

Generalities on planning (*)

1. Can peacefulness and speed be combined?

Peaceful planning for national development is the burning question of the day in a large number of underdeveloped countries in Asia and Africa and it is also an important issue in many countries of Europe and Latin America. There is indeed hardly any country that cannot be looked upon as underdeveloped in one sense or another. My own country Norway is an example in point where peaceful planning is a big economic question.

At the same time speed is essential. Not only the urge of the people to progress but also the compulsion of circumstances necessitates rapid advance.

Can these two objectives: peacefulness and speed be combined? The question is pertinent because basically the two objectives are antagonistic. They can be combined, however, on one condition, a condition which is a *sine qua non*: A streamlined rational methodology, for the planning work must be developed, a methodology that utilizes deep ploughing scientific procedures not only for the gathering of technical and statistical data but also for *selecting the optimum way* in which to combine the various kinds of development.

2. Thinking in real terms versus thinking in monetary terms

The first condition for getting a firm grasp on the problem of economic planning is to begin by ridding ones mind of the monetary way of thinking. The concepts and instruments of banking, finance, credit and money, only pertain to a special case of institutional set up. Behind this sphere there is a world of realities which will persist no matter what sort of economic institutions man devises for solving his economic problems. Behind the concepts of interest, dividends, stockprices, money, liquid assets etc. we have to look for such concepts as the sufferings of men, his daily bread, his clothing, the health service we can give him and the actual means of obtaining this: agricultural products, steel,

(*) Memorandum fra Sosialøkonomisk Institutt Universitetet i Oslo, 27 February 1957.

cement and locomotives. We must *begin* by planning in terms of these real thing.

Of course, the monetary aspects of the problem do come in, as means of implementation, but for clear and efficient thinking they should be considered as coming into the picture only afterwards, when we discuss convenient means to use in carrying out the physical plan. We have a considerable freedom of choice in shaping and reshaping this system of tools. But we have very little freedom of choice with respect to the physical means. It is therefore in the physical system that the essence of the problems resides. Anyone who approaches the problem of economic planning by starting to discuss monetary circulation, interest rates and the like, has by this very fact proved that he has not understood what the problem is about. This verdict may seem hard, but so much inefficient handling of economic problems has sprung from the monetary way of thinking, that it is necessary to be very explicit on this point.

3. - Planning must be operational, not only formal

For realistic planning some sort of theoretical models is of course necessary. But it must be a theory of a special sort. It must be operational, not only formal. It is not sufficient to have an elegant very aggregated and easily understandable theory involving a few concepts such as overall production, consumption, employment, investment, foreign balance of payments and a few other of the big central economic concepts, or to have a more comprehensive but purely formal theory with many symbols provided with subscripts, superscripts and other affixes of various sorts. To be sure such theories can be indispensable as a preliminary guide and a programme for more realistic investigations, but they do not lead to what should be considered essence of planning analysis: A scrutiny of actual possibilities ending up with specific advices of how to handle the actual economic problems as they appear in the language of every day discussions in government administration and within the public.

Here the levels of production in *specific sectors* come into the picture. There must be at least a break-down of, say, 30, but better something between 100 and 200 sectors perhaps. Also the prices of the various products, the tax system and the rates of specific taxes, the application of specific form of direct controls etc. must be discussed.

And all these elements must be considered simultaneously in their mutual effects and counter-effects. Operational planning then is eco-

nomie planning from a viewpoint that on the one hand is sufficiently detailed so that one can recognize the concrete problems of daily life and understand what is meant by an advice on them, and on the other hand is sufficiently aggregated so that we do not loose ourselves in the wilderness.

4. - The target setting approach to planning

The usual form of planning for economic development is by *target setting*. First one chooses certain *primary* targets for some all important economic elements such as for instance a definite increase in consumption or in investment in certain sectors or the abolishment of unemployment or a given improvement in the foreign balance of payment etc. over a certain definite period. These primary targets may be set more or less by guess-work based on an intuitive mixture of desires and a rough estimate of what is possible under the given circumstances.

Once such basic primary targets have been adopted, a whole series of *consequences* will follow and may be computed and discussed in an analytical way so as to arrive at a number of what may be called *deduced* targets. For instance, if an industrial development of given size and given distribution is to be carried through in India, it is necessary to improve the transportation system. Given the industrial development — its general level and distribution — one can figure out the needed increase in mileage of railroads, number of cars needed, etc. These requirements may be studied in detail once the primary targets have been adopted. In such an approach to planning everything hinges on how successful one has been in setting the primary targets.

Any number of examples of the technique of such procedures can be given.

The crudest form of this approach is the one that consists in calling for schemes of all kinds from ministries or state or municipal governments and making a selection out of these on an ad hoc basis to suit existing budgetary resources. A more refined version of the target setting approach is obtained through the application of what may be called a method of balances. That is to say, the schemes are collected and the consequences so far as demand for man power and basic commodities such as coal, wood, Diesel oil, cement etc. computed, and on the basis of the discrepancies thus discovered one tries to readjust by trial and error the whole plan so as to make a balanced whole. It seems that some of the eastern European countries have

developed this technique to a considerable extent. To make such a system work, it is, however, necessary to have considerable buffer stocks of basic commodities to smooth out the effects of unforeseen gaps.

5. - The optimal plane frame approach to planning

The target setting approach is in a sense an easy approach because it does not require difficult methodological thinking, but only a practical grasp on things and careful handling of figures. This, of course, is what explains the wide-spread use of the target setting approach as we witness it in yearly national budgets or four or five year plans in many countries.

But the target setting approach has its obvious shortcomings. In the great and complicated system which is displayed by the economic life of a nation, consequences do not work only one way, but they work in all directions. They form a net work, not a string of beads. Therefore the planning cannot be adequately described by starting from certain elements — however important they may appear *prima facie* — and from them compute the other elements. Everything must be considered simultaneously.

When we fully recognize this, it becomes clear that when a planning alternative — a yearly national budget or a long term plan — has been worked out by the target setting method, we really have no means of verifying that this is *the best alternative* that can actually be reached under the given circumstances. To find out what is really the best — the optimal — alternative takes a combinatorial technique of a much more refined sort than even the best of the target setting procedures (such as the method of balances and the procedure used in Norway) this more refined technique which permits to locate the optimal alternative and gives a practical criterion for it, may be designated under the catchword optimal fixation of the plan frame. Efforts at working out a practical way of actually handling the planning problem in this way has been going on in the University Institute of Economics, Oslo, for several years. To proceed in practice along these lines will take more hard labour and more hard thinking than to work with the target setting approach, but I believe the optimal determination of the plan frame will be the method of the future.

A few examples will illustrate the intricacies of the interrelations that must be taken account of in a planning procedure based on the simultaneous consideration of all factors.

Suppose one considers a proposal for increasing residential building in Norway by 100 mill.kr. and one wants to know how much import this program will entail. We know that about 8.5 per cent of total output in the building industry in Norway is made up of imports, this gives 8.5 mill.kr. in the case considered. This, however, is not all the imports we have to reckon with. We know that about 11.1 per cent of the total output in the building industry is made up of input from the iron- and metal industries. Consequently the 100 mill.kr. program of expansion in the building industry will entail approximately 11.1 mill.kr. increase in the output of the iron- and metal industries, and this increase in output also entails some imports. As a matter of fact this item is not negligible — about 2 mill.kr. — because a relatively large percentage of the output in the iron- and metal industries is made up of imports. There are also other industries that deliver goods to the building industries: The cement industry, the chemical industries, the wood industries etc. and all these industries also have their import needs. But that is not all. The 11.1 mill.kr. increase in the iron- and metal industries will necessitate also increase in the electro-metallurgical industry and this industry also has an import need, indeed a quite important one. In this way we run into an infinite chain in so many directions as there are sectors. If all such effects, direct or indirect, are taken account of one will find that the 100 mill.kr. program of expansion in residential buildings will not cause 8.5 mill.kr. imports — which was the direct import need in the building industry — but a total of approximately 15 mill.kr. import. When deciding whether the 100 mill. kr. program of expansion in residential buildings shall be authorized or not, it is, of course, the figure of 15 mill.kr. import one has to consider and not 8.5 mill.kr. Similarly for the direct and indirect effects on labour requirement, on the flow of incomes — wages, salaries and ownership income — on national income as a whole, on consumption, on the balance of payment situation, on tax revenues, etc. And even if all these direct and indirect effects are computed, we are still left with only one proposal: That of increasing residential building by 100 mill.kr. When this proposal is to be weighed against a hundred or a thousand other proposals of doing desirable things, how shall we find out which combination of proposals is not only possible, but actually the most desired according to a given scale of judgement?

Or again, to take another example. Certain features of a development policy in an underdeveloped country may be so obvious that one can see off hand and without any calculation that *some* activity

in these directions will be useful and within reach. For instance the building of steel mills of at least a total capacity of, say, 4 mill. tons yearly. Therefore, so long as we do not work out more ambitious plans than this, there may be no harm in going ahead with this development as a separate item. But when it comes to developing a coherent plan where the total steel mill capacity enters, it is impossible to do it just by more or less intuitive target fixation of this particular item. Then we must see this development in connection with other developments in, say, aluminium, cement, fertilizers, heavy machine tools, the transportation system and all the items on the consumption side. In principle there is really no difference between this problem and the more restricted example just discussed in the Norwegian building industry.

As a third example take the «estimating demand» procedure. In order to obtain some primary figures from which consequences can be computed for incorporation in a plan, one sometimes starts by asking experts to estimate what the demand for specific production or consumption good will be next year or some years in the future. On the basis of this one then proceeds to plan development projects in the sectors producing these goods. This is a text-book example of how the target setting approach fools itself. The demand in question will, of course, depend basically on what the complete plan will be in other-departments. It is as if the planner would say to the expert: «Try to guess what I am going to do. Then use your guess for estimating the demand for such and such a good. On the basis of your figure I will then decide what to do».

6. - The problem of determining the optimal plan frame as distinct from the problem of implementation

One problem is to find out what constellation of the economic system will represent the best alternative under the circumstances. Another problem is to find out how one can go about it to induce the system to assume this desired constellation. The latter problem is the problem of implementation. Here the central question is what sort of instruments — parameters of action — the government (taken in its broadest sense) has at its disposal. Will it be only tax rates, money rates and other classical means of influencing the situation, or will more or less direct controls be permissible.

In both problems the number of degrees of freedom is an important concept. In the selection problem — that is to say the problem of selecting the optimal constellation of the system — the number

of degrees of freedom will come in as an essential feature determining the combinatorial technique by which the search for optimal combinations is carried through. This number of degrees of freedom being given, obviously the system can assume constellations in that many different dimensions. This being so, the same number of degrees of freedom will, of course, come in when it is a question of implementation. Government (taken in its broadest sense) must have at its disposal a sufficient number of parameters to be able to make the system assume the desired shape in all the dimensions involved (1).

7. The conflicting objectives

In planning work much wishful thinking has taken place regarding the *harmony* which is supposed to exist between the different objectives such as increased production, higher standards of living, labour saving machinery, elimination of unemployment etc. It is more or less taken for granted that all of these elements tend to work in the same desirable direction. As a matter of fact many of these objectives are mutually contradictory at least in the short run. One only has to think of the eternal conflict between labour saving machinery and unemployment, or between high consumption and increased production through investment, and so on.

These are uncomfortable facts that the planner has to face. The politician and the big industrialist ought also to face them, but often it is more agreeable to avoid these questions and say, for instance, as a big Indian industrialist said (2). «It can hardly be any difference of opinion that the country should have as its objective larger volume of production and fuller employment so that the standard of living of the people may be raised as speedily as possible». It is tempting to paraphrase on this by formulating the following statement: «We all know the desire of our ladies to have shoes that look neat, not large and clumsy. And we also know the desire to have the shoes comfortably large. It can therefore be no difference of opinion that our ladies' shoes should be made small on the outside in order that they may be large on the inside». A main purpose of the optimality technique is to compromise between the conflicting objectives.

(1) The distinction between the two types of problems is considered in my United Nations memorandum E/CN.I/Sub.2/13, 18 April 1949: *Price-Wage-Tax-Subsidy Policies as Instruments in Maintaining Optimal Employment* (Publicato ne «L'industria» n. 4, 1949).

(2) «The Hindustan Times Weekly», 6 March 1955.

8. - The qualitative judgement

To proceed towards an optimal determination of the plan frame must, of course, take a considerable amount of calculations. This does not mean that all qualitative judgement is *replaced* by calculations. No computing machine can ever replace the wise judgement of a competent economist. What the calculations can and must do, is to *push forward* the frontier line where the qualitative judgement has to be applied. In reality there is no conflict between the two viewpoints and most of the controversies that have appeared from time to time are really unfounded.

One version of the argument against calculation is that on poor data it is better to use qualitative judgement. This is not a sound argument. If the data are poor, of course, they cannot form as good a basis for action as they could have formed if they had been better. But the possibilities are certainly not improved by declining to accept that sort of aid which can come from computation. One aspect of computation is precisely that one can indicate limits to the uncertainty which emerges from the pooriness of the data. And certainly, when very many alternatives are involved, it is impossible to find ones way without a rational numerical technique.

9. - The human factor

A rational planning, not only on paper but in reality, is, of course, essentially dependent on the human factor. This applied not only to those in government administration who are to be responsible for the working out of the plan and the directives, but it depends on the human element on all levels and in the last resort on the population as a whole. Whole-hearted co-operation and loyalty from the population as a whole is needed for real success. And the question controls as distinct from classical means (monetary regulations, credit policy and tax rates etc.) must be answered quite differently in a loyal population with a highly developed co-operative spirit and in a population which is very individualistic and where everybody is set on attending to his own business. Therefore the question of direct controls has no universal answer.

Quite apart from the question of loyalty and co-operation, there is the question of how much one can *depend on* the energy, precision and initiative of those in charge of the scheme. If there is a general attitude of evasiveness in the population, the situation, is extremely

difficult. In certain countries one finds a type of intellectual workers who like to be polite and like to please by saying « yes », but cannot be depended on when it comes to doing hard work and actually performing something.

Much depends on education and how far the general philosophy of planning and co-operation has penetrated into the population. One must believe that in the face of present day extreme economic difficulties in many countries, the willingness to co-operate will be developing even if it is a slow process.

10. - The various phases of planning work

In what follows will be given a bird's eye-view of the various phases of a planning work that aims at reaching a really optimal choice of the alternative for the economic political action of the country. This work will involve the co-operation between a great number of different organs and different capacities, responsible politicians, technical analysts etc. A wise organisation of co-operation between them is necessary. Only a condensed statement on main points will here be given. Details are discussed in memoranda and working papers elsewhere.

1. General publicity and main organisation.

To enlist the co-operation of the largest possible circles it is desirable to give everybody concerned, government administrative organs as well as the general public, the best possible information about the nature of the planning work. Well thought out pamphlets should be distributed, explaining the principles involved. The main part of such pamphlets must, of course, be in non technical language, but it would be desirable to append certain explanations of a somewhat more technical sort, attempting in this way to carry over to the most interested part of the public as much as possible of a technical understanding of the problem. Successful planning on truly democratic lines is fundamentally dependent on the public understanding as much as possible of the principles involved. For government servants and other specifically involved special short-courses would be needed.

In so far as the actual carrying out of the work is concerned, there would be three different kinds of organs staffed with people of very different capacities:

A. Project collecting organs.

B. A project processing unit working out the comprehensive planning chart.

C. A solution unit which would take care of the mathematical work involved in determining the optimal plan frame.

The activities of these three types of organs are briefly discussed in the sequel.

II. *Collecting of projects.*

This phase of the work simply consists in gathering ideas about things that some people think would be useful as parts of a development or steering plan for the economy. Most of this material is already brought into the picture in a democratic society through public discussions of various forms, but suggestions of possible activities should explicitly be invited from various quarters and a systematic canvass of previously published proposals should be made. It is a question of *bringing order into the suggestions*. The development projects must be listed and pass through a preliminary processing if they are deemed of a sufficiently serious sort. The larger the number of activities that one includes in the list of possibilities, the larger will be the chance of finding later — through the operational technique — an optimal solution with satisfactory properties. At this state no commitment of any sort should be made as to whether any such project would actually be included in the final plan or the extent to which it might be included.

To work out this list of possibilities in an orderly fashion would be the first task of the project collecting organs. In view of the highly divergent ideas about the way in which the economic policy in a country should be conducted, one would expect that there would be projects of extremely different sorts. This is exactly what will make the optimal plan frame approach promising. The technique itself will later decide which one of these various alternatives are the best according to the scale of preference to be adopted.

III. *The technical description sheets.*

It is, of course, not enough to have a list of the possibilities. To actually incorporate an activity in the further analysis it must be *technically described*. To do this for the large number of activities

that may come in for consideration, is a big task and to complete it in a satisfactory way, one has to mobilize the enormous technical and scientific knowledge that exist in the country. Any technical or scientific expert should feel that he is carrying out his well assigned part in the great national effort.

The work of processing the various collected projects is the first task of the project processing unit. This unit would have to consist of economists and statisticians with a different type of qualifications from the staffs of the project collecting organs. As we are now approaching a more refined stage of the programming work, more qualified workers are needed. At this stage there is not yet need for any through-going mathematical training. It is more a question of precision and care in handling of data and an understanding of the specific form in which these data must be organized.

The organization of the information should take place according to a well thought out technical description sheet. The purpose of these sheets are to organize the data in such a form that the projects in question can be incorporated into the big interflow table that will serve as the basis for the programming work proper, that is to say that part of the work which aims at determining the optimal plan frame. The interflow table is discussed elsewhere. Here it suffices only to mention that it is a flow table that includes not only the classical industrial input-output table, but also other flows in the community, in particular it includes an explanation of the way in which purchasing power generated in the production sectors find its way to consumers and by this fact creates a new demand.

The technical description sheet would have first of all to have an indication of the geographical area and the general production group to which it pertains, also an exact information about whether it pertains to an activity that is in actual operation or it only refers to a possibility.

The activity may be defined in a wider or in a narrower sense. Sometimes it may be specified in so much detail that it will concern the production of only one specific commodity in one specific enterprise, but more frequently the activity will pertain to a product-mix and the technical structure of the process will retain a sufficiently precise definition only to the extent that the composition of this product-mix remains constant.

These statistical refinements need not be discussed in detail here. It is sufficient that one can have a rough idea which makes it possible to attach some degree of *physical* meaning to the value figure

or the output. The size of this value figure for the output will then (1) give an indication of the physical volume of the output. Similarly for the figures representing inputs. For instance wages, salaries, necessaries of production of various sort bought from other enterprises. All these data are to be recorded if need be through the help of technical specialists.

If it is not natural to assume even roughly a constant composition of the product-mix, and if the input-figures to be recorded would be significantly different for different compositions of the product-mix, then the activity under consideration must be broken down and special technical description sheets used for separate parts of the activity. This breaking-up procedure should, however, be used only as a last resort. In the preliminary phases of the work only rough approximations are needed and it is very desirable not to make the analytical set up more complicated than strictly necessary.

The kind of activities discussed above were the *current operations*, that is to say activities where the result comes in the form of a more or less continuous flow of goods and services.

Another type of activities consists in making a *real capital investment*. This means working towards the completion of some well recognizable complex of capital objects: a steel plant, a bridge, a road etc. — or in working towards the improvement of such a complex of capital objects.

While the result of an activity of the current operations type is indicated by the quantum of the annual output, the result of an investment activity is indicated by two data, namely the size of the complex of capital objects that is being built, and by the *construction period* needed.

The size is a once-for-all figure, not an annual flow. It can be measured either in some obvious technical units such as kilometers of road or square feet of factory space or it can be measured by some *capacity figure* which will express how large a *current* production one may get when the complex of capital goods considered are completed. For instance tons of steel produced per year.

If an investment activity has a construction period of more than a year, it may be convenient to let the information on input elements pertain to what can be expected to be the input made in the course of each year. If so it should be indicated what percentage of the total this refers to.

(1) At constant prices but possibly changing quantities.

With regard to the input elements the various kind of labour should be split up into as many kinds of labour as one think is necessary for giving a realistic description of the process, but one should not carry this break-down any further than is strictly necessary. Simplicity is a great advantage. Similar break-down for the salaried personnel.

An estimate should also be made of the ownership income which will probably be generated through the activity.

Input items from other national sectors must be specified carefully. Classification should be made according to a standard nomenclature adopted. Besides indicating the sector from which the input elements would have to come, one should also give a *description* of the items so that it is possible to get a realistic picture of the physical nature of these input elements. One should, however, not go into more details than is strictly necessary to give a realistic picture.

The import elements should be specified in a similar way, indicating country of origin if it is necessary to bring the goods from a specific country. If there is a choice between two or a small number of countries, one should indicate the choice.

IV. *The planning chart.*

The next step is to co-ordinate the technical description sheets as well as the general statistical information about the interflow in the country so as to bring out a complete programming chart.

The basis for the work is an interflow chart of actually existing activities. The nature of this interflow table is described in other connections. It is based on the real flows (1). But prices can be considered (2).

In an interflow table of this form where the main emphasis is on the real flow aspect, while prices are included in a fairly simple form (but not a full-fledged money credit and financial circulation is included as in the refimodel), the *potential activities* according to the technical description sheets are entered. These potential activities will have to be aggregated according to the same terminological scheme as is used in the interflow table.

(1) Memorandum of 10 October 1956: *Main features of the Oslo Medium model.*

(2) Memorandum of 21 October 1956: *Supplementary remarks on the Oslo Medium model.* Section 12.

The degree of aggregation to be used in the interflow table and in the corresponding inclusion of the activities according to the technical description sheets will, of course, depend essentially on how large an analytical unit one is prepared to organize. Even though a fairly heavy aggregation is needed, the resulting programming chart — which includes not only the actually existing activities but the potential ones as well — will, I think, prove to be of immense value in discussing the possibilities that are open for the economic policy. It would probably be most convenient to list within each general sector of production first the actual activities — that is to say the activities that are already in operation — and next the potential activities.

Through such a procedure where the potential activities are included together with the actual ones, one avoids the danger of being *too conservative* in the planning, the danger of fixing target rates to a too slow progress. This danger always exists when the programming problem is approached the target way. Two things contribute to this conservatism. In the first place the expert group that are asked to estimate demand will not be in a position to evaluate what the total effects of the plans really will be, they will therefore act cautiously and to a considerable extent rely on the experiences of past years. In the second place the planners on their side, not seeing the far-reaching and complicated consequences that may follow from a development program, will naturally also tend to be cautious and perhaps let considerations of financing along known orthodox lines be the guiding and limiting principle for the plan. The poorer the means of navigation, the more slowly it will be necessary to move.

V. *The top level goals.*

The whole programming work depends, of course, on the fixation of a human value or political scale of judgement. To arrive at this a co-operation is needed between top level politicians and the technical analysts. First a few words of a general sort on this co-operation.

Expressed briefly and therefore necessarily without complete precision, we can say that the politician must introduce the human evaluations, the social value judgements, while the task of the scientist is objectively to find out what the factual situation is and what the inherent tendencies for change are and what consequences *would be expected* if one decided to put into effect such and such measures. In this work the scientist will simply have to take as data the goals themselves and the social value judgements back of them.

If we scrutinize this distinction closer, we will, of course, — as always when it is a question of distinctions of principle — see that there can be marginal cases which are difficult to decide. In the last resort we will perhaps have to retain only this formulation: The goals and the social value judgement are what the scientists *do not desire to take up for analysis*. It is that part of the problem which is too difficult or too vague to be amendable to exact scientific methods. Therefore, to a certain extent the distinction becomes relative and may change as we change the purpose of the analysis or we get at disposal new tools of analysis or new factual information. For all practical purposes the distinction between the task of the politicians and that of the scientists is, however, clear enough.

In planning the concept of *time* is important. In how long spans of time shall we reason when we are doing national economic planning? Recently I had an opportunity of working on the methodology of economic planning in India, and I well remember how India's Prime Minister Mr. Nehru in one of our discussions emphasized the enormous difference between the problem as it appears in the United States and in India: In the United States the problem was how one could bring the most refined technical gadgets, let us say in the construction of refrigerators, into general use. In the Indian population, on the other side, the urgent problem was how to keep *hunger* away from the population and how the country could work up a reserve stock of food grains and other goods fundamental for feeding the population, so that one did not risk to be forced into a situation where food grains *had to be* imported at any cost. When one remembers the situation in India some years ago, this distinction between the two types of problems is obvious and indeed very realistic. But when it appears that we can in India now safely disregard the problem of technical refinement in refrigerators for the population, it is only because of the *time horizon* one chooses to adopt. When the responsible Indian politicians — rightly — look at the question as they do, it is because they reason within a horizon which is wide enough to make it possible to solve the nutritional problem safely within this span of time, but not wide enough to make it possible to introduce technical refinements in refrigeration for the bulk of the Indian population. This refrigerator problem too will present itself in India but only at such a distant future time that we do not need to bother about it now.

How much weight shall be put on the first, the most burning problems and how much on the long views expanding into the future, is a matter of judgement. In order to form an opinion on this, the re-

sponsible politicians must so to speak already have *guessed* what the solution would be of an imaginary analysis of an enormous problem where all possible details in the present and all possibilities of the future were specified. So we have here an example where on has brushed aside the distinction between the social value forming politician and the objectively working scientist. The politician must, whether he wants it or not, act in both capacities. It is, however, only in the very first phase of the analysis were such a compromise has to be made. For the further study of the complex of problems that has been circumscribed by « the horizon of imagination of the politician » we can fully and with the greatest efficiency apply the principle of division of labour between the politician and the scientist.

The scientist's task then is to describe the coefficients of the *current* production, as well as the coefficients describing the *investment* activity. We must scrutinize how the building up of the capital equipment in any given industry will necessitate the use of means of production from many sectors in the internal economy and also will create needs for import. Further we must consider the average *time* which will most likely elapse between the input of investment goods and the moment when the new capital outfit is ready. For instance, in the case of a steel mill, this *maturity lag* may be several years, perhaps 3 or 4. In the case of textile machinery the lag is much shorter, perhaps a year and a half. In the production of light machinery, such as for instance handlooms in India, the maturity lag is very short, perhaps 3 or 4 months. Further it is necessary to know the *depreciation percentages* for real capital in the various sectors. And last but not least we must know and understand the facts responsible for the *growth rate of the population*. These facts about the actually existing situation as well as for the potential production are needed.

When all this factual material has been described, it is the task of the politician to define what they — within their horizon of imagination — think ought to be the objectives. The ideal would be that the wishes of the politician are not expressed with regard to the means of production, but with regard to *final consumption* and other *direct indicators of social welfare*. The objectives for the means of production is something which it is the task of the economists and statisticians and in general the scientific analysts to discuss, provided they are able to build a model where the year to year effects of investment on capacity etc. are incorporated. But if the model is less elaborated, the politician will have to express his wishes also with regard to investment.

The politician's preferences can be fixed in various way. For some groups of goods in the consumption spectrum the objective can be fixed as a certain *lower bound*. One may, for instance, say: We want a production of agricultural products that is at least of such and such a magnitude. Or one may fix a bound for certain specific types of agricultural products, for instance, rice, wheat and other of the fundamental food, grains. Similarly one may fix a lower bound for the production of fine drugs. This production is of considerable economic and medical importance in countries with low sanitary standards. Possibly one may also want to fix a lower bound for textile production. More generally, one may fix such bounds in the form that one defines several linear expressions in the variables of the problem and impose the condition that each of these linear expressions shall be not less than a certain lower bound. A number of problems for instance in the pressure on the import budget or the pressure on the labour-force within specific sectors etc. can be formulated in this way.

On the whole it is, however, advisable not to introduce the formulation of objectives in the form of lower bounds for more goods or more linear forms than absolutely necessary, and it is not advisable to fix the lower bounds higher than strictly necessary. If this is done, one will run the risk that the subsequent combinatorial analysis will give the answer: There does not exist any solution of the problem as now formulated. And then one has to begin a new with reformulation of the objectives.

A more elastic way to formulate the objectives is to fix certain *valuation coefficients* for some of the variables in the model (in principle for all of them) or more generally to construct a *preference function* that will express what the politician *would* choose if such and such a choice were possible. Practical methods of actually constructing such functions through interviewing are discussed elsewhere (1). The optimality technique will then consist in seeking a solution which maximizes the preference function.

For certain extremely important groups of consumption goods it may be desirable to choose a middle of the road alternative: one will fix a relatively low lower bound for the consumption — a bound so low as to represent an extreme minimum — and then one will simultaneously let this good or this group of goods enter into the preference function with a very *high* evaluation coefficient.

(1) Memorandum of 14 February 1957: *Numerical determination of a quadratic preference function for use in macroeconomic programming.*

VI. *The basic equations and the optimal solution.*

When the various projects have been aggregated and pooled together with the interflow table of existing activities so as to form a comprehensive programming chart for current operations, we have already at disposal an analytical instrument of great value. Through the technical coefficients of this system — determined in part from statistics and in part by technological experts — the various magnitudes in the current years activity will be connected by equations somewhat in the way exemplified in the Oslo Median model (1). Specific questions of the form: What will most likely happen if we take such and such measures? can be answered from this table.

In addition to the programming chart as such and the ensuing equations for the current years activity the variables involved will be subject to certain conditions in the form of bounds derived from technical capacities, the immobility in the labour market etc. and also bounds expressing political aims. All these things will have been worked out by the project processing unit as explained.

Anyone who has actually worked with such models, will recognize how limited are the possibilities of finding a really *good* alternative by the trial and error method, asking a number of times what will happen if we take such and such measures? This is therefore the point where the numerically determined preference function must be brought into the picture. On the basis of this function and the equations and bounds of the model, one will formulate and solve the optimum problem. That is to say, one will determine the constellation of the variables that maximizes the preference functions subject to the equations and bounds in the current years problem.

For the dynamics of the long-range view we can proceed by splitting the problem into the current years problem on the one hand the asymptotic problem on the other. Through the solution of the asymptotic problem a certain ideal capital structure will be defined and this ideal may be taken as a datum when discussing the current years problem from the viewpoint of long-range developments.

From a formal viewpoint both problems can be attacked by the same type of mathematical methods, namely the technique known as quadratic programming, or as an approximation, linear programming. It is believed that for such problems in macroeconomics, the multiple method will be highly effective (2). Even on desk machines.

(1) Memoranda of 10 October 1956 and 21 October 1956.

(2) Memorandum of 14 February 1957.

The work of determining the solutions of these mathematical problems should be entrusted to a solution unit whose members need not be trained economists although it is always, of course, an advantage if they have some knowledge of the concrete meaning of the data.

A word must be said about the difficulty of avoiding errors in the writing out of tables of coefficients and data or storing them on punched cards or tape. An absolutely fool proof system with checks and cross checks must be worked out. Preferably a special team should be organized for independent checking, a sort of «detective» team.

Through this work will emerge a *plan frame* for the general national planning. It will be aggregated, of course, and it may not contain all the variables which it will be necessary to consider later, but at any rate this plan frame will give a *starting point* for further discussions. This plan frame will take the place of the *primary target setting* in the usual type of programming work.

VII. *Scrutiny and criticism of the plan frame.*

When the plan frame has been worked out by the solution unit, it should be referred back to the various organs representing economic and statistical knowledge and scrutinized and criticized by these organs from all the viewpoints they can represent. Governmental organs and even the general public ought to be called upon to exercise such scrutiny and criticism. This will be a technical checking and control of the optimum combination expressed by the plan frame. The optimum combination with all its specifications should be made public. At this stage the whole set up of technical committees and expert bodies can do a useful job. These bodies could not be of much help in actually determining primary targets, because the number of possibilities were too great, but now that a definite system of targets — at least in rough outline — is available, they can employ their expert knowledge on matters of detail to see whether the various estimates show *inner consistency* within the degree of accuracy needed for practical work. Any minor discrepancies can be corrected ad hoc. Only if major discrepancies are brought to light, need the case be referred back to the solution unit for verification of the optimal solution.

VIII. *Governmental, parliamentary and legal procedures for accepting the plan frame.*

When the optimum combination has been checked by the various specialized expert bodies, it should be put before the relevant poli-

tical bodies, and Governmental, parliamentary and possibly legal procedures followed for finally accepting or rejecting the optimum combination.

Since the optimum combination in the form now brought before the politically responsible bodies is in essence only the technically worked out *consequences* of leading principles which have previously been accepted by these bodies, one would expect that in most cases the optimal combination would be accepted. There would, however, be nothing illogical in a rejection. It would simply mean that the responsible bodies, now that they see clearly the consequences, recognize the need for *modifying* some of the desired ends previously formulated, or perhaps taking up a search for new types of activities which may perhaps make it possible to reach a more acceptable optimal combination without giving up any of the desired ends as originally formulated.

When the optimal combination is finally accepted by the responsible bodies, it assumes the legal status of a *plan frame*.

IX. *The planning in detail.*

There will always be a limit to the *amount of detail* which it is possible to incorporate in the formulation of desired ends and in the specification of the contemplated activities and finally in the working out of the optimum plan frame.

Such a limitation is given by the need for speed in handling the practical aspects of the problem at the various stages, and it is also given by the size of the computational problems one is prepared to handle in the determination of the optimum combination. Therefore the optimum combination as expressed in the plan frame will only have the character of an overall framework for the economic activity of the country.

Even so it is of basic importance and a great achievement will have been made when a good plan frame has been finally accepted.

For the completion of the work the details will now have to be filled in by the various branches of government administration or special expert groups. The whole classical planning machinery can here play its rôle. So long as the over all framework into which these details are bound to fit, has been determined by a scientifically sound optimum procedure, no great disaster can be caused if some of the details should be worked out in a way which is not rigorously the most effective one. Therefore no great harm will be done by leaving

these details to be determined in an administratively *decentralized* fashion. Such a decentralization would give the central organs the necessary leisure to give adequate attention to the basically important aspects of the planning work.

II. *Problems of implementation*

The question of implementation of the plan — that is to say of steering the economy towards that particular constellation which has been selected as the optimal one — I shall not discuss to any great extent, only a few words on the rôle of the private sector in the overall plan. The overall plan must, of course, embrace both the private and the public sector and the question arises of how the public sector can be induced to perform its function in such a way and to such an extent as is assumed in the national plan. A particular question is how this can be worked out so as to create in the private sector a spirit of cooperation, not a spirit of antagonism.

To a large extent the private sector can be steered, positively or negatively, through economic incentives.

As examples of economic incentives can be mentioned an effective combination of differentiated sales taxes, differentiated outlay and investment taxes — with a corresponding reduction in the income tax — and further the manipulation of a system of permissions issued to private enterprises for using investment fund which they hand previously been allowed to build up free of taxes — possibly this could be made in connection with differentiated credit facilities and, if need be, through allocation of raw materials or other production and investment necessities.

12. *Planning must be continuous*

Whatever method is used for the elaboration of a plan, it is not possible in the changing world to-day to publish at a given data a plan for, say five years, with much detail, and *petrify* it, trying to follow this petrified pattern for the five years. Planning is a continuous process. At intervals, most conveniently every year, the whole problem should be reconsidered in great perspective taking account of new information, improved data and improved analyses. At each such round certain commitments will have been made that cannot be changed, while others are such that they may be modified in the light of the new information and analyses. A technique for such pe-

riodic revisions should be worked out and incorporated as an essential part of the planning machinery.

At each such revision one should reconsider both the asymptotic plan and the current years plan which is based on the asymptotic plan. This means that the work would always proceed as if one were in the *beginning* of a long term plan and *was guided by the most up to date information*. This is more rational than to be guided by the formal question of how many years « are left » of some, say, five years plan that was decided upon on the basis of data which are by now several years old.

13. - Pareto optimality

Pareto optimality is a concept that has been very much misused. It has been misused particularly because one has not taken care to state carefully the conditions under which the choice is assumed to take place. We have for instance Pareto optimality under the production constraint. Or we have Pareto optimality under a set of conditions that consist simultaneously of the production constraints and some sort of distribution constraint. It is by a confusion on such points as these that one has in the past fallaciously used the principle for instance for such purposes as to prove the superiority of the regime of free competition. I shall not insist on these misuses of the principle in this connection. The unwarranted applications which have been made of the principles must not, however, make us through it away all together. Correctly interpreted it can serve us well in clearing our minds about some very fundamental principles underlying planning and macroeconomic programming (1).

A point is said to be Pareto optimal under such and such a constraint if under this constraint it is impossible to depart from the point without making at least one of the parties involved worse off.

Applied to a concreta problem this pinciple will, correctly interpreted, be one of negation, not one of affirmation. We can say that if a point is not Pareto optimal under the constraint considered, then it cannot be said to be a good or efficient point under this constraint. And this must be our conclusion *regardless* of how in detail we have formulated our desiderata for a « good » or « efficient » point. In other words the principle gives a necessary condition, it segregates a class of point to which our « good » or « efficient » point must belong if any such

points can be determined. Since the principle only gives a necessary condition, it leaves considerable lee-way in the determination of economic policies. First Pareto-optimality has to be determined under a set of *obligatory* constraints, that is under constraints which it is humanly impossible to change. And *within* the degrees of freedom that then remain, the choice must be made by a *postulate* in the form of a social value judgment. This value judgment is something which the economist as scientist and technician simply has to take as a datum. But *all the rest* is within his sphere of competence. It would seem that even with the above limitation of the economist's field, there is more than enough for him to do.

14. - Postscript

We witness a race between economic research and fast changing economic facts. It is no exaggeration to say that it is a race of life and death. Perpetual unrest and dissatisfaction, even wars, will continue if the economic problems of the millions are not solved.

These considerations apply not only to the collection of data, but in no smaller degree to the elaboration of analytical machinery. It may be just as inadequate to apply to a given economic problem a ten or twenty year old analytical machinery as it would be to apply ten or twenty year old statistical data.

We must move swiftly and look for ways and means of putting into application the newest and most powerful techniques. We must not wait until these techniques have become « classic » or even « belated ».

The rational technique of macroeconomic programming with fixation of optimal alternatives is, as I see it, one of these new tools that can in a truly democratic way help us to win the race between economic analysis and the rapidly and perpetually changing economic facts.

(1) *La théorie de l'avantage collectif et les régions de Pareto*. « Economie Appliquée ». Tome VII. Numéro 3, Juillet-Septembre 1954.