CHAPTER 2

DEVELOPMENT PLANNING WITHOUT SPACE: A SUMMARY

2.1. Purpose of the Chapter

The purpose of this chapter is to summarize the main concepts and methods used in development planning before the element of space is introduced explicitly. The development plans of most countries do not pay much attention to a geographical subdivision and this chapter therefore represents the present state of planning techniques used at the national level. It cannot be maintained, however, that spatial elements are completely lacking in the existing methods; thus, all plans do consider foreign trade which in a way implies the distinction between two spaces: the country considered and the rest of the world, at least as soon as one recognizes that not all products can move equally well between these two spaces. We will follow this habit.

Planning will be defined as the preparation of a policy and, more particularly, a development policy. This implies that planning is defined sufficiently widely to apply to any type of policy, from almost laissez-faire to complete control. Planning in this sense is still characterized by three elements: (i) looking ahead or making forecasts; (ii) setting aims and (iii) choosing and co-ordinating the means of a policy.

Since an economy and still more a society is a complicated subject, planning its future is a complicated activity and it is virtually impossible to consider the construction of a plan as something that can be done *uno actu.* The usual method is to construct a development plan stepwise or in stages. We will also follow this practice. Often three stages are chosen, the macro, the middle (or sector) and the micro (or project) stage; in addition, a number of preparatory studies and a number of iterations, or corrective stages are added. Among the choices to be made the optimal rate of growth of production remains a very important choice; the three stages are reflected here by the choice of the growth rate of the economy as a whole (macro stage), the

choice of the rate of growth of a number of sectors or industries (middle stage) and the choice of single projects to effectuate that growth (micro stage). The reader will find these steps in the sections of this chapter.

These choices are not the only ones to be made, however. Any development policy can be described in terms of its aims and its means. These aims and means can also be chosen and described stepwise, in that, first the most important ones are chosen, next some subdivision and finally a considerable number of details. Later in this book the same approach will be advocated with regard to the element of space or geographical subdivision. All this means that the three main phases can be distinguished in many aspects of the planning process and not for the choice of economic activities or sectors alone. This will become clear in what follows.

Finally, the authors attach considerable importance to a basic distinction between short-term and long-term policies. By the former policies are meant those which have to be effective within the period of one year or less and which have to be revised at least every year. By the latter policies are meant those affecting the changes in the economy and in society over longer, and usually much longer time spans. We feel that the distinction is so important as to justify a division of responsibilities and accordingly to distinguish between authorities responsible for short-term policies and authorities responsible for long-term policies. As a first crude indication we may say that there must be authorities in charge of maintaining a number of short-term equilibria or of conducting an anti-cyclical policy and authorities in charge of development whose main means of action may be in the field of investment, investment incentives and education and training. One of the conclusions we are going to draw from such a division of labour is that the criteria for the selection of sectors and projects for long-term development will be simplified (cf. Sections 2.5 and 2.6).

2.2. The Macro Stage

During the macro stage of development planning one or more of the main means of development policy are provisionally chosen on the basis of (i) one or more of the main aims of such a policy with the aid of (ii) an econometric macro model of the economy.

The most important aim of almost all types of development policy so far

conducted is a rise of national income or national product (gross or net), often expressed in a single figure, for instance 5, 6 or 7 per cent per annum. A second aim of high priority is the development of employment, especially of unskilled workers.

The most important means to be used are, first, material investments and second, education and training. Material investments in the public sector can be handled directly; material investments in the private sector will be the subject of indirect policies, creating incentives for the groups concerned. In the macro stage of planning, however, private investments themselves may be considered a means and the question of what incentives to create may be answered in the following way. They may consist of financial incentives and of various forms of technical assistance, training and information. Also, some of the public investments, in infrastructure for instance, may be among the means to stimulate private investments.

The econometric model will have to express the relationships existing between the aim variables and the means variables, with the intermediary of other, so-called irrelevant variables. These relationships are either reaction equations (such as demand and supply relations) or relations of a technical, definitional, institutional or balancing nature.

A well-known example of a very simple model, connecting the main aim with the main instrument is the Harrod-Domar model or, even simpler, the acceleration principle. Very briefly it says that a given rise in net national product can be obtained by an amount of investment equal to the rise in income times the capital-output ratio. The model can be refined in several ways. It may state that investments can be financed out of two main sources, national savings and foreign capital inflow. It may express, in addition the relation between foreign capital inflow and imports and exports and again the one between imports and national income.

There is a tendency to construct more elaborate and hence more precise macro-models. One of the new elements introduced is the existence of a few sectors. We will give particular attention to the introduction of a national or domestic sector, producing non-tradables (cf. Section 1.2). Another is to introduce some more details of the savings behaviour or the production process (savings function and production functions, respectively).

Finally, the introduction of some degrees of freedom by the introduction of more means or instrument variables than the strict minimum gives a different mathematical form to the problem, which becomes a problem of

mathematical, usually linear, programming. This means that an optimum growth pattern is sought for, maximizing or minimizing some "objective function" or "aim function". One very simple example (with two international sectors) is that a given rate of growth of national income is set up and that investment costs are minimized. A linear programming model in particular requires that there are a number of restrictions which limit the possibilities of the economy. They give rise to what is known as a "feasible area", the first thing to be ascertained in any problem of this kind. This way of formulating the problem often enables the planner to take into account a number of "bottle necks" characteristic of the situation of many developing and even developed countries, although not necessarily as sharply determined as the model expresses them. Thus, there are fairly sharp limits set to, for instance, the amount of foreign aid available, the amount of national savings or the marginal savings rate, or exports. In recent years models have been presented by Hollis B. Chenery, in co-operation with others (E.g. CHENERY *et al.*, 1962; 1966-1; 1966-2), expressing a number of such bottle necks.

Since the remainder of this book deals mainly with the middle and micro phase of development planning, we will not discuss explicitly the macro models which can be used. For a proper understanding of what follows it suffices to say that the main results from the macro stage are provisional figures as a whole, sometimes subdivided into figures for some very broad sectors, such as international versus national industries. In most of the methods proposed in this book to deal with the spatial aspects of development planning we will take these income increase aims as data for the further stages. For some characteristics of macro-models we may therefore refer to other publications[1]).

2.3. The Sector Stage: Demand and Costs

The main problem to be solved in the sector stage of development planning is to determine the most desirable rates of growth of a number of individual sectors once the most desirable rate of growth of the economy as a whole has been determined in the macro stage. The number of sectors to be distinguished will be at least fifteen and may occasionally be much larger.

[1]) In a very simple form these are discussed in TINBERGEN (1967).

As a rule the assumption is made that prices will not change. In a general way this is a reasonable assumption: planning aims at maintaining equilibrium between demand and supply and this means that no price changes will be necessary. Clear exceptions are those of new products subject to cost reductions for technological reasons. There are other exceptions which we will discuss somewhat later.

It is also assumed in most planning models that the production process in any sector requires inputs from other domestic sectors and from abroad (non-competitive imports) and inputs of primary factors (labour, capital, land). Often the material inputs from other sectors are supposed to be proportional to the volume of production of the receiving sector (input-output analysis).

As already stated, we will take account of one consequence of the space element, namely, the existence of national or domestic and international sectors. This phenomenon is so fundamental that we cannot disregard it without becoming unrealistic. The essential difference between them for purposes of sector planning is that the productive capacity of national sectors must be geared to the demand for their products, whereas the capacity of international sectors should be based on their comparative advantages in world trade.

As long as we stick to the assumptions of constant prices and of linear relationships between the output of any industry and its inputs the optimal structure of an economy with international and national sectors remains extremely simple. There should be only one international industry and all the national industries. The international industry should be the one with the highest comparative advantages, taking into account the complementary national industries needed to allow it to operate. The method to be used in order to determine the capacity of the complementary national industries will be discussed in Section 2.5.

This picture of the optimal structure is oversimplified, of course; but it constitutes a useful starting point for more realistic approaches to the problem. We will sum up some of the elements which have to be introduced to make the model more realistic.

(i) First, it may be that within the margin of error that necessarily applies to any figures on comparative advantages, more than one international sector appears to be attractive. Since diversity offers some advantages, it will then be better to have several international sectors, provided the pro-

duction units can still be of optimal size (that is, sufficiently large to show minimum costs).

(ii) Another factor causing diversity is the existence of considerable transportation costs for some international products. It appears that only for a few so-called heavy products are they important enough to influence significantly the geographical distribution of production in a way that diminishes the degree of specialization. Such heavy products are dealt with in Chapters 5 and 6.

(iii) There may be restrictions with regard to the quantities that can be exported. If we introduce the limitation of demand in the international market in this particular way, and have not yet reached the income increase target, there will be another international industry, the next best, to invest in. If again there is a limitation on the quantities to be exported, a third industry may follow and so on. In order to find out what the "next best" sector is we have to be aware of the fact that the limitation put on the exports of the "best" sector makes it function as a national sector for the solution of this problem. This may change the original ordering of the remaining sectors according to their attractiveness.

(iv) For some industries we may have to introduce non-linear relationships. This may be so for the costs of production, for instance because of the existence of increasing marginal costs. Or we may have to introduce the price of the product as a function of the quantity produced. For products whose markets are dominated by the country concerned this may be a more realistic picture (jute for India or Pakistan, long-staple cotton for Egypt, etc.).

(v) A fifth way to make the model more realistic may be to introduce a number of regions within the country considered and to set income targets for each of the regions. Then we may have to develop one international industry in one region and another in another region, again causing diversity. This approach will be followed in Chapters 4 and 6.

The choice between international sectors may be influenced by an aspect which we have not mentioned separately so far, namely the differences in gestation lags and in life time of the assets created. Other things being equal, an industry requiring a long gestation period is less attractive than one having a short gestation period. Similarly, an industry requiring capital goods which can be replaced after a short period is more attractive than one which uses equipment with a long life: in the former case technological innovations

can be applied after a shorter period than in the latter case. We will deal with some of the technicalities of this problem in Section 2.6.

Finally, attention may be drawn to the fact that in this section the problem is cast in the form of minimizing the use of scarce factors with a given income target. If one reverses the problem into one of maximizing a target variable or a combination of target variables with given amounts of available scarce resources, then the answer might differ. In particular, if the number of target variables does not equal the number of scarce resources, then the answer of the reversed problem is in general different. With one target variable and one scarce factor, however, it is always the same.

2.4. Scarce Factors Different among Eras and Areas

The relative scarcity of the various factors of production is not always or everywhere the same. During their development process the countries now considered developed have passed through phases of changing relative scarcities. The most important change has been a reduction in the scarcity of capital compared with that of unskilled labour. This explains changes in emphasis in the theories of development which have been presented by successive authors during the last century. The changing relative scarcity also expressed itself in the relative prices of capital and labour.

Similar changes have occurred in the scarcity of land compared to labour, particularly in countries showing a marked increase in population and a small surface of arable land; or in the relative scarcity of qualified or skilled labour: generally qualified labour has become less scarce as a consequence of intensified education.

There are not only differences over time, but large differences, at any moment, between different geographical areas. In the developing countries capital and qualified or skilled labour are relatively more scarce than in developed countries.

The production factors "natural resources" and "labour" are far less homogeneous than the phrases suggest and than the factor of capital. Natural resources can take very different forms and the relative scarcities of each of them show extremely wide variations between countries. In practice it does not make sense to speak of natural resources; they must be specified and may be coal, petroleum, gas, or many other mineral deposits or many

types of land and climate, each of them appropriate for some agricultural products; or they may be geographical position, that is, distance from markets or from main transport facilities. A considerable portion of foreign trade and hence of the specialization of production has always been due to the differences in specific natural resources between countries. This has been known for a long time to traders and geographers but only recently been given more scientific economic content by precise studies as the one by W. LEONTIEF (1953-2; 1956) on American trade and the ensuing discussion.

As a consequence of varying relative scarcities the problem of the choice of technology within one industry may have different solutions in different areas. In some industries, particularly those which have already existed a very long time, a variety of technologies exist among which a choice can be made. In agriculture, manpower may be replaced by oxen, horses or tractors. In building, manpower may be replaced by baskets, wheel-barrows, trucks or bulldozers. In weaving, one person may supervise a small or a large number of looms. In passenger transportation manpower may be replaced by bicycles, motor cars, trams, busses or trains. Dependent on the relative scarcity and the ensuing prices as well as on the volume of demand, the cheapest technology may be different in different countries (cf. BOON, 1964).

Even in much younger industries, such as modern metal working, the use of single-purpose machines may alternate with that of multiple-purpose machines as a consequence of the relative scarcity of capital compared with manpower.

On many occasions *foreign exchange* is considered a scarce factor of production especially for developing countries. There can be no doubt that for short-run decisions this is correct. Yet in this book we will treat foreign exchange in a way different from the treatment of other scarce factors. If the division of labour between the authorities for short-term and those for long-term policy is accepted, the latter can concentrate on the execution of an ideal development path, by which we mean a process with a minimum of disequilibria. Such a process will be characterized by balance of payments equilibrium (considering, at the side of foreign currency receipts, foreign aid as one of the items). It can be carried out by the execution of bunches of investment – to be discussed in Section 2.5 – and these bunches do not require any net amount of foreign exchange. This is only correct, to be sure, if the country's expenditure equals its income plus foreign aid. It should be the responsibility of the authorities for short-term policies

that the nation behaves in this way. If it does not, it is only fooling itself by a process of inflation; in real terms no country can spend more than its income plus foreign aid (considering also the reduction of foreign currency reserves as foreign aid).

This is one of the simplifications due to the separation of long-term policies from short-term policies. It can only be applied, however, if indeed the short-term policy is followed which was described above. This will be facilitated by an increase in foreign aid. It will also be facilitated by a policy, perhaps of subvention, of industries with unused capacity, so as to use to the full whatever capacity is available. Also such subventions should be accepted by the outside world on the condition that really unattractive industries should not expand their capacity but on the contrary should gradually reduce it.

2.5. The Project Stage: Bunches

We are now going to deal with the micro phase, or, as far as the choice of industries is concerned, the project stage. Some of the techniques which will be explained in this section can also be applied to the sector stage, as was stated earlier.

The project stage deals with the selection of projects, for instance with the question whether to prefer a paper factory to a weaving factory as an addition to the country's productive capacity.

We have already argued that we want to base the choice on the assumption that the country has to carry out an "ideal development process", meaning a process with a minimum of disequilibria. Some disequilibria cannot be avoided, for instance the disequilibrium between the demand for and the supply of unskilled manpower. It is only through the development process that this "fundamental disequilibrium" can be overcome. Most other markets can be kept in equilibrium, however, for instance, the markets for other factors (capital, skilled labour) and those for products. In other words, we assume that the ideal development process is characterized by the full use of all productive equipment, and, among other things, by education processes adequate to provide the necessary numbers of trained and qualified workers.

This implies that no factory producing an international good (to be called an international project) can be established in isolation. For its operation

it needs inputs from national industries; since these are assumed to have no idle capacity, the creation of an international project must always be accompanied by the creation of additional capacity in the national industries. These additional capacities must be sufficient to produce not only the direct inputs needed by the international project, but also the indirect inputs, for instance, the energy input needed for the additional transport output. In short a set of additional capacities must be created bringing the economy to a new level of some ideal development process. We will call this set, taken together with the international project, a *bunch of investments*.

If this is done we may say that account is taken of the macro-economic complementarity between any international investment and the corresponding investments in national industries. A bunch is the real unit to be considered; the choice is not between the paper factory and the weaving plant, but between their respective bunches. Whatever the criterion of attractiveness to be applied (cf. Section 2.6.), we must choose the bunch which is the most attractive. This may not be the same choice. The indirect effects represented by the set of investments in national industries needed may influence adversely the attractiveness of a bunch. Thus, a paper factory may appear attractive at first sight, but may in fact be less attractive than a weaving plant because of the heavy energy inputs it requires.

While there is complementarity between an international project and the set of national investments that must accompany it, there is no real complementarity between one international project and another. Even the creation of a weaving plant does not, as is often suggested by input-output analysis, require as a complement, the creation of say a spinning plant or a finishing plant. Yarns may instead be imported; or the finishing of any tissues may be done abroad.

It is only the inputs from national industries which have to be taken into account, that is only a portion of all inputs. This is why the method used to estimate the composition of a bunch has been baptized the semi-input-output method (cf. TINBERGEN, 1966, 1967).

2.6. The Project Stage: Criterion and Prices

So far we have discussed the problem of the choice of sectors or of bunches of projects without specifying the criterion of attractiveness, except for the

occasional reference to "comparative advantages". We are now going to discuss the criterion in more detail. In principle it should be the yield to be expected for the policy of development from the use of scarce factors. There should be a close correspondence between the definition of this yield and the aims of development as seen by the government. We think the yield should be of the general form

$$r = \frac{b_1 + p_2 b_2 + p_3 b_3 \ldots}{f_1 + q_2 f_2 + q_3 f_3 \ldots}$$

Here b_1, b_2, b_3, etc. are the contributions made to the various aims of development policy; f_1, f_2, f_3, etc. are the quantities of scarce factors used; p_2, p_3, etc. are the prices attached to one unit of b_2, b_3, etc. in terms of b_1; q_2, q_3, etc. are the prices attached to one unit of f_2, f_3, etc. in terms of f_1. The number of terms in the numerator is equal to the number of aims; the number of terms in the denominator equals the number of scarce factors distinguished. As examples we may consider b_1 to represent the addition to national income; b_2 the addition to employment of unskilled labour; b_3 the health improvement; and f_1 the amount of capital, f_2 the quantity of qualified labour, f_3 the quantity of skilled labour and so on.

Prices p_2, p_3, etc. are the autonomous valuations by the government of the aims concerned, for instance the value attached to creating one thousand more man-years of employment, expressed in the same units as national income, for instance, millions of rupees.

Prices q_2, q_3, etc. are of a different character; they are not autonomous, but must express the relative scarcity of the factor considered compared with that of f_1.

Somewhat hidden in this formula, but coming to the open as soon as b_1 or f_1 are calculated is the time discount to be applied to income increases or scarce factor outlays in later years. In fact a term such as b_1 should be a long series of future income increases, duly discounted as is usual in business-economic calculations. Also account should be taken of the fact that the relative scarcity of factors of production might change over time.

Also somewhat hidden in b_1 and f_1 are the prices of the individual commodities involved in the calculation of the income increase. These prices should be international prices, that is, prices c.i.f. for the imported goods, prices f.o.b. for the exported goods. Prices of national goods should be

based on their marginal costs, applying international prices to international inputs and scarcity prices to factors of production.

All this implies that in many cases the market prices prevailing in the country should not be applied but rather accounting or shadow prices; that is, prices clearing the market.

In actual practice such prices can often only be estimated in an approximate way.

For new industries there is scope to allow for the effects of a learning process, meaning that after some years the efficiency of the production process may be higher than in the beginning. Again these effects will be difficult to ascertain.

As already set out in Section 2.4 we do not think that foreign exchange needs to be considered as a scarce factor since in a bunch as a whole the net amount of foreign exchange needed equals zero. This is only true in the longer run and on the condition that the short-term policies of the country are "correct" in the sense specified in Section 2.4. But we think that for development purposes the long run is what matters.

2.7. The Time Horizon

The time span of development plans has been chosen intuitively so far. In the early days of Soviet planning the five year span was popular and it still is. It has been accompanied, however, by longer spans, of fifteen or twenty years, in the so-called perspective plans, which have increased in significance. In theoretical analyses the assumption has been made that the span should be infinitely long, with the discount rate taking care of the imminent danger that such exercises become meaningless. Yet we are still faced with the question of either the choice of the proper discount rate or the choice of a limited time horizon. The question is relevant since it can easily be shown that the contents of a plan and particularly the rate of growth to aim at are different with different discount rates or horizons. Recently the problem has been given much deeper attention by M. INAGAKI (1969), who criticizes the customary approach as one applying only to a "society of immortals" and instead proposes to introduce such concepts as a "generation", a "feeling of allegiance" with future generations and the "instantaneous government" as the decision maker. Since his analysis requires further research before

concrete choices can be based upon it we are not going to discuss the question in this book. We only want to remind the reader that all that was said in this chapter rests on an intuitive choice of the optimum rate of growth which, in any case for the world at large, remains arbitrary within certain limits. For individual countries the rate will be influenced by the level of wellbeing of other countries, with which the former want to "keep up".