance, should not be brushed aside: the difficulty of organizing the management of larger units; social problems caused by the over concentration of personnel, pollution, security of investments etc.

## POINTS OF VIEW OF THE NATIONAL ECONOMY

The question of whether it is more advisable to import a product or to manufacture it will not be discussed here; we shall instead concentrate on ascertaining whether, once a country has decided to manufacture a particular product, it should execute the project on its own or carry it out in co-operation with one or more neighbouring countries.

From the point of view of the national economy – and this is the whole value of socio-economic techniques of project evaluation – the problem has to be analysed from various aspects: what is needed is a cost-benefit analysis, and it therefore has to be ascertained what in each case is the exact significance to be attributed to costs and benefits respectively. The balance sheet then has to be drawn up in terms of present value.

### Examination of costs

The costs, that is to say the drawbacks presented by the launching of a project, are the following in the present case.

#### *Investment*

For the reasons analysed above, whenever the manufacturing unit established is below the "critical mass", relatively more investment has to be made per unit of output than would be the case for a larger project being carried out in co-operation with other partners.

The concept of the capital coefficient or capital-output ratio is used in all development models. If the ratio between the average annual value added produced and the investment which had to be made to obtain this output is termed $r$:

$$r = \text{output/capital ratio} = \frac{VA}{I}$$

$$c = \frac{1}{r} = \text{capital coefficient} = \frac{I}{VA}$$

It is quite clear that the larger the investment required to obtain a certain amount of value added, the higher the capital coefficient will be and consequently the less rapid the growth of the economy; the over-all formula for economic growth in fact takes the following form:

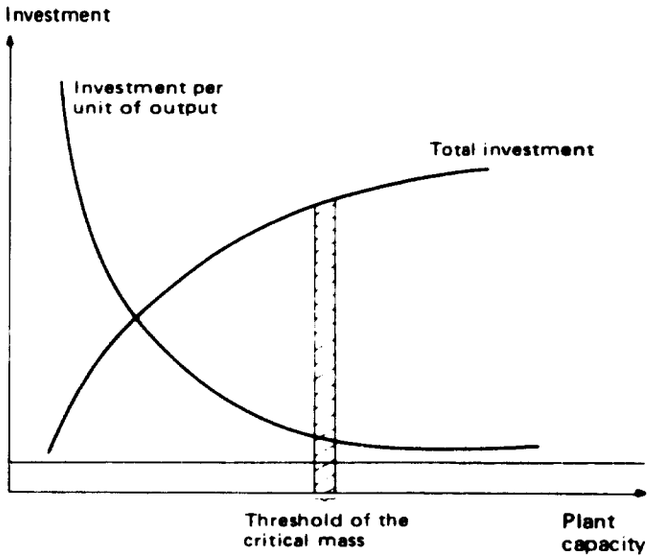
$$G = \frac{S(1 - M)}{c}$$

where: $G$ = rate of growth of the economy
$S$ = rate of saving
$M$ = import coefficient

It can thus be seen that it is very much in the interests of the country as a whole to endeavour to obtain the highest possible value added per unit of investment made or, which amounts to the same, to use the lowest possible investment to obtain a certain amount of value added.

Figure I shows investments in relation to output in industries where the phenomenon of the "critical mass of production" occurs.

*Figure I. Investment in relation to capacity*




#### *Social cost of investment*

The problem of investment "waste" is one that has to be considered, by determining the real cost of an investment to the nation. A decision to make an investment of low cost to the nation is obviously not to be assessed in the same manner as a decision to make an investment which has a high social cost.

The "opportunity" cost of the investment will thus be crucial; the higher this cost is, the more attention must be given to economizing on the type of investment envisaged.

In the developing countries, industrial investment can hardly ever be made without equipment and tools, or at least a large proportion of them, being imported from abroad; foreign currency costs are thus involved and these must be considered as being proportionately higher the less foreign currency the country concerned has to finance its development.

The other elements of investment consist of land and buildings; the opportunity cost of sites may vary considerably, depending on the facilities available and their proximity or otherwise to major items of infrastructure (ports, for example). Buildings are assessed variously according to their nature and the capacities available in the country for producing the materials required (cement factories, parpen plants, iron and steel works producing various sections etc.).

In the alternative we are considering here, the differences will possibly be more or less minimal in respect of sites and buildings; on the other hand, they will often be very substantial so far as equipment, and imported equipment in particular, is concerned.

It can therefore be taken that, in almost all cases, when the field of production in question has a critical mass above the absorption capacity of the local market, a decision to carry out a multinational project will make it possible to save on the investment of foreign currency, which is a rare commodity. This is certainly a most important consideration.

*Operating costs*

The concentration of production in a single unit, assuming that it is below "critical mass", makes it possible to reduce the imputs consumed per unit of output.

*Materials*

In social evaluation terms, this element is generally affected only marginally by a decision in favour of one or other of the possibilities considered here. On the other hand, the problem of supplies should be taken into consideration where countries which decide to collaborate would each have only to manufacture certain components of the product. The units to be established in each of the countries participating in an industrial collaboration arrangement will have to be selected in such a way as to ensure that the investments made are really those which will permit the best possible use to be made of existing investments. One country might have capacity available in the form of foundries, another in forges, another in the rolling of sheet metal for pressing etc. and it is by these considerations that the planner should be guided.

It may, however, occur that in many cases a larger-scale project enables the consumption of materials per unit of output to be reduced; this advantage would, of course, be more significant the higher the social cost of the material on which savings are realized (as in the case of imported materials).

Turkey, for example, has until now been manufacturing vehicles in limited quantities (in the range of 8,000 per year), using reinforced fibreglass technology to produce the bodywork. An increase in production (due in this case to the development of the domestic market and not to an organized collaboration arrangement with a neighbouring country) is inducing the country to change its techniques and henceforward produce bodywork in thin sheet metal. This is an example of an important modification in the use of materials which may be brought about by an increase in the output of a plant; thus, to evaluate the investment project for the establishment of a bodywork pressing plant in Turkey, the planner had to assess the actual cost to the nation of fibreglass on the one hand and thin sheet metal permitting deep pressing on the other, before deciding whether or not the technique should be changed.

*Manpower*

The execution of two national projects, as against one multinational project common to two countries, will tend to increase manpower requirements, usually to a considerable degree. This problem should be examined carefully, since in socio-economic evaluation terms, the consquences are not the same for all categories of manpower.

*Unskilled labour*

Since the developing countries almost invariably have large surpluses of labour, the opportunity cost of unskilled labour is generally very low; in social evaluation terms, an increase in the use of this labour force does not therefore significantly affect the cost-benefit analysis.

Nevertheless, attention should be paid to related investments which will have to be made by the community to establish residential areas, new social amenities, extra transport facilities etc.- in other words, to urbanize the areas surrounding the sites of the new plants. Thus, from this viewpoint, a decision involving a high consumption of manpower, even unskilled, may incur higher indirect costs than are initially apparent.

*Skilled labour*

In most cases, two plants each with output $P$ will together use more skilled labour than one plant with output $2P$. Since skilled labour is a very rare commodity in the developing countries, it will be worth while ensuring that the skilled labour which has been trained or is available is responsible for as many unskilled workers as possible. This will yield a larger total value added per unit of this rare commodity consumed.

In many cases, a relatively large proportion of this skilled labour force will be foreign nationals and consequently the foreign currency costs will be higher in one solution than in the other.

In a socio-economic evaluation, a multinational project will therefore appear much more favourable in this respect than a national project.

## Indirect effects

Any assessment of the advantages of a project at the national level should pay close attention to the indirect effects of making the investment concerned.

Since we are still dealing, in the present case, with units of subcritical size, the comparison will have to be made with a national project having unit costs which exceed those of the corresponding multinational project.

Consequently, the output of the multinational project will be higher than the sum of the outputs of the national projects $P_a$ in each of the countries participating in the agreement, because of the price elasticity of demand.

For each of the countries involved in a multinational project, the induced effects will thus be greater than would be the case with independent national projects.

In social evaluation terms, this factor will generally weigh very heavily in favour of multinational projects. It is well known that in making a social evaluation of a given project, the following ratio has to be examined:

$$\frac{\Sigma_{VA}}{\Sigma_I}$$

where $\Sigma_{VA}$ is the sum of direct and indirect value added to be credited to the project and $\Sigma_I$ is the sum of all the direct and indirect investment required to establish and

operate the project. This ratio will be proportionately higher the more spare capacity is available in the industries supplying the project; in the case of a multinational project, increases in production in the order of 20, 30 or 40 per cent may often be obtained and requirements for intermediate supplies and consumption will increase accordingly, very often without new investment having to be envisaged. So far as indirect effects alone are concerned, it will thus not infrequently occur that the ratio $VA/I$ is in the order of 30–40 per cent higher in the case of a multinational project than for a national one.

### Transport costs

A multinational project will generally incur higher transport costs than a national project–either because the countries which are collaborating by each manufacturing certain parts of the whole have to exchange the parts and elements produced among themselves (as is frequently the case in engineering and electronics industries) or because the plant, being located at the centre of gravity of the various countries participating in the agreement, is situated at some distance from the domestic market of each of the countries involved.

The problem, thus, is one of evaluating the social cost of these additional transport operations. To what extent, however, may these costs differ from the market prices?

#### *Railways*

In most countries, railway companies operate at a deficit and are therefore subsidized by public authorities. In calculating the prices of railway shipments, allowance will therefore have to be made for subsidies by the community. Thus, rail transport is generally more expensive in social evaluation terms than in market price terms.

The validity of this method of calculation is, however, open to question; one must in fact consider what would happen if the project were not carried out and ascertain what factors of production the project in question will absorb to the detriment of other productive sectors. If there is a surplus of railway staff, if energy is cheap, as is the case in countries which produce their own hydroelectricity or fuel oil, if, lastly, there is rolling stock which is under-utilized, it may be concluded that the social cost of the transport operations required for the functioning of the project is low.

This problem will therefore have to be weighed extremely carefully in each specific case, before rushing to the conclusion that transport costs are very high.

#### *Road transport*

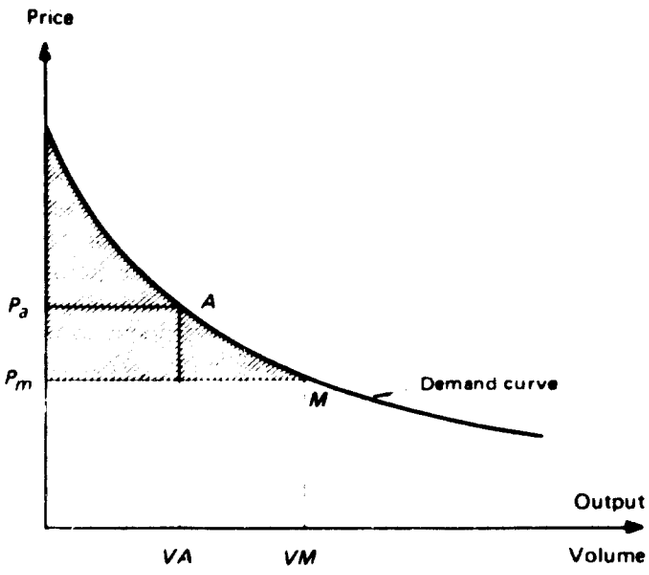
For purposes of social evaluation, State subsidies should be added to market prices and State taxes deducted from them. Tax on fuel and other charges, if any, will therefore have to be deducted from transport costs.

Likewise, the effects of the project under evaluation on road transport should be examined. The problem here is quite different from the case of rail transport where one is often tempted to adopt a marginal approach. The multinational project will probably consume more lorries, drivers and fuel than the national project; market prices, with allowances made for taxes where necessary, will thus accurately reflect the costs for the nation.

### Advantages

The advantages of a multinational project reside in the production of goods at lower costs. Thus, if intermediate or capital goods are concerned, the country which has participated in a multinational project will have at its disposal means of producing other capital or consumer goods less expensively and the effect on the economy will be beneficial. If it is consumer goods which are involved, the consumer surplus will be increased and so will the number of consumers. This, in the final analysis, is the objective of the economy: to increase the well-being of the population by meeting its consumer requirements. Figure II shows the advantage of larger-capacity projects in industries where the cost-output relationship plays an important role.

*Figure II. Consumer surplus*




A national project $A$ resulting in a selling price of products $P_a$ is contrasted with a multinational project $M$ giving a price $P_m$. The quantities demanded are $VA$ and $VM$ respectively, with $VM > VA$ and the consumer surplus (the shaded part of the table) is substantially increased.

A larger quantity of goods is made available to consumers with the same amount being invested and, if the country is able to consider exporting, it may be able to improve its competitive position appreciably on the international market. If a national project was the only option open to the country, the State would have to subsidize exports heavily, and the subsidies would have to be taken into account in the cost-benefit analysis of the project.

## SAMPLE FIGURES

A set of sample figures will show how a national project can be compared with a multinational project, the data of course being simplified for the purposes of the exercise.

### Data on the national project (country on its own)

It is assumed that the project is evaluated for a period of only five years, to simplify calculations. The figures will in that case be the following.

| *Year* | *Output in physical units* | *Earnings in monetary units* |
|---|---|---|
| 1 | 100 | 100,000 |
| 2 | 110 | 110,000 |
| 3 | 122 | 122,000 |
| 4 | 134 | 134,000 |
| 5 | 146 | 146,000 |

#### *Investment*

The investment to be made will be taken to be the equivalent of 300,000 monetary units (200,000 in foreign currency and 100,000 in local currency).

#### *Operating account*

The components of the operating account are assumed to be the following:

| *Year* | *Materials*[a] | *Manpower*[b] | *Depre-ciation* | *Transport costs* | *State subsidy* |
|---|---|---|---|---|---|
| 1 | 50,000 | 30,000 | 20,000 | 5,000 | 5,000 |
| 2 | 55,000 | 35,000 | 20,000 | 5,500 | 5,500 |
| 3 | 61,000 | 40,800 | 20,000 | 6,100 | 5,900 |
| 4 | 67,000 | 46,600 | 20,000 | 6,700 | 6,300 |
| 5 | 73,000 | 52,400 | 20,000 | 7,300 | 6,700 |

[a] Including 40 per cent imported.
[b] Including 5,000 to be paid in foreign currency.

#### *Indirect effects*

It is assumed that indirect effects are linked to supplies and that they would be the following:

| | | |
|---|---|---|
| Investment: | | 120,000 |
| Value added: | Year 1 | 30,000 |
| | Year 2 | 33,000 |
| | Year 3 | 36,000 |
| | Year 4 | 39,000 |
| | Year 5 | 42,000 |

### Data on the multinational project

Only the part of the project which concerns the country contemplating the national project described above will be dealt with here. The data are in that case taken to be the following.

#### *Production*

It was assumed, in the foregoing case, that the national project would sell its products at the same price as the multinational one; to permit this, provision would have to be made for annual subsidies, which would not be required in the case of a multinational project. The figures are thus the same as in the preceding case.

#### *Investment*

The investment to be made by the country concemed is assumed to be reduced to 210,000, due to the scale-up factor (including 140,000 in foreign currency).

#### *Operating account*

The operating account of the multinational project would be as follows:

| *Year* | *Materials*[a] | *Manpower*[b] | *Depre-ciation* | *Transport* | *Results* |
|---|---|---|---|---|---|
| 1 | 50,000 | 27,000 | 14,000 | 7,500 | 1,500 |
| 2 | 54,000 | 31,000 | 14,000 | 8,300 | 2,200 |
| 3 | 60,000 | 36,600 | 14,000 | 9,200 | 2,200 |
| 4 | 65,000 | 41,900 | 14,000 | 10,100 | 3,000 |
| 5 | 70,000 | 47,200 | 14,000 | 11,000 | 3,800 |

[a] Including 40 per cent imported;
[b] Including 4,500 to be paid in foreign currency.

#### *Indirect effects*

These are assumed to be the same as before; but since a smaller range of products will need to be manufactured, these results may be obtained with less investment. It is assumed that in the present case investments for allied industries amount to 90,000.

### Evaluation

#### *Calculation of real costs*

It is assumed that since the local currency is over-valued, a correction has to be made in respect of the exchange rate, and that unskilled manpower is to be calculated at 80 per cent of its market price.

*Investments*

*(i) National project*

| Investment | Cost in foreign currency | Exchange rate: Official | Exchange rate: Estimated | Cost in local currency: Market | Cost in local currency: Calculated |
|---|---|---|---|---|---|
| Imported equipment | 200,000 | 1 | 1.25 | 200,000 | 250,000 |
| Customs duty | | | | 10,000 | |
| Local equipment | | | | 50,000 | 50,000 |
| Local overheads | | | | 10,000 | 9,000 |
| Unskilled labour | | | | 20,000 | 16,000 |
| Skilled labour | | | | 10,000 | 10,000 |
| Total | | | | 300,000 | 335,000 |

*(ii) Multinational project*

| Investment | Cost in foreign currency | Exchange rate: Official | Exchange rate: Estimated | Cost in local currency: Market | Cost in local currency: Calculated |
|---|---|---|---|---|---|
| Imported equipment | 140,000 | 1 | 1.25 | 140,000 | 175,000 |
| Customs duty | | | | 7,000 | |
| Local equipment | | | | 31,000 | 31,000 |
| Local overheads | | | | 8,000 | 7,000 |
| Unskilled labour | | | | 15,000 | 12,000 |
| Skilled labour | | | | 9,000 | 9,000 |
| Total | | | | 210,000 | 234,000 |

*Annual expenditure*

*(i) National project*

| Annual expenditure (first year) | Cost in foreign currency | Exchange rate: Official | Exchange rate: Estimated | Cost in local currency: Market | Cost in local currency: Calculated |
|---|---|---|---|---|---|
| Imported materials | 20,000 | 1 | 1.25 | 20,000 | 25,000 |
| Customs duty | | | | 2,000 | – |
| Local materials and supplies | | | | 25,000 | 25,000 |
| Taxes | | | | 3,000 | |
| Foreign labour | 5,000 | 1 | 1.25 | 5,000 | 6,250 |
| Skilled labour | | | | 5,000 | 5,000 |
| Unskilled labour | | | | 20,000 | 16,000 |
| Transport costs | | | | 5,000 | 6,000 |
| Total | | | | 85,000 | 83,250 |

The same calculations give for the following years the figures listed below, in real costs for the nation:

| | |
|---|---|
| Year 1 | 83,250 |
| Year 2 | 90,850 |
| Year 3 | 105,415 |
| Year 4 | 115,415 |
| Year 5 | 126,780 |

*(ii) Multinational project*

| Annual expenditure (first year) | Cost in foreign currency | Exchange rate: Official | Exchange rate: Estimated | Cost in local currency: Market | Cost in local currency: Calculated |
|---|---|---|---|---|---|
| Imported materials | 20,000 | 1 | 1.25 | 20,000 | 25,000 |
| Customs duty | | | | 2,000 | – |
| Local materials and supplies | | | | 25,000 | 25,000 |
| Taxes | | | | 3,000 | – |
| Foreign labour | 4,000 | 1 | 1.25 | 4,000 | 5,000 |
| Skilled labour | | | | 4,000 | 4,000 |
| Unskilled labour | | | | 11,000 | 8,800 |
| Transport costs | | | | 7,500 | 9,000 |
| Total | | | | 76,500 | 76,800 |

The same calculations give these results for the following years in real costs for the nation:

| | |
|---|---|
| Year 1 | 76,800 |
| Year 2 | 85,387 |
| Year 3 | 103,570 |
| Year 4 | 114,540 |
| Year 5 | 124,860 |

*Real benefits for the nation*

*National project*

For purposes of evaluation at the national level, the subsidies granted annually to the proejct by the State must be deducted from earnings.

Earnings are therefore the following:

| | |
|---|---|
| Year 1 | 95,000 |
| Year 2 | 104,500 |
| Year 3 | 116,100 |
| Year 4 | 126,700 |
| Year 5 | 139,300 |

*Multinational project*

Since the project is not subsidized, the earnings to be taken into account are the same as those entered in the enterprise's account.

*Results*

*Evaluation from the standpoint of the entrepreneur*

At the level of the entrepreneur, results are as follows:

*(i) National project.* The national project operates at a deficit, at least for the first five years, which is the period under consideration here.

*(ii) Multinational project.* This project, which required an investment of 210,000, yields some profit but not much; the balance sheet for the fifth year, for example, would show a result before taxes of 3,000, which should be compared with the 210,000 units invested (assuming that the investment was raised entirely from private capital).

In fact, in order to assess the earnings from a project correctly, the project's internal rate of return should be calculated. This is worked out in the following way:

| *Year* | *Investment* | *Cash-flow* | *Residual value of investment* |
|---|---|---|---|
| 0 | 210,000 | | |
| 1 | | 15,500 | |
| 2 | | 16,200 | |
| 3 | | 16,200 | |
| 4 | | 17,000 | |
| 5 | | 17,800 | 140,000 |

The internal rate of return is identified in the following way:

| | | | *Discount at 1%* | | | *Discount at 5%* | | |
|---|---|---|---|---|---|---|---|---|
| *Year* | *Investment expenditure* | *Cash flow* | *Rate* | *Expenditure* | *Cash flow* | *Rate* | *Expenditure* | *Cash flow* |
| 0 | 210,000 | | | 210,000 | | | 210,000 | |
| 1 | | 15,500 | 0.990 | | 15,345 | 0.952 | | 14,756 |
| 2 | | 16,200 | 0.980 | | 15,876 | 0.907 | | 14,693 |
| 3 | | 16,200 | 0.971 | | 15,730 | 0.864 | | 13,996 |
| 4 | | 17,000 | 0.961 | | 16,337 | 0.822 | | 13,974 |
| 5 | | 157,800 | 0.951 | | 150,068 | 0.783 | | 123,557 |
| | 210,000 | 222,700 | | | 213,356 | | | 180,976 |

Through interpolation, an internal rate of return can be identified for this project in the order of 1.5%–a very low, but nevertheless positive, rate while the national project had a negative return.

*Evaluation at the level of the national economy*

The real value of a project can be assessed using the concept of the present value of social benefit.

Assuming that the rate of discount used is 8 per cent (in fact several values–8, 10, 12 per cent for example, should always be explored), the figures will be the following:

*(i) National project*

| *Year* | *Present value coefficient with rate of discount at 8%* | *Earnings (direct and indirect)* | | *Costs (investment + annual costs)* | |
|---|---|---|---|---|---|
| | | *Annual* | *Discounted* | *Actual* | *Discounted* |
| 0 | 1.000 | | | 455,000 | 455,000 |
| 1 | 0.926 | 125,000 | 115,750 | 83,250 | 77,089 |
| 2 | 0.826 | 137,500 | 113,575 | 90,850 | 75,042 |
| 3 | 0.751 | 152,100 | 114,227 | 105,415 | 79,166 |
| 4 | 0.683 | 165,700 | 113,173 | 115,320 | 78,763 |
| 5 | 0.621 | 381,300[a] | 236,787 | 126,780 | 78,730 |
| | | 961,600 | | 976,615 | |

[a] Including residual value of investments reckoned at net book value.

Taken over a period of just five years, which is obviously too brief but is used here in the interests of simplicity–the social benefit of the national project under consideration would have a negative present value.

*(ii) Multinational project*

| *Year* | *Present value coefficient with rate of discount at 8%* | *Earnings (direct and indirect)* | | *Costs (investment + annual costs)* | |
|---|---|---|---|---|---|
| | | *Annual* | *Discounted* | *Actual* | *Discounted* |
| 0 | 1.000 | | | 324,000 | 324,000 |
| 1 | 0.926 | 130,000 | 120,380 | 76,800 | 71,116 |
| 2 | 0.826 | 143,000 | 118,118 | 85,387 | 70,529 |
| 3 | 0.751 | 158,000 | 118,658 | 103,570 | 77,781 |
| 4 | 0.683 | 173,000 | 118,159 | 114,540 | 78,230 |
| 5 | 0.621 | 432,000[a] | 268,272 | 124,860 | 77,538 |
| | | 1,036,000 | | 829,157 | |

[a] Including residual value of investments reckoned at net book value.

In this case, the present value of the social benefit is 1,036,000–829,157 = 206,843 monetary units. The difference between this and the national project, which is considerable, clearly illustrates the value of the multinational solution.

# *An appraisal of the opportunities for co-operation between the Maghreb countries in the automotive industry**

Claude SICARD**

## INTRODUCTION

The automotive industry is a typical example of those industries which have a high "critical mass" and are difficult to develop at present because the markets are too restricted; it is therefore one in which co-operation at the subregional or, better still, at the regional level is necessary.

The example of the Maghreb countries discussed in this study clearly shows how projects which would not be at all viable if limited to individual markets can become economically sound propositions when undertaken by several countries in co-operation. Each country can benefit from such co-operation in two ways:

It can develop its industry, without the cost of locally made goods being unduly high, and thus eliminate a source of inflation which is structural in many countries (i.e. cost inflation);

It can produce goods that can be exported to international markets, such exports being of decisive importance in stimulating growth in any developing economy.

Industrial co-operation between countries in a given subregion can, therefore, alter the fundamental nature of these industrialization problems. Beginning with a situation in which various kinds of manufacturing, if undertaken in total independence, could only be achieved with a high "cost penalty", it is possible, through the national specialization that can be arranged under a regional economic co-operation agreement, to organize industrial development of a fully viable kind, by which each partner can undertake certain activities on a competitive scale, to the greater benefit of the consumer and of the countries concerned.

As a single market, the Maghreb countries could, in a very short time, form what would indubitably be a powerful economic grouping.

According to the forecasts which can be made at the present time, by 1980 those countries should make up a market of 45.5 million people with a *per capita* income of approximately $US 400.

**Forecasts for 1980**

| | *Tunisia* | *Algeria* | *Morocco* | *Maghreb* |
|---|---|---|---|---|
| Population (in millions) | 6.3 | 18.7 | 20.5 | 45.5 |
| GDP (in $US million) | 2,190 | 9,350 | 6,360 | 17,900 |
| *Per capita* GDP (in $US) | 350 | 500 | 310 | 393 |

The above figures suggest that the Maghreb would, in only 7 or 8 years' time, be an economic entity comparable in size to, say, Spain in 1960 or Mexico in 1965.

*This study is only a preliminary outline of the prospects for co-operation between the Maghreb countries in the automotive industry; it summarizes the material collected for the purposes of a seminar organized by the Maghreb Industrial Studies Centre and UNIDO at Tangier, 22 January – 2 February 1973, on the study and evaluation of multinational projects (document UNIDO/IPPD.109).

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## PROJECTIONS FOR VEHICLE DEMAND IN 1980

The forecasting methods used for the purposes of this study are based on space-time correlations for passenger cars (PC) and commercial vehicles (CV); for farm tractors the methods were developed from econometric models designed by us, which correlate the growth of investment in agricultural machinery with the growth of farmers' income. Table 1 shows market trends over the period 1963–1970.

TABLE 1. MARKET TRENDS OVER THE PERIOD 1963–1970

| *Registrations* | *Tunisia* | *Algeria* | *Morocco* | *Maghreb* |
|---|---|---|---|---|
| Passenger cars | | | | |
| 1963 | 2,370[a] | 13,865 | 8,334 | 24,569 |
| 1969 | – | 9,549 | 17,546 | – |
| 1970 | 4,217 | – | 19,708 | 31,000[b] |
| Commercial vehicles | | | | |
| 1963 | 2,610 | 2,400[a] | 4,615 | 9,625 |
| 1964 | 1,855 | 6,070 | 5,341 | 13,266 |
| 1970 | 2,440 | (–) | 6,489 | 14,000[b] |
| Farm tractors | | | | |
| 1969 | 235 | 3,085 | 1,550 | 4,870 |
| 1970 | 1,200 | 3,725 | 1,918 | 6,843 |

[a] 1964 instead of 1963.
[b] Estimates.

**Probable market developments between now and 1980**

Figures I and II show the assumptions used for forecasting the development of car density in each of the countries concerned. The space-time models used suggest that the three Maghreb countries were heavily over-motorized in 1963, but that they have since consistently tended to come closer to the line of regression, except in the case of commercial vehicles in Morocco.

The forecasts made for this project are therefore based on the assumption that the three countries will steadily come closer to the international model, at the same pace as in recent years. It is assumed that once the countries are back on the curve they will follow a "normal" path, that is to say, in accordance with the average elasticity observed in the study of this phenomenon in a great many other countries.

The forecasts for 1980 made on the basis of these calculations are summarized in table 2 and set out in greater detail in the annex.

TABLE 2. VEHICLE MARKET IN THE MAGHREB IN 1980

| | *Tunisia* | *Algeria* | *Morocco* | *Maghreb* |
|---|---|---|---|---|
| Passenger cars | 7,735 | 44,730 | 31,775 | 84,240 |
| Commercial vehicles | 4,055 | 21,880 | 18,070 | 44,005 |
| Farm tractors | 1,610 | 8,550 | 5,940 | 16,100 |

The Maghreb market in 1980 would therefore be approximately as follows:

| | |
|---|---|
| Passenger cars | 85,000 per year |
| Commercial vehicles | 44,000 per year |
| Farm tractors | 16,000 per year |

The above figures must be regarded as very substantial and suggest that the Maghreb countries should carefully consider what kind of industrial set-up they should establish in order to rationalize production and draw maximum benefit from the scale effects characteristic of the automotive industry.

## OPPORTUNITIES FOR CO-OPERATION BETWEEN THE MAGHREB COUNTRIES IN THE AUTOMOTIVE INDUSTRY

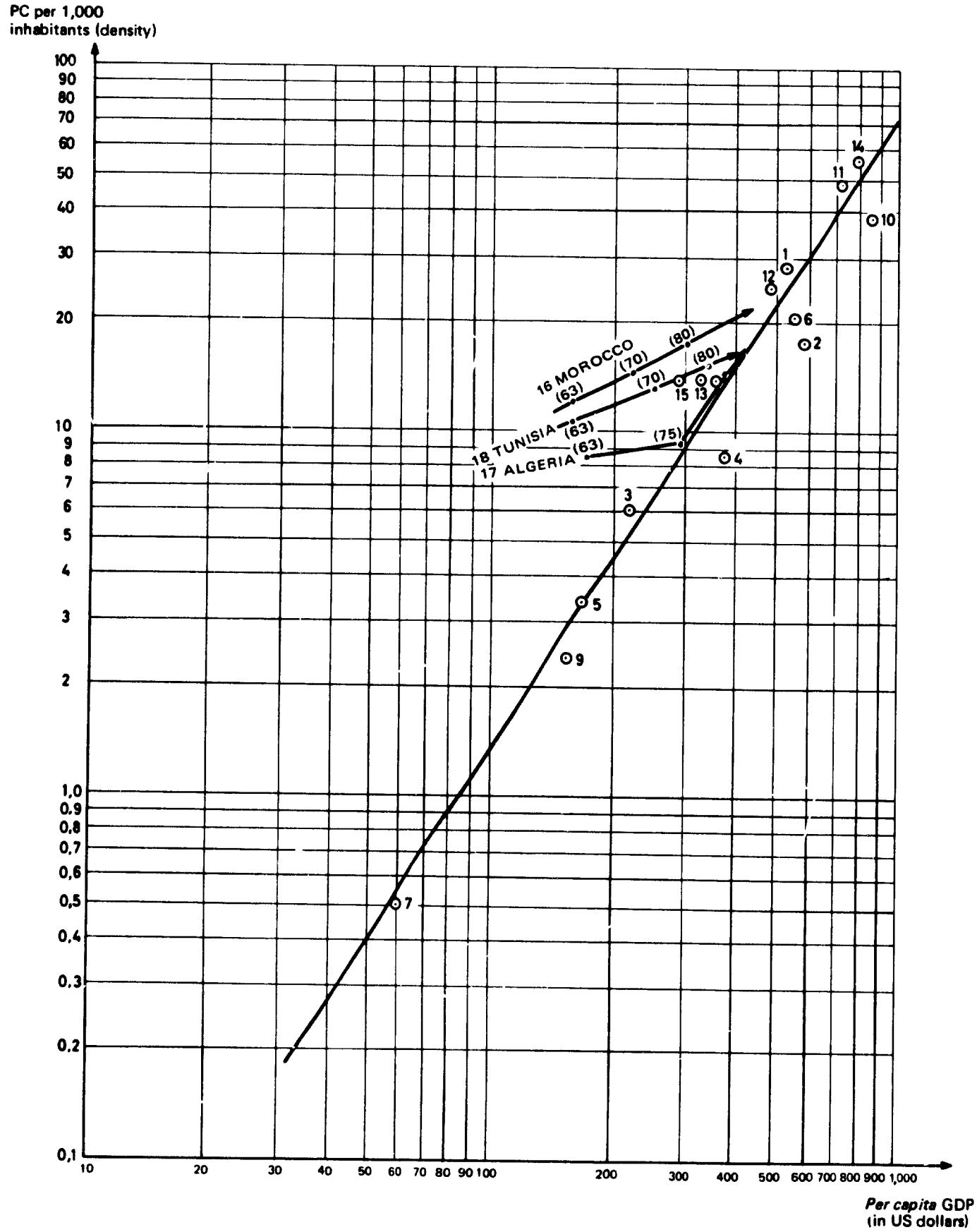
One pitfall which the Maghreb countries should take care to avoid at the outset when shaping a common automotive policy is that of unduly restricting the scope of the proposed co-operation. The experience of other countries--especially those of the Latin American Free Trade Association–clearly shows that countries are better able to solve problems relating to industrial co-operation if experts working on preparatory studies have defined the area to be covered by the negotiations correctly.

In the case of the automotive industry, it would clearly be very much in the interest of the Maghreb countries to negotiate on the entire vehicle industry, and not hesitate to expand the scope of the negotiations to include tractors and stationary engines.

First of all, let us see how the Maghreb market might be broken down according to the range of models to be produced, that being of necessity the first step to be taken in this field. The aim will be to keep the number of models to a minimum. We shall then examine briefly the cost-output ratios in the automotive industry as a basis on which to assess the advantages to be derived from the longer series that could be produced as a result of inter-Maghreb co-operation. We shall also consider transport costs, in so far as they can be roughly assessed at the Maghreb level at present, in the knowledge that they are bound to tend downwards in the future.

Secondly, we shall examine, on the basis of these various figures, the way in which inter-Maghreb co-operation might be planned, taking into account the investments which each of the countries concerned has already made in the industry.

*Figure I. Number of passenger cars in relation to* per capita *GDP*




*Key:*

1 Argentina (1929)
2 Argentina (1954)
3 Brazil
4 Chile
5 Guatemala
6 Venezuela
7 India
8 Lebanon
9 Philippines
10 Belgium
11 France
12 Federal Republic of Germany
13 Italy
14 United Kingdom
15 Mexico
16 Morocco
17 Algeria
18 Tunisia

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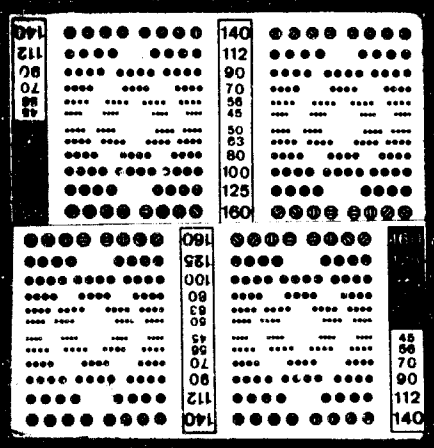
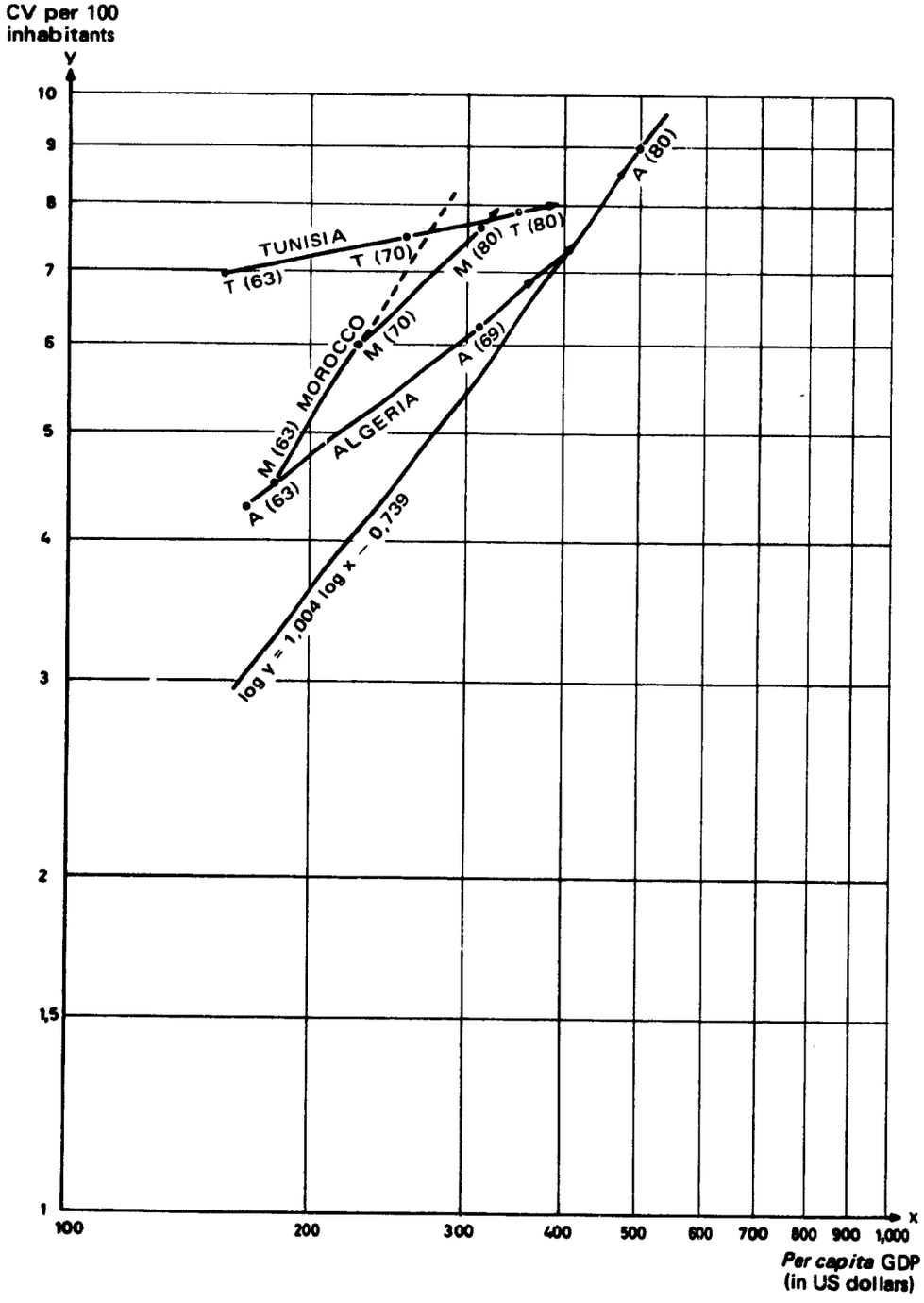


*Figure II. Number of commercial vehicles in relation to* per capita *GDP*




## Analysis of data

### *Vehicles to be produced in 1980*

The forecasts given above, which are only quick estimates made solely for the purposes of this study, may be amplified as follows:

*Passenger cars*

The pattern of supply under an inter-Maghreb plan may be envisaged as follows:

TABLE 3. PROSPECTS FOR 1980

| *Category* | *Proposed pattern of output* | *Units* |
|---|---|---|
| A. Small cars (less than 1,200 cm³) | 60 | 50,000 |
| B. Medium-size cars (1,200–1,500 cm³) | 30 | 25,000 |
| C. Large cars (over 1,500 cm³) | 10 | 9,200 |
| Total | 100 | 84,200 |

It is assumed that the demand could be met with the above three types of vehicle.

Admittedly, the assumption that the market could be divided between no more than three models is somewhat far-fetched; we consider it advisable, however, to begin forecasting on this simplified basis and only later introduce more sophisticated assumptions which, being designed to meet requirements of a different nature, would tend to lead away from the economic optimum.

On this assumption, sales in each country would be approximately as follows:

| | *Tunisia* | *Algeria* | *Morocco* |
|---|---|---|---|
| Category A | 4,620 | 26,400 | 19,000 |
| Category B | 2,210 | 13,200 | 9,500 |
| Category C | 905 | 5,130 | 3,275 |
| Total | 7,735 | 44,730 | 31,775 |

*Commercial vehicles*

The term "commercial vehicle" covers a very wide range of types, from small vans adapted from passenger cars to 40-ton trucks.

However, commercial vehicles may be broadly classified as follows:

*(a)* Vehicles with a load capacity of 200–300 kg, i.e. vehicles adapted directly from private cars;

*(b)* Vehicles with a load capacity of up to 1,000 kg, i.e. vehicles with the engines of passenger cars of the same cylinder capacity but with a special bodywork (e.g. estate cars such as the Volkswagen "Kombi" and the Renault "Estafette");

*(c)* Vehicles with a load capacity of 1,000–3,000 kg, a category which includes a fairly large number of commercial vehicles;

*(d)* Vehicles with a load capacity of over 3 tons, i.e. medium and heavy trucks.

In the light of the present pattern of demand and its probable development, the Maghreb market in 1980 may be broken down as follows:

| *Load capacity* | *1980* |
|---|---|
| 200–300 kg | 5,800 |
| Under 1,000 kg | 8,200 |
| 1,000–1,500 kg | 4,400 |
| 2–3 tons | 6,500 |
| Over 3 tons | 19,105 |
| Total | 44,005 |

Car production series would thus be increased by 5,800 in the case of small cars and by 8,200 in the case of medium and large cars, at any rate as far as the engines and some bodywork parts are concerned.

The over 3-ton category may be broken down as follows:

| | |
|---|---|
| 3-5 ton | 8,500 |
| 5-7 ton | 5,800 |
| 7-10 ton | 2,900 |
| 10 ton | 1,905 |
| Total | 19,105 |

*Tractors*

We have estimated that by 1980, the demand would be for some 16,000 tractors per year, of which approximately 2,000 to 2,500 would be light tractors.

Assuming for the sake of simplicity that only very few caterpillar tractors would be required by farmers in 1980, the demand in the Maghreb region would be:

| | |
|---|---|
| Farm tractors of over 45 hp | 10,000 |
| Farm tractors of 35–45 hp | 4,000 |
| Light tractors of less than 35 hp | 2,100 |
| Total | 16,000 |

*Summary*

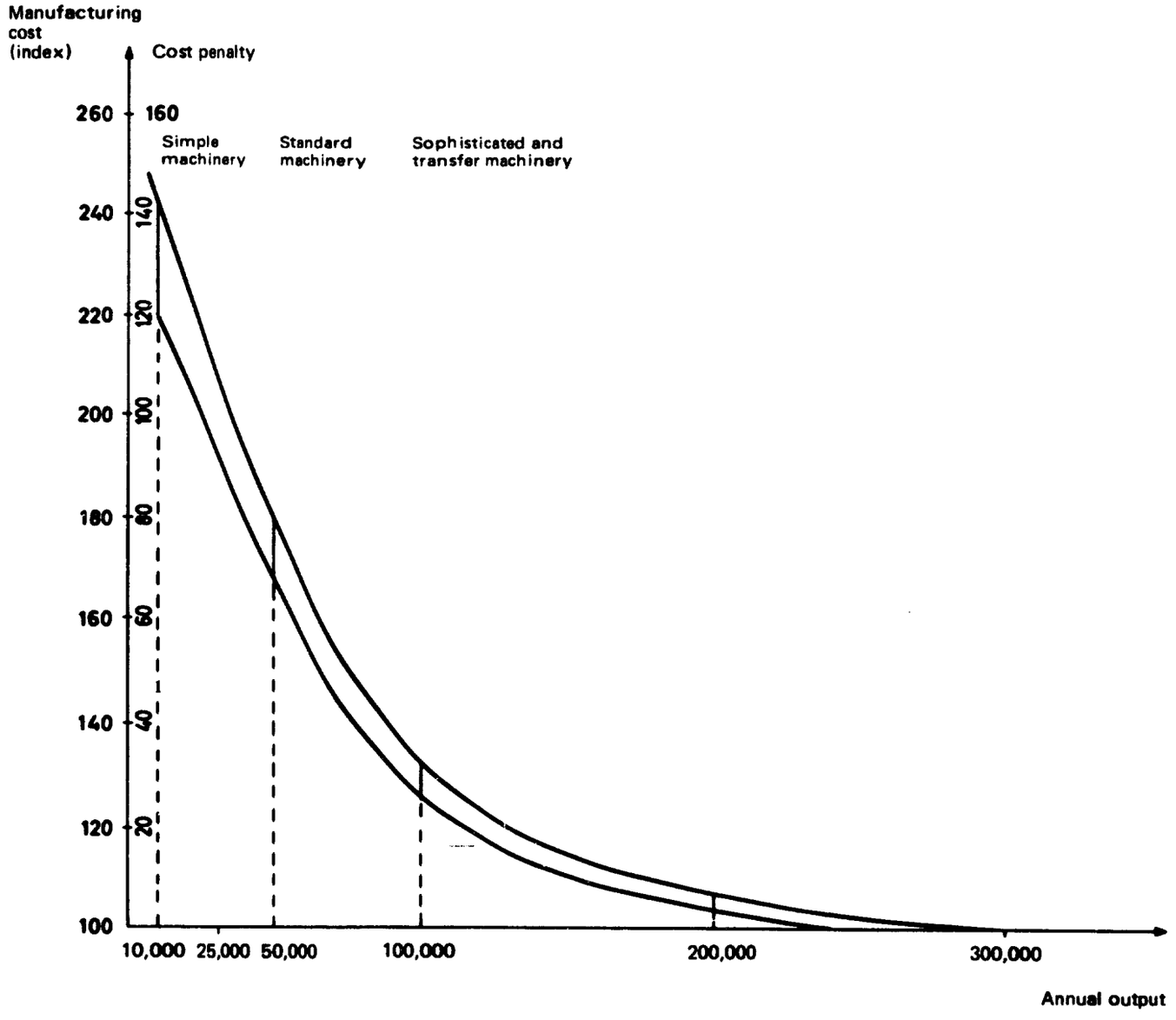
We can thus take it, as an initial assumption, that production figures for 1980 will be as in table 4.

TABLE 4. MAGHREB PRODUCTION IN 1980

| | *Tunisia* | *Algeria* | *Morocco* | *Maghreb* |
|---|---|---|---|---|
| Passenger cars | 7,735 | 44,730 | 31,775 | 84,240 |
| Commercial vehicles adapted from passenger cars | 2,000 | 8,070 | 3,930 | 14,000 |
| Total | 9,735 | 52,800 | 35,705 | 98,240 |
| Light commercial vehicles (1–3 ton) | 960 | 4,490 | 5,450 | 10,900 |
| Medium and heavy commercial vehicles (over 5–ton) | 1,095 | 9,320 | 8,690 | 19,105 |
| Light tractors (under 35 hp) | 500 | 500 | 1,100 | 2,100 |
| Medium tractors (35–45 hp) | 610 | 1,700 | 1,690 | 4,000 |
| Heavy tractors (over 45 hp) | 500 | 6,350 | 3,150 | 10,000 |
| Total | 1,610 | 8,550 | 5,940 | 16,100 |

*Figure III. Cost penalty for manufacture of mechanical parts in relation to output*

(Base: Cost penalty 0 for a large European plant producing 300,000 vehicles per year)




*Cost-output ratios in the automotive industry*

The relationship between costs and output is very marked in the automotive industry, which is well known to be an industry where economies of scale are very considerable.

It would be impossible to give prime cost-output curves here for all the different parts and components, since as many as 5,000 different parts go into the making of just one passenger car. A few curves (see figs. III to VII) have, however, been plotted to give a general picture of prime costs in relation to output for the main manufacturing processes. (See "Study of problems related with the establishment of motor vehicle industries in developing countries", a document submitted by the author to a seminar organized by the Economic Commission for Latin America at Santiago, Chile, in September 1970).

*Mechanical parts manufacture*

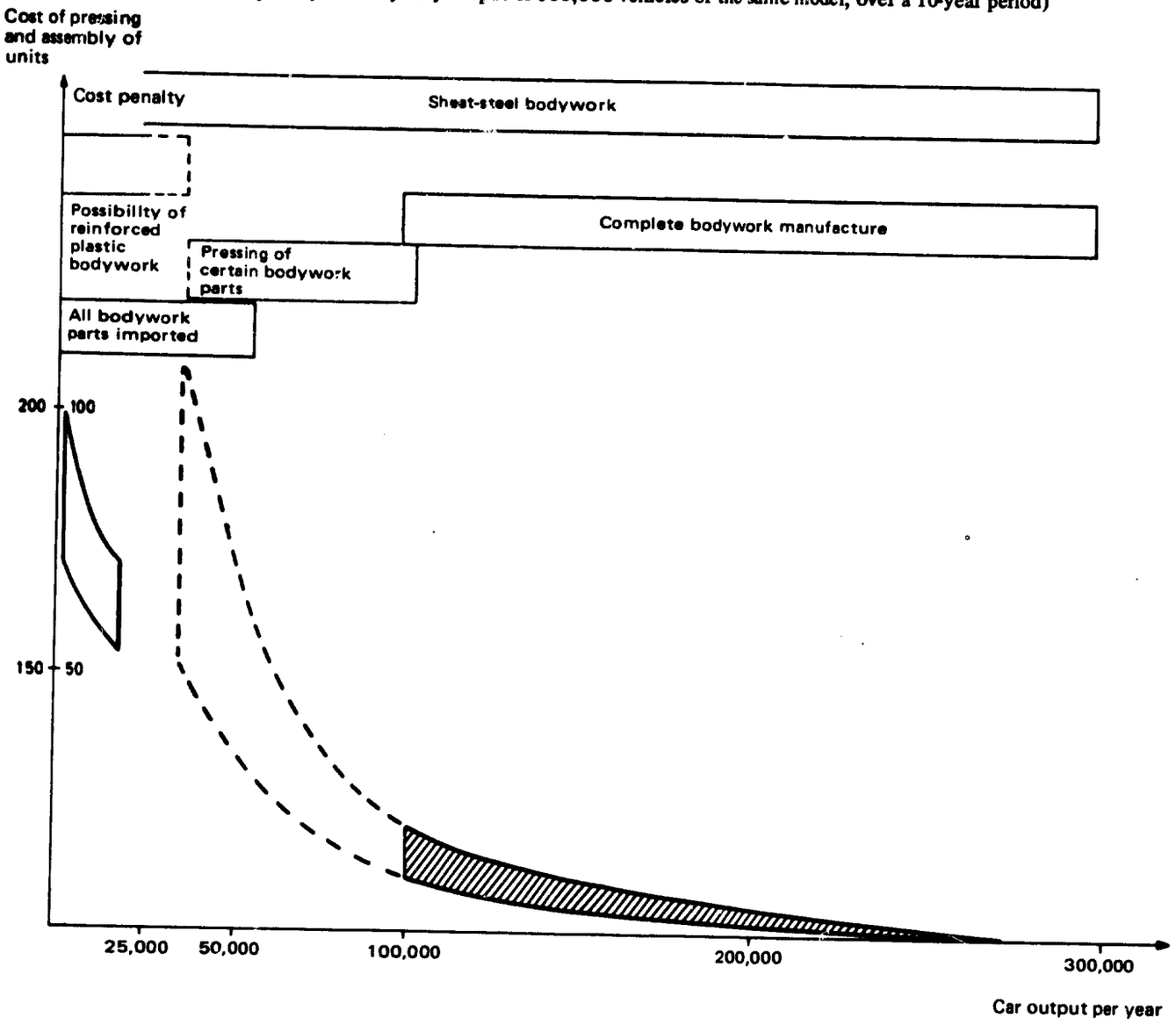
The cost-output curves are of course specific to each manufacturing process; the curve in figure III is merely a resultant reflecting an average cost pattern, on the assumption that labour productivity and investment costs are the same as in Europe.[1]

| *Output (vehicles per year)* | *Manufacturing costs (index)* |
|---|---|
| 10,000 | 240 |
| 25,000 | 200 |
| 50,000 | 180 |
| 100,000 | 132 |
| 300,000 | 100 |

[1] All figures in this study are based on investment values calculated in 1967/1968 French francs and according to prices prevailing in Europe at that time.

*Figure IV. Cost penalty for pressing and assembly of units in relation to output (production of a single model)*

(Base: Cost penalty 0 for a yearly output of 300,000 vehicles of the same model, over a 10-year period)




*Pressing* (see figures IV and V)

Because of the very high cost of the equipment, prime costs of pressing vary considerably with the length of the series. They also vary considerably according to the bodywork style (shape and design of the parts). As a first approximation, however, the following cost-output ratios may be assumed for a model whose steelwork remains unchanged over a 10-year period:

| *Output (vehicles per year)* | *Cost of pressing and assembly of units (index)* |
|---|---|
| 10,000 | – |
| 25,000 | 180 |
| 50,000 | 142 |
| 100,000 | 110 |
| 300,000 | 100 |

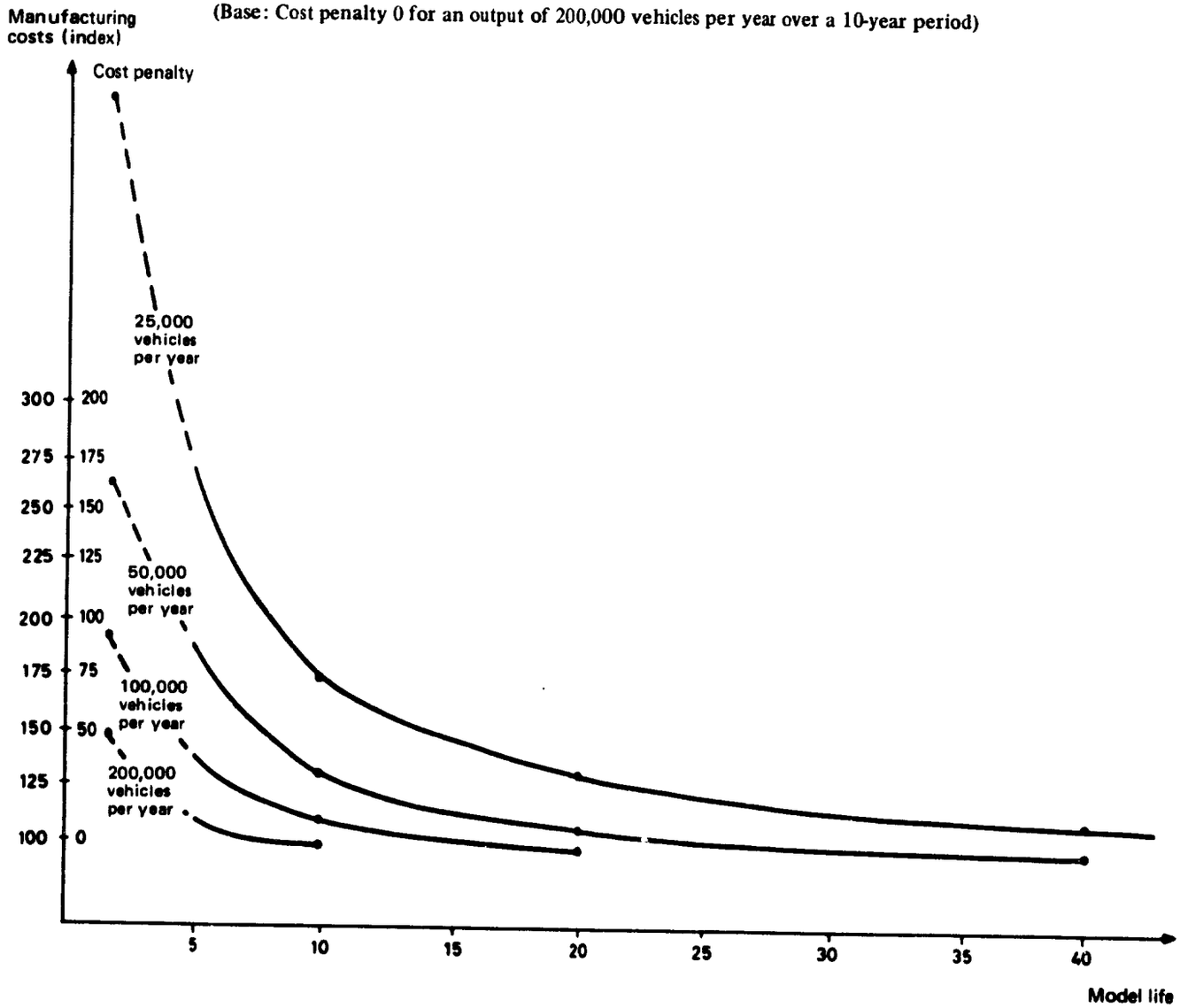
In addition, the variation of costs in relation to model life is shown in figure V.

*Parts obtained from outside sources*

It is common in the automotive industry for 40 per cent of vehicle parts and components to be manufactured by outside suppliers.[2] It would obviously be very risky to try to give even a very general outline of the relationship between costs and output in this instance, since the costs of parts obtained from suppliers and subcontractors vary widely according to the general level of development attained by the country in question. However, on the basis of an analysis of the situation in various countries, we can, as a first approximation, put forward a curve (see figure VI) which gives a fairly clear picture of such supply costs in relation to the level of output in different countries.

[2] In addition, car manufacturers have to obtain supplies of raw materials (steel bars, sheet, paint etc.); such purchases account for some 12–14 per cent of the plant's operating account.

*Figure V. Cost penalty for pressing and assembly of units in relation to model life (on the assumption of total local content)*




| *Output (vehicles per year)* | *Supply costs (index)* |
|---|---|
| 10,000 | 175 – 220 |
| 25,000 | 150 – 175 |
| 50,000 | 135 – 150 |
| 100,000 | 110 – 115 |
| 300,000 | 100 |

*Final assembly*

The cost of final assembly operations is likewise influenced strongly by output. For example:

| *Output (vehicles per year)* | *Assembly costs (index)* |
|---|---|
| 10,000 | 205 |
| 25,000 | 170 |
| 50,000 | 147 |
| 100,000 | 128 |
| 300,000 | 100 |

*Summary*

Figure VII summarizes the manufacturing costs per vehicle in relation to the number of vehicles produced per year, taking into account the rate of local content, which can fluctuate between 0 and 100 per cent.[3] These curves show that when vehicle manufacture is carried out entirely in just one country, costs can be 200 per cent higher on an output of some 8,000 vehicles and 42 per cent higher on an output of some 50,000 vehicles per year, assuming European conditions with regard to labour productivity, investment costs,[4] energy costs etc.

*Transport costs in the Maghreb*

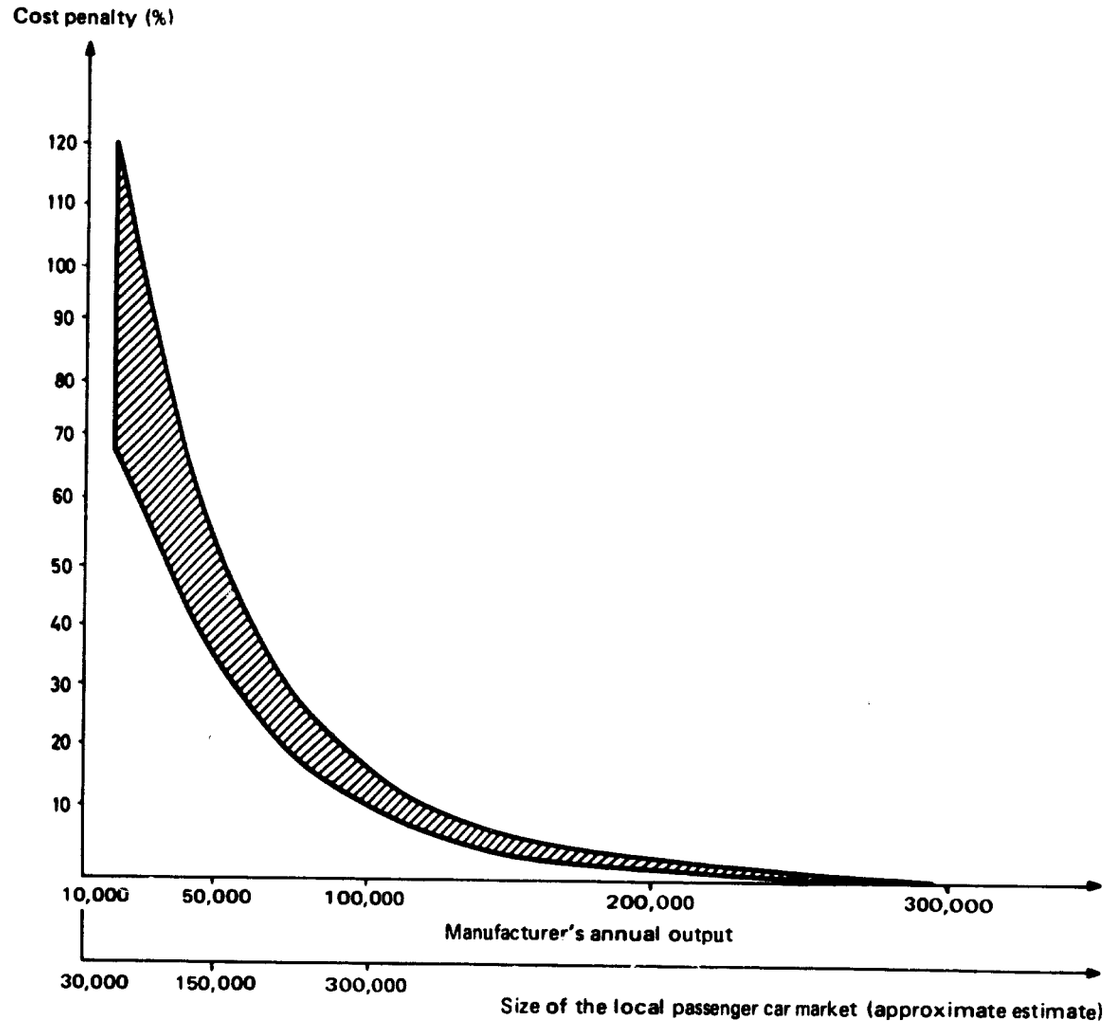
Transport facilities, especially shipping, are relatively undeveloped in the region at present, with the result that trade between the three countries is very limited.

[3] According to the usual definition of local content rates, based on the deletion rate and the value of the completely knocked down (CKD) kit as base 100.

[4] Investment costs in developing countries are at present 20–30 per cent higher than in industrialized countries.

*Figure VI. Average cost penalty of purchase of components in relation to vehicle output*

(Base: Cost penalty 0, value as in Europe)




It is therefore inadvisable to go by present freight charges in order to estimate what transport costs in the Maghreb region would be if there were more trade, as would be the case if the three countries started co-operating closely in order to develop industries such as the automotive industry on a joint basis.

As a working assumption, we may suppose that present freight rates might go down by 20 per cent (in constant value) in years to come.

*Present freight charges*

TABLE 5. RAIL FREIGHT RATES

| *Rates as at November 1972 (in Algerian dinars per ton)* | *Built-up cars* | *CKD cars* |
|---|---|---|
| Sousse-Algiers | 161.55 | 169.23 |
| Sousse-Oran | 218.39 | 231.23 |
| Algiers-Casablanca | 167.04 | 176.43 |
| Annaba-Casablanca | 254.43 | 273.29 |

*Source:* Algerian National Railways.

The above table shows that transport costs for a built-up vehicle on the longest run, Sousse-Casablanca, amount to less than 5 per cent of the vehicle price.

The rates suggested by the Maghreb Shipping Secretariat are given in table 6.

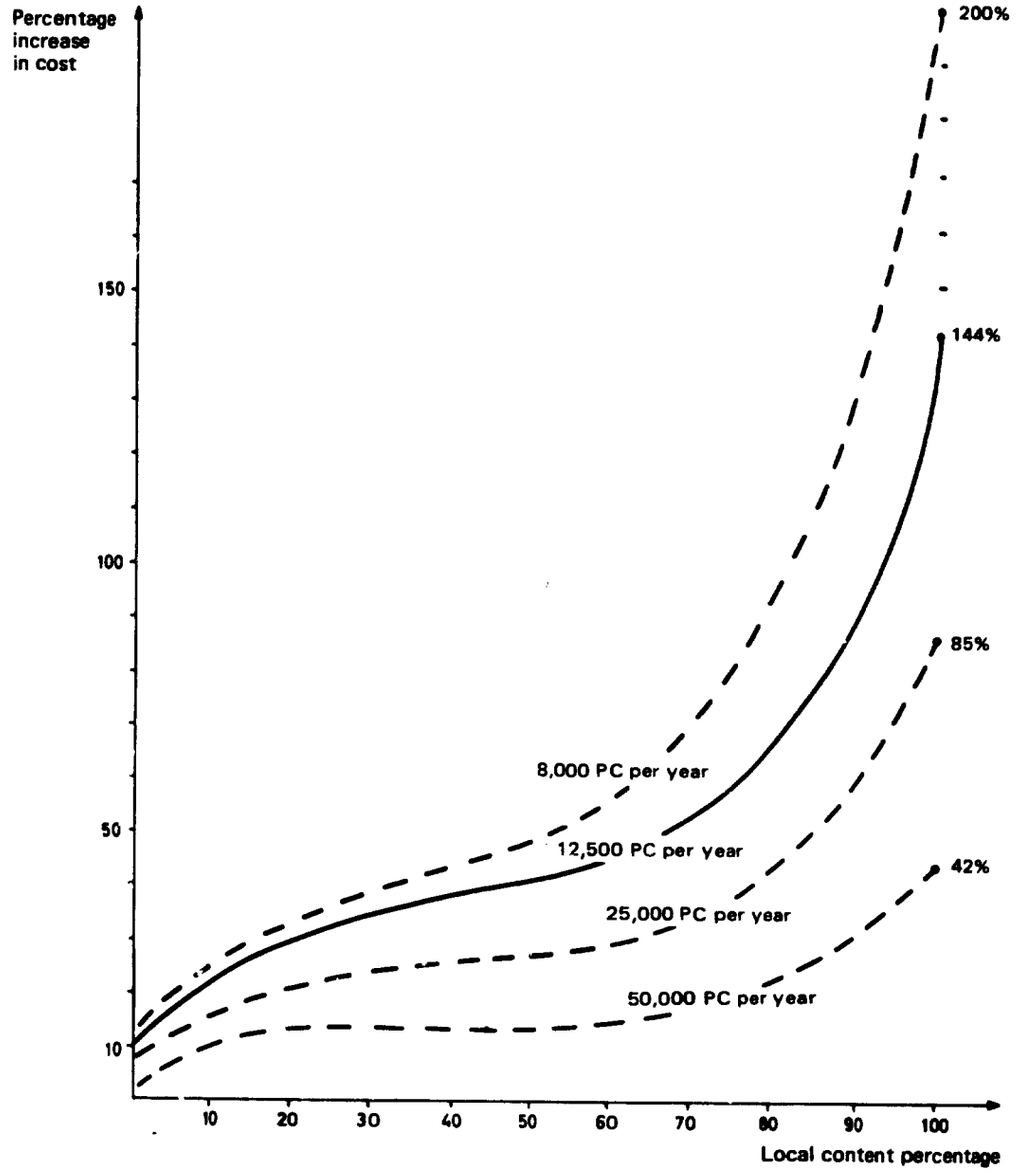
TABLE 6. SHIPPING FREIGHT RATES

*(in US dollars)*

| | *Vehicle of Renault R8 type* | *3-ton trucks* |
|---|---|---|
| Algiers-Sousse | 80 | 180 |
| Algiers-Casablanca | 72 | 160 |
| Sousse-Casablanca | 110 | 210 |

Transport costs could not, therefore, exceed 2–3 per cent of the price of vehicles, even under present conditions.

*Figure VII. Cost increases in relation to percentage of local content for outputs of between 8,000 and 50,000 passenger cars per year*




*Note.* It has been assumed that the change-over to local content would be carried out as rationally as possible (by stages according to increases in costs).

## The options

The curves showing the expected variation of prime costs in relation to output give some idea of the considerable advantages the Maghreb countries would gain by embarking on a policy of collaboration. The reduction in prime costs resulting from an increase in output would be much greater in the Maghreb than the rise in transport costs which would inevitably result from any specialization in manufacture.

The way is thus open for fruitful co-operation between the Maghreb countries.

### *The proposed programme*

The main guidelines to be adhered to in formulating policies in this field are as follows:

*(a)* Each country should be able to cut down vehicle production costs and save on investment;

*(b)* Each country should have a level of activity at least comparable to what it would have on its own;

*(c)* Each country should retain a measure of autonomy, so as to be able to revise its policy in the event of regional agreements being terminated;

*(d)* Each country should have a fair share of the proposed output.

In addition, a realistic approach calls for a very thorough appraisal of the investment already made by the three countries, especially by Algeria very recently. That country has just set up a large diesel engine and tractor plant at Constantine and a large commercial vehicle plant at Rouiba, which is producing a complete range (the Verliet range) of medium and heavy trucks.

Morocco has invested quite heavily in private car assembly (the SOMACA plant), in truck and tractor assembly and in some local content processes.

In Tunisia, the Société tunisienne d'industrie automobile (STIA) has set up a plant at Sousse to assemble passenger cars and commercial vehicles.

These facts must be borne in mind, as it would be unreasonable to expect these countries to write off investments which are still very recent and have in some instances been quite heavy.

On the basis of table 3, and taking into account the investment already made by the Maghreb countries, the following general plan might be envisaged:

*Algeria*

In view of the production facilities it has already established, Algeria should specialize, under a Maghreb co-operation programme, in the following fields:

Manufacture of medium and heavy tractors

Manufacture of medium and heavy commercial vehicles

Production of a wide range of diesel engines, to be fitted on tractors and trucks produced in Algeria either on initial assembly or as replacements.

In addition, both for economic reasons and for reasons of security, Algeria should have one large plant to assemble passenger cars and light commercial vehicles.

*Morocco*

Morocco would be given the task of manufacturing all passenger cars and light commercial vehicles to meet the requirements of the Maghreb market. The Société marocaine de construction automobile (SOMACA) should therefore be expanded, since it undoubtedly offers a most suitable basis on which to launch the programme.

With regard to commercial vehicles and tractors, only assembly operations would be carried out in Morocco, which might have to reorganize this sector.

*Tunisia*

Tunisia could specialize in the production of light (1–2 ton load capacity) vehicles and farm tractors of less than 35 hp.

Tunisia could then also develop the production engines, partly for the light commercial vehicles and tractors made locally, and partly to meet the demand of the Maghreb market for stationary engines, expected to be at least 20,000 per year by 1980. To meet this rather wide variety of needs, Tunisia would do well to consider producing engines of the "add-on" type, so as to be able to supply the Maghreb market with engines covering a wide range of horsepower, from single-cylinder to 4–6 cylinder engines.

In addition, Tunisia could, like the other two countries, keept its own passenger car assembly facilities.

Table 7 shows the output that each country should achieve by 1980.

A new prospect thus opens up, namely, that by 1980 the Maghreb region could have several plants, each producing an output corresponding to a respectable level of "critical mass". For example:

Algeria

One plant producing 20,000 trucks per year;
One plant producing 14,000 tractors per year;
One plant producing 40,000 engines per year.

Tunisia

One plant producing 35,000 engines per year;
One plant producing 10,000 commercial vehicles per year.

TABLE 7. PRODUCTION POTENTIAL OF MAGHREB COUNTRIES IN 1980

| *Country* | *Passenger cars and petrol engines* | *Commercial vehicles and diesel engines* | *Farm tractors* |
|---|---|---|---|
| *Algeria* | Assembly (and local content confined to a few simple items) of approximately 50,000 PC per year (with CKD supplied by Morocco) | Complete manufacture of 20,000 CV (5 tons and above) and 40,000 diesel engines (35 hp and above) per year | Complete manufacture of 14,000 tractors (35 hp and above) per year |
| *Morocco* | Complete manufacture of approximately 100,000 PC per year (three models)<br>Production of 100,000 engines per year:<br>60,000 engines of 1,000 $cm^3$<br>30,000 engines of 1,500 $cm^3$<br>10,000 engines of 2,000 $cm^3$ | Commercial vehicle assembly (built-up parts supplied by Tunisia and Algeria) | Assembly of tractors or BU imports from CKD supplied by Algeria and Tunisia |
| *Tunisia* | Assembly of 10,000 PC per year (from CKD supplied by Morocco) | Manufacture, with high local content, of 10,000 light CV per year; 30,000 "add-on" engines per year | Manufacture, with high local content, of 2,100 tractors (under 35 hp) per year |

In the case of Morocco, a project for the production of 100,000 cars per year would be very worth while, even though this figure would still not be high enough for prices to be fully competitive on the international market. The programme, if adopted, would have the twofold advantage of cutting down prime costs and leading to savings in investment. There should also be other advantages. Detailed studies would have to be made in order to establish just what gains could be expected. At this juncture, only some likely orders of magnitude can be suggested, and the investment estimates given below are based entirely on ratios and past experience.

### Reductions in prime costs

The expanded production series which might result from well-organized co-operation in the Maghreb would lower production cost considerably, since the automotive industry is one in which increased output has a very strong impact on prime costs.

The reductions in prime costs which may be expected in each country are set out below.

#### *Algeria*

*Passenger cars*

If Algeria produced them on its own, the cost penalty might be in the region of

+45 per cent in a plant producing 50,000 cars per year of only one model (which is very unlikely);

+65 per cent in a plant producing three different models.

With specialization in the Maghreb, there would be only one passenger car plant in the region, located in Morocco.

This plant would produce 100,000 vehicles a year in three models, at production costs approximately 30 per cent higher than those of leading European manufacturers.

Assuming that Algeria would import CKD kits from Morocco, the approximate prime costs of Algerian produced vehicles would be:

| | (%) |
|---|---|
| CKD imported from Morocco | + 30 |
| CKD transport costs | + 5 |
| Assembly in Algeria[a] | + 5 |
| | + 40 |

[a] 50,000 vehicles per year; at this output assembly costs are approximately 50 per cent higher than for long series, and final assembly costs (including paintwork) account for approximately 10 per cent of the prime costs per vehicle.

The proposed plan would, therefore, enable Algeria to cut the cost of its passenger cars by 25 points, i.e. a reduction of approximately 15 per cent (index 140 instead of 165).

*Commercial vehicles*

It is estimated that on its own, Algeria could produce commercial vehicles in 1980 at an average cost penalty of approximately 25 per cent by comparison with European manufacturers' costs.

Under the proposed plan for the Maghreb, the cost penalty might be:

| | | (%) |
|---|---|---|
| Commercial vehicles produced in Algeria (approximately 20,000 per year) | | 0 |
| Commercial vehicles imported from Tunisia | | + 30 |
| of which: ex-works Tunisia | + 25 | |
| transport costs | + 5 | |
| Weighted average (allowing for the needs of the Algerian market) | | + 10.5 |

*Farm tractors*

If Algeria were to produce tractors on its own in 1980, it is estimated that the prime costs would involve a cost penalty which can be put at approximately + 15 per cent.

Under the proposed plan, tractor output might go up to 14,000 per year; since the engines made in Algeria would also be fitted to the commercial vehicles produced at the Rouiba plant, the cost penalty would, in view of the high output, come to practically nil.

The tractors needed by Algeria would then be delivered to the local market with the following cost penalties:

| | (%) |
|---|---|
| Tractors produced in Algeria | 0 |
| Tractors imported from Tunisia (20% + 5%) | + 25 |
| Weighted average | + 2 (approximately) |

Algeria would thus be in a position to eliminate virtually all cost penalties on the manufacture of tractors, which would be very helpful to its agricultural development.

#### *Morocco*

*Passenger cars*

With Morocco producing on its own and assuming that the local content of its production is raised to a very high level between now and 1980, the cost penalty could be expected to be approximately + 60 per cent for one-model production and + 85 per cent for three-model production.

Under the proposed plan, the cost penalty would be reduced considerably from about + 85 to + 35 per cent (CKD = + 30 per cent; assembly = + 5 per cent).

*Commercial vehicles*

Assuming that Morocco, producing on its own, would be able to make all the commercial vehicles it needs, which is not certain, the average cost penalty would be approximately + 25 per cent.

Under the proposed plan, the cost penalty would be:

| | (%) |
|---|---|
| Vehicles imported from Algeria | + 5 |
| Vehicles imported from Tunisia | + 10 |
| Weighted average | + 15 (approximately) |

*Farm tractors*

For tractors produced by Morocco on its own, a cost penalty of approximately + 25% is to be expected.

Under the proposed plan, it would be:

| | (%) |
|---|---|
| Tractors imported from Algeria | + 5 |
| Tractors imported from Tunisia | + 25 |
| Weighted average | + 8.2 |

The total cost penalty on tractors would therefore be reduced by about two thirds.

### *Tunisia*

It is highly unlikely, if Tunisia is confined entirely to its domestic market, that it could go much beyond the stage of simple assembly operations such as it performs at present.

Only the prices which Tunisia would pay for its vehicles under the proposed plan are given below; it is emphasized, however, that in return for accepting that arrangement, Tunisia would have to be able to set up plants producing light tractors and commercial vehicles, and engines for commercial vehicles, all with a very high local content.

*Passenger cars*

The cost penalty on passenger cars delivered to the local market would be:

| | (%) |
|---|---|
| Vehicles imported from Morocco, CKD | + 30 |
| Transport of CKD | + 5 |
| Assembly in Tunisia (output of 10,000 per year) | + 10 |
| Total | + 45 |

*Commercial vehicles*

The cost penalty would be:

| | (%) |
|---|---|
| Vehicles imported from Algeria (transport costs) | + 5 |
| Vehicles produced in Tunisia | + 25 |
| Weighted average | + 15 (approximately) |

*Farm tractors*

The cost penalty would be:

| | (%) |
|---|---|
| Tractors imported from Algeria (transport costs) | + 5 |
| Tractors produced in Tunisia | + 20 |
| Weighted average | + 10 (approximately) |

The case of Tunisia should, therefore, be given special attention, since it looks as if that country will have to pay more dearly for its industrialization than its two larger neighbours. On the other hand, the tentative estimates made for this study of the effects of the proposed plan compared with those of allowing the existing situation to continue suggest that Tunisia's investments under the plan would pay rich dividends, both economically and socially.

TABLE 8. PRODUCTION COST PENALTY: SUMMARY
*(Percentage of European costs)*

| | *Algeria* | | *Morocco* | | *Tunisia* | |
|---|---|---|---|---|---|---|
| | *On its own* | *With co-operation* | *On its own* | *With co-operation* | *On its own* | *With co-operation* |
| Passenger cars | + 65 | + 40 | + 85 | + 35 | – | + 45 |
| Commercial vehicles | + 25 | + 10.5 | + 25 | + 15 | – | + 15 |
| Farm tractors | + 15 | + 2 | + 25 | + 8 | – | + 10 |

*Note.* It is emphasized that the above estimates are based on productivity levels assumed to be the same in the Maghreb as in Europe; it has likewise been assumed that the number of models to be produced would be kept to a strict minimum, e.g. only three kinds of passenger cars, and that those models would have a relatively long life (10 years at least). If more models or shorter-life models were produced, the above percentages would go up considerably.

## Savings in investment

The preliminary estimates one can make with regard to investment, which at the present stage are to be regarded as very tentative, are as follows:

### *Algeria*

On its own, Algeria would have to invest the following amounts:

*Passenger car plant*

Algeria is expected to set up a plant able to produce 50,000 vehicles a year. The investment required (excluding technical assistance, staff training and the purchase of licences) may be put at 720 million francs.

*Expansion of the tractor plant at Constantine*

The capacity of this plant would have to be raised by approximately 70%. The investment may be put at 80 million francs.

*Expansion of the commercial vehicle plant at Rouiba*

The capacity of this plant would have to be raised to approximately 10,000 vehicles per year and a new plant established to make 1–3 ton commercial vehicles (approximately 4,500–5,000 per year). The cost can be

estimated at 200 million francs for the expansion scheme and 450 million francs for the new plant. The total investment to be made by Algeria would therefore be approximately 1,450 million francs.

*Morocco*

*Passenger vehicle plant*

The output of the SOMACA plant would have to be raised to 35,000 vehicles per year and local content brought up to the level proposed under the plan for inter-Maghreb co-operation. That would call for an investment of approximately 600 million francs.

*Commercial vehicles*

If Morocco were to produce these vehicles on its own, output in 1980 would have to be about 14,000. If they were manufactured entirely in the country itself, this would call for an investment of approximately 800 million francs over and above that already made.

*Tractors*

If the tractors were produced in Morocco and with a high local content, an additional investment of about 350 million francs would have to be made. The total investment to be made by Morocco would, therefore, amount to 1,750 million francs.

*Tunisia*

It is rather difficult to suggest figures for Tunisia at present, since at the level of output envisaged for this country it would not normally be possible to increase the local content to any great extent. To keep the calculations uniform, however, we shall assume for the sake of argument that the figures are as follows:

| | *Millions of francs* |
|---|---|
| Manufacture of passenger cars (and light commercial vehicles adapted from them) | 400 |
| Manufacture of commercial vehicles | 250 |
| Manufacture of tractors | 120 |
| Total | 770 |

Allowing for existing assets that could be re-used, the above total might come down to about 700 million francs.

*Maghreb*

Total investment for all three countries if producing on their own would be about 3,900 million francs.

**Inter-Maghreb co-operation**

Under the proposed plan, each country would be expected to make the following investments between now and 1980:

*Algeria*

Algeria's investment under the proposed plan would be as follows:

*Passenger cars*

Only an assembly plant able to produce 50,000 vehicles per year is envisaged. The investment may be put at 120 million francs.

*Commercial vehicles*

The capacity of the Rouiba plant would have to be raised to 20,000 vehicles per year. The investment called for may put at 750 million francs.

*Farm tractors*

The output of the Constantine plant would roughly have to be trebled. This would call for an investment of approximately 200 million francs. Algeria's total investment between now and 1980 would therefore be 1,070 million francs.

*Morocco*

*Plant producing 100,000 passenger cars per year*

The investment needed for a plant of this capacity would be some 1,000 million francs, i.e. about 900 million francs over and above that already made.

*Commercial vehicles*

Morocco would have only to assemble commercial vehicles for its home market, i.e. about 14,000 vehicles a year. This would call for an additional investment of about 100 million francs at the most.

*Farm tractors*

It is assumed that tractors would be assembled in existing plants from CKD kits imported from Algeria and Tunisia. The investment required would be very small; it may be put at 20 million francs.

Morocco's total investment would therefore amount to 1,020 million francs, most of which would go into the SOMACA passenger car plant.

*Tunisia*

The proposed plan would enable Tunisia to produce vehicles with a very high local content, thus going beyond the simple assembly operations to which it is now confined by the size of its home market.

The investment Tunisia would have to make would be as follows:

*Passenger cars* (assembly only)

The output of the STIA plant could be raised to 10,000 vehicles per year. The necessary investment would be, at the most, about 30 million francs.

*Engines*

A plant producing 20,000 to 30,000 engines per year would have to be established. A very tentative estimate puts the investment at 80 million francs.

*Light commercial vehicles*

A plant with a capacity of 10,000 vehicles per year would be required. For purposes of calculation the investment may be put at 400 million francs.

*Tractors*

About 2,000 tractors a year would have to be produced, using engines made elsewhere. The investment required may be put at 60 million francs, assuming that the local content would not be pushed to the limit. Tunisia's total investment would, therefore, amount to 570 million francs.

*Maghreb*

Table 9 shows the total investment for the region as a whole.

TABLE 9. INVESTMENT REQUIRED[a]

*(in millions of francs)*

| | *Countries producing on their own* | *Inter-Maghreb co-operation* |
|---|---|---|
| Algeria | 1,450 | 1,070 |
| Morocco | 1,750 | 1,020 |
| Tunisia | 700 | 570 |
| Total | 3,900 | 2,660 |

[a]In addition to that already made.

The saving that could be made on investment would thus be considerable. It may be put at 1,240 million francs for the period 1972–1980, i.e. a total saving of 33% on the investment the Maghreb countries would have to make if they were each operating on their own.

## CONCLUSIONS

The preliminary estimates made to establish the advantages of inter-Maghreb co-operation in the automotive industry show how greatly it would benefit the countries of the region if they agreed to develop their automotive industries jointly. Each of the three countries would derive considerable advantages from such an agreement, and the enlarged market for the vehicles produced by each country would, in many instances, open the way for exports to the international market. Thus, the change in scale that would occur could alter the very nature of the industrialization problems facing the three countries in the production of vehicles and combustion engines.

As has been pointed out, some of the plants which would be set up in the region would be of a size very close to the present critical mass in these industries; it is worth noting in this connexion that in 1968, there were some European firms with outputs of between 12,000 and 20,000 vehicles per year.

It is emphasized that the plan proposed in this study would take into account the various constraints mentioned above; in particular, each country would assemble its own passenger cars and some other types of vehicle. It is not inconceivable that, if the countries so desired, each might be allowed to assemble all the vehicles required by its home market. Another important point is that the proposed plan aims to give a fair share of the output to each of the three countries. The preliminary estimates show that each country would be allocated an output which would yield a value added in proportion to its share of the population of the Maghreb.

Implementation of the plan would require Algeria to take immediate steps to curtail its passenger car project, for which tenders have already been invited (for a plant at Oran), and confine this project to assembly operations alone. Thus Algeria would only set up an assembly unit, which would nevertheless be quite a large plant, since it would employ 2,200 to 2,500 workers.

The industrial prospects which co-operation would open up for the Maghreb countries thus appear highly attractive; the leading world manufacturers would be bound to become interested in this new economic grouping, and this would probably enable the Maghreb countries to negotiate agreements with such multinational firms, agreements which could be very much to their advantage in the long run.

# *Annex*

## PROJECTED MAGHREB DEMAND IN 1980

| | *Tunisia* | *Algeria* | *Morocco* | *Maghreb* |
|---|---|---|---|---|
| *Passenger cars* | | | | |
| Category A (under 1,200 $cm^3$) | 4,620 | 26,400 | 19,000 | 50,020 |
| Category B (1,200 $cm^3$ to 1,500 $cm^3$) | 2,210 | 13,200 | 9,500 | 24,910 |
| Category C (over 1,500 $cm^3$) | 905 | 5,130 | 3,275 | 9,310 |
| Total | 7,735 | 44,730 | 31,775 | 84,240 |
| *Commercial vehicles* | | | | |
| 1,200 $cm^3$ engine | 800 | 3,270 | 1,730 | 5,800 |
| 1,500/2,000 $cm^3$ engine | 1,200 | 4,800 | 2,200 | 8,200 |
| 1–1.5 ton load capacity | 685 | 1,895 | 1,820 | 4,400 |
| 2–3.0 ton load capacity | 275 | 2,595 | 3,630 | 6,500 |
| 3–5.0 ton load capacity | 300 | 3,125 | 5,075 | 8,500 |
| 5–7.0 ton load capacity | 350 | 3,500 | 1,950 | 5,800 |
| 7–10 ton load capacity | 200 | 1,600 | 1,100 | 2,900 |
| Over 10 ton load capacity | 245 | 1,095 | 565 | 1,905 |
| Total | 4,055 | 21,880 | 18,070 | 44,005 |
| *Farm tractors* | | | | |
| Light tractors (up to 35 hp) | 500 | 500 | 1,100 | 2,100 |
| Medium tractors (35–45 hp) | 610 | 1,700 | 1,690 | 4,000 |
| Heavy tractors (over 45 hp) | 500 | 6,350 | 3,150 | 10,000 |
| Total | 1,610 | 8,550 | 5,940 | 16,100 |

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