7

The middle phase

1 Regional aims

As I have already indicated in chapter 6, section 1, the country is divided, during the middle phase of the plan, into a limited number of regions and a limited number of sectors, or industries in the broadest sense. In both cases, this number may vary from two to twenty, but it is preferable not to deal with too many regions and sectors at the same time. The actual number of regions into which the country has to be divided for the practical purposes of the plan will depend on the nature of the country itself, its size and whether it is homogeneous or not. Large countries will, of course, generally have to be divided into a greater number of regions of different kinds than smaller countries. If there are clear cultural differences in a country, such as linguistic or racial differences, then it may be necessary to make these the basis for regional subdivisions. Belgium, for example, could for certain purposes be divided into three regions – the Flemish part, Wallonia and Brussels. Generally speaking, however, the division will be made on a basis of natural factors or transport possibilities. This is the case, for example, in certain Latin American countries, such as Peru, Ecuador and Colombia, in which a distinction can be made between a coastal region, a mountainous region and a forest region. It is on the whole desirable that transport should be easier within a given region than between regions. Transport barriers will therefore partly determine the regional boundaries. It is, however, also desirable that the regions should consist of combinations of administrative units. In this case, both regional planning from statistical data and the carrying out of a regional development policy will be simplified. This is, for example, the case in Turkey, where the sixty-seven provinces have been combined into ten to fifteen regions, each of which includes a number of entire provinces. In the plans for India, the states are considered separately. The Soviet Union is divided into some hundred *sovnarkhozy*, which have in turn been regrouped into seventeen larger units. Sometimes a development that has already taken place in certain parts of the country can lead to a natural division of the whole country into more developed and less

developed regions. In such cases, the country will also be subdivided according to differences in income. In Mexico, for example, a division of this kind into four main regions has been considered. Some developed countries, like the Netherlands and the United Kingdom, have their 'backward' or problem areas. In some ways, the division of Holland into only two regions, a western and an eastern region, is an example of this.

It will, of course, be obvious that, if the number of regions is to be kept to a minimum, it is not possible to satisfy all these requirements at the same time. Any solution to the problem of regional division will have to some extent to be a compromise.

The practice of formulating separate aims for different regions within the development policy itself is becoming increasingly common. Where this is done, there is a marked tendency to aim at a reduction of the difference in prosperity between the various regions. This may take the more precise form of formulating aims in income for the separate regions. These aims may, for example, express that the income per head of population in a future year will differ less than in the year which is taken as the starting-point. It is advisable, if this course is followed, to make a preliminary study (see chapter 4, section 4) of the spontaneous movement of the population between regions before choosing these aims. A voluntary migration of a section of the population from a poorer region to more prosperous areas will make the development problem easier. Generally speaking, however, the poorer regions will most likely be those with less favourable natural conditions for an increase in production than in the more prosperous zones, with the result that a higher investment will be required in these regions than in the more prosperous zones if the same increase in income is to be attained. It is possible to go even further and facilitate the movement of population from poorer to richer regions. None the less, part of the population is bound to remain in the poorer regions, and an attempt will have to be made to bring their income more closely into line with that of the population in the other regions.

In formulating aims in income, possible differences in remunera-

tion in different industries or branches of industry will also have to be taken into consideration. As a general practice, industries requiring a lower level of education will receive a lower average income than those requiring higher qualifications.

It is also possible to have other aims in view for regional development, such as those offering opportunities for employment. These aims may, however, be provisionally classified under the heading of income, and I shall assume that all regional aims chosen are in this form.

2 Types of sector

After dividing the country into regions, the national economy will be further subdivided into sectors. Here too, it is important to establish the principles according to which the sectors should be defined. As in the case of the regional divisions of the country, the aim should be to have a relatively small number of sectors that are fairly homogeneous. Their selection will of course depend to a great extent on the structure of the country itself. In a country like Venezuela, with an important oil industry, this sector will have to be given a separate place. Many developing countries will have a large part of their manpower in agriculture. If one of the agricultural products plays a particularly important part in the country's economy, as for example cotton in Egypt, then it may perhaps be necessary to treat this as a separate sector. Other sectors may also be chosen which are for the time being 'empty', that is to say, which show no production, but do show imports. Such sectors are permissible, of course, only so long as it can be established that production within them will at a later stage be considerable. It is essential too that a distinction be made between regional, other national, and international sectors, since it is important that planning in sectors should take place simultaneously with planning in regions. The definition of these three types of sector can, however, be only approximate. The regional sectors may be defined as sectors whose products cannot be transported to other regions

because of prohibitive transport costs. The other national sectors may be regarded as those whose products cannot, for the same reason, be transported abroad. These two types of sector, the regional and the other national sectors, are together known as the national sectors, and may be contrasted with the international sectors, whose products can be transported abroad.

A good example of a regional sector is the building industry. Because of their very nature, buildings cannot be transported from one region to another. The exception, namely prefabricated buildings, is so unimportant that it can be left out of consideration. Most of the other regional sectors are those which provide services. Examples of these include the letting of buildings, personal services such as domestic service and hairdressing, all kinds of repair industries, the whole of the retail trade and a part of the wholesale trade, government services at the lower level, most forms of education and certain kinds of traffic, such as town traffic.

Examples of national industries are another part of wholesale trade and of traffic, government services at the higher level and higher education and, in a number of cases, the supply of power. The production of raw materials, such as mineral oils, coal, etc., for power, does not, however, come under the title of national industry in this sense. In the case of very large countries, it is possible, as a first approximation, to include certain industries whose products – for example, coal, steel and building materials – are very heavy per unit of value. It would be incorrect to include these industries among the national sectors in the case of smaller countries.

The international sectors are therefore virtually all branches of industry, agriculture and mining, which produce material commodities.

There is no need in the middle phase of planning for the sectors to be further subdivided. In the microphase, however, the regional sectors can be further divided, for example, into local sectors and even into sectors for cities, town and villages. I shall come back to this point in chapter 9.

The distinction between regional, other national and international sectors is mainly a distinction according to the level of the transport costs of the products concerned. It will therefore be clear that this distinction is, as I have previously indicated, approximate. The cost of transporting any kind of product is subject to continuous change and a division into three types of sector is, in a number of marginal cases, practically impossible to maintain with any degree of precision. An approximation of this kind, however, has the advantage of great simplicity, as against a method in which the transport costs are introduced separately. This method was used in the theory of international trade, when a distinction was made between production factors – labour, land and capital – which were regarded as nationally, and products which were regarded as internationally, mobile.

This distinction is very similar to that made in town and country planning between primary and secondary industries. Taking the country as a whole, the international sectors of the middle phase of development planning comprise the primary industries and the national sectors the secondary. In the case of an individual region within the country, the international and other national sectors are primary and the regional sectors secondary. The economist's method is, however, different in that he has to consider communities of different size – the whole country and individual regions – simultaneously and has accordingly to interpret the concept 'primary industries' in this instance in two different ways. I shall discuss this question more fully in chapter 9, when it will be seen that it is necessary in the microphase to subdivide the smaller communities into further categories of different size.

There is also an affinity here with the term 'infrastructure'. It is possible to regard the national sectors of industry as broadly speaking the same as the infrastructure. The same meaning is, however, not always placed on the word infrastructure. Sometimes it is understood to mean what has to be done by the state so that the superstructure of industry is able to carry out its function. Two difficulties arise if the word infrastructure, interpreted in this way,

is used in this context. First, it implies that politics are to some extent involved in defining national sectors. Secondly, it excludes from the infrastructure everything that is not strictly necessary, in other words, all luxury goods, even when the production of these should, according to our definition, form part of the activities of the national sectors.

3 Complementary bunches of investments

The terms introduced in the preceding section are especially important, as a sector that is national because it is impossible to transport its products must be present to a given extent if the equilibrium in the national economy is not to be upset. Since one of the most important reasons for preparing development plans is to prevent any such imbalance, planning can take advantage of this conclusion. This is especially applicable whenever an ideal process of development is conceived and plans are made for it. There must, of course, be no unused capacity for production in any ideal process, except in cases in which the indivisibility of certain means of production is involved (see section 8 of this chapter). If an addition of new capacity to an international industry is contemplated, by the carrying out of a definite project in an international sector, this will result in an increase in the demand for a number of national products, and a consequent need for expansion of capacity in the sectors responsible for these products. If the quantities of each product needed are known per unit of a given product, then it can be calculated how much these expansions in capacity will come to. I shall refer to all these complementary investments, together with the given investment in an international sector, as the 'bunch' of investments. In order that a balance may be maintained between production capacity and demand for each product, investments must always be made in the form of whole bunches, and not simply as parts of such bunches, in the international sector concerned. For this reason, whether an investment in an international sector is accepted or not is bound to depend on whether the

bunch of investments as a whole is attractive. Whether or not this is so will in turn depend on the one hand on the contribution it makes to the development aims, and on the other on the sacrifices that are necessary in respect of certain scarce factors. This aspect of the problem will be discussed in more concrete detail in chapter 9. In this chapter, I am more concerned with the object to which these criteria of attractiveness have to be applied, in other words, the bunch of investments itself.

It is possible to calculate the composition and scope of this bunch of investments relatively simply if it is assumed that 1 inter-industrial supplies are proportionate to the increase in production in the receiving sector and 2 in the case of increasing income, consumption of different goods is linearly dependent on this income. Assumption 1 is that of the well-known input-output method of Leontiev, applied to increases in production and inputs. Assumption 2 may be called the assumption of linear Engel curves, since these curves show the relationship between a change in incomes and a change in the quantities consumed.

I have chosen a fairly simple example to illustrate the method used in making this calculation. The reader who is allergic to mathematical symbols can leave out the rest of this section. Since only part of the information that the input-output method assumes to be available is necessary in this method, it may be called the semi-input-output method. The following are the symbols and variables used:

v^h increase in production in sector h
c^h increase in consumption in sector h
e^h increase in the balance of exports in sector h (the balance of exports can also be negative, in which case it is in fact a surplus of imports)
y increase in income.

In order to simplify the argument, let us assume that there are only 9 sectors, 1–6 representing the international sectors and 7–9 representing the national sectors. Let us further assume that an

expansion is contemplated in sector 1, shown as $\bar{v}^1$. This also means that $v^2 = v^3 = \ldots\ldots v^6 = 0$. In the case of the national sectors, it can also be assumed that there will be no surplus of exports, with the result that the change here is also always 0: $e^7 = e^8 = e^9 = 0$. Finally, it may be assumed that the country's investment is constant; here it is a question of comparing various possible alternatives with each other. We may consequently take the changes in the quantities of all goods intended for investment as equal to nil and therefore leave them out of the equations.

The equations which satisfy all the variables are shown in their general form as follows:

$$\left.\begin{array}{l} v^1 = \varphi^{11}\, v^1 + \varphi^{12}\, v^2 + \ldots\ldots\ldots\ldots + \varphi^{19}\, v^9 + c^1 + e^1 \\ v^2 = \varphi^{21}\, v^1 + \varphi^{22}\, v^2 + \ldots\ldots\ldots\ldots + \varphi^{29}\, v^9 + c^2 + e^2 \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ v^9 = \varphi^{91}\, v^1 + \varphi^{92}\, v^2 + \ldots\ldots\ldots\ldots + \varphi^{99}\, v^9 + c^9 + e^9 \end{array}\right\} \quad \ldots\ldots\ldots(1)$$

$$\left.\begin{array}{l} c^1 = c^1_1 y \\ \ldots\ldots\ldots\ldots \\ c^9 = c^9_1 y \end{array}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

$$y = \varphi^{10}\, v^1 + {}^{20}\, v^2 + \ldots\ldots\ldots\ldots + \varphi^{90}\, v^9 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The equations (1) are those of the input-output method. They show that the increase in production of every commodity 1–9 is equal to the increase in supply to all industries for their production process plus the increase in consumption plus the increase in export surplus. The coefficients $\varphi^{hh'}$ show how much of the commodity h is needed for an increase in production of commodity h' by one unit.

The equations (2) show how much the consumption of each commodity increases with a given increase in the national income.

Equation (3) shows the increase in income caused by a given increase in the production of each of the commodities. The coefficients φ^{h0} depend on the coefficients $\varphi^{hh'}$ in the equation

$$\varphi^{h0} = 1 - \varphi^{1h} - \varphi^{2h} - \ldots\ldots\ldots\ldots\ldots\ldots - \varphi^{9h}.$$

The unknowns which directly concern us are v^7, v^8 and v^9. The unknowns which do not directly concern us are e^1, e^2, ... e^6. These are the changes in the export surpluses of the international sectors which are the result of the expansion in capacity of sector 1. For all the sectors 2–6 they will be negative, because more of these products are needed and no more are produced.

After filling in the particular values that we have given to v^1, v^2, ... v^6, equations (1) and (3) will appear as follows:

$$\left.\begin{array}{l} \bar{v}^1 = \varphi^{11}\,\bar{v}^1 + \varphi^{17}\,v^7 + \varphi^{18}\,v^8 + \varphi^{19}\,v^9 + c^1 + e^1 \\ 0 = \varphi^{21}\,\bar{v}^1 + \varphi^{27}\,v^7 + \varphi^{28}\,v^8 + \varphi^{29}\,v^9 + c^2 + e^2 \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ v^7 = \varphi^{71}\,\bar{v}^1 + \varphi^{77}\,v^7 + \varphi^{78}\,v^8 + \varphi^{79}\,v^9 + c^7 \\ v^8 = \varphi^{81}\,\bar{v}^1 + \varphi^{87}\,v^7 + \varphi^{88}\,v^8 + \varphi^{89}\,v^9 + c^8 \\ v^9 = \varphi^{91}\,\bar{v}^1 + \varphi^{97}\,v^7 + \varphi^{98}\,v^8 + \varphi^{99}\,v^9 + c^9 \end{array}\right\} \dots\dots (1')$$

$$y = \varphi^{10}\,\bar{v}^1 + \varphi^{70}\,v^7 + \varphi^{80}\,v^8 + \varphi^{90}\,v^9 \dots\dots\dots\dots (3')$$

Equations (2) do not change.

If we fill in (3′) in (2) for sectors 7, 8 and 9, and the values found thereby for c^7, c^8 and c^9 in (1′), it will be seen that in the last three equations, the only unknowns to occur will be v^7, v^8 and v^9, which can be solved from these equations. The number of unknowns and equations is thus equal to the number of national sectors and therefore much smaller than in the case of the input-output method that is usually applied.

In this way, we have succeeded in calculating the complementary expansions in production in the national sectors together with the composition of the bunch of investments for an expansion of $\bar{v}^1$. The quantities v^7, v^8 and v^9 are not only those which are needed to produce $\bar{v}^1$, but also those which are needed for the manufacture of these last mentioned products (the indirect quantities of the first order) and the indirect quantities of all higher orders – in short, the quantities necessary if a new equilibrium is to be obtained.

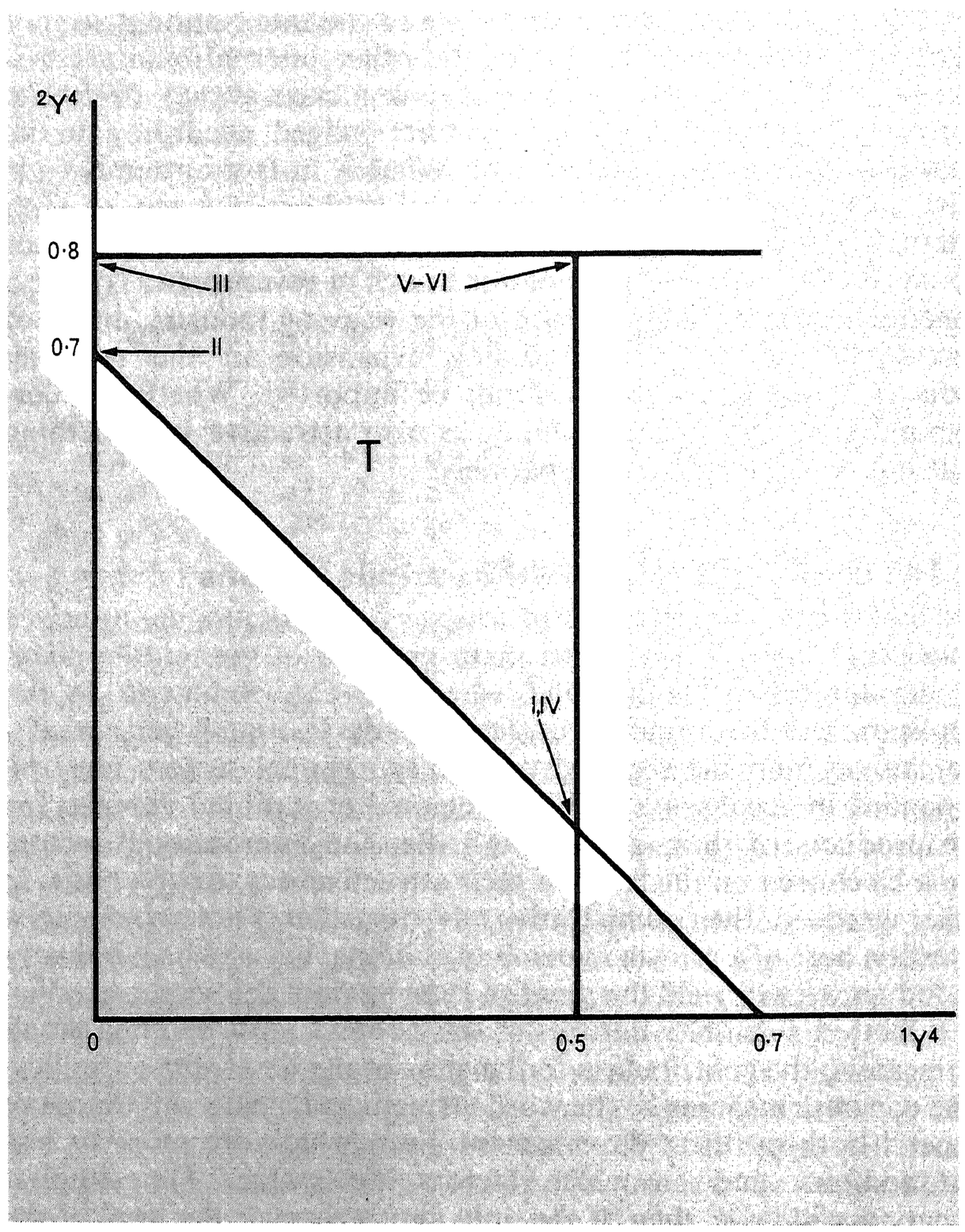
It should also be noted that an application in the traditional way of the input-output method is out of place here. It is possible to apply this method in various ways, but it does also tend to suggest,

for example, that an expansion of one of the international sectors also necessitates an expansion of the other international sectors. This is in principle neither necessary nor even always desirable, especially if one of the other sectors, judged according to its bunch, happens to be unattractive. What it in fact amounts to is this: a decision can be made concerning the expansion of each international sector individually and independently, but this does not apply to the components of one bunch of investment. To give a concrete example, an expansion of the weaving industry does not necessarily imply a corresponding expansion in the spinning industry – the yarns required can be imported. Whether a corresponding expansion in spinning is also attractive is something that has to be considered separately.

4 The choice of sectors in the various regions

We have now reached the point where we can discuss the principle underlying the solution to the main problem of the middle phase of development planning and where we can comment on the application of this principle in simple cases. Putting it very briefly, we can say that the regional and other national sectors must be expanded in accordance with the regional or national demand for the products of these sectors, and that the international sectors must be chosen on the basis of their attractiveness; on the basis, in other words, of their comparative advantages. It is not principally a question here of a growth in demand at home, but of which industry or industries will yield the greatest returns from the scarce production factors available. Returns in this context must be understood as meaning the contribution to the aims of the development policy. The concrete meaning of the word attractiveness here will therefore depend both on these development aims, which are more or less autonomous, and on which factors are scarce. The simplest situation will arise, then, if the only aim is to raise the level of the national income and the only factor that is regarded as scarce is capital, including, if so desired, education as an investment.

Figure 13. *Example of a simple problem of linear programming*. The diagram illustrates in a very simple way a now widely used method of planning, known as linear programming. It is characteristic of this method that the unknowns (often the volumes of production of the various industries, here represented by the symbols ${}^1\gamma^4$ and ${}^2\gamma^4$) must first of all satisfy certain restrictions. Geometrically



this means that the point representing the unknowns is permitted to be only inside the area known as the feasible area, indicated here by T. Within this area the 'best' point must then be ascertained. (For a fuller explanation see appendix F.)

Attractiveness in this case will be the relation of increase in income to investment, or the reciprocal of the (marginal) capital-output ratio.

To illustrate what this principle means, let us take as our example a country that has not been divided into regions with separate income aims. In such a country there will consequently be only national and international sectors. Furthermore, only one of the international sectors will be developed. This will be the sector which shows the lowest capital-output ratio for its bunch of investments. This complete specialisation will, moreover, only continue to be worth pursuing for as long as it can be assumed that all the coefficients will remain constant. In practice, a number of different international sectors will usually be expanded simultaneously. This action can be defended, even when the coefficients are constant, if different regions have been considered with separate aims. It may be, in this case, that international sectors will have to be developed in several of these regions. These sectors will be those that are most attractive in those regions, even if they are far less attractive than the sector that is the most attractive from the national point of view.

If the structure of production and demand is even simpler than it is usually assumed to be, the choice of sectors will also be correspondingly simpler. If, for example, it is assumed that the demand in each region for regional products is dependent on the income of the region, the extent of the regional sectors will already have been ascertained by establishing the aims in income. If the same assumption is made with regard to the demand for other national products and these are thus assumed to be dependent on the national income, the total extent of production in the national sectors will also be established. All that remains to be done in this case is to distribute production over the various regions and to determine the extent of the international sectors in each region in such a way that the income aimed at is reached with the lowest total investment. This problem can be solved mathematically by the linear programming method. It also contains fewer unknowns

than the more general form. A simple example is shown in appendix F. The solution to this problem is shown as a graph in figure 13.

Indeed, as a first approximation, it is often assumed that the demand for regional (or national) products is dependent only on regional (or national) income. But this assumption cannot be made if there are, among those to be chosen, industries requiring a certain regional or national product in exceptional quantities, for instance, the production of aluminium, which needs a great deal of energy. The demand for regional (or national) products will in this case also depend on the composition of the regional (or national) income according to industries. This problem can also be solved by the linear programming method, though now there are a greater number of variables – it is not possible here to regard the extent of the regional (or national) sectors as having already been determined by the aims in income.

The reality can be better understood if a number of other complications are borne in mind. I propose to discuss some of these very briefly now. The first is that the period of investment, or gestation period, of one sector may well be longer than that of another. Thus, irrigation dams or mines may demand years of investment activity before a beginning can be made with production. Forestry is another example of an investment with a long period of gestation. This often leads first of all to difficulties in making the various parts of a plan dovetail. If various products need to be available at the same time, an earlier beginning must be made with investment for some of these products, in accordance with their longer gestation period. This has resulted in extremely complicated methods of planning, generally referred to nowadays as network planning. Something of the nature of these problems will be discussed in chapter 8, under the heading of education planning, since it is in this sphere that the phenomenon occurs to a particularly high degree.

The attractiveness of an industry (which, as I have said, will be dealt with more fully in chapter 9) also depends on the length of the gestation period of the installations. If the total investment and

the total contribution to national production are equal in two industries A and B, industry A will be less attractive than industry B if the gestation period of its installations is longer than that of industry B. Its production will be available later on, and future commodities have less value than present commodities. This can be expressed in the capital-output ratio by ascribing a higher value to investments that have to mature long before production can commence. If investment for industry B must mature in one year before production can commence and that for industry A in two years, then the investment needed in the first year for industry A must be increased in price by a factor $1 + m$; m here representing the premium of present commodities over commodities becoming available a year later.

In chapter 9 too, I shall consider in greater detail another complication that occurs whenever there is more than one scarce factor – for example, foreign exchange together with capital – or if there is more than one aim, in other words, if the aim is not only to increase income, but also, for example, to create opportunities for employment or to improve the situation in the distribution of incomes. In the meantime, all these may be regarded as linear problems.

This, however, becomes different when the phenomenon known as rising marginal costs is introduced. (It may be noted here that rising marginal costs are equivalent to decreasing returns.) This factor is necessary for the sake of realism in the case of expansion in certain industries – in agriculture on poorer soils for example, or mining at deeper levels. What in fact happens here is that certain inputs no longer develop linearly with production, but according to a curve with an increasing slope. The marginal attractiveness (and possibly even the relationship between incomes and capital) is in this case no longer a constant. If this sector was initially the most attractive, then in this case it will probably cease to be so after a certain amount of expansion. Another industry may then become more attractive. One result of the occurrence of this factor is to introduce a greater diversity in the economy.

Table 8. Capital-output ratios for certain sectors in the United States.

Letting of houses	7·1
Communications	3·6
Steel production and rolling	1·8
Agriculture	1·4
Cotton spinning and weaving	0·83
Trade	0·53
Furniture and other wooden goods	0·34
Shipbuilding	0·23
Building industry	0·08

Source: W. Leontief and others, *Studies in the Structure of the American Economy*, New York, 1953, pp. 220–1.

It is not only increasing marginal costs which can make an industry less attractive. This can also happen if increasing production is accompanied by a fall in the prices paid for the product. This frequently occurs in the case of countries supplying a large part of the world market with their products. Examples of this are Egypt's supply of cotton and India's or Pakistan's supply of jute. I shall discuss later on, in section 5 of this chapter, how this factor can be related to development planning.

I have dealt at some length with the principle underlying the choice of sectors. It is important at this point to consider some concrete data concerning the attractiveness of certain industries to developing countries. As a first approximation, the capital-output

Table 9. Capital-output ratios for certain sectors in India.

Letting of houses	11·0
Transport and communications	8·2
Industry	3·1
Mining	1·6
Agriculture	1·1
Trade	1·3
Handicrafts	0·8

Source: M. Mukerjee and N. S. R. Sastry, *An Estimate of the Tangible Wealth of India*, International Association for Research in Income and Wealth, Fifth Conference, 1957.

ratios provide a good criterion of this.

The figures of the capital-output ratios tend to show considerable differences between the sectors, and the international sectors are generally in the middle – these, in other words, show less dispersion than the national sectors. This tendency is illustrated by the American figures shown in table 8 and the Indian figures shown in table 9 (see also appendix E).

We have very few accurate figures for the many different kinds of handicrafts and personal services, but we may assume that the capital-output ratios for these will be fairly low. The tendency to which I have already referred results in a very serious disadvantage as far as the developing countries are concerned. Since these

countries are bound to develop their national sectors, their chances of keeping the average capital-output ratio as low as possible are not very great, because of their narrow choice of sectors. They can in fact only choose from among the international industries, which show much smaller variations. Their choice of the most attractive industries will therefore result in only a comparatively small contribution being made to the desired development. This does not mean, however, that they do not have to make their choice from among the most attractive sectors.

This tendency also explains why the variation that occurs in the average capital-output ratios for each country is far smaller than would be expected on a basis of the widely divergent figures for the industries.

The international sectors do, however, show variations – the textile industry shows lower capital-output ratios than, for example, the chemical industry. This is the reason why the developing countries often tend to concentrate on their textile industries.

There are also other tendencies. It often happens that industries within the same class show a lower capital-output ratio in the sphere of finished products than in that of the extraction of raw materials, which can only take place on a more massive scale and by means of more mechanised processes. This is also the case, for example, with the textile industry, in which spinning has a greater capital intensity than weaving, and weaving has a greater capital intensity than the clothing and tailoring industry. In the metal industry, too, steel production shows a greater capital intensity than shipbuilding or mechanical engineering. This means that developing countries are generally able to obtain more income from a unit of capital if they develop import-replacing industries rather than export industries. The former manufacture finished products, whereas the latter are usually concerned with the early stages of the manufacture of raw materials. Another tendency, however – one which has to do with the size of the market – cuts across this tendency for import-replacing industries to be preferable in developing countries. A small underdeveloped country will

probably also have only a small market for its import-replacing industries, a market which may well be insufficient to justify the setting up of optimum plants, that is plants which are large enough for costs to be cut to a minimum. This can, however, be encouraged by entering into partial customs unions with neighbouring countries.

Despite these adverse factors, however, it is clear from an investigation made by Professor H. B. Chenery (see appendix G) that import-replacement has played an important part in the development of most of the developing countries.

Finally, it should also be pointed out that in certain industries different production methods are possible that show an unequal capital-output ratio (see also chapter 4, section 6). Boon mentions two methods[2] in the building industry that are characterised by capital-output ratios of 1·5 and 0·8. In general, however, his findings show that, even when there are great variations in the capital intensity (that is, in the ratio between the quantity of capital and the quantity of labour), the variations in the capital-output ratio (that is, the ratio between capital and net production) are far less great, partly as a result of the buildings necessary for a greater number of workers.

In conclusion, it should also be noted that the extent of a number of the so-called social sectors, including education, medical care and various forms of cultural expression, is in principle determined by the choice of the industrial sectors. In view of their special character, I shall be devoting a separate chapter (chapter 8) to these sectors. The long gestation period is one of the most prominent aspects of these social sectors. This is particularly marked in the case of many educational processes.

5 The role of prices in the choice of sectors

In determining the attractiveness of various sectors, it is necessary to compare the products of these sectors – both those that will be obtained and those that will be sacrificed – and the various

production factors with each other. This is done by considering the prices in each of these categories. There are, however, three main difficulties involved in this method. The first is that there are often important differences, in the case of international commodities, between prices on the world market – here to be taken as prices of imports – and prices on the home market. Generally speaking, it is the world market prices that must be applied when this method is used, and not the prices on the home market, which are often arbitrarily increased by the introduction of import duties and other restrictions. The most important reason for applying world market prices here is that this is the price for which any desired quantity can be obtained. The reservation must, however, be added that the world market prices obtaining at any given moment are subject to correction if they have a clearly temporary character. This may occur in the case of unstable markets where prices are fluctuating considerably, or in the case of markets where the natural equilibrium of the world market price has been disturbed by artificial action on the part of other large countries. This happened, for example, to the prices of wheat and cotton as a result of the United States' policy of relief. The world market prices, after any necessary adjustment, must also be applied to the ratios of the input-output tables that are used – this is something that is not always sufficiently considered.

The second difficulty is encountered in the choice of prices when the extent of production in a country for which a plan has been prepared is such that it exerts sufficient influence on the world market to cause a lowering or a raising of the price if a variation occurs in the quantity planned (see also section 4 of this chapter). The relationship between price and volume of production must in this case be used in the planning method in order to ascertain the precise extent to which production in the sector concerned must be expanded for this sector to remain more attractive than the following sector. In cases such as this, which are in practice not very numerous, this relationship can usually be found by econometric research, and a curve showing the world demand can thus be obtained.

The third difficulty that may arise in the choice of prices is connected with the prices of national commodities and production factors. Because there is either very little or no international mobility here, there will in principle be no international prices. There will, however, often be national prices, but these (market) prices are not always the most precise expression of the relative scarcity of the national commodities or factors. This is why I shall advocate the use of accounting prices (shadow prices) here later on in chapter 9, section 2.

6 The mutual interdependence of technical coefficients

In the foregoing discussion, the assumption has always been that the technical coefficients, both the capital-output ratios and those of the input-output tables, may be regarded as given for each industry, even if the costs are not linearly dependent on the volume of production. A further complication may arise when the coefficients of the one sector depend on the region in which another sector is developed. The commonest way in which such a situation can occur is when the transport costs of raw materials or semi-finished articles play an important part. We have preferred not to introduce transport costs as such into our calculations, which means that they will be hidden in some of our coefficients. What we have in fact done is to regard part of the transportation as a part of the production of the sector concerned.

The complication occurs especially in the case of relatively heavy products (per value unit of the product). Let us take the example of cement and coal, two sectors of industry with heavy products. If there is a choice of developing both these industries in one or more of a number of regions, the cost of the cement may in fact be dependent on the region from which the coal must come. The income from the cement industry in different regions will therefore not be independent of the choice of the regions in which coal production is expanded. I intend to do no more than simply point out that this situation can and does arise, since the

solution to this kind of problem is not possible without a concrete mathematical setup, which will be different in each case.

7 Models with a small number of sectors

In the history and the literature of economic planning, there are several examples which must be regarded as intermediate cases, occupying a place halfway between the macrophase and the middle stage. [1] [10] [13] [27] All these cases have a small number of sectors and no regions. In connection with India's plans, Professor P.C. Mahalanobis has made calculations with a model with two sectors and one with four sectors. In the first case, he distinguished between capital goods and consumer goods. In the second, he divided the last sector into three further sectors, the first comprising the factory production of consumer goods, the second production in small-scale industries and cottage industries and the third the production of services. One of the aims of the development policy to which special attention was drawn in this case was that of employment, which was obtained in far greater quantity per unit of product in the third than in the second sector – the well-known example of India's textile industry. Mahalanobis' work in this field is especially noteworthy because it was essentially pioneering. It dates from 1953 and 1955.

Professor C. M. Palvia has prepared a model with an agricultural and a non-agricultural sector in order to study the consequences of decreasing returns with increasing volume of each of the production factors separately during the development of an economy.

Dr M. Atallah has used a similar model to forecast the development of the terms of trade of agricultural products versus manufactured products. Both he and Professor Palvia have continued along the road first pioneered by Colin Clark[6] who as long ago as 1942 attempted to forecast the development of world economics with a similar model. As these authors have not used their models for the specific purpose of economic planning, I shall do no more than simply mention their work.

Finally, Professor H. B. Chenery has made use of data from a large number of developing countries to calculate a process of development, divided into main sectors (see appendix B) and smaller sectors (see appendix C), but without any subdivision into regions.

8 Investment plans in the case of indivisible capital goods

A final complication that is often met with when sectors are being selected for investment occurs when some of the means of production in one or more of the sectors considered for development are clearly indivisible. This indivisibility is most evident in the case of certain forms of transport and communications. It is sensible to build a road or a railway only if the entire distance between the two centres to be connected is spanned. If, for example, the road has to be of a certain minimum width or the railway track of a minimum weight, then a considerable investment will have to be made on the basis of a single decision. Some authors, stressing the extreme importance of this phenomenon of indivisibility, have concluded that development must consequently take place in leaps and bounds, or at least that the increases in prosperity resulting from development will occur in leaps and bounds. The need for big pushes or big leaps forward has been emphasised, implying that small investments are both insufficient to promote any genuine development towards a modern economy and also inherently dangerous in that they tend to be squandered on small and less attractive objects. There is certainly an element of truth in this as far as relatively small countries are concerned. In the case of larger countries, however, it is difficult to discover any clear statistical evidence of big leaps forward in development. The probable explanation for this is that a relatively large country has a sufficiently large number of objects of this kind for them to be dealt with in turn, with the result that it is seldom possible to establish any discontinuity in the figures for the country as a whole.

The problem of the choice of investments may be regarded here as the problem of the precise moments at which the sudden increases in capacity ought to take place in the sectors that are characterised by this indivisibility. From the point of view of method, this problem is both important and interesting, especially in connection with the question as to which decisions concerning investments can be left to 'lower units', in particular individual enterprises. This subject will be further discussed in chapter 10. In certain circumstances, which will also be discussed in chapter 10, it may be assumed that the individual enterprises concerned will take the same decisions as a central authority acting in the public interest. This means that profit serves as quite a good guide to decisions about the expansion of a sector, though this is, of course, an oversimplification of the situation. There is, however, good reason to doubt the correctness of decentralised decisions in the case of industries with indivisible means of production. Such industries often suffer inevitably from overcapacity – for example, a railway may well be useful, but it will not necessarily be used to its full capacity. Over-capacity, however, leads to anomalies in the determination of prices. If there is free competition in the market supplied – in the example that we have taken, this is the transport market for the 'relation' concerned – then prices will fall to such an extent that a private enterprise will resort to the formation of a monopoly. The profits which can be made here are probably a solution to the problem that faced the individual transporter, but they are no real criterion of the social utility of the services performed. Even if it is decided not to go ahead with the formation of a monopoly, which would be possible if a system of two-part rates were set up, there would still be an arbitrary element in the profits of the individual enterprise which would render these unsuitable as a guide to the most desirable volume or the best period for investments. In these circumstances, the better solution is, in principle, central planning. For this reason, I propose to give some attention to this problem in this chapter.

The principle may be formulated as follows. Let the total capital available to an economy show a given development in time, for example, an increase at a constant rate. Let there be several sectors in which investments can only be made at given leaps forward, which represent the minimum extent of an investment. All the other sectors can be grouped together as one sector, in which the capital to be invested can increase continuously. At each level of the total capital of the economy, there is one division over the different sectors which will bring about a maximum total prosperity. This can be estimated if the social utility function (dependent on the quantity of each of the commodities that are produced) and a number of technical coefficients (mainly capital-output ratios, but also, if so desired, input-output ratios) are known. Among the secondary conditions that have to be fulfilled are those which stipulate that the capital invested in industries with indivisibilities can only increase in leaps. In the case of relatively small economies, the co-efficients required to solve the problem can be taken from data relating to larger countries. [25]

9 Estimating the demand for finished products

Three kinds of coefficient are required if this method is used to choose the sectors and the regions in which these sectors can best be developed. They are the input-output ratios for inter-industrial supplies, the capital-output ratios for the necessary investments and the coefficients which show the relationship between the increase in demand for finished products and the increase in the national income.

An example of the first is given in appendix H. Examples of the second can be found in appendix E. We have already met with the third group of coefficients in section 3 of this chapter, in the symbols c_1^1, c_1^2, ... c_1^9. They enable us to estimate the consumption component in the demand for finished products. This estimate is often made by means of the so-called family budgets, which are themselves the result of normally extensive statistical research. This

research establishes how much is spent by each of a large number of families with different incomes on each of a number of groups of products differentiated for the purpose of the investigation. A graph can then be made for each of these groups of products; income is plotted on the horizontal axis, and what is spent on the group of products in question is plotted on the vertical axis. If the points are more or less grouped around a line, the curve of this line can be plotted with the help of one of the recognised econometric methods.

A great deal of material of this kind has become available for a large number of countries. This has been divided into various social groups, such as manual workers, intellectuals, agricultural workers, farmers and so on, all well represented with the exception of the big-business executives. There are quite big differences between these social groups, and there are also quite striking similarities between countries in which similar conditions prevail. Reasonable estimates can therefore usually be made on the basis of these data.

The second component in the demand for finished products, the investment component, is estimated in principle from the increases in production in each of the sectors recommended for expansion by means of the capital-output ratios. These estimates may be fairly rough, if only a small number of investment commodities are distinguished, or they may be more precise. In principle, every commodity may be regarded as an investment commodity, since an increase in stock is also an investment. It should also be borne in mind that the stocks of an economy must expand in relation to the volume of production. This relationship does not necessarily have to be proportionate – a saving can be made in stocks by an improvement in the organisation of trade and production. If the investments in various goods which necessitate expansion in one single sector are taken into account, then it is possible to obtain as many capital-output ratios for this sector as there are commodities, and each of these ratios may be called a partial capital-output ratio. By taking the length of the process of investment into account, it is also

possible to go a stage further. If production in a given sector is to be expanded in a given year, it is normally necessary for investments to be made for a number of years preceding the year of expansion. It is thus also possible to distinguish partial capital-output ratios according to the period separating the investment from the moment at which production begins to increase.

The third component in the demand for each finished product is the export surplus, in other words, the difference between exports and imports. In the method used in this chapter, the export surplus is, as it were, the closing entry; it is the result of total production and of inter-industrial supplies, consumption and investments. This is in accordance with the view that the world market for the overwhelming majority of the products exported by most developing countries is so much greater than the exports of the country in question that an expansion in exports should be possible so long as the product is available for export. This is, of course, assuming that the quality of the product, after grading, is acceptable on the world market. In the few cases in which the supply of a product is able to some extent to satisfy the world demand for it, an influence on the price must also be taken into account (see section 5 of this chapter).

Other methods are also used, especially for short-term planning. The most satisfactory are based on a study of the demand for finished products and on the assumption that the exporting country can maintain its share in the market – again, only so long as certain conditions of quality and price are fulfilled. In a number of plans based on studies of this kind, rigid upper limits are placed on the quantities that can be exported. This seems to me to err on the side of inflexibility. If this method is used, however, the equations of the input-output method must also be employed in order to revise the estimated volume of production.