# 9 The microphase

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### 1 Project appraisal: the criterion

We must now consider the microphase of development planning, the stage at which the most detailed subdivision into sectors and geographical units has to take place. This is also the stage at which the administrative elements of the development policy must be planned. As far as the sectors are concerned, these elements may be either separate projects or else complexes of projects and measures which are dealt with by one single administrative body. Any decisions affecting these projects will in fact mean the practical realisation of a development policy and the delegation of responsibilities for the carrying out of this policy. Generally speaking, these projects will be the major projects, either in the public or in the private sector. If they are in the public sector, they will be carried out by the government. If, on the other hand, they are in the private sector, they will be carried out by private firms, possibly subject to government permits or to special negotiations. The name quasiproject is given to groups of smaller projects, to measures promoting the administration of such smaller projects or to measures of a different kind that are of importance in the country's development. For the sake of brevity, I shall generally use the word project, even when such quasi-projects have to be included under this heading.

Projects provide a more concrete subject for planning than sectors and, if they are well prepared, the data available are more accurate and more detailed. They also enable a more accurate analysis and appraisal to be made, and this may at the same time lead to an improvement in the available information about the 'attractiveness' of various projects to the country's development. These data can also be used to correct the coefficients discussed in chapter 7.

The task of obtaining these data is one of the biggest that the planning machinery has to undertake. A great deal of thought will therefore have to be given to the time at which this work should be begun and to the size of the staff to be employed. To a great extent, it will be the responsibility of various specialised ministries and the

services which come under their control. Projects planned by private firms will be an important source of data. It will not always be easy to obtain these data, but, as it is important for private firms to secure the co-operation of the state in order to procure scarce factors (foreign exchange) or to obtain permits for building and so on, it is possible for data to be obtained in this way.

In this section, I shall discuss principally the method of appraising projects according to their 'attractiveness' to the country's development. The various refinements in the formulation of aims and scarce factors can also be discussed at this stage, since it is possible to assess these in greater detail than in chapter 7, when the middle phase was under discussion.

What was said in chapter 7, section 3, about the need to group investments in complementary bunches also applies to project appraisal. We shall therefore not take a project in the administrative or practical sense as the object of our consideration, but a bunch of projects, consisting of one project in an international sector together with the corresponding investments in the national sectors. Although this does, on the one hand, imply a complication, it also means that the situation is to some extent simplified, since there will be no need for a separate analysis and appraisal of projects in the national industries.

A bunch of projects of this kind is appraised in the microphase on the basis of a criterion that does full justice to all the important aims of the development policy and to all the important scarce factors rather than to the one most important single aim or factor that is expressed in the income-capital ratio. The criterion r may be taken as the ratio between the contributions to the development aims and the costs in scarce factors that have to be made when the bunch of projects is carried out. In order that this may be possible, these contributions and costs must be 1 expressed quantitatively and 2 valuated in relation to each other. This does not mean that our method will be subjected to any real limitation, since the same happens in the case of every appraisal, even though this is not always explicit.

If we call the contributions to the development aims  $x_1$ ,  $x_2$ ,  $x_3$ , etc., and the quantities of scarce factors  $y_1$ ,  $y_2$ ,  $y_3$ , etc., and then call the prices of a unit of  $x_2$ ,  $x_3$ , etc., in relation to a unit of  $x_1$ ,  $p_2$ ,  $p_3$ , etc., and the prices of the scarce factors  $y_2$ ,  $y_3$ , etc., in relation to factor  $y_1$ ,  $q_2$ ,  $q_3$ , etc., then the criterion can be expressed thus:

$$r = \frac{x_1 + p_2 x_2 + p_3 x_3 + \dots}{y_1 + q_2 y_2 + q_3 y_3 + \dots}$$

in which the number of terms in the numerator is the number of aims to be considered and the number of terms in the denominator is the number of scarce factors to be considered.<sup>[27]</sup>

As examples, let  $x_1$  be the contribution to the national income in millions of rupees,  $x_2$  the contribution to the employment of unskilled labour in thousands of man-years, and  $x_3$  the contribution to health expressed as a percentage of absenteeism due to illness. In this case,  $p_2$  must be the value, in millions of rupees, put on the creation of a thousand man-years of employment of unskilled labour and  $p_3$  the value, in millions of rupees, put on a reduction of absenteeism by 1 per cent.

Similarly, let us suppose that  $y_1$  represents the amount of capital,  $y_2$  the amount of foreign currency and  $y_3$  the amount of qualified labour. In this case,  $q_2$  will be the price of foreign currency, expressed in terms of capital,  $q_3$  the price of qualified labour, similarly expressed, and so on.

A special knowledge of the variables x and y is required, in the case of each bunch of projects, and a general knowledge of the prices p and q if the criterion is to be applied. There is, however, a difference between the prices p and q. The prices p are to some extent the autonomous preferences of the government, parliament or the electorate. The prices q express the actual shortage of the scarce factors. I shall be dealing with the assessment of these prices in section 2.

The attractiveness of the projects is measured by the value of r

and the priority which they ought to be given is thereby established. It should also be borne in mind that the most attractive projects in certain sectors will probably have to be repeated from time to time. This may, for example, be done in the case of industries that are not obviously restricted to one particular place or to particular natural resources.

The values obtained for r may show that the sectors that were initially regarded as the best are not in fact the most attractive. This will lead to a revision of the first appraisal, or at least to a different choice of the extent to which various sectors have to be expanded, for example, because the marginal projects in one sector seem better than those in another.

Two circumstances play an important part in the practical choice of bunches of projects. First, there will, at any given moment, be a certain number of projects in progress, and these will take up part of the total capacity for investment. It is only the remainder of this total capacity that will be available for the commencement of new projects. Secondly, not all the projects that can be carried out during the whole period will be known at the beginning of the planning period. There will, therefore, always be a chance that some of the projects that become known at a later stage are in fact better than those known at the outset. This means that those responsible for the plan must always be ready to revise it in the light of this new knowledge (see section 5). It is because of this lack of accurate data about projects that it is necessary to work partly with pre-investment studies and statistical data.

## 2 Some details concerning the calculation of the criterion

As I have already said, project-appraisal – and this ultimately means the calculation of the criterion – necessitates a great deal of detailed work. A few comments may help to make this clear. The data will have to extend over what is in principle an infinitely long period, which may be divided into an investment or gestation period

and an operation or production period. The project itself, for example a dam or a factory, is built during the first period. Its use, during the second period, leads to an increase in production. The data will first and foremost describe both of these processes technically – how many workers, engineers and so on are involved, the quantities of raw materials that are required, how much of the product can be expected, and so on. These data must be viewed critically and compared with what is known about the environment – the geology and climate of the district and the skill of the labour employed – and with similar projects elsewhere. They must also be used to calculate the contributions  $x_1$ ,  $x_2$ , etc.

In calculating the contribution to national production, the method of business economics will be used, but with this difference -that the calculation can be made I at national market prices for products, raw materials, etc., and 2 at world market prices. The first calculation can be done as an ordinary calculation of profits, though this is, of course, not the same as the contribution to the national income. In this case, it will provide a good indication to the private sector as to whether the project is attractive or not. It is also important for the government to know this (see chapter 10). But clearly, it is the contribution to national product that is the most important for the government, here world market prices must be used for all international commodities (see chapter 7, section 5). Returns and costs for later years must be discounted, and the important question of the time discount arises here. I shall deal with this question in section 3 of this chapter, where I shall advocate a higher rate of interest than that prevailing on the market, for example, 10 per cent. There are, in principle, two possible ways of calculating this contribution. The method that I have chosen here is that of the annual contribution to the national income, whereby the annual constant flow of income which has the same constant value as the flows that are actually expected is sought. In those cases in which there is no very accurate information about the progress of production, it is possible to attempt to assess this 'average' contribution in a partly intuitive manner. If this is done, it is important to know after how many years this flow will in fact begin. The earliest possible moment will be on completion of the investment, though it will probably take place even later, because of the 'learning period' necessary in most industries.

The contribution to the employment of unskilled labour, which is regarded here as a social aim and not as a cost factor like the employment of qualified labour, may, as before, be calculated by analogy. Only unskilled labour which is constantly employed during the operation period is taken into account. Employment during the gestation period is not considered, on the assumption that the total volume of investment is a given quantity in which no variation occurs during the gestation period even if a different group of projects is chosen. This assumption is, however, not entirely water-tight and it may be preferable, for social reasons, to carry out the work of building the dam or factory for example by the intensive use of labour. This is a real possibility if there is an abundant supply of unskilled labour, and the total expenditure on investment can still remain constant. This whole problem has, however, not yet been adequately dealt with in the literature on the subject.

It will be necessary to calculate the contribution to health, which may possibly be included among the aims, only in a limited number of cases. These will be either those cases in which health is being specially dealt with, or those in which health is negatively influenced as a by-product of a positive contribution to the national income. This negative influence may be felt in certain chemical industries, in occupational diseases and in industrial accidents. Data are available in the case of more developed countries with a fairly complete system of social insurance, but generally speaking our information about this subject is limited.

No fresh difficulties arise in connection with the calculation of the sacrifices in the scarce factors involved in the carrying out of a project. Considerations similar to those outlined above apply here too.

It must, however, be emphasised once again that the calculations

must relate to the entire complementary bunch of investments as defined in chapter 7, section 3 and referred to again in section 1 of this chapter. So long as care is taken to ensure that whole bunches are always carried out at the same time, no change will ever occur in the balance of payments and no net consumption of foreign currency will consequently be necessary.

#### 3 Accounting prices

I have already indicated in section 1 that a great number of prices have to be applied in the appraisal of projects. Not only the relative values p of the various aims and the prices of the production factors q, but also the prices of the commodities produced and consumed that are contained in the contribution to national income  $(x_1)$  are necessary elements in our calculations.

The prices p are to some extent autonomous here, because the responsible government bodies may have their own views about the relative attractiveness of the various aims of the development policy. It is only if these aims cannot be reconciled with each other that a limit will be imposed on this autonomy. Those responsible for advising the government will have to indicate this limit.

The prices of the production factors  $\dot{q}$  and the prices of both the international and the national commodities must indicate their relative scarcity. In an economy in which all the markets concerned are in a state of equilibrium, this will be indicated by the prevailing market prices. The private industrialist will act as if this were in fact the case, which is, of course, understandable from his point of view. There is, however, good reason to believe that a number of markets, especially in developing countries, are not in a state of equilibrium. It may therefore be better to work with prices that differ from the market prices. These prices are known as accounting or shadow prices.

This lack of equilibrium occurs as a result of the special circumstances that often prevail in developing countries. There is often such a shortage of capital and land that not all the labour can be

usefully combined with these other production factors. Again, there is frequently no equilibrium in the balance of payments, with the result that the official rate of exchange is not a true criterion of the scarcity of foreign currency. Frequently too, there is a great shortage of skilled and qualified labour. For all these reasons, the assessment of shadow prices often forms an important part of the activities connected with the appraisal of investment projects.

In practice, it is not usually possible for this assessment to be very accurate – nor does it in fact need to be very accurate. As I have already said, world market prices can be taken for international goods. For the production factor of capital, it is obviously better to take a higher price than the rates of interest at which limited sums can be borrowed under certain conditions. This means that the interest-rate at which world bank loans can be obtained is too low in this case. An interest-rate of 10 per cent would seem to be a reasonable figure, when it is remembered that developed countries such as Germany have an interest rate of 7–8 per cent and the United States had this rate a century ago, whereas personal loans are often made in developing countries at a rate of 25–30 per cent.

A premium will often have to be calculated for foreign exchange. This can be based on the 'black' or 'free' rates, if the amounts to be converted both at these and at the official rates are taken into account. If the official rate is 5 and the black rate is 10, and conversion at the official rate is four times as great as that at the black rate, then a calculated average  $\frac{4 \times 5 + 1 \times 10}{5} = 6$  would be quite serviceable as an accounting price.

It sometimes happens that unskilled labour has to be taken into account as a cost factor. (This is not necessary in calculating the contribution to national income.) When this occurs, the price can often be set at almost nil, at least in places where such labour is present.

The accounting prices of national goods are best based on a calculation of cost. The quantities of international goods and

scarce production factors that are 'ultimately' necessary are calculated in this case.

In certain situations it is possible to calculate the accounting prices much more accurately, even though these more accurate calculations are not always necessary. Such a situation can exist when all the projects and the available quantities of scarce factors are precisely known.

The standard method used in such calculations is that of linear programming. A maximum value is obtained from a number of possible production processes with the help of the given quantities of scarce factors and on the assumption that the prices of the products are given. The prices of the factors can then be calculated. This is the so-called dual problem. In calculating the prices, every process that is not applied shows a loss and no process that is applied does. This means that, at these prices, even a decentralised decision on the part of separate industrialists will lead to the most desirable production program. If this method is to be applied, the production processes must be such that only linear relationships exist between the volume of production and the quantities of inputs required.

There are also other situations which make a precise calculation possible, by means of quadratic programming and other more complicated procedures. These are often stylisations of reality and the question that must be answered first is whether the model is sufficiently close to the reality of the situation.

As an example of this kind of method, we may take the case of a continuous collection of small projects, in which the capital-output ratio and the foreign exchange coefficient are assumed to be distributed equally over a plane, the co-ordinates of which are these two coefficients. [26] (The foreign exchange coefficient is the amount of foreign exchange required divided by the net product to be obtained.) It may then be demonstrated that the relative accounting price q of foreign exchange in relation to capital must be taken as equal to the ratio of the amount of available capital and the amount of available foreign exchange.

Instead of an equal distribution over a plane, other distributions can be introduced and, provided that the mathematical structure remains simple, the accounting prices can still be calculated. What is essential, however, is that there be many projects and every possible combination of the two coefficients.

The problem of determining the accounting prices or simply of finding by direct means the most desirable combination of projects to be carried out becomes mathematically much more difficult when the indivisibility of a number of projects plays an important part. (This is the case in integer programming.) The new possibility that arises here is that priority must sometimes be given to a smaller, less attractive project over a larger and more attractive one, since the amounts of scarce factors still available after the most attractive projects have already been chosen allow only the smaller project to be carried out, but not the larger one. As is so often the case with this kind of problem, the only practicable method is frequently that of trial and error.

#### 4 Micro-regional plans

The national development plan must also be divided in the microphase according to geographical territories. In the middle phase, a fairly small number of regions and a fairly rough division were considered sufficient. Along the lines of town and country planning, the country has to be divided in the microphase into even smaller territorial units, which I shall call districts and centres. These can also be subdivided into groups of towns and villages, for example, of certain sizes and, as a final stage, each parish or even each part of a parish can be considered separately. How many intermediate stages are desirable here is still an open question, which depends to a great extent on the size and the nature of the country. So long as creative action is to some degree possible, there will always be a certain freedom of choice in this matter, and at this stage of human development the choice is often made intuitively.

A distinction can be made between cases in which the subdivision

of the region is already given and it is simply a question of developing new sectors in existing towns and villages, and those cases in which this subdivision is still free, as in virgin territory. The districts of a larger territory can be divided first into sub-districts. A smaller territory can, however, be divided straightaway into centres, in which the principal consideration is difference in size.

The problem that has to be solved by any kind of micro-regional planning is how to determine the development of the various sectors in these smaller geographical units. Expressed in more precise terms, a table with a double entry must be completed, showing the investments according to sectors and according to the geographical subdivisions of each of the regions dealt with in the middle phase of planning.

What is new in this aspect of the problem is that this further subdivision into districts and centres is considered and that the other regions are disregarded, so that the problem is kept manageable. At the same time, the regional sectors are also further subdivided into what may be called district and local sectors. The local sectors may also be distinguished according to size into groups. In fact, a complete hierarchy of sectors can be distinguished here, and we can draw on the knowledge and experience of town and country planners in this task. At each of the various territorial levels – the district, the large city, the medium-sized town, the smaller town and the village, for example – there are sectors which principally serve the population of the geographical unit itself, in other words, the secondary industries, and other sectors which export their produce to other territorial units. Thus, the baker, the smith and the primary school, for example, are found both at the lowest territorial level, such as the village, and in all the higher geographical units. The small town will have its own building industry and textile retail trade, the medium-sized town its own printing works, and so on. It is most important for these various categories to be clearly distinguished, since one of the principles underlying the solution of the problem is that the secondary sectors must be local.

The problem may, therefore, be expressed in the following way. In which of the territorial units that have been distinguished in the micro-regional phase must expansion of – and thus investment in – the different kinds of sector be carried out, the total volume of expansion – and of investment – having already been established in the middle phase of planning? It will be assumed here that the information used in the regional phase to choose the 'most attractive' international and other national sectors was correct, and thus based on the best possibilities within the region. This will, however, not always necessarily be the case – a closer study of the various subdivisions within the region may well reveal that the heterogeneous nature of the region has been underestimated and that the data used have been too rough.

The problem is therefore in some ways the same as that dealt with in the middle phase, although here, of course, it relates to smaller units – the districts and the groups of local centres. In applying the concepts of national, regional, district and local sectors, it is possible to connect the 'lowest' categories with the kind of territory whose demands they must meet. In the middle phase, these were the regional sectors; in the micro-phase they are the district and local sectors. The 'higher' sectors can be shifted between the territories that they have to supply. In the middle phase, too, the 'other national' sectors may be transferred between the regions. This can be done on a basis of comparative advantages, with the side condition that the income aims of the regions be realised. In the same way, applying similar principles, the 'other regional' sectors can be shifted between the districts, and the 'other district' sectors between the local centres. Microregional planning is, of course, different from regional planning in that there is not simply one class of 'lower' sector, but two or more – the district sectors and the local sectors, which may in turn consist of several levels.

A second principle can also be applied in solving this problem – that of a certain hierarchy within the local centres. Some of the higher sectors cannot occur in smaller centres, usually because

transport costs will be at a minimum whenever industries with a small number of undertakings are sited at central points.

The problem of keeping the transport costs, or rather, the sum of the transport and production costs, of a group of products serving a certain territory to a minimum is, of course, a very complicated one. That is why I have stylised the problem of transport costs by reducing it to the difference between commodities that are or are not to be transported outside a certain territory. Various attempts have also been made to find the optimum spread of economic activity over a territory, and this may go some way to providing a starting-point for the solution of the problem of micro-regional planning. [20] [21] (See also appendix J.)

#### 5 Revision of plans

This brief outline of the last phase in development planning concludes the survey commenced in chapter 6. I have tried to show how the complicated problem of simultaneous planning both for sectors of industry and for geographical divisions can be approached in stages by subdividing the work according to sectors and according to geographical units and by increasing the number of aims. The method of planning in stages is equivalent to the method of successive approximations, but whenever certain conditions are not fulfilled, the method of trial and error has to be used. This means that the results of a later phase in planning may show that certain initial figures of a previous phase have to be revised. A simple example is that of the capital-output ratio that is used in the macrophase. A different figure may be found for this ratio, as the average of the sector coefficients, in the middle phase. If this figure is very different from the one originally accepted in the macrophase, then it will be necessary to revise the original calculations. Revisions of this kind may also be necessary at a later stage if, for example, it becomes clear that the initial stock of qualified labour is insufficient for a certain rate of development.

Every plan has also to be reviewed periodically as new data

become available and new ideas arise. I have already alluded, in section 2 of this chapter, to the possibility of new projects becoming known that are better than those that were known previously—with the passage of time new statistical data about recent development and the results of recent research are bound to become available. The most important reason, however, for periodic revision is that from time to time a new program of action will be needed, usually a one-year program, in which all the new information can be used. This means that the results of the development policy and all the development activities during a period in the past will be taken into account and an attempt will be made to profit from the results obtained—both the positive and the negative results.

Because of the interdependence of all the figures in a development plan, it is advisable to carry out these revisions at fixed times rather than currently. The one-year plan usually has to be available when the new budget is presented and the activities envisaged by the plan are begun at a period when the task can be accomplished in the shortest possible time.