SPEED WITH SAFETY THROUGH NATIONAL PLANNING

by

RAGNAR FRISCH

ان المنبت لا أرضا قطع
ولا ظهرا ابقى

The hurried man will never reach his goal and he will lose his beasts.

From the Sayings of the Prophet MOHAMMED. (1)

I. - PROLEGOMENA

1. Acknowledgements

The following discussion of national planning is based on many years of study of the technique of planning and on practical experiences in my own country as well as in some underdeveloped countries. And it is based not least on many inspiring talks with and suggestions and help from prominent people in the Egyptian region of the United Arab Republic.

During my work here I have learned a great deal and I feel it a pleasant duty to give due credit to those who have contributed through inspiration or painstaking work towards the results now obtained.

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(1) This excerpt from the Prophet's Sayings was given spontaneously by His Excellency Hussein El Shafei, Minister for Social and Labour Affairs, as a comment to my remark that if one wants to reach a goal as quickly as possible, one must not try to save time by starting to run immediately, before having taken the time necessary to find out *in what direction* to run.

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My work has been carried out in a spirit of deep devotion and personal attachment to the cause of the materially underdeveloped countries and to that of the United Arab Republic in particular. I will feel happy indeed if my labours can contribute in some measure to this great cause.

2. The ultimate purpose

The ultimate purpose of progress is something way beyond an increase in living standards. It is cultural, spiritual and moral and it is a training in the philosophy of helping others.

This basic wisdom is a heritage from the great oriental and middle east thinkers and sages of old. It has been passed down to us through the centuries and millenaries in many different forms but always with emphasis on the superiority of contemplation, serenity, goodness and duty over and above the material desires.

To quote but one example: We find it typically expounded in the Indian Bhagavad-Gita (1). Here we learn that whenever action is needed and unavoidable, it should not be motivated by a desire for pleasure, material advantages and domination over others, but it should spring from goodness and a feeling of duty. Nothing should be considered as belonging to oneself. One should cherish a feeling of love for everybody, friends and enemies alike (2) and should wish the best for all creatures, men and animals.

But superior to all action, even the most virtuous ones, is contemplation, serenity of mind, composure and inner tranquillity. Only through these states of mind is it possible to be delivered from the sham of the material world with its desires and pains.

(1) The Bhagavad-Gita is part of the immense epopee Mahabharata. Bhagavad-Gita recites a metaphysical talk between the young prince Ardjouna and God before a big battle, God being disguised as one of Ardjouna's companions.

(2) An emanation of this virtuous attitude we find in the famous saying of Mahatma Gandhi "infinite resistance to the wrong-doing and infinite love for the wrong-doer".

Such thoughts were not confined to cultivation in the exclusive circle of a few intellectuals. It penetrated deep into the thinking of the millions and influenced their behaviour and outlook in a most profound way.

It is a significant fact that this eternal wisdom has survived in the materially underdeveloped but culturally, artistically and spiritually highly mature countries of the orient and the middle east. But it has been nearly completely forgotten in the overcomplicated, industrialized countries of the West.

It has been forgotten to a point where a faint gleam of the old wisdom, when it occurs, will appear to be a sensational discovery of something *new.*

Much has, for instance, been written lately about the "discovery" that it is necessary to find a new guiding principle, a new *purpose* in the economies of the extremely commercialized and developed countries.

It has become more and more obvious that the increase in productive capacity in these countries does not any longer serve the real and worthy *needs* of the population.

To find an increasing outlet for such consumer goods that can be sold at a profit in a free market economy, it has become necessary to *invent* ever new needs that can be forced upon the public through high pressure salesmanship, inducements to buy on credit and a reckless exploitation of people's fear of appearing not to be able to afford what "the others" can.

Slum-clearing, improvement of general sanitation and health services, general education, a general dissipation of cultural values, improvement in old age pensions, social security in general and the hundred other worthy things that can only be realized through Government initiative, represent wants that certainly do not need to be invented. They are there. But their satisfaction has lagged behind and only very slowly has it followed the general economic progress. The reason for this is simply that it does not, in a commercial sense, pay to satisfy these wants. There is no profit motive behind them. It pays better dividends to use the productive resources of the nation for the creation of and the satisfaction of more and more crazy *commercializable* wants.

In this way the materially highly developed nations have been led more and more towards the extreme opposite of the ancient oriental and middle east wisdom.

Life in highly developed countries has become more and more hectic, more and more concentrated on how to get hold of the newest gadgets for pleasure and high pitch entertainment, and on how to find means of paying the oldest bills due.

It is no coincidence that this development towards inner restlessness and tension has taken place simultaneously with a cult of the noisy, the ugly and the insane in all forms of art, and also simultaneously with a frightening increase in juvenile and adult criminality and a wave of psychiatric ills.

Is this necessarily the price we have to pay for economic development?

Do the materially underdeveloped countries have to go through this same cycle only to *rediscover* in the end the millennial truth which the ancient oriental and middle east thinkers and sages tried to teach us?

It would be defeatism to think that this is necessary. We *must* find a way to abolish poverty, illiteracy, malnutrition and ill health without losing the prizeless inheritage of old culture and old wisdom.

This *is* possible, but it takes a determinate policy to achieve it.

In the first place the economic development must be *guided.* It cannot be left to itself.

And in the second place we must clearly recognize that material development *has its real dangers.* At every turn of the road we must watch carefully that nothing is done that can work counter to the ultimate purpose of progress: the cultural, the spiritual and the moral values.

To be concrete: It serves a higher ideal to give the population of a materially underdeveloped country an opportunity to eat more eggs, and to stimulate its craving for harmonious art, meditation and high moral, than to furnish it with the latest gadgets for "enjoying" exciting entertainments.

Material development is necessary indeed. Nobody with a beating heart can fail to be moved by the present state of affairs in materially underdeveloped countries. But it must always be remembered that economic development is only a means towards a higher goal.

This confession, obviously, is based on a judgment of ultimate values, and it should, therefore, perhaps be outside the realm of the objective scientist. But it has such a basic meaning for the whole work on economic development that I must be forgiven for stating my case clearly before I now turn to the strictly economic analysis.

3. The causes of economic underdevelopment

The smaller the part of the national income used for consumption, i.e. the larger the part used for domestic investment or for exports (causing an improvement in the country's foreign balance), the more easy it will be for the country to assure *later* a rapid increase in the national income.

It does not take much originality to understand that here is the crux of the problem for the materially underdeveloped countries. The living standards are so low that it is out of the question to press them even lower. It is, therefore, difficult for such a country to start its upward move without foreign aid, either in the form of loans or gifts. To become *more* wealthy through its own efforts a country has to start by *being* wealthy.

This raises an interesting philosophical question: *Why* is it that some countries are to-day highly developed in the material sense and others underdeveloped?

This question is of precisely the same sort as the question of the ultimate causes - genetical, biological and historical - of the fact that the earth has become inhabited by such and such differentiated species of plants and animals.

It may be an alluring intellectual exercise to ponder about this, but such studies would not seem to be of much use for the politician or scientist who is eager to help overcoming as quickly as possible the sufferings of man. Such a politician or scientist will have to concentrate on the more immediately relevant factors.

To be concrete let us take the situation as it existed in Egypt in the last centuries or the last decades. There were three main and conspicuous obstacles to economic development.

First, *foreign domination*. The foreign rulers thought too much of exploiting the country. They only gave attention to such kinds of improvements that could advance their own interests and assure further exploitation.

Second, *feudalism*. This was a system which permitted one small national group, the big landlords, to exploit a large group of the rest of the population. It was in the direct interest of this small group to resist a general dissipation of agricultural improvement and modern technology. Such a development would have imperilled their own position as exploiters. This small group worked hand in hand with a corrupt monarchy.

Third, *private capitalism*. This system permitted another small national group to exploit a part of the population. This small group worked hand in hand with the foreign rulers. Sometimes the big capitalist interests were able to direct and shape the Government of the country.

This was the situation. No economic progress was possible before these three main obstacles were removed.

Now they have been removed. They have been removed through the institution of the democratic, socialist and co-operative society.

Can anybody doubt that this was a logical necessity, the prime prerequisite for effective development?

But it would be a fallacy to think that all that was needed was to carry out these main political and economic reforms. The rest cannot be left to take care of itself.

Once these reforms were achieved, a host of new problems of a more specific and detailed nature arose.

4. The difficulties

In underdeveloped countries that strive to achieve rapid economic progress, one is nearly always confronted with the same common pattern of difficulties and conflicting goals.

To create employment and raise living standards as quickly as possible in a rapidly increasing population, one starts more or less by force and active Government interventions, all sorts of economic activities: Improvemets in agriculture, industrial developments in light industries as well as in heavy industries like steel, fertilizers, electricity production etc.

Since all this activity means spending lots of money, an inflationary pressure emerges in the investment sector and there is a heavy drain on foreign reserves.

On the other hand the investment activity increases purchasing power in the hands of consumers. Social reforms such as the redistribution of land tend in the same direction. People want more food, more clothes - and perhaps more children. Since most of the production that has been started, does not immediately yield consumer goods, the inflationary pressure spreads to the consumption sector. If one should combat this latter form of inflationary pressure, one would have to redirect productive forces into consumer goods production. But this would retard final progress - a very unsympathetic alternative.

And again there is the eternal conflict between high standards of living through high production per man hour and the necessity of creating new jobs

In more advanced countries the problems are partly the same and partly different. For instance, here a new and special sort of inflationary spiral emerges which no country has been able to avoid. It works in booms and depressions alike. It is created through the fact that the price-wage fixation to a large extent takes place through collective bargaining or state organized negotiations between labour, industry and agriculture.

The bargaining must take place in this form if a general economic warfare is to be avoided. But in such negotiations it is always easier to reach an agreement by *raising* some rates than by lowering some rates, and so necessarily the inflation goes on. And each party will blame the others for "contributing to inflation".

So it seems that in whatever direction one looks, the situation is the same: By trying to solve one problem one creates several new problems. The whole picture is bewildering and it is hard to know precisely what course to follow.

The bewilderment stems from the difficulty of *taking account of several things at the same time* and from the fact that some effects are *inmediately visible* while others can only be traced by a highly technical analysis.

We now have to look closer into the nature of these difficulties.

II. - WHY NATIONAL PLANNING ?

1. Direct and indirect effects

In the current operations of a factory or a specific industry the inputs needed from other domestic sectors in order to produce a given output from the factory or industry in question (under an assumed system of prices, say the prices in a base year) can be determined fairly accurately from technical data. Likewise the amount of wages (labour) can be determined and also the distributed ownership income and the non competitive imports. The residual input (savings and taxes) is defined as equal to total product minus the above inputs.

These data are examples of *direct* effects caused by the current operations at a certain level of output in the factory or specific industry considered. To describe these direct effects one has to rely on specialists in the factory or the industry. These specialists will have a clear picture of the direct effects. But they will not be in a position to follow the infinite variety of *indirect effects* that will be produced all over the economy when an economic policy is adopted which will in one way or the other affect the ouptut of the factory or industry.

As an example of direct effects I listed the *non competitive imports*. These are imports of a kind of good or service for which it is obvious for natural or technical (or cost) reasons that they cannot be produced domestically either this year or some other year in the near future.

On the other hand imports of a kind of good or service that is or could conceivably be produced domestically (if certain investments were made), are *competitive* imports. Whether such imports are needed or not in addition to the local production in any given year now or in the near future, cannot be determined by considering only the current operations of any specific factory or specific industry. It will depend on the capacities of production in many of the domstic sectors (and these capacities may change in the near future) and it will also depend on the requirements for the various goods or services during the current operations in the whole economy in the years to come. Hence, the competitive imports are examples of *indirect* effects.

These remarks were concerned with the effects of the current operations of a specific factory or industry, but similar remarks apply also in the case of an investment project. The specialists will be able to describe fairly accurately the direct effects that will follow if the project is adopted. They can tell how much input will be needed from domestic sectors to carry out the the project, how much non competitive imports will be needed (for instance in the form of imports of machinery that cannot at this stage or in the near future be produced locally), how much labour is needed and so on. This they will be able to estimate for each year in the construction period.

Likewise they will be able to estimate the *addition to capacity* that will follow from the investment, and the year or years when the new capacity will emerge.

If the investment is expected to cause a *saving of inputs* in the subsequent current operations, for instance saving of raw materials or saving of labour (and, perhaps, for certain kinds of inputs the increase that will be caused), the specialist will also be in a position to estimate these savings (or increases).

All these data as well as the direct effects of the current operations that will follow when the factory or industry has reached the actual production stage, are features of the *project description*. Without an adequate project description no project can be taken seriously. All these data represent necessary information. They express the direct effects of the investment. The specialists can and should supply this information, and they should do it in the most precise form possible.

But in the investment field no less than in the field of current operations it will be impossible for the specialists to keep track of the infinite variety, of indirect effects. It would be humanly impossible for them to do so. Thus, while the information contained in the project descriptions is necessary, it is by no means sufficient for a rational decision on investment policy.

There are numerous and exceedingly important effects that are *not visible* from the project descriptions. This applies no matter how careful the specialists have been when the project descriptions were worked out.

Hence the need for a group of analysts who can build on the data from the specialists and who have at their disposal an analytical technique for following the indirect effects and drawing the consequences from them that are pertinent for decisions on investment and other aspects of economic policy.

This group of analysts are the national planners.

2. Investment planning vs. investment pushing

Without full knowledge of the indirect effects no true development planning can take place.

True planning means *overall* planning. No investment project should be accepted merely or primarily on the basis of a scrutiny of the information contained in the project description. It is extremely dangerous to build a decision on such a scrutiny.

Even though a project - or a group of projects - may appear to be "good" by an inspection of the data contained in the project description, and even though the project is favourably received by the public (perhaps under the influence of pressure groups) or by a group of authorities meeting to discuss the project on the basis of the project description and to evaluate the means of financing it, the project may have hidden consequences which, if known, might completely change the opinion on it.

In particular it might completely change the status of the project in comparison to *other* projects that compete for room within a given frame of scarce resources. True national planning means a *comparison* of all projects, not a decision on projects one by one or group by group.

To decide on projects on the basis of the direct effects that are visible from the project description is investment pushing, not true investment planning.

In public discussions the word planning is soarly misused. Most of the time it is simply taken as a synonomous with project making. Or at best it is taken as synonomous with what I have called investment pushing.

This confusion of ideas is one of *the greatest dangers to a speedy and safe development in underdeveloped countries.*

It leads to an enormous waste of resources (often a waste of which the public and even the authorities are not aware). After a while it will unfailingly lead to set backs and deceptions and a growing loss of confidence.

In the end it may even lead to a cataclysm which imperils political stability internally and externally.

These dangers are what true planning is designed to prevent.

3. A Tool is available

The results of a true planning analysis can and should be presented as an advice in a *flexible* form that does not hinder political manouvrability but increases it. It is not the task of the analyst to *make decisions*. Final decision should and must reside with the top level political authorities. The task of the analyst is to give an *advice* and to show what it would *cost* if the responsible authorities decide for one reason or another to deviate from what has been found to be the optimum policy from the strictly economic viewpoint.

The work which has been done in the National Planning Committee under my direction during the last years and with the whole hearted cooperation of the technical staff, has aimed at providing a tool for giving such a rational advice on economic planning.

This work has been done as a direct continuation of the ideas which I had the good fortune to put before the President on my first visit. The work has now reached a stage where concrete and practical applications can be made.

The analytical tool may be rough and incomplete as yet, but even so, it may be a real help in heading off brooding difficulties.

4. The seriousness of the problem

The following will illustrate the seriousness of the problem that may arise if investments are pushed one by one or group by group instead of being carefully planned in an integrated overall analysis where not only the direct but also the indirect effects are fully accounted for.

In his statement to American reporters on 21 March 1960 the President said that the development projects in the Southern Region for the next five years total about L.E. 1200 mill. and that about 40 percent of this would be expenses in foreign currency.

In a very restricted sense this figure of 40 percent is true. But the figure does not give the full information about those features of the foregin currency or foreign indebtedness side of the problem which are the crucial ones to know when a decision is to be made.

The figure 40 percent only expresses the *direct* foreign currency expenditure on the projects over the years envisaged. In this connection it does not matter very much whether each project is looked upon separately or the projects are aggregated into groups, one project being, perhaps, considered as a needed complement to another. The figure 40 percent would not be much affected by a regrouping.

What matters enormously is that the figure quoted only takes account of a part of the burden on the foreign balance of indebtedness. To this figure must be added all the *indirect* imports required.

Any single investment will need a great variety of inputs from domestic sectors of production, and these domestic sectors, in order to be able to make the deliveries to the investment projects *will in turn need imports on current account*. There is a great variety of indirect effects of successive orders of this sort that must be taken into account. And there are also other sorts of indirect effects. In the sequel some practical examples of this will be given.

These examples are only intended to illustrate *the kind of analysis* that is needed. They contain no reflection whatsoever on the extent to which it will actually be possible to carry the expansion. In particular they contain no reflection on the possibility of doubling the national income in 10 years.

5. The Idfo Sugar Factory

The Idfo Sugar Factory(1)to be built near Luxor needs imported machinery and other imported items that are directly visible from the project description. These imports are parts of the 40 percent quoted above.

In addition to this the contruction of the Idfo Factory will need inputs from a number of domestic production sectors. The followring items produced locally may be mentioned:

Steel

Cement

Glass

Fixtures, e.g. doors and windowframes of wood

Roofing material

Electric wires.

As an example take steel and let us consider its production in the Helwan Steel Factory.

(1) For concrete data in connection with this and the following examples I am indebted to Dr. Mahmoud Shafie.

This production will yearly need inputs of various sorts, for instance:

Imports of coke, manganese, chrome etc.

Iron ore from Aswan

Transport of ore by rail (or barges) from Aswan

Water (steel production and other metallurgical productions are heavy water consumers).

Lime

Electricity

The imported coke, manganese,chrome etc. which are needed to make the Helwan Steel Factory able to deliver the steel to the Idfo Factory, are obviously items that must be counted as imports *caused by the construction of the Idfo Factory.*

Similarly: The wooden fixtures that are produced locally will need import of timber. How much of such imports are needed to produce the wooden fixtures for the Idfo Factory?

The above are only examples of *first order* indirect effects. To exemplify second order indirect effects consider the rail transport of iron ore from Aswan to Helwan. This transport will need yearly inputs of such imported items as coal and or heavy oils (solar or mazout). How much of such imports are needed to put the steel factory in a position to deliver the steel that is needed to build the Idfo Sugar Factory? This also must be added as an import effect of the construction of the Idfo Factory.

As another example of second order indirect effects, consider the domestic production of the electric wires needed for the Idfro Factory. Let us for simplicity disregard whatever imports that may be needed directly for the production of these wires, and let us assume that all inputs into the production of electric wires come from the following domestic sectors:

Metallurgical Industries

Textile Industry

Rubber Industry

Plastic Industry.

As an example take any of these sectors that deliver inputs to the production of electric wires, for instance the metallurgical industries. They will need some direct imports that must be charged to the Idfro Factory. And - equally important - they will need fuel and transport. And so we are *back*

to a similar cycle of indirect effects as we discussed for that part of the steel factory production which was needed to enable the steel factory to deliver the steel used in the construction of the Idfo sugar factory.

It will be readily recognized how utterly impossible it is to describe all these effects adequately without a well worked out technique of overall national planning. Many of the indirect effects may be small, but the total may be considerable.

6. The consumption effect

But this is not all.

Any investment activity will cause an increase in the flow of wages and distributed ownership income to consumers. And this will entail an increased demand for consumer goods. This demand will partly be directed towards imported consumer goods, and this is an example of first order indirect import effects in the consumer direction caused by an investment activity.

But the increased consumer demand will also be directed towards locally produced consumer goods, and this production may in turn need imports, and so we are back in a new cycle of import repercussions of the second, third and higher order.

The increase in consumption may be looked upon as in itself a desirable feature, but this point is irrelevant in the present connection where we only want to face honestly and correctly the complete import effect of a given investment policy.

7. The peak load of foreign indebtedness and the recuperation period

Through an adequate analytical tool it is possible to describe with a fair degree of approximation what the *total* balance of trade effect will be of a given investment policy. It is possible to estimate the effect on the country's net foreign indebtedness in each year in the near future.

The total effect of any given project will as a rule have the following course. To begin with it will add to the country's net foreign indebtedness, and later it will reduce this indebtedness because it will have a net positive effect in increasing exports and or saving imports.

In this connection there are two questions that are absolutely crucial:

First, how large is the *peak load* of foreign indebtedness which a given project will entail?

The meaning of this is the following. We cumulate from year to year the additions to foreign indebtedness which a project will produce so that we have in any year a picture of the total existing foreign indebtedness which this project has produced up to this time. And then we ask: What is the *maximum* which this total indebtedness will reach?

And we may add: In what year will this maximum occur?

If all existing projects and all those needed to double the national income in 10 years are pooled together, the peak load on foreign indebtedness will amount to a considerable figure. A fairly exact figure can be estimated when a complete list of projects is specified.

These figures apply if the projects are decided upon more or less ad hoc taking the projects one by one or group by group and basing the decisions primarily on the effects that are visible from the project descriptions. A considerable saving in the peak load of foreign indebtedness is possible if all the projects are considered in an overall national analysis and a special technique is applied to find out the *optimum structure* of the investment policy.

Second, how long is the *recuperation period* of a given project? The recuperation period is the number of years that will have to elapse before the project has paid its way back in terms of foreign indebtedness, when all effects, direct as well as indirect, have been accounted for. In other words, it is the number of years that will have to elapse before the total foreign indebtedness which is entailed by the project, has been brought down to zero. It is surprising how long this recuperation period is for many projects. And it is surprising to see how fundamentally this feature will influence the optimal decision on acceptance or postponement of a given project.

8. The compelling necessity

If it shall be possible to reach the goal of doubling the national income in 10 years, and if it shall be possible to do so in a *safe way* without causing set backs and deceptions and a loss of confidence that may endanger political stability, it is a compelling necessity to face fully the need for rational and operational planning.

This will involve the following steps:

First, one must intensify the work on the *elaboration of projects*. One needs a stockpile of projects many times as large as one can hope to go through with. And each project must be carefully described. Without careful project descriptions no form of rational planning is possible. And - equally important- one must not only concentrate on project elaborations for big and conspicuous

project, but pay due attention to a large number of medium and small projects. And the projects must be as diversified as possible.

Second, no project should be accepted before its *overall effects* - direct as well as indirect - have been fully clarified. This involves a processing of the available date which goes very much beyond the kind of information which is immediately visible from the project descriptions.

Third, an analytical technique must be used to find out what is the *best selection* of the projects - the optimum selection - from the national economic viewpoint when all effects, direct as well as indirect, are taken account of.

As a first approach an analysis has been made on the basis of the existing data in the Egyptian region. The results are available.

In the sequel the main features of the analytical machinery used will be described. It will be done in all brevity. Anyone who wants to be informed about details should consult the specialists in the National Planning Committee or read the memoranda or other special expositions prepared in the Committee.

III. - THE ANALYTICAL MACHINERY

In the following description of the analytical method followed to reach a flexible advice on investment policy, many details have been left out, but a fairly complete *enumeration* is given of the various economic magnitudes and relations considered. Wherever convenient I have given footnote references to mimeographed material where more detailed explanations can be found. (1).

1. A planning advice must be operational

1a. What is meant by "operational"?

To be operational an economic analysis must lead to an advice on a specific *decision to be made* or an *action to be taken* regarding a practical, concrete problem.

Frequently it is a problem that is circumscribed in considerable detail.

Typical examples of questions that can be made the object of an operational advice are questions about investments. It is necessary to build up a scheme of investment analysis which is such that it leads - for any *single* investment project or for a *group* of projects - to a definite advice in the form of "yes" or "no" or "so much".

(1) In particular I have referred to my series of "Memoranda" and "Current Notes". These references will be abreviated in the following way.
M28-2 Memorandum No. 28, Section 2.
M28 (4.1) Memorandum No. 28, Tab. - or formula - (4.1).
CN16-3 Current Notes No. 16, Section 3.
CN16 (3.4) Current Notes No. 16, Tab. - or formula - (3.4).

A discussion of such general concepts as the savings rate, the total employment and similar macroeconomic magnitudes is not operational because these magnitudes are not object of direct decision and action. They are *consequences* of such decisions and actions. The operational analysis must aim directly at the magnitudes that pertain to decision and action. Only in this way will the analysis be immediately applicable for practical purposes.

1b. Investment planning vs. general planning

General economic planning will, of course, involve decision on a number of questions that are not directly concerned with investments but with the current account operations of the economy. And to the extent possible decisions about these aspects should be drawn into the analysis. But investments play such a dominant rôle and has such vital consequences in nearly all compartments of the economy, that it seems justified - at least in the first approach in an underdeveloped economy - to pay particular attention to them. This will be done in the sequel.

1c. Planning period and repercussion period

The planning period is the span of years for which one considers the direct decisions and actions. A five-year plan, for instance, will give more or less detailed lists of investments to be started in each year of the plan.

In order to reach a rational decision about the actions to be taken in each year of the plan, it is, however, necessary to have an open eye for the economic *repercussions* that will follow over a longer period after the planning period. This more extended period is the repercussion period.

For instance, even if the actual plan is confined to five years, it will as a rule be necessary to consider the repercussions over at least 10 or 15 years. For certain special repercussions one may even need to consider a longer period, for instance for investments in capital goods with a very high life expectancy (electric power stations etc.). For most effect it will, however, be sufficient to consider 10 or 15 years. Beyond this time so many unexpected things may happen that the foreseable effects lose themselves in the haze of the future. (1).

(1) CN5-5.

1d. Planning at the establishment and commodity level

The most complete and most satisfactory approach to planning is to base it on the experiences and relations of individual *establishments* (1) and to take full account of the *physical balances* for a number of the key commodities (2).

Some work on physical balances have been done in the National Planning Committee and it is the intention to carry this work further. Certain aspects of establishment problems for big establishments (such as the Helwan Steel factory) have also been considered. But in the approach for which an optimal solution is now available, more aggregated concepts of investments and current account operations have been used.

1e. Planning in projects and planning in channels

In the spring of 1959 quite extensive analyses were made in the National Planning Committee with a view to reaching investment advice on *individual project*. The experiences were methodologically very successful and there is a definite feeling that this approach is fruitful and that considerable emphasis should be put on this type of analysis as soon as more reliable project data become available.

Awaiting these more exact data it has been found more useful to aggregate the projects into *channels* - i.e. groups of projects - and base the channel characteristics on whatever information may be available through existing projects or other sources. It is felt that in this way inaccuracies of the data will be smoothed out so that conclusions will rest on a more solid foundation.

2. The macro-structure of the economy

2a. The interflow table

In order to keep track of the various economic magnitudes and assure that the balancing principles amongst them are taken care of, it is necessary to use an interflow table where each delivering sector has its row and each receiving sector its column, and where there are also rows and columns for other of the important concepts.

Such a table is invaluable not only for correct processing and balancing of numerical data but also for *correct thinking* about the relations between the various magnitudes. When using such a table one is automatically forced

(1) I use the terminology of ISIC (International Standard Industrial Classification of all Economic Activities). An establishment is the technical unit (plant, factory) while enterprise is the commercial unit that may comprise several establishments.

(2) Details in this connection are discussed in a memorandum of 1 May 1960 from the Institute of Economics. University of Oslo.

to take account of all effects. The effects must appear *somewhere* in the table. It is impossible to escape them whether they are agreeable or not.

Such tables can be worked out numerically for every planning year and every repercussion year once the structure of the plan is fixed. They have played a great rôle in the analyses in the National Planning Committee (1).

The special technical problems regarding the system of prices to use for recording (ab sector prices, that is, prices exclusive of trade margins, cif or fob prices etc) and the balancing of the interflow table under changing prices will not be discussed here (2).

2b. Sectorial input coefficients

A main feature of the simplification from the establishment and commodity approach (as discussed in Subsection 1d) is the aggregation of the current account operations of the economy into *sectors*. In the National Planning Committee sector breakdowns at various levels are available. In the present analysis aiming at advice on optimal investments one considers 31 sectors, namely.

1. *Agriculture*

Industry:

2. Food industry
3. Leather industry
4. Petroleum industry (refining).
5. Mining and Quarrying (including prospecting for oil).
6. Basic chemical industry.
7. Building materials industry.
8. Basic metallurgical industry.
9. Pharmaceutical industry.
10. Engineering industries.
11. Textile industries.
12. Electricity production.

Construction activity:

13. Construction of houses (residential and all others).
14. All other construction activity.

(1) M28 - (2.1), (2.2) and (4.0)
(2) CN5-3, CN5-4, CN 12-1, CN 13-2.

Transportation, communication and storage:

Inland transportation

15. Railways (tracks, stations and rolling stock)
16. Intertown roads (including intertown buses and trucks)
17. Intratown transportation (including trams and intratown buses).
18. Water transportation (including barges).
19. Pipe-lines (including pumping stations).
20. Marine transportation (domestic and competitive imports.).
21. Air transport (domestic and competitive imports).
22. Communications (telegraph, telephone and post).
23. Storage facilities.
24. Suez Canal.
25. *Housing* (Ownership of buildings intended for habitation, offices or incidental shops, but not separate factory buildings).

Public works:

26. Water supply.
27. Sewages.

Services:

28. Trade and financial services.
29. Personal services.
30. Special training (vocational and technical).
31. Tourism (including hotels).

For each such sector has been estimated the current account *input coefficients*. These are coefficients that indicate how large a proportion of the total ouptut from any given sector will normally come form each of the other sectors. (1).

In computing these coefficients much will, of course, depend on the precise definition of what is included in the various sectors. One important feature of the table for the Egyptian region is, for instance, that most of the cotton is looked upon as passing from "Agriculture" to "Textile industries" to be ginned (or further processed). Most of the export value of the cotton will therefore come from "Textile industries", not from "Agriculture".

Special training is an important sector. Investment in this sector is just as important as investment in a factory (2).

(1) M28 (2.1).
(2) CN3-4

The substitution possibility between different kinds of inputs (for instance because of changes in relatives prices) raises the problem of the *constancy* of the input coefficients over time. If the sector specification is not too detailed, this problem will not be very serious, at least not in a first approximation.

A more serious problem in this connection is the infra-effect of investment, i.e. the effect which investments may have in changing the current account input coefficients. This effect is taken care of in an approximate way (1). Compare also the remarks below under 3 f.

Besides the current account input coefficients from sectors we also have to consider the current account input coefficients from the following sources:

32. Non competitive imports.
33. Wages.
34. Distributed ownership income.
35. Residual input (taxes and gross non distributed profits).

2c. Government input coefficients

Also for Government consumption on current account (in the direction of Health, General education, Government administration, Basic scientific research, Culture and Defence) input coefficients have been used expressing how large a proportion of the total Government outlay in a given direction comes from each domestic sector 1 - 31 or from the sources 32 - 35. (2)

2 d. Private consumption coefficients

Private consumption of the product from the various sectors, and from the other sources 32 - 35, has been looked upon as depending on the *income* of the private households. The relevant coefficients form an important part of the analysis. (3).

A special treatment was given to the private demand for housing and intratown transportation. For these categories of demand account was taken of the fact that a *demand pressure* may exist because the available supply is not sufficient to satisfy demand (4).

(1) CN 16-5.
(2) CN 18 (4.13).
(3) CN 8-2, CN 18 (4.12).
(4) CN 12-3.

3. The project descriptions

3a. Importance of the project descriptions

The project descriptions form an extremely important part of the operational investment analysis. In the project descriptions one aims at *standardizing* and *stream-lining* all the project information that is relevant for optimal investment analysis.

Such a standardization and stream-lining are needed because of the bulk of the material that frequently accompanies the presentation of a project and because of the different ways in which the primary material is often organized.

Much work on systematization of project descriptions has been made in the National Planning Committee and the work continues. The project description is one of the fields where extemely important practical results will emerge by an active cooperation and support from all Ministries and other organizations engaged in Planning.

3b. The concept of a project

When circumscribing what is meant by a "project", one should try as much as possible to group together as a single "project" everything that really belong together *technically*.

For instance roads and railways that are immediately needed either during the construction period or in the subsequent current account operation of a factory or a power station should be considered as part of the investment project for the factory or power station. (1) Similarly a steel factory should be considered in connection with its technically subsidiary establishments.

In the case of the housing accommodation for the workers or experts or administrators connected with a factory or power station, the question must be handled in a different way. We take it as a separate investment that is *complementarily connected* with the factory or power station (2). Compare also the remarks below under 5h.

3c. Investment starting vs. carry on activity

In a truly dynamic analysis, such as is needed in operational planning, we cannot assume that all inputs needed for the realization of an investment project take place in the same year. The *time distribution* of inputs is essential.

(1) CN 2 - p.7, CN 5 - 6.
(2) CN 2 - p.8.

This leads to a clear distinction between the *starting* of the realization of an investment project and the *carry-on activity* which is needed in order to complete it.

The following numerical example will illustrate the situation (1).

Let 50, 70 and 10 be the *total* outlays (in, say, thousands of L.E.) which will be involved in three projects that are to be started respectively in years 1, 2 and 3, (year 1 being, for instance, 1960). Suppose that for all these projects 30 per cent of the total outlay will take place in the same year as the project was started, 50 per cent in the next year and the remaining 20 per cent in the following year.

The carry-on activity in each of the years 1, 2 ... 7 will then be as indicated in tab. (3c. 1) below.

Table (3c. 1) **Illustrating the carry-on activity**

Total actual investment input in the calender year

	t= 1	2	3	4	5	6	7	Total
From first project	0.3×50	0.5×50	0.2×50	0	0	0	0	50
From second project	0	0.3×70	0.5×70	0.2×70	0	0	0	70
From third project	0	0	0.3×10	0.5×10	0.2×10	0	0	10
Total actual investment entailed by the above startings	15	46	48	19	2	0	0	130

A similar consideration may be made about each specific category of carry-on inputs needed, for instance inputs from each specific domestic sector or from the sources 32 - 35.

3d. The carry-on coefficients

When the carry-on inputs connected with a specific project are expressed in relation to the *total* outlay involved in this project (the total indicated to the right in tab. (3c. 1) above), we get what may be termed the carry-on coefficients of the projects. These coefficients play an important rôle in the optimal investment analysis.

(1) CN3 (3.5)

A great amount of work has been done in the National Planning Committee on computing these coefficients. (1).

3e. The capacity-effect coefficients

The capacity of a production sector is a factor which excerts a *limiting effect* on the production in this sector. It is a limiting effect superimposed on the limiting effect which stems from the limited supply of the current account input factors and is expressed through the sectorial input coefficients (compare Section 2b above) - and possibly also superimposed on other capacities. (2).

The capacity can be increased (later) through investment startings (now). This is a fundamental dynamic relation that enters into the operational investment analysis.

The effect which an investment has in increasing the capacity of one of the 31 sectors listed in Section 2b above was considered in its complete dynamic form. The time shape of this capacity effect can be considered for any single project as well as for a channel of investments. In the latter case we simply have to aggregate the characteristics of the individual projects so as to get an expression that is characteristic for the channel as a whole.

In the work now done we considered one specific channel of investment for each of the 30 sectors Nos. 2 - 31, and two specific channels la and 1b for agriculture, namely horizontal and vertical expansion respectively. In addition some specific channels were considered such as High Dam, Harbour facilities and Airport facilities.

The main characteristics of the capacity effect time shape are the following four time periods (3). The *waiting period* indicates the length of the time when investment activity goes on before any result in the form of actual production from the factory or capital good starts to emerge, the *growing period* is the time during which the actual production stage is reached, perhaps little by little (one aggregate after the other being put into operation in a power station), the *stationary period* is the time during which the factory or capital good in question exists in complete and full working order - regular maintenance being assumed but no replacement (4) - and the *declining period* is the time during which the capacity effect is gradually exhausted and reduced to zero.

(1) CN 8-4.
(2) CN 14 (1.8) and CN 9-2.
(3) CN 8 text between (5.6) and (5.7).
(4) CN 2-2.

A considerable amount of work was done in order to determine theee characteristics for the investment channels considered, using life expectancy data from other countries as well as different kinds of Egyptian data (1). Ths difference between these characteristics for modern and non modern equipment was taken care of explicitly (2).

In addition to these four time characteristics we need information about the output to capital ratio. The concept needed in operational analysis is gross output to gross investment (i.e. to the magnitude recorded in the last column of tab. (3c. 1) above). (3) Seven different types of data were compared in order to arrive at reliable figures for the output to capital ratio applicable to the Egyptian situation (4). The ratio thus determined gives the capacity effect coefficient during the stationary period, and the effects during the growing period and the declining period are determined by a simple linear interpolation. (5)

In certain special cases it is necessary to consider the concept of capacity in its relation to the concept of input coefficients in order to arrive at a clear and logical definition (6).

3f. The infra-effect coefficients

These coefficients express the effects which an investment may have in changing the input coefficients. Compare Section III. 2 above. These coefficients have a time shape similar to the capacity effect coefficients. (7)

3g. Project checking and auditing

To check and audit the various project data in the particular form needed for operational investment planning is a work that demands special knowledge and training. People working in this field must have some knowledge of the operational purpose for which the data are to be used and experience in the usual auditing technique and at the same time they must have intimate contact with the various Ministries and other organs where work on project making goes on.

It is therefore highly desirable to create a *specialized organization* for this checking and auditing work.

Whether it should be done in a centralized unit or through specially trained experts working in the different Ministries and other organs concerned

(1) M 28 (4.4).
(2) CN 14-1.
(3) CN 12-2.
(4) M 28 (4.4), CN 11-20.
(5) CN 14-1
(6) CN 13-1
(7) CN 16-1 and CN 16-5

with project making, is a practical matter. In any case it would seem natural to relieve the National Planning Committee of this work.

3h. Project guidance

The possibility of making rapid and safe strides towards economic development depends very much on the presence of a great stockpile of that particular kind of projects that can give the highest possible contribution to the optimal solution. The special features of a project that are the most valuable ones in this connection will be *approximately known* from previous work on operational investment analysis in the Egyptian Region (pilot investigations or more extensive investigations that have now been done).

These particular project features can be described and publicized for the benefit of all organizations working on project making. Project making should then be concentrated in the direction of projects that have as much as possible of the desirable features. As mentioned at the end of Section 6 below, some generally desirable features are a high output to capital ratio, a low peak load on foreign indebtedness and a short recuperation period. But other and more special features can also be indicated.

These guiding principles should be used in the project making, but they should never replace the subsequent operational analysis. Compare Sections II.1 and II.2 above.

4. Committed-to vs. decisional elements

4a. General remarks on committed-to vs. decisional elements

Planning is a continuous process. At any stage certain decisions will previously have been made and certain actions will have been taken. The effects of these decisions and actions will go on, and will have to be taken as *data* in the situation where new decisions are to be made. Hence the need for a clear distinction between the committed-to elements of the analysis and the truly decisional elements. The latter are the elements for which there is still a possibility of saying "yes" or "no" or "so much".

This distinction applies to any element entering into economic policy making, and in particular it applies to the investment activity.

When looking upon an investment project from this angle, the concept of committed-to should be interpreted in a *restricted* sense (1). Included in the concept are projects on which work has already been started and also projects for which *irrevocable* decisions have been made in the form of signed

(1) CN 2-1.

contracts, and furthermore projects that are technically inseparable from projects that are already committed-to according to the above definition.

But a project should not be considered as committed-to by the mere fact that it has *in principle* been accepted by a high authority. Such a decision may indeed be reversed later when the consequences for the national economy of all projects have been better clarified through a scrutiny of the results of an overall, operational planning analysis.

4b. The carry-on effects of committed-to investments

Considerable work has been done on describing these effects as precisely as possible. We are here interested in the final result measured in absolute figures, but information about carry-on coefficients may be helpful to reach the absolute figures. (1)

4c. The capacity-effects of committed-to investments

This also took considerable research effort. (2) It is believed that the results obtained are satisfactory.

4d. The extradecisional startings

There are also elements that are taken as *data* in the decisional analysis, but they are data of a somewhat different character from the committed-to investments dicussed above.

They represent investments - particularly investments in some very big projects - which are in fact not yet committed-to but which the analyst wants to single out for special treatment. He may for instance work a whole optimal solution through under *different assumptions* regarding the extradecisional startings. (3) This will give a more complete picture of the consequences that would follow from some particularly important big decisions.

5. Repercussion-coefficients

5a. Decisional magnitudes and repercussion magnitudes

Combining all the various kinds of information described in Sections 2-4 above it is possible to classify all the relevant magnitudes of the economy in two distinct groups: the *decisional* and the *repercussional* ones. The former represents the "causes", i.e. the magnitudes which can be directly and

(1) CN 8-3, CN 18 (4.14) and (4.15).
(2) CN 14-2, M 28 (4.7a), CN 18 (4.7b)
(3) CN 4-3, CN 8-10.

immediately decided on and acted upon. The latter represents "the effects", i.e. the consequences that follow when the decisional magnitudes have been fixed.

The explanation of the *way* in which the decisional magnitudes affect the repercussional ones is the main purpose of the first stage of the operational analysis.

5b. The repercussion-coefficients

The way in which the repercussions take place is described through the *repercussion coefficients*. These are coefficients that indicate how large a change that will be caused in a given repercussion magnitude if such and such a change is made in a decisional magnitude (and all other decisional magnitudes are unchanged).

5c. A general form of the repercussion coefficients

The repercussion coefficients may be worked out in a general form or under more special assumptions. In the operational analysis now made it was decided first to work the coefficients out under the most general assumptions, i.e. by considering a rather large list of magnitudes as decisional. This gives more freedom in making later simplifying assumptions, and it also gives more insight into the structure of the economic relations. (1)

5d. The simplified form of the repercussion coefficients

Subsequently some simplifying assumptions were made which would reduce, or completely eliminate, the number of non-investment decisional variables.

For instance, the sectors were divided in two groups, one for which it was assumed that the addition to capacity that emerged through investments, was always fully utilized, and another group for which it was assumed that export could be estimated ad hoc and thereafter taken as a datum in the operational analysis. (2) It was felt that these simplifications were quite justifiable at the present stage.

The repercussion coefficients that resulted from these simplifications were the ones actually used. In order to be able to handle the great number of data and coefficients that entered at this stage of the work, extensive use was made of punch cards and punch card computations. (3)

(1) M 28 (4.1).
(2) M 28 (4.2).
(3) CN 19-1 and 2

The final result appeared in a form where all repercussions depended only on the *decisional investments*. This is the form that is particularly adapted for operational investment analysis.

In this form it is possible to attack not only the problem of which investments to accept and which to reject, and the investment amounts to be used in the different channels, but also the problem of *phasing*, that is to say the problem of deciding in what year to make the various startings.

But the form considered also permits to make further simplifications, for instance to assume a fairly uniform time distribution of the startings in each channel and to determine only the *amount* of this uniform starting in an operational way. (1) This has been worked out as a first approach, but the shape of the data permits also to work without this extra simplification.

5f. A list of repercussion effects

The following is a list of some repercussion magnitudes studied by means of the repercussion coefficients.

Exports - in each repercussion year - from all sectors for which the exports were not estimated ad hoc.

The total production - in each repercussion year - in all production sectors.

The net foreign indebtedness in each repercussion year.

Private savings (and taxes) in each repercussion year.

The gross national product (essentially the same as national income) in each repercussion year. The investment effect on national product will normally increase up to a maximum some 3 or 4 years after investment starting, and then decline somewhat (because the income producing effect of the carry-on acticity itself disappears). (2).

From the above effects it is possible, if wanted, to estimate practically all other important magnitudes that characterize the constellation of the economy in a given year.

5g. Projections of the economy

The repercussion coefficients in the simplified form described under 5d above, can also be used for *other purposes* than operational analysis proper.

(1) CN 19-5. Compare also CN 7-4 and CN 9.
(2) M 20-15.

In particular they can be used for *projections* (forecasts for the economy)(1).

When projecting the future course of the economy over, say, five years, it is absolutely essential to make some assumptions about the investment decisions that are to be made. This is necessary because the amount of and the distribution of investment has such a fundamental influence on the speed and nature of the development.

A projection which is made without specific assumptions about the nature of the investments to be made, but relies primarily on an extrapolation of observations of the past, may be of some interest in a country where the development is left more or less to proceed by the free play of forces, but it certainly has no meaning in a country where the development is proclaimed to take place under strong national initiative and steering, and where the explicit purpose of the policy is to *change the previous course of affairs*, and to reach specific goals.

This being so, the repercussion coefficients permit to make the projections in a logical way once the necessary assumptions about investment startings are made. The repercussion coefficients also make it possible to study the further course of the economy under different *alternative* assumptions about the investment startings.

The working out of a number of such projections has a considerable didactic value. It will demonstrate how impossible it is to find a really *optimum choice* of the investment startings without an operational technique that permits to locate the best alternative.

5h. The complementarity coefficients for startings

In Section 3b above was mentioned that not all technical interconnections between projects - for instance housing accommodation in connection with a factory or power plant - (2) could be conveniently handled by grouping projects together. If we should try to solve all complementarity problems in this way, we would finish by considering the whole economy as one single "project".

In certain cases it is, therefore, necessary to consider several projects as items that in many respects are separate but in a specific way are interconnected through complementarity coeffiients. (3) This leads amongst other things to the distinction between the autonomous and the consequential parts of a starting. (4) A special computational technique was developed for handling problems in this field. (5)

(1) CN 15-3 and 3b.
(2) CN 2-4.
(3) CN 8-7.
(4) CN 4-2, CN 11-27.
(5) CN 7-1, 2 and 3.

6. The optimum selection : A simplified example

To illustrate the nature of the optimum selection of an investment policy on the basis of data of the form discussed in the previous sections, we will go through an extremely simplified example. The figures in this example have on purpose been chosen so as not to reveal any significant fact about the Egyptian economy. They are chosen much smaller than those that will actually apply. The actual figures are contained in memoranda to the National Planning Committee.

The problem of the optimal selection falls in two parts: to indicate what are the *admissible alternatives*, and second to find which particular one of the admissible alternatives that is the best, the *optimal* one.

The admissible alternatives are defined through two kinds of conditions: the *bounds* that are imposed on the economic magnitudes, and the *relations* that these magnitudes have to satisfy. The admissible alternatives are the alternatives that are *compatible* with the bounds and the relations which the economic magnitudes have to satisfy.

The following are some examples of objectively given bounds: In a given investment channel (such as for instance agriculture, the textile industry, electric power stations etc.) it is impossible to push the investment beyond the limit given by the number and the amounts of the *projects* that are available or can reasonably be expected to be brought forward in the near future. The actual production in a domestic production sector cannot be pushed beyond the *capacity* that exists at any given time (and this capacity will itself depend on previous decisions on investments). The *export possibilities* of product from a given sector are at any given time roughly limited by the the situation in international markets. These possibilities are to some extent dependent on previous efforts of building up an export organization (much in the same way as the production capacity of a sector can be expanded by investments in the way discussed in previous sections), but at any given moment we are here facing a limiting factor that must be taken account of. A number of other examples of bounds could also be given.

Examples of relations between the economic magnitudes are: The relation between the *inputs needed* in a given sector of production and the total level of production in that sector, the relation between the *private demand* for domestic and foreign products and the income of the consumers. And so on.

Amongst the admissible alternatives thus defined we have to choose that particular alternative which is the *optimum* one.

Which one of the alternatives that is the optimum one, will depend on the specification of *what one wants to obtain.*

This is described through what may be called the *preference function*. The preference function is simply that particular economic variable or that particular combination of variables which one would like to see as *large as it is possible to make it* when account is taken of the bounds and relations which the variables must satisfy.

As one example of a preference function let us take the maximum rate of increase of the national income over the first five years. Is this the object one has in mind?

Or is it rather the maximum rate of increase of the national income over the first ten years, or is it a *compromise* between the maximum rate of increase over the first ten years and the possibility of expansion in a more *remote* future about which we cannot to-day say anything as definite as we can say about the first five or ten years. The kind of economic policy to choose and the decisions to be taken in order to reach an optimum solution, *will not be same* if we have one or the other of these various objects in view.

It is not the task of the economic analysts but that of the responsible politicians to choose the preference function. But consultations with the economic analysts must, of course, take place in order to reach a realistic formula. A technique for this consultation is an extremely important part of rational planning. And a flood of light can be shed on the whole problem of economic development if such consultations can take place regularly.

In the small example that is discussed in the sequel, it is assumed for the sake of argument that the preference function is taken to be the increase in national income in the course of five years.

In the programming analysis there are certain economic magnitudes that are *decisional*, i.e. magnitudes that have to be decided upon by authorities. Typical decisional magnitudes are the investments to be made in the different investment channels.

In our simplified example we consider only two decisional magnitudes, namely the average annual investment in *agriculture* and the average annual investment in *industry*. We may, for instance, think of averages over a five year investment period, say 1960-1964. It should be clearly understood that this extreme simplification is made only in order to exhibit the nature of the analytical technique. In actual computations in the National Planning Committee one considered in one case - the channel model - 31 decisional variables and in other cases even a much larger number.

The various combinations of the two decisional magnitudes in the example can be represented by point in the diagram fig. (6.1) where we have measured the annual investment in agriculture along the *vertical axis* (10 mill., 20 mill. ect. as indicated) and the annual investment in industry along

the *horizontal axis* (10 mill., 20 mill. etc. as indicated). For instance, the point P represents (as is seen by reading off from the diagram by the eye) 2 mill. in agriculture and 8 mill. in industry, the point B represents 7.5 mill. in agriculture and 12.5 mill. in industry, the point D repersents 3.5 mill. in agriculture and 27.5 in industry, and so on. Any such point we may call an *investment point*. As long as no additional conditions are imposed on our choice, all the investment points in the diagram are admissible.

Now suppose that for some reason or other we have prescribed that the average shall be *at least* 2 mill. in agriculture and 8 mill. in industry. This means that in the diagram the point must be chosen over and to the right of the point P. Through P we draw the vertical line PA and the horizontal line PQ. The condition imposed then means that we must be to the right of PA and at the same time above PQ.

Now consider the employment situation.

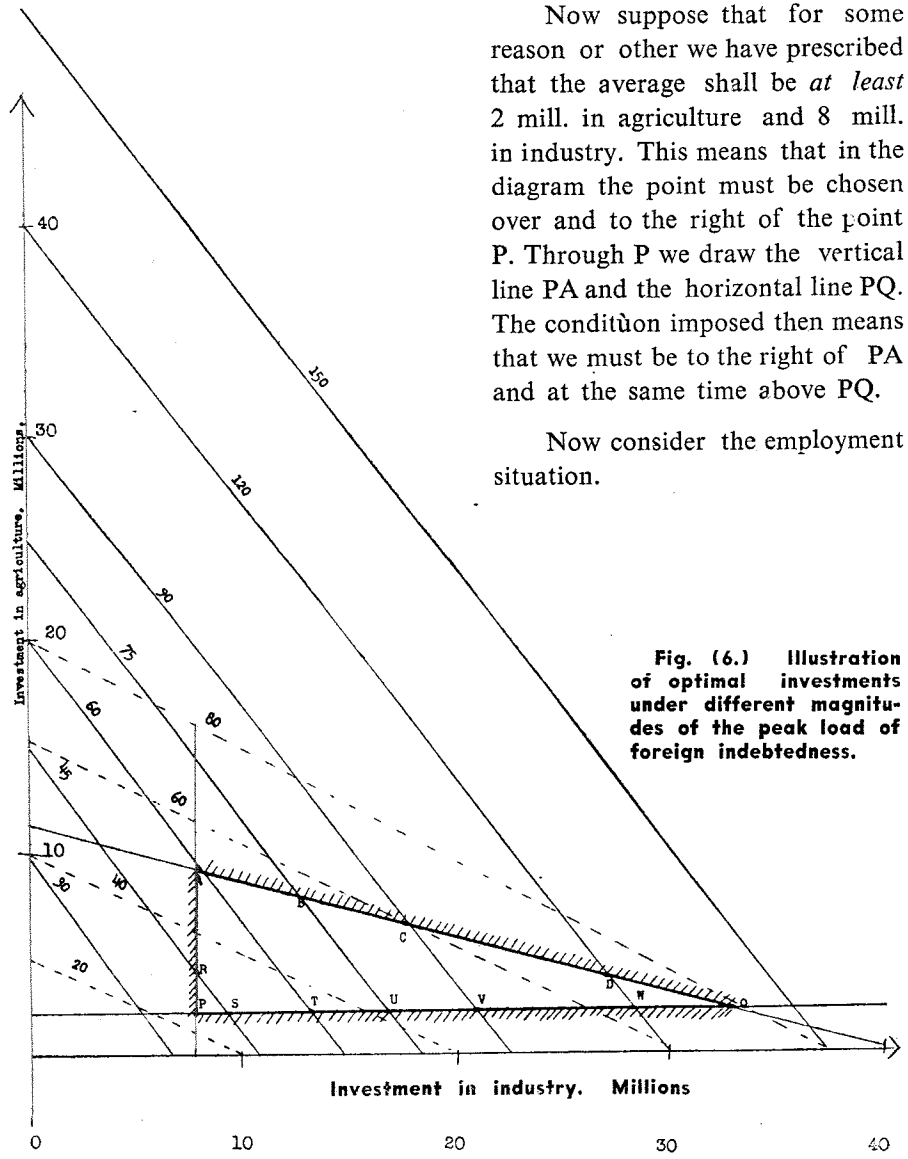

Fig. (6.) Illustration of optimal investments under different magnitudes of the peak load of foreign indebtedness.

The available amount of labour depends not only on the number of persons but also on their training and skill. From this viewpoint it may be necessary to consider labour as a limiting factor even though there is in a general sense unemployment. This limiting factor can be changed by the development policy (much in the same way as investment can increase the capacity of production in a given production sector). But at any given moment the limiting effect of the available trained and skilled labour force should be taken account of.

Suppose it has been found that due to this limiting effect, the average investment in agriculture and the average investment in industry must be chosen in such a way that 2.8 times the former plus 0.8 times the latter is *not larger* than 32 mill. (measured in the same units as the other items). This means that the point in the diagram must be chosen below the straight line AQ which is drawn between the point 32/2.8 = 11.4 mill. on the vertical axis and the point 32/0.8 = 40 mill. on the horizontal axis. We have now a triangle, the heavily drawn triangle PQA, which is such that any point inside this triangle represents an admissible alternative, and any point outside is not feasible.

But the admissible alternatives will have to be still further limited by conditions on the peak load of foreign indebtedness. Suppose it has been found that the peak load of foreign indebtedness (including all effects, direct as well as indirect), will be roughly 3 times the average annual investment in agriculture plus 4 times the average annual investment in industry. This means that if we impose the condition that the peak load of foreign indebtedness shall be not larger than 30 mill., we must choose a point which is *on or below* the straight line marked 30 which is drawn between the point 30/3 = 10 mill. on the vertical axis and the point 30/4 = 7.5 mill. on the horizontal axis.

If we relax the condition on the peak load to 45 mill., we get the line marked 45 which is parallel to the first line, but pushed 50 per cent upwards and to the right. Similarly we get in succession the parallel lines marked 60, 75, 90, etc., corresponding to the bounds 60 mill., 75 mill., 90 mill., etc. for the peak load on foreign indebtedness.

Let us consider these new conditions in succession. The peak load line 30 is so low that not even the point P is below it. This means that the lower bounds 2 mill. on the average agricultural investment and 8 mill. on the average industrial investment are *incompatible* with the condition that the peak load on foreign indebtedness shall not surpass 30 mill. No admissible point will exist if all these conditions are imposed simultaneously.

If we relax the peak load conditions to 45 mill., a small admissible region of alternatives emerge, namely the small triangle PSR. If we further relax the peak load conditions to 60 mill, we get the larger admissible triangle PTA. If we relax it to 75 mill., we get the quadrangle PUBA. At 90 mill. we get the larger quadrangle PVCA. And so no.

Suppose we have given such a condition on the peak load of foreign indebtedness that an admissible region exists. Then a new problem arises: Which one of the points in the admissible region represents the best choice, the *optimum* selection?

Here is where the choice of the preference function comes into the picture. Suppose for the sake of argument that we take it as the annual average rate of increase in national income over the first five years.

Further suppose that in agriculture an investment will produce an annual average increase in *income* amounting to 40 per cent of the annual average *investment*, and that in industry the corresponding figure is 20 per cent (and I repeat that the figures are chosen only for illustration purposes). This means that the increase in annual income that can be created, will be 0.4 times the annual average investment in agriculture plus 0.2 times the annual average investment in industry. For convenience let us express this as the total increase in income achieved over a ten years period (even if we want to *maximize* the annual average increase in income over the first five years, nothing prevents us, of course, from *measuring* this increase by its total effects over a ten years period). This total increase will - if for simplicity we reckon with simple, not compounded, rates - be 4 times the average investment in agriculture plus 2 times the average investment in industry.

How can these figures be expressed in our diagram?

If the 10 years increase in income shall be 20 mill., we must choose a combination of agricultural and industrial investment which is situated somewhere along the straight dotted line marked 20 which is drawn between the point 20/4 = 5 mill. on the vertical axis and the point 20/2 = 10 mill. on the horizontal axis. If the 10 year increase in income shall be 40 mill., the combination of agricultural and industrial investment must be situated somewhere on the dotted line marked 40 which is drawn from the point 40/4 = 10 mill. on the vertical axis to 40/2 = 20 mill. on the horizontal axis. And so on.

The parallel dotted lines indicate *increasing values* of the 10 years increase in national income. If we take the highest possible addition to national income over five years as our goal, we must consequently try to move upwards and to right in the diagram. In this way we can reach ever higher

dotted lines. The dotted lines are the contour-lines (the lines of constant level) of the preference function. We must try to move in such a way as to reach the highest possible contour-line.

It is, of course, possible to draw many more contour-lines than those that are actually indicated in fig. (6.1.). We can conceive of the diagram as filled by a continuous sequence of these contour-lines, all of them being parallel to the dotted lines indicated.

It is now easy to see geometrically what the optimum solution of the investment selection problem will be under different values of the bound for the peak load of indebtedness.

If this bound is put at 30 mill., no solution exists as we have already seen.

If the bound is 45 mill., the small triangle PSR is admissible, and within this triangle the top-point R must be the best. Indeed, by moving a dotted line upwards (and constantly parallel to the given direction), we see that we can continue to push it upwards until it reaches the point R. But beyond this we cannot go lest we get outside of the now admissible region. Hence R is the optimum point when the bound on the peak load of foreign indebtedness is 45 mill.

This point R is characterized by industrial investment being at its lower prescribed bound 8 mill. and agricultural investment being increased to about 4 mill. (as judged by eye-measurement in the figure). In other words for these low values of the peak load bound it is most profitable to *concentrate on agricultural* expansion. This is due to the fact that in the example agriculture absorbs more labour than industry and this absorption of labour increases most effectively the "value added" and hence the national income. We have not introduced explicitely any desire for social reasons to do away with unemployment since our preference function does not depend *explicitly* on employment. Such a desire could have been introduced in the preference function and this would have produced an even stronger reason for concentrating on agriculture under these low values of the peak load bound.

As the bound on the peak load of foreign indebtedness increases further, the optimum point will move vertically from R to A, this latter point being reached for a peak load bound of 60 mill. That is to say, all the additional investment which is now made possible shall be directed into agriculture, while the industrial investment is constantly kept at its lower bound 8 mill. In the point A the average annual agriculture investment is about 9 mill.

When the peak load bound passes 60 mill., *the picture changes completely*. We have now reached the employment bound and in any further expansion we must take account of the limited labour force. (1) As the peak load is further increased from 60 mill. to 75 mill., the optimum point moves from A to B. That is to say the additional investment *is now to be directed into industry*, and we ought to *reduce* the investment in agriculture. In the point B the agricultural investment is reduced to about 7.5 mill. (as judged by the eye) while the industrial investment is increased to about 12.7 mill. We must now turn more in the direction of industrial investment because these investments *yield a higher output per man hour*. This we must do even though the industrial investments entail a higher peak load of foreign indebtedness than the agricultural ones.

As the bound on the peak load is further increased to 90 mill. and to 120 mill., the optimum point moves to C and D respectively. This means that we now move still further in the direction of industrial expansion and still further reduce agriculture investment. The actual point where the change takes place, will, of course, depend essentially on the size of the coefficients entering into the relations. This is why so much emphasis has been put on obtaining the best possible data as explained in previous sections.

This example illustrates the fundamental fact that *the structure of the optimal investment is completely dependent* on the opinion one has formed on the maximum permissible height of the peak load of foreign indebtedness. This opinion may be founded on a desire - for political or other reasons - to avoid becoming at any time too heavily dependent on foreign creditors, and, of course, it will also depend on the actually existing possibilities of obtaining foreign loans. Without having a very definite opinion on what is a permissible peak load of foreign indebtedness, it is impossible to say what is the best investment policy. But once this permissible peak load is given, the structure of the optimum investment policy is well determined.

The fixation of the maximum permissible peak load of foreign indebtedness is a good example showing the need for consultations between the responsible politicians and the analysts. The latter can tell how the fixation of the maximum permissible peak load of foreign indebtedness will determine what is actually the best investment policy. And in the light of this information and considering the various aspects of the whole situation that cannot, at this stage, be expressed exactly in qualitative terms but must be handled intuitatively, the political authorities will be able to reach a final decision.

(1) Such a situation is now reached in the Soviet Union after many years where additional labour could be drawn from the partly unemployed rural population.

In this oversimplified example the interest rate and other conditions on the foreign loans have been left out, but they can be worked into the analysis without changing the principle.

Fig (6.2) shows how an increasing peak load of foreign indebtedness permits to reach higher and higher levels of the increase in national income, when we require all the time that the investment structure shall be optimal. The increase in national income is rapid to begin with, and later it is slower. The endpoints P and Q in fig. (6.2) correspond to P and Q in fig. (6.1). Below the peak load of about 39 mill. in P it is not possible to go if the average annual agricultural investment shall not go blow 2 mill. and the industrial investment not below 8 mill. And above the peak load of 120 mill. in Q it is no use to go, because the limited labour force is now the bottle-neck.

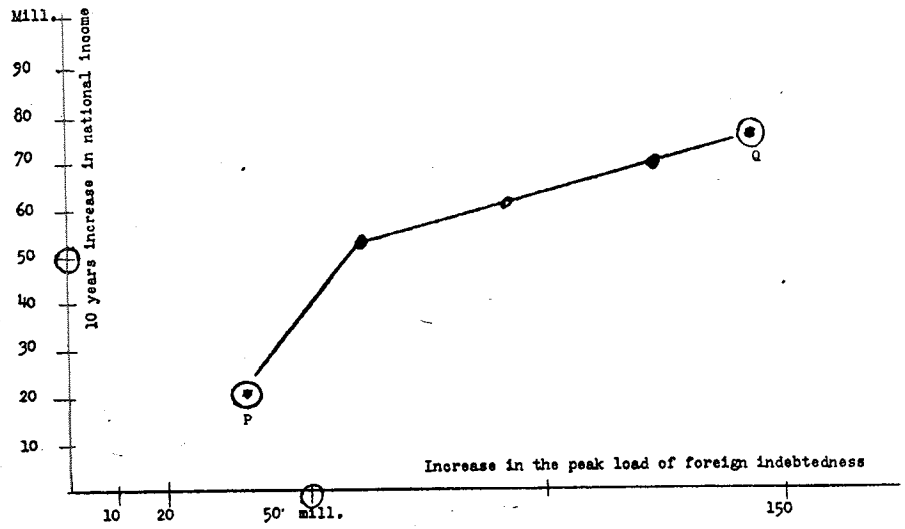

Fig. (6.2) Illustrating the increase in national income that is possible at given levels of the peak load of foreign indebtedness.

If it should be possible to go beyond Q, we would have to find *new types of investment projects* where the labour requirement in the current account operations are *smaller* than in the projects so far considered. This means that we would have to push the limiting line AQ in fig. (6.1) upwards, possibly by changing its slope. A flatter slope means projects where the industrial investments are such as to require very little labour in the current account operations.

The peak load can be seizably reduced by trying to find new projects with a high output to capital ratio, (which roughly means little capital per man hour in the current account operations), a low contribution to the peak load of foreign indebtedness (when direct as well as indirect effect are taken account of) and a short recuperation period.

The peak load can also be reduced by severely restricting private consumption below the demand that will manifest when income increases. This means arranging the economic policy in such a way that a given increase in national income takes more the form of capital formation than that of consumption. If this is done, one has to put up with the consquence that this will cause a high *demand pressure* for consumption goods. Whether such a policy is to be preferred to one with higher consumption and a larger peak load of foreign indebtedness, is a question to be decided on at the political level.

The above example was purposely simplified to make a clear case. The actual analysis made in the National Planning Committee, has of course, been of a much more detailed nature. In the actual calculations on the channel model there were 31 different decisional investment channels instead of the 2 channels in the above example. And there were many more types of repercussions, each of them being considered separated in each of 11 years. This gave a total of 325 individual repercussions instead of the 2 repercussions that were considered in the above example (which were: a single figure for employment and a single figure for the peak load on foreign indebtedness). If one is perpared to make the analytical effort, it would even be possible to go still further. Planning is a continuous process. Each year one will want to improve the analytical results in the light of past experiences and better data.