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A SUGGESTED APPROACH TO THE PROVISION OF DATA FOR SOCIO-ECONOMIC  
ANALYSIS AND PROJECTIONS

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## INTRODUCTION

This seminar has been organized for the purpose of arranging a discussion between planners and statisticians in which the requirements of the planners are confronted with the possibilities of the producers of statistics, to develop them in the directions desired. Indeed, this is a type of those meetings between users and producers of statistical information essential for a proper understanding of the views of each other. Such confrontations are bound to result in a sympathetic consideration of one another's views and will eventually lead to speaking the same technical language. It is hoped that such meetings will occur more frequently at the national and sub-regional levels than at the regional level.

2. Already, a critical review of the uses to which the available statistical data in the different countries of the region have been put has been made and the weaknesses therein and the gaps still left to be filled have been indicated. Moreover, the paper on the potentialities of the revised SNA has explained the areas of economic and social analysis where the system is very useful. Together, these items of the discussion programme have highlighted the needs of data for economic and social analysis and projections as well as indicating how these needs can be met.

3. It seems then that the other point on which conclusions will have to be reached is how best to organize data provision so that the needs of economic and social analysis, projections and hence planning can be adequately met. For this to be achieved, decisions will have to be made on a desirable procedure for planning as well as on the responsibilities for providing the different types of data required for analysis and projections.

4. However, before suggestions are made as to how the problem can be tackled, it is necessary to explain briefly the link between economic and social analysis and planning since the decisions on data needs for economic and social analysis and projections have important implications for planning techniques and procedure.

## PROJECTIONS AND PLANNING

5. Projections are statements about future events based on empirically tested propositions concerning the past. Basically, they rest on two assumptions - an orderly pattern in the past and a determinable relation between the past and the future. But to be able to identify the orderly pattern in the past, a vigorous analysis or diagnosis is imperative. This analysis (diagnosis) helps to identify the variables and the probable relationships that may be employed in the projections.

6. Analysis provides the background for making hypotheses which form the basis for projections. Projections help to establish alternative possibilities. When these possibilities are confronted with the constraints in the economy - policy, institutional, etc. - policy-makers can make decisions about feasible development targets. When these decisions have been made, plans are drawn up. Thus the first step in any realistic planning is the analysis of the past and the present situations. Projections based on such findings and policy variables form a framework for the determination of development targets.

"The first problem involved in the technique of formulating a programme consists in determining the possible targets of development in a given economy. Such a problem cannot be resolved without a prior review of past events and present possibilities, and its solution must be the result of painstaking analysis. First, to undertake what might be termed a diagnosis of the national economy, an examination must be made of the way in which a country has evolved in latter years, and of the dynamic factors which have played a part in its growth. Of special importance is the determination of the most recent rate of growth, as well as of the efforts made by the economy to attain it. Secondly, a study must be undertaken of probable future trends, and of the possibilities of change or of persistence in the internal and external factors that have played a role in recent years. An overall survey of these elements will enable the economy's growth potentialities to be assessed, and the degree of effort required to attain various rates of growth to be defined. Projections are only the basic elements on which must be founded the objectives, plans and measures of economic policy which make up a programme. In projections, economists present the probable results, the consequences of the various alternatives for development, and state the indispensable requisites for the implementation of each of these alternatives. A programme (plan) implies that a decision has already been taken; the competent government or institutional authorities will have adopted one of the proposed alternatives with a view to putting it into effect..."<sup>1/</sup>

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<sup>1/</sup> United Nations, Analyses and Projections of Economic Development  
I. An Introduction to the Technique of Programming.

## DATA REQUIREMENTS

7. The data needs so far reviewed and additional items required for projections and planning purposes are usually discussed under three heads: policy variables (target and instrumental), parameters and what have been described as the "third-type data".
8. Policy variables are the most widely discussed in the literature on development. They are of two types - target variables - output, employment, consumption, investment, etc. and instruments - tax rates, tariffs, subsidies, etc..
9. Parameters (coefficients) are derived data. They are estimated from the relationships postulated as existing between the policy variables.
10. Third-type data. Since projections are to serve as aids in systematic planning, they have to be more than simple extrapolations of historical trends. Among others, the objective of planning in the region is to effect structural changes in the economies of the different member countries. Hence, extrapolation based on coefficients or structural relationships derived from time-series will not be adequate. Production techniques are bound to change and businessmen are bound to change their plans. When projections are used for the purpose of clarifying intended or desirable patterns of change, they have to be based to a greater or lesser extent on certain normative judgements. Invariably, the changes that may occur in coefficients or structural parameters will occur through technical progress, government policies and business policies. Because of these, third-type data are of two types - engineering estimates and the expectations of economic agents. To improve the normal judgements of planners, these sources of probable changes in situations observed in the past must be explored.

## THE NEED FOR SYSTEMATIC ORGANIZATION OF DATA

11. The level of sophistication adopted in model building, projections and planning is often dependent on the quantity and quality of the available data, as well as the quality and experience of the planning staff. And as already discussed, existing data in most of the region leave much to be desired both in their coverage and quality in terms of planning needs; yet planning cannot wait until all these defects have been rectified. Hence, the implication is that in the initial stages of planning, very simple methods of analysis and planning will have to be adopted with the advanced techniques being reserved for later stages when the necessary data are available and the quality of the planning staff has been improved.
12. In this search for an optimum order of organizing planning techniques and data provision, we are fortunate in having work done within the United Nations system in the fields of statistics and economic and social planning,

namely the revised system of national accounts and the recommendations of groups of experts who have worked on planning problems in the developing countries.

13. Particularly relevant in the latter case are the recommendations of the groups of experts who worked on planning problems for the ECAP. In some cases, these recommendations have been adopted at one time or the other by some countries of the region - Morocco, Tunisia and U.A.R. for example. (See the list of references especially No. 8.)

14. The relevant portion of the revised SNA is chapter 9 which concerns the adaptation of the revised SNA to developing countries. It appears that the recommendations there on priorities of data compilation and the recommendations on planning procedure in developing countries recommended by the group of experts referred to above (see reference 1, No. 1), can be integrated to provide a well ordered procedure of supplying data for planning purposes.

15. It is very important that this scale of preferences should be established, otherwise the existing problem of planners asking for information which is not available in the statistical agency will not be solved. The order of priorities in planning, if aligned with the order of priorities in data collection, will go a long way in helping the statistical agencies to programme their activities.

16. In the following section, the recommended procedure for planning in developing countries which takes account of the characteristics of their economies, the problems of data collection and analysis and the problem of planning staff will be given. In the section on priorities, the relevant parts of chapter 9 of the revised SNA will be compared with the needs of planning.

#### SURVEY OF PLANNING TECHNIQUES FOR DEVELOPING COUNTRIES

17. As indicated above, the techniques discussed here are those recommended by the group of experts who worked for the Economic Commission for Asia and the Far East on programming techniques. Volume one of the series is particularly relevant.

18. Broadly, the techniques correspond to three stages of development planning and roughly coincide with what Tinbergen has called the macro phase, the middle phase and the micro phase.<sup>1/</sup> The first stage is characterised by the search for a feasible rate of economic growth and

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<sup>1/</sup> J. Tinbergen, Development Planning - World University Library.

the parameters used are usually taken from the experience of other countries with similar economic and social characteristics. In other words, this is the stage of planning by "analogy". The second stage corresponds to the period when more formalised methods are being adopted. At this stage, the planning staff should have improved in quality and more reliable data become available on the key sectors of the economy. The third stage comes when more linkages have been established among the sectors of the economy and the planning and statistical agencies are well equipped and experienced both to use advanced techniques and to provide detailed data on the economy respectively. A full description follows.

The determination of the general rate of growth of output

19. As indicated above, apart from the specific economic problems to be solved, the adoption of techniques of planning depends on the quantity and quality of available data, the size and capability of the planning staff and the complexity of the economy. For these reasons economic programming has to be undertaken in stages corresponding with the degree of complexity of the economy.

20. Thus in an under-developed economy, characterized partly by inadequacy and poverty of statistical data and partly by a simple economic system, simple methods of analysis and projections are usually adopted at the initial stages of planning. The main task is to determine the feasible or desirable targets for development.

21. Since the needs of such countries are various, the result is a welter of development objectives which are sometimes conflicting - an accelerated rate in per capita income and full employment; a reasonable stable price level and equilibrium in the balance of payments; income redistribution and high rate of savings, etc.. In the short-run and sometimes also in the medium one, there is little that can be done to resolve these contradictions; but in the long-run, solutions are possible since most of the constraints in the short- and medium-terms can be treated as variables.

22. However, there is a limit to the length of the long-term period since the longer the period the greater the uncertainties and irrationalism. Thus people usually plan prospectively for 15 to 20 years and then use the medium- and short-term plans as means of implementing the perspective plan. As far as techniques of projections are concerned, long-term ones will have to incorporate more of the third-type data. Similarly, structural parameters have to be modified. But as far as economic and demographic variables are concerned, the need is the same except that for long-term projections, time-series of these variables for a sufficiently long period are a sine qua non.

23. When it is realized that the source of all material well-being and perhaps spiritual well being is the availability of goods and services, the objective of a rapid rise in per capita income should be given a high priority. In fact, most of the apparent contradictions in the objectives of policy can be resolved only if per capita income increases satisfactorily. Thus the first task is to determine the desirable target of development in terms of the growth rate of output. In its usual formulation, it is a function of domestic savings, capital inflow and the capital coefficient - the Harrod-Domar type of growth model. (See the mathematical appendix for an illustration.)

24. Since two of the problems which usually face a developing economy, especially in the African region, could be the need to raise the standard of living and the need to provide gainful employment, the target for the rate of growth of income can be established by using the fact that income is equal to the product of population and per capita income (standard of living) or the product of gainfully employed persons and productivity. (See the mathematical appendix.)

25. The determination of the desired level of income is only the supply side of the problem; the demand side has to be examined. In other words, the aggregate level of income has to be broken down into the components of demand - investment including changes in stock (private and public), consumption (private and public), and exports. Moreover, since foreign transactions are involved, imports have to be taken into account and a consistency check between the availability of resources and their uses should be made.

26. From the discussion above the data needed for this exercise have been indicated. They are data on national income, savings, investment, exports, imports, capital coefficients and population (including age structure) over a period of several years in the recent past. Earlier data will also be useful.

#### Planning the main sectors approach

27. The techniques of determining the general rate of growth, and consequently of setting the target, is necessarily aggregative, and it should be understood that this approach is preliminary and exploratory. Economic development implies structural change due to the different rates of growth in various sectors. Particularly, evaluation of the spectrum of long-range economic possibilities calls for detailed analysis of structural changes at the sectoral level. What aggregate analysis does is to help focus attention on problem areas where policies can be directed, and it is the nature of such aggregate analysis that specific policy instruments cannot easily be identified.

28. Hence, once the desirable level has been determined, its implications for production activities should be pursued and this is best done by breaking the economy into sectors. However, at this stage as in the first, the shortage of statistical data, experienced staff for planning and time to complete a plan make it necessary to limit the number of sectors.

29. There are many ways of breaking the economy into sectors and the following are the most common - agriculture versus the rest of the economy; capital goods industries versus consumption goods industries; domestic versus foreign sector; modern versus traditional sector or, public versus private sectors. The particular criterion adopted is usually dependent on the problem to be solved and the particular inclination of the analysts. Chapter 9 of the revised SNA is helpful on this subject. But however many sectors are singled out for critical analysis, it should be understood that the model must be complete in the sense that the rest of the economy must be accounted for, realistic in the sense that the most important and relevant parts are represented and consistent so that the objectives desired are made to agree with the resources available. (An example is given in the mathematical appendix.)

30. Similar to the determination of the general rate of the growth of output, the data needs for this approach comprise the elements of national accounting. Thus the variables already indicated are now to be extended to cover more thoroughly such aspects as values at constant prices, finer analysis of imports and exports into sources of imports and destination of exports by geographical areas and/or currency areas, the accounts of the agents of production especially production, capital formation and consumption accounts, and labour force by industry distribution.

31. Since disaggregation into sectors permits a better examination of policy implications of aggregate models, the data enumerated above are necessary but not sufficient; additional statistical information will facilitate the inclusion of a sufficient number of instrumental variables. Hence, data on foreign exchange reserves, money supply and prices, government credit transactions and foreign aid and loans are needed; in other words information on financial transactions is also essential.

#### Input-output analysis

32. The sectoral approach discussed above follows the disaggregation of gross national product into its components both on the supply and the demand side. Hence the production function relates "value-added" to capital input (Harrod-Domar variety) or capital input and labour input (Cobb-Douglas variety) and in effect disregards the input of raw materials. Yet, in any realistic projections, the implications of output for intermediate inputs are very important. The method that has been found for treating this problem and for treating more fully the interrelationships among the sectors of the economy, is the input-output analysis or inter-industry analysis. In many ways, this approach seems to be the most



appropriate method for long-term projections because, as an interdependence system, it provides mutually consistent values for the most important economic magnitudes, namely total output, intermediate demand and final demand. Besides it accounts fully for the precise degree of interdependence among the various sectors of the economy.

33. Basically, this method starts with the division of the economy into as many sectors as possible, the limiting factors being availability of data, computing facilities and the particular problems the approach is designed to solve. For each sector so defined, account is given of the distribution of its output into intermediate consumption (raw materials, fuel etc.), and final demand (investment, public and private), consumption (public and private) and exports and in order to take account of the total availability of the particular sector's product, the import of this type of commodity is also recorded in the same row but with a negative sign. Similarly, for the same sector, account is taken of its total costs of production divided into current input (raw materials, fuel, etc.) and primary inputs (value added) - wages and salaries and property income (profits, rent and interest).

34. By definition the total costs of producing a particular commodity must be equal to the market value for a traded commodity. Thus there is a balance equation for each sector and hence for the whole economy, in that the sum of the elements in the row must be equal to the sum of those in the column.

35. Two aspects of the input-output analysis technique are usually distinguished - the static and the dynamic. In the static analysis the emphasis is placed on the technical coefficients and they are usually assumed constant. In the dynamic aspect, questions of technological changes and capacity-creating effect of investment are specifically considered. In effect, the basic data needs (especially economic statistics) of these two aspects are not different. Any extra information required in the case of dynamic input-output analysis is in respect of third-level data as well as capital-coefficients.

36. The theoretical framework of the input-output approach can be meaningfully discussed under the following headings: (i) the accounting system (ii) the basic model and (iii) the method of solution. (See the mathematical appendix.)

37. Input-output analysis permits flexibility of use depending on the particular problems which it is designed to solve. Thus for use in analysing possibilities of import substitution, the table can be designed in a way that imports can be analysed into complementary and competitive imports.

38. The big question about input-output analysis is the demand made on data and human resources as well as computational facilities. For these

reasons, use is usually made of a commodity balance approach initially. This approach tries to trace the disposition of certain commodities or factors through the different channels of use. Thus, assuming iron and steel is the commodity, we have total Supply = Final Demand + Intermediate Demand where total supply is made up of domestic production, imports and change in stocks; final demand is made up of consumption (private), government consumption, investment and exports and intermediate demand comprises uses in industries as inputs for production.

39. In connexion with this examination of input-output analysis, it is appropriate to mention a variation which was constructed by an ECA/FAO team for use in Zambia some time ago. The table has been christened "Seers' modified input-output analysis", after the name of the then Director, Economic Development Division of ECA, although in the main document the analysis bears the name of Mr. B. Abbai, an Economic Affairs Officer in the Economic Development Division, ECA. The analysis differs from the usual type of input-output analysis in that it has more columns than rows, incorporates the components of demand as well as sources of supply in separate columns and classifies recipients of factor income into African and non-African households. Copies of the tables are available for distribution. A more complete discussion of the input-output analysis is given in the revised SNA. (See chapter 3.)

#### Dynamic input-output analysis

40. In the static input-output analysis, emphasis is placed on the current input coefficients; investment is treated as part of final demand. Yet when we discuss the problem of development we are really discussing the problem of capital accumulation. Investment is not really a final demand like consumption and exports. It is one of the quantities dependent on consumption and exports. Thus it is necessary to introduce investment into the system instead of treating it as exogenously determined. The static input-output system becomes dynamic when the capacity-creating effect of investment is taken into account, and this is done by incorporating into the system the sectoral capital input-output ratios. Since, capital stock in any industry comprises various types of equipments, these sectoral coefficients are finally broken down into sub-sectoral capital coefficients.

41. Apart from computational facilities and the financial and human resources required for input-output analysis, data requirements constitute another problem. Specifically, information is required on both the supply and demand sides of the individual sectors delineated. Information is needed on the components of final demand-consumption, investment and exports mostly in value terms, and for important commodities, in value and physical terms; on the supply side, gross output and imports. Gross output will be broken down into costs - intermediate inputs (materials, fuel etc.) and value added (depreciation, wages and salaries, and surplus). In addition, there is need for information on capital stock, investments, labour inputs (number and man-hours) so as to be able to estimate levels of investment and labour after the levels of output have been determined.

Mathematical Programming:

(i) Linear programming

42. In the assumptions underlying input-output analysis, substitution between processes for producing a commodity is ruled out. Similarly, constant returns to scale are assumed. Also, excess capacity is not taken into account except in dynamic input-output analysis which is not even efficient for this purpose and in that case, the problem is better treated by the linear programming approach. It is assumed that what is available is used. These aspects of the input-output analysis make the approach unsuitable for dealing with the problem of introduction of new technologies and new industries.

43. Yet, development programming must include some method of finding the best technologies to adopt and the best industries to develop. For these problems the mathematical programming approach - linear and non-linear is the best.

44. The two shortcomings of the input-output models which mathematical programming can overcome are (i) input-output models do not consider technical substitutability of inputs to produce the same commodities, and so they are not appropriate for purposes of discussing the choice of techniques in development programming (ii) input-output models do not permit the consideration of boundary conditions which must sometimes be taken into account in development programming; limitations of scarce resources or social considerations of all sorts can always be formulated as inequalities.

45. Thus the linear programming technique is a natural extension of dynamic input-output analysis.

46. The main characteristics of a linear programming problem are (i) the specification of an objective function (ii) the enumeration of the constraints (boundary conditions) and (iii) the non-negativity conditions. The last characteristic is necessary in order to avoid having nonsensical results. (See the mathematical appendix for a symbolic representation.)

47. Data needs for linear programming problems are production levels of all the sectors indicated, their induced investment, exports and consumption both given exogenously, imports, capital stock, input coefficients, capital coefficients, labour supply and labour input-coefficients. These are enormous and they can only be provided at an advanced stage of statistical development and mutatis mutandis they will be needed at the advanced stage of development planning.

(ii) Non-linear programming

48. In linear programming analysis, the objective function and the structural constraints are linear functions of the variables. When one

or more of them are non-linear in the variables, the problem is then of non-linear programming. As far as data are concerned, there is no difference; the difference is in the method of solution.

(iii) Dynamic programming

49. Similarly, when the decisions that are to be made are those in which time plays a crucial role and in which the order of operations is crucial, these approaches become "dynamic". But once again, the data needs are not very different.

(iv) Principles of simulation

50. This technique of dealing with problems of economic development has been described as a "Computer Study of Economic Take-off Problems", the objective being the comparison of the effectiveness in an economy of different kinds of economic policies and programmes intended to promote continuing growth of real income while avoiding undesirable side effects.

51. It involves trying a great variety of programmes and policies and observing their consequences through time in terms of a whole set of criteria. Essentially, it is a synthesis of many kinds of relations including some which are derived from econometric studies and from input-output analysis as well as others inferred from qualitative observation of dynamic processes. The model has to be in terms of specific numbers, whether hypothetical or actual.

52. From the brief description given above, the needs of this approach in terms of data are enormous. The type of data needed can only become available when an economy is already mature, for not only must the coverage be extensive, the quality must be of the highest standard. Hence, it is an approach that cannot easily be adopted in the region for the foreseeable future.

OTHER MATTERS CONNECTED WITH DEVELOPMENT PROGRAMMING  
AND PROJECTIONS

53. In the foregoing section, a survey of planning techniques has been made. In this section, some other matters which cannot strictly be classified into stages in that they can occur at any stage of development programming are discussed.

Regional (sub-national) planning

54. Essentially, regional planning does not require a different technique from those already discussed. In fact, for each region, all the sectors identifiable for the economy and most of the data already indicated above can easily be established on a regional basis. Thus the information needs at the regional (sub-national level) are problems of analysis. However,

it is necessary to point out that whenever regional planning is adopted, the analysis must be within the framework of national analysis.

The commodity approach (or project approach)

55. Since 'planning' in the context of this paper refers to calculations covering the whole economy, the logical step after inter-industry analysis is to consider the projects that will make possible the implementation of the development programme. This is very necessary since these projects are without meaning unless they are related to the overall targets of the development plan.

56. The overall projections obtained through aggregative and inter-industry analyses only provide a framework for identifying the sectors which have a significant bearing on long-term development. Detailed studies of the potentialities for development in the sectors will provide information on feasibility, input requirements and technological change which should be fed back into the original projections to make them more realistic and operationally useful.

57. In this approach, the unit of examination may be what is considered as a key sector. Thus agriculture, energy or transport may be considered or it may be a question of a key factor of production such as scientists and within scientists, engineers. In each of these cases a deeper study is made of the characteristics of production as well as of demand for the particular sector or commodity.

58. However, from the nature of these things, they have to be related to the other sectors of the economy or to external factors. Thus a detailed analysis in the work the UN Food and Agricultural Organization did on commodity projections of the products of agriculture was made. All factors affecting supply and demand, both at home and abroad, were taken into account.

59. From the above description, it will be seen that data needs for project analysis and projections can be organized within the framework of an input-output analysis. However, data derived from engineering sources are also needed. This kind of data refers to a wide range of possibilities of technological alternatives for a specified technical unit at varying scales of production, and by their nature they refer to the future.

Social development

60. Social development planning is an area where data needs are also enormous. In the case of educational planning, it is very necessary to relate this to the levels of projected output even though allowance will have to be made for education as part of personal consumption. If this is done, then education should be treated as a sector and studies made of the factors affecting supply and demand at all stages.

61. This will entail detailed information about children in all types of schools and all levels of education, the length of stay in each "stage", the number of passes, of failures and of drop-outs; the number of teachers at every level as well as on the accommodation facilities available.

62. In addition, there is need for information on the present use of labour and its distribution in industry. Against all these data will be placed manpower needs calculated from the targets already worked out for sectors. Of course, for the purpose of providing for education as part of consumption, information is needed on school-age population.

63. In the case of the other subsectors of social planning, namely, health, housing and social welfare, it is very difficult if not impossible to relate them to the projected levels of output since they are inputs into production in the same way that education can be regarded. Invariably, decisions on what resources to devote to them are more political and hence more subjectively based than in the case of education. However, basic data needs in respect of their planning will be mainly in respect of population, its characteristics, existing facilities for health services (hospitals, hospital beds, doctors, nurses, etc.), and the prevailing delinquency rates. Almost all these types of data are products of administration and they should not be difficult to compile.

#### Financial aspects of development planning

64. Since investment is crucial to economic development, it follows that funds for investment financing must be found. Hence, it is necessary to have reliable information on the financial transactions of the institutional sectors of the economy. This is very important as the method of financing an investment programme is crucial because of the effects different sources of finance can have on development efforts.

65. Thus, a thorough analysis of the financial transactions of the government is a "must". This should cover the sources of revenue as well as the purpose and functions of expenditure.

66. Similarly, the activities of the banking system and the financial institutions should be analysed in order to be able to assess their role in economic development.

67. Finally, a thorough analysis of external transactions should be made since external resources are crucial for economic development in the Africa region.

68. In addition to the government, the financial sector, and foreign sources, non-financial enterprises and the household sector are the other sources of finance, and for a realistic analysis of the savings position, their financial accounts should be covered.

69. The household sector is the more difficult one and it implies the need for a better organization of household surveys.

70. If the governments can control business organizations adequately, it should not be difficult to have a reasonable picture of the financial activities of this institutional unit.

#### Integration of projects into the development plan

71. Principally, this is the headache of the planner since it is he only who knows the criteria to be adopted in accepting projects into the plan proposed for execution, and at any stage of planning, the question will always come up. However, there is need for information on certain variables which will help him in decision-making.

(a) Use of accounting prices - Accounting prices are "shadow" prices which are meant to reflect the true demand and supply conditions of products, raw materials and primary factors of production - labour, money capital, natural resources and foreign exchange. Another word for accounting prices is "opportunity cost". Strictly speaking, accounting prices are the solutions to the "dual" of the linear programming problem. Hence, they ought to be obtained by the solution of the dual problem. Unfortunately, this is usually very difficult and recourse is usually had to the subjective method of evaluation. But to reduce the areas of uncertainty and improve the subjective evaluation, sufficient information should be available on the supply and demand for the particular product, raw material, labour, etc.. In addition, there must be information on the actual market prices of these commodities so that the planner may be able to estimate albeit subjectively, the degree of over or under-valuation.

These points have already been covered under the different stages of planning discussed hitherto. The problem of "accounting prices" has been mentioned in order to stress the importance of these statistical data.

(b) Investment criteria - Again this is the problem of the planner. Once the objectives of development policy have been determined it is his duty to decide the weight to be given to them in the national menu. What other information he needs is to be part of the presentation of the projects and this has already been discussed in the body of this paper.

#### DATA NEEDS AT THE REGIONAL LEVEL

72. Two of the papers for this seminar are:

- (i) Methods used in recent economic projections:  
Projections at regional and inter-regional levels;

- (ii) Attempted projection of some national accounts aggregates for the years 1975 and 1980 for African countries.

73. These two papers illustrate the type of analysis and projections being carried out at regional and world levels. In this part of the present paper, an attempt is made to take a look at the raison d'être of these exercises as far as the African region is concerned.

74. One of the disturbing features about the countries of the region is that a number of them are too small in size to undertake rational economic policies without comprehensive information about the rest of the countries of the region. To help such countries to make economic progress, economic co-operation has been declared as part of the strategy for the United Nations Second Development Decade.

75. Moreover, a lot of countries in the region have entered into economic co-operation and/or integration and others are intending to do so. In this connexion, it is desirable to have a common picture of the economies of the region as a background for member countries in their development efforts. "Multinational programming" which is being suggested by the Economic Commission for Africa as a positive method of economic development, will have to be approached from the standpoint of "framework" planning, that is, viewing all of Africa in relation to the changing "rest of the world" situation as well as the countries of the region vis-à-vis one another.

76. Such analysis can throw light on the comparative performance implied in different national plans; it can indicate "norms" for the region in a more technical sense, and reveal weaknesses or inconsistencies in individual national projections and finally, it can provide an informed basis for regional co-operation, illuminating areas in which national plans involve incompatible goals or mutual dependencies.

77. Because of the nature of the exercise, the variables required have to be aggregative. Moreover, such a regional analysis necessarily involves comparisons of national projections principally because of the disparities in sizes and levels of development of the countries of the region.

78. There are two broad areas where countries would have to make data available to the secretariat - national accounts aggregates and external transactions accounts. Information will be needed on gross domestic product and its components - investment, consumption, savings, exports, imports. As soon as possible, information will have to be provided on capital stock. In the external transactions accounts, distinction will have to be made between intra-African trade and trade with the rest of the world. Similarly, information must be available on commodity exports as well as invisibles. Data on population characteristics are a "must".



### Problems of Data Comparability

79. To be able to achieve the desired goals, certain problems will have to be cleared. At present in some of the countries of the region, it has been found that there is no standardization of concepts and definitions. For instance it is not uncommon to find the planning agency using one concept while the statistical agency uses another when discussing the same data. This non-standardization creates problems for outside users of such information.

80. Similarly, this lack of standardization exists between the countries of the region. In a way, this situation reflects the fact that most countries of the region have failed to adopt international recommendations even when already adapted to African conditions.

81. Hence, it is being urged that concepts and definitions should as far as possible be standardized. A great deal has been done in this respect by international organizations, especially the United Nations family system.

82. For a more co-operative effort in the Second Development Decade, all countries in the region will have to adopt the terms and definitions being worked out for the strategy of the Second Development Decade as well as the statistical indicators of progress suggested.

83. Other technical problems that have to be tackled are common currency unit in which the figures for the region can be expressed and appropriate deflators. One only hopes that the problems of common currency unit will be satisfactorily solved when the present study on purchasing power equivalents being carried out in the region by the United Nations Statistical Office is completed. The problem of deflator can only be solved through greater co-operation among countries of the region and the adoption of international recommendations.

### Values in current and constant prices

84. Most of the countries of the region have so far prepared national accounts series at current prices. However, since projections are usually given in constant (base year) prices, consideration needs to be given to constant values also. Hence, there should be information on the variables both in constant and current values, and this emphasizes the importance of need for information on price series at different levels. Not only are prices necessary for calculating the aggregate variables, but their evolution too is very important. The non-fulfilment of targets is due partly to wrong ideas about the path of price evolution.

## IMPLICATIONS FOR NATIONAL STATISTICAL PROGRAMMES

85. The discussion of planning techniques given above has implications both for planning agencies and those responsible for providing the statistical data involved.
86. In the first place, it implies that planning agencies will have to plan their own work so that they can indicate ahead to statistical agencies what type of data they will need and at what stage of their planning exercises and in addition indicate the weaknesses in existing data.
87. Secondly, they will have to use their needs for statistics for planning purposes to support the programme of work of statistical agencies. And this support will be, not only on the provision of more funds for more surveys and processing facilities but also in advocating equitable conditions of services for statisticians.
88. For statistical agencies, the shopping list of data needs already indicated means that more censuses of population, industry, etc. will have to be undertaken. More surveys - rural, urban, demographic etc. will be mounted. In achieving these tasks more resources - material, financial and human will be needed. And in this connexion, efforts will be made to train more staff, retain them and retrain the existing ones.
89. Above all, in view of the magnitude of the needs, their variety and the urgency for providing them, it is necessary to discuss whose responsibility it is to provide the different data needs.
90. Apart from the types of data already discussed, information on natural resources - land, types of soil, water resources, minerals, etc. is very necessary in order that perspective plans may be undertaken. And invariably, the responsibility for this type of information is always that of ministries responsible for geological surveys.
91. Since the third-type data are from engineering estimates and economic agents' expectations, they are best obtained by planners themselves for various reasons. In the first place, they are usually closer to decision-making authorities. Secondly, they are likely to be in closer contact with engineers and other technicians in industry since these professionals are also involved in development planning.
92. On the other hand, since parameters are derived from the relationships postulated between variables by planners and researchers, it seems appropriate they should be responsible for their computation in collaboration with the statistical agencies in whose offices computing facilities are likely to be installed.

93. Finally, since target variables are in the fields of economics, demography and sociology and these are the fields usually covered by statistical agencies, these agencies are the proper governmental agencies for supplying them. Hence, attention will be concentrated on this aspect of data supply in the section on priorities.

#### SUMMARY

94. The main aim of this seminar is to establish some guidelines for the co-ordinated development of African statistics and economic analysis in the light of planning requirements.

95. This need for systematic organization has arisen, because, despite the efforts of the United Nations family system, especially the Economic Commission for Africa, in the last ten years to put statistical services on a firm footing in the region, most of the data being made available are not yet in the form most usable by planners. In a way, this situation is the result of weak statistical and planning organizations, and more in respect of the latter than the former.

96. In view of the paucity and poverty of the required data and of the weak planning machinery as well as the fact that planning is a complex exercise, economic development planning has to be undertaken in stages and the approach advocated in the paper could be described as proceeding from the general to the particular.

97. For planning and projections exercises, three types of data have been identified - policy variables which are in fact economic and demographic data, structural coefficients or parameters and third-type data (engineering information and businessmen's estimates).

98. In view of the fact that planners are responsible for postulating the functional relationships assumed between economic and demographic variables from which structural coefficients are estimated, as well as the fact that they are likely to be in closer contact with researchers and engineers, it is considered desirable that planners should be responsible for obtaining the last two groups of data while the statistics agency should be responsible for the first group.

99. Moreover, since in most countries of the region, information on natural resources (land use, mining resources, etc.) is usually not the responsibility of statistical agencies, and there are usually Central Banks and Manpower Planning agencies, it is also necessary to have a division of labour between these organizations and the statistical agency.

100. Thus ministries of agriculture and mines and power should provide information on the inventories of natural resources necessary for

evaluation of long-term prospects for development; the Manpower Boards should be responsible for information on human resources and manpower, while the Central Bank should be responsible for information on the activities of the financial and monetary sectors of the economy as well as information on external transactions of the country.

101. However, the statistical agencies will have to co-operate with these agencies especially in supplying statistical personnel and offering methodological advice. More importantly the statistical agency will have to supply information on population characteristics to enable the Manpower Board to perform its work efficiently.

102. In addition, in this task of improving the data needed for planning, the planning agencies, apart from improving their technical competency, will have to use their often more favourable positions in the hierarchy of the government to support any measures for improving statistical services put forward by the statistical agencies. Specifically, they will have to give very strong support to proposals for improving the service conditions of statisticians and providing more funds for equipment, field surveys and materials for analysis.

103. Finally, there will be more consultations between planners and the suppliers of data since it is of the utmost importance that planning needs must always be indicated in advance to enable them to be incorporated in the development programmes of statistical agencies. Indeed, planning agencies need to be more inclined to look ahead, anticipate their future needs and make these known to the statistical agency for incorporation in its programme of work.

104. It is odd that in drawing up their plans, planners have never consciously thought of incorporating statistical development as a policy objective. It is no wonder that frustrations invariably occur when they phone up the statistical agencies for information and they are told that it is not available. It is hoped that these situations will be remedied after this seminar.

## MATHEMATICAL APPENDIX

Determination of the general rate of growth (See Reference 1, No.1).

105. The model that has been found most useful for this exercise is the Harrod-Domar model of economic growth which expresses the growth rate of income in terms of savings and investment coefficients.

Let us assume that  $\frac{Y_{t+1} - Y_t}{Y_t} = \frac{\triangle Y}{Y} = g$  where Y is income,

t is time variable and g is the growth rate of income, g can be established as a function of domestic savings (private and government) and foreign capital inflow if some of the great ratios of econometrics - marginal capital-output ratio, savings ratio, consumption ratio, are given. Specifically g can be established as

$$g = \sigma s + \sigma \left\{ (s' - s)^d + s'^i \right\} + \sigma \left( \mu - \frac{E}{Y} \right)$$

where g is as defined above

$$\sigma = \frac{Y_{t+1} - Y_t}{I_t} \quad \text{marginal output - capital ratio}$$

$$s = \frac{Y^p - C^p}{Y^p} \quad \text{average propensity to save in the private sector}$$

$$s' = \frac{Y^g - C^g}{Y^g} \quad \text{average propensity to save in the government sector}$$

$$\tau^d = \frac{T^d}{Y} \quad \text{the ratio of direct tax to income}$$

$$\tau^i = \frac{T^i}{Y} \quad \text{the ratio of indirect tax to income}$$

$$\mu = \frac{M}{Y} \quad \text{average propensity to import}$$

$$\gamma = \frac{I^g}{C^g + I^g} \quad \text{the ratio of government investment to government expenditure}$$

and

$C^P$  : Private consumption

$I^P$  : Private investment

$C^G$  : Government consumption

$I^G$  : Government investment

$E$  : Exports

$M$  : Imports

$Y$  : National income at factor cost

$T^i$  : Indirect tax minus subsidies

$T^d$  : Direct tax minus transfer payments

$Y^P$  : Disposable private income

$Y^G$  : Disposable government income

106. Hence, whenever the target is established in terms of the growth rate of income and the need for external resources is considered, the real problem is to determine the level of savings this implies in terms of private savings, government savings and foreign resources. If one is only concerned with a closed economy and then with the role of the private investment in determining the pace of development then  $g = s$ . But in view of the role of government and foreign resources in development the first rendering of  $g$  is the most applicable.

#### Target setting

107. Since two of the problems which usually face a developing economy especially in the Africa region could be the need to raise the standard of living and the need to provide gainful employment, the target for income growth rate can be established by using the following two relations, namely

$$Y = \alpha P$$

$$Y = pN$$

where  $P$  : total population

$\alpha$  : National income per capita or the standard of living

$N$  : Active labour force

$p$  : Average productivity of labour

- (i) On estimating the future population as well as the desired standard of living, we can get the desired target of income level in the terminal year i.e.  $\alpha_t P = Y_t$ . Using present values of  $\alpha_0$  and  $P_0$  we have  $\alpha_0 P = Y_0$  initial income. Then if we use the geometric growth formula  $Y_t = Y_0(1+g)^t$  we can deduce the required average rate of growth.
- (ii) Estimate the future population and the percentage of the active labour force to get the future strength of the labour force. Then set the required percentage of workers to be employed in the labour force and so  $N_t$  the required level at the target date is known. But it is important to translate this target in terms of  $Y$ . Hence we need to estimate the average productivity of labour in the future either by extrapolating its past trend or by estimating it from the "progress function or learning curve" -

$$p = \bar{\beta} Y^{\beta} \quad \text{or}$$

$$= \beta' Y + \bar{\beta}'$$

where  $p$  is as defined above,  $\beta$  is the elasticity of income with respect to productivity,  $\bar{\beta}$  a constant,  $\beta'$  the slope of the income curve and  $\bar{\beta}'$  a constant. Having obtained  $p$ ,  $Y_t$  can be obtained

$$Y_t = p_t N_t$$

$$= \bar{\beta} Y_t^{\beta} N_t$$

$$\therefore Y_t^{1-\beta} = \bar{\beta} N_t$$

$$\therefore \log Y_t = \frac{1}{1-\beta} (\log \bar{\beta} + \log N_t)$$

$$\text{or } Y_t = \frac{\bar{\beta}'}{1-\beta' N_t} N_t$$

With  $Y_t$  determined,  $g$  can again be determined by using the function  $Y_t = Y_0(1+g)^t$ .

108. The determination of the desired level of income is only the supply side of the problem; the demand side has to be examined. In other words, the aggregate level of income has to be broken down into the components of demand - investment including changes in stock (private and public), consumption (private and public), and exports. Moreover, since foreign transactions are involved, imports have to be taken into account. Thus we have the balance equation

$$\begin{aligned} Y &= C^P + I^P + C^G + I^G + E - M \\ Y' &= Y + T^i = Y^P + T^d + T^i = Y^P + Y^G \\ B &= M - E \end{aligned}$$

where in addition to the definitions given above,

$Y'$  : National income at market price  
B : Foreign loans and grant.

109. Another formulation of this balance equation is in terms of resources available, viz

$$V + M = C + G + I + E$$

where V is the gross domestic product (at market prices)

M is imports  
C is private consumption  
G is government consumption  
I is gross investment (public and private)  
E is exports.

110. The technique described above has been explained in great length, not to teach planning techniques but to indicate the basic variables usually required in development planning. Whatever techniques are adopted, these variables in various forms - broken down among institutions and/or among economic sectors and their variants recur every now and again.

111. The projected breakdown of total supply among the components of demand can be secured in various ways depending on the information available and the type of policy followed by the government. If the policy of the government is to restrict consumption to a given level, then investment, government consumption and exports may be set at the desired levels and consumption determined as a residual. But investment cannot exceed the total of domestic savings plus the amount of foreign loans and grants that are available; exports depend largely on developments outside the economy and a preliminary estimate of them can be based on an assumption of no change in the effective exchange rate, and in a consistent programme, imports are limited to the capacity to import, i.e. the sum of foreign



exchange available from exports, foreign capital inflow, and changes in reserves.

### Planning the main sectors

112. To indicate the data needs at this level and the type of sectoral breakdown that may be made, the following illustration is presented. (See Reference 1, No. 3.)

### The basic features

- (i) two sectors - agriculture and industry with foreign trade.
- (ii) exports are divided into developed market economies and centrally planned economies.

### The equations

$$Y_{G,t} = \alpha_0 K_t^{\alpha_1} (1 + \alpha_2)^t \text{ Aggregate production function..... (1)}$$

$\alpha_0$  a constant

$\alpha_1$  elasticity of GDP with respect to capital stock

$\alpha_2$  technological shift of production function

$$D_t = \beta_0 + \beta_1 K_t \text{ Depreciation function..... (2)}$$

$\beta_0$  a constant

$\beta_1$  marginal depreciation rate

$$S_t = \gamma_0 + \gamma_1 W_t + \gamma_2 (Y_t - W_t) \text{ Domestic Saving..... (3)}$$

$\gamma_0$  a constant

$\gamma_1$  propensity to save from wage income

$\gamma_2$  propensity to save from non-wage income

$$M_t = \delta_0 + \delta_1 I_t + \delta_2 C_t + \delta_3 (G_{G,t} - I_t - C_t) \text{ Import function (4)}$$

$\delta_0$  a constant

$\delta_1, \delta_2, \delta_3$  represent the import requirement per unit of respective components of demand

$$E_M = A_M(X_M)^b \quad \text{Export demand in market economies.....} \quad (5)$$

$$E_C = A_C e^{\lambda t} \quad \text{Export demand in centrally planned economies...} \quad (6)$$

$$E = E_M + E_C$$

$$L_t = B_1(1-\ell)^t Y_{G,t} \quad \text{Total labour demand.....} \quad (8)$$

$\ell$  is growth rate of labour productivity

$$L_t = \omega N_t \quad \text{Labour supply.....} \quad (9)$$

$\omega$  is ratio of available labour to total population

$$N = f(t) \quad \text{Population function.....} \quad (10)$$

#### Identities

$$Y_{G,t} = C_t + I_t + G_t + E_t - M_t \quad \text{(Resources availability and Uses Balance Equation).....} \quad (11)$$

$$I_t = S_t + F_t \quad \text{Investment equals savings + foreign capital inflow.....} \quad (12)$$

$$M_t = E_t + F_t \quad \text{Balance of Payments Gap.....} \quad (13)$$

$$L_t \leq L_t \quad \text{Demand - supply of Labour.....} \quad (14)$$

$$I_t = \Delta K_t \quad \text{Investment equals change in fixed capital stock...} \quad (15)$$

$$Y_t = f(Y_{G,t}) \quad \text{National income.....} \quad (16)$$

$$W_t = \psi(Y_t - W_t) \quad \text{Wage income.....} \quad (17)$$

#### Sectoral breakdown

$$Y_{NA,t} = \alpha_0 K_{NA,t}^{\alpha_1} (1 + \alpha_2)^t \quad \text{corresponding to equation .....} \quad (18)$$

(1)

$$C_{NA,t} = f(Y_{G,t}) \quad \text{Consumption of non-agricultural product.....} \quad (19)$$

Completing the model, we have

$$Y_{G,t} = Y_{A,t} + Y_{NA,t} \dots\dots\dots (20)$$

$$K_t = K_{A,t} + K_{NA,t} \dots\dots\dots (21)$$

The variables

$Y_G$  : Gross Domestic Product

$C$  : Private consumption expenditure

$I$  : Gross domestic capital formation

$G$  : Government expenditure

$E$  : Export quantum

$M$  : Import quantum

$N$  : Population

$Y_G$  : Increase in GDP

$B = P_E E - P_M M$  : Balance of payments gap on the current account (= sum of net short-term capital inflow including net income from abroad and net changes in foreign assets and net long-term capital inflow and donations).

$t$  : time

$K_0$  : Initial capital stock

$P_E$  : Export price

$P_M$  : Import price

$F$  : Net capital inflows

$M_I$  : Imports of capital goods

$M_C$  : Imports of consumer goods

$X_I$  : Quantum of capital goods produced domestically

$X_C$  : Quantum of consumer goods produced domestically

$E_M$  : Exports to market-oriented economies

$E_C$  : Exports to centrally planned economies

$$M_I + X_I = I_t$$

$$M_C + X_C = C_t$$

- $X_M$  : Volume of production in market oriented economies  
 $K_t$  : Capital stock measured at the beginning of period  $t$   
 $D_t$  : Depreciation in period  $t$   
 $S$  : Net domestic saving  
 $W$  : Wage income  
 $L$  : Labour force  
 $\Delta K_t$  :  $K_t - K_{t-1} = I_t$  investment  
 $Y_A$  : Gross value-added by agriculture  
 $Y_{NA}$  : Gross value-added by sectors other than agriculture  
 $K_{NA}$  : Capital stock in non-agriculture sector  
 $K_A$  : Capital stock in agriculture sector.

Input-output or inter-industry analysis

The theoretical framework (See Reference 1, No. 6.)

(i) The accounting system

113. The accounting system of the input-output table can be presented by the following table:-

The accounting system of the hypothetical economy

Purchasing sectors

	Intermediate use Sectors	Total inter- mediate use.	Final demand	Total pro- duction	Import	Total use
	$X_{11} X_{12} X_{13} X_{14} X_{15}$	$W_1$	$Y_1$	$X_1$	$M_1$	$Z_1$
	$X_{21} X_{22} X_{23} \dots X_{25}$	$W_2$	$Y_2$	$X_2$	$M_2$	$Z_2$
Producing sectors	" " " ... "	"	"	"	"	"
	" " " ... "	"	"	"	"	"
	$X_{51} X_{52} \dots X_{55}$	$W_5$	$Y_5$	$X_5$	$M_5$	$Z_5$
Total intermediate inputs	$U_1 U_2 \dots U_5$					
Value added	$V_1 V_2 \dots V_5$		$V$			
Production	$X_1 X_2 \dots X_5$		$Y$	$X$	$M$	$Z$

114. As indicated above, the distinguishing features of this system are (a) production activities are grouped into sectors; each sector appears twice, once as a producer and again as a user of inputs, (b) each row indicates the disposition of output of a sector into intermediate use (i.e. used for production in other sectors) and final demand (investment, consumption, exports), (c) each column shows the inputs of the sector as produced (raw materials, fuel, etc.) and primary (value added) which accounts for all payments.

115. With the following designations of the symbols, the system can be represented as follows:

- $X_i$  = total production of commodity i.
- $X_{ij}$  = amount of commodity i used in sector j.
- $Y_i$  = final demand for commodity i.
- $W_i$  = total intermediate use of commodity i.
- $M_i$  = import of commodity i.
- $Z_i$  = total supply of commodity i.
- $U_j$  = total use of intermediate inputs by sector j.
- $V_j$  = value added in sector j.

Thus in each row we have

$$Z_i = M_i + X_i = \sum X_{ij} + Y_i = W_i + Y_i \dots\dots\dots (1)$$

(i = 1, 2, .....n)

in each column we have

$$X_j = \sum X_{ij} + V_j = U_j + V_j \dots\dots\dots (2)$$

(j = 1, 2, .....n)

(ii) The basic model

116. The following assumptions about input-output analysis enable us to write the demand for each industry (sector) as a function of its own level of output: (a) a given product is supplied only by one sector (b) there are no joint products and (c) the demand for input is a function of the level of output. Thus from the table we have

$$X_i - \sum a_{ij} X_j = Y_i - M_i \text{ for each row} \dots\dots\dots (3)$$

where  $a_{ij}$  coefficients are known as technical coefficients.

If M is given a specific function such as

$M_i = m_i X_i$ , then we have

$$X_i - \sum_j a_{ij} X_j = Y_i - m_i X_i \dots\dots\dots (4)$$

$$\therefore X_i + m_i X_i = \sum_j a_{ij} X_j + Y_i \dots\dots\dots (5)$$

$$(1 + m_i) X_i = \sum_j a_{ij} X_j + Y_i \dots\dots\dots (6)$$

(iii) Method of solution

117. Expressing the input-model in matrix form we have

$$X_1 - (a_{11} X_1 + a_{12} X_2 + \dots\dots\dots a_{1n} X_n) = Y_1$$

$$X_2 - (a_{21} X_1 + a_{22} X_2 + \dots\dots\dots a_{2n} X_n) = Y_2$$

$$\vdots$$

$$X_n - (a_{n1} X_1 + a_{n2} X_2 + \dots\dots\dots a_{nn} X_n) = Y_n$$

which is equivalent to

$$\begin{bmatrix} 1 - a_{11} & -a_{12} & \dots\dots\dots -a_{1n} \\ -a_{21} & 1 - a_{22} & \dots\dots\dots -a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ -a_{n1} & -a_{n2} & \dots\dots\dots 1 - a_{nn} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}$$

which becomes on rearranging the matrix of coefficients,

$$X - AX = Y$$

or  $(I - A)X = Y$  and with imports added

$$(I + M - A)X = Y$$

To find a general solution, use must be made of matrix inversion, i.e.

$$X = (I - A)^{-1}Y \text{ and}$$

$$X = (I + M - A)^{-1}Y.$$

or

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \dots & r_{nn} \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}$$

Where column sector  $X$  represents output levels, the matrix with  $r_{ij}$  represents the elements of inverted matrix and column sector  $Y$  represents levels of final demand for each industry. The implication of this formulation is that sectoral outputs can be determined if sectoral final demands are known. Hence, it is usual to determine the levels of components of final demand—consumption, investment and export autonomously i.e. outside the system.

#### Dynamic input-output analysis (See Reference 1, No.1.)

118. As indicated under the description of dynamic input-output analysis, the static input-output system becomes dynamic when the capacity-creating effect of investment is taken into account and this is done by incorporating into the system the sectoral capital input-output ratios.

119. Given the capital coefficients, a dynamic input-output system may be expressed by the following system of equations:

$$(1 + m_i)X_i - \sum_j a_{ij}X_j - I_i = C_i^p + C_i^g + E_i \dots \dots \dots (1)$$

$$\sum_j b_{ij}X_j + \bar{b}_{ij} K_i \dots \dots \dots (2)$$

Where  $I_i$  is the investment part of  $i^{\text{th}}$  sector's output and  $K_i$  is the total level of investment of  $i^{\text{th}}$  sector's output used by sector  $j$ .

120. If the system is operating at full capacity, then (a) can be written as

$$\sum_j b_{ij}X_j + \bar{b}_{ij} = K_i \dots \dots \dots (3)$$

and given  $K_i$ ,  $C_i$ ,  $C_i^g$  and  $E_i^h$ , equations (1) and (3) can be solved.

The time-path of  $X_j(t)$  and  $K_i(t)$  will be determined accordingly if the future patterns of  $C_i^p$ ,  $C_i^s$  and  $E_i$  are predetermined. Already, we have entered the field of optimilisation over time and it is necessary to discuss linear programming. This is done in the next section.

### Linear programming (See Reference 1, No.1.)

121. To fix ideas, let us assume that we want to attain a prescribed level of consumption and export with the minimum amount of investment. Before going on, however, it is advantageous to specify the usual conditions the plan must satisfy: (a) total demand for all goods produced by a sector must be equal to the total domestic production of the sector plus imports (sources total). Here total demand consists of the inter-industrial inputs related through input coefficients to the levels of sectoral output, the prescribed sectoral consumption and exports, the inter-industrial capital inputs related through capital coefficients to sectoral investment, (b) the level of each sector's production cannot exceed its capacity level, which is the sum of the initial capacity and the additional capacity created by sectoral investment during the relevant period i.e.

$K_j \leq \bar{K}_j + \Delta K_j (= b_{ij}K_j)$ , (c) total value of imports cannot exceed the value of exports by more than the maximum deficit permitted i.e.

$M = M_i + M^1 \leq \text{Max. } E - M$  where  $M$  is total import divided into competitive import  $M_i$  and non-competitive import  $M^1$  and  $E$  is total export, (d) the demand for labour cannot exceed the available labour supply i.e.  $\bar{L} \leq N$  where  $\bar{L}$  is labour demanded and  $N$  labour available.

122. Those four constraints are the minimum. Others can be specified depending on the objectives of policy.

Now writing the above problem symbolically, we have:

Minimize  $\sum I_i$

Subject to

$$\sum (e_{ij} - a_{ij})X_j - I_i + M_i = C_i + E_i \dots\dots\dots (1)$$

$$-\sum b_{ij}X_j \geq \bar{K}_i - K_i \dots\dots\dots (2)$$

$$\sum h_i E_i - \sum g_i M_i \geq -D \dots\dots\dots (3)$$

$$N \geq \sum n_i X_i \dots\dots\dots (4)$$



Where  $X_i$  is the production in sector  $i$ ,  $I_i$  is the investment part of the production of the  $i^{\text{th}}$  sector,  $M_i$  is the import of the production of the  $i^{\text{th}}$  sector,  $C_i$  and  $E_i$  are the prescribed levels of consumption and exports of the product of the  $i^{\text{th}}$  sector,  $\bar{b}_i$  is initial capital stock and  $K_i$  is total current investment in  $i^{\text{th}}$  sector,  $D$  is the maximum foreign trade deficit,  $h_i$  is the price of exports from sector  $i$  in foreign currency,  $g_i$  is the ratio of import prices to domestic prices in sector  $i$  at the given exchange rate ( $h_i$  and  $g_i$  are assumed constant);  $N$  available labour,  $n_i$  is the labour input coefficient for sector  $i$ .

#### PRIORITIES IN THE PROVISION OF DATA

123. The survey of planning and projections techniques undertaken in the body of this paper has been done in such a way as to indicate the priorities being suggested in the provision of statistical data for planning purposes in the region. Since the provision of adequate statistical data both in quantity and quality is a function of time, and this provision is a determinant of the level of sophistication to be adopted in planning, it is inevitable that this systematic approach should be adopted.

124. However, we have to understand that the countries of the region will be on different points of this time scale and so each country will have to consider what level is appropriate to it. But in the nature of things, the presentation has to be general so that the different characteristics of the countries of the region can be encompassed.

125. This approach has been from the general to the particular. It has been found appropriate because of the integrated picture which the aggregative approach presents. Like an architect who wants to design a house, we have to have constantly before us the whole picture although the details will have to be filled in later.

126. It is one of the admirable features of the significant progress made in the organization of data in recent years that all the details given in the survey of planning and projections above can be organized within the framework of a system of national accounts as has recently been produced by the United Nations Statistical Office and which we have had the opportunity to examine in this seminar.

127. About five years ago, one of the caveats against the United Nations System of National Accounts was that it did not cater adequately for the needs of planning since it excluded the very inter-industry transactions

which are of great importance to development planning. The defect has now been rectified since provision has been made to integrate input-output analysis with the structure of the revised SNA. (See chapter 3 of the revised SNA.)

128. Similarly, when the present work on "An Integrated System of Demographic, Manpower and Social Statistics and its Links with the System of National Accounts" is completed, we shall have a complete inventory of the economic and demographic and social data needed for development planning. The main problem is how to order our scale of preferences so that eventually all the elements in these frameworks can be provided.

129. Having made the above comments it is now time to sketch the proposed order of priorities.

#### I. NATURAL RESOURCES DATA

130. Since, in what follows, only data (economic, social, and demographic) that specifically enter into planning models will be discussed, it is necessary to indicate first the place of natural resources data in planning.

131. An inventory of natural resources data is important for at least two reasons. In the first place, any country's potentialities for economic development will depend on that country's natural resources endowment. Hence, to be able to have at least a qualitative view of the potentials for development, it is necessary to have information on the availability of natural resources and their probable future development - mineral deposits, water resources, the quality of the land available, etc.. Secondly, the availability of these resources coupled with that of human resources helps in the assessment of the comparative advantages of the particular economy at any given time. In this context, it is information on the availability or non-availability and the extent of the reserves of these resources that is discussed here. Information on their production and use comes under economic statistics.

132. As indicated in paragraph 89 above, the responsibility for this type of information is that of the authorities responsible for geological surveys. However, it is also the duty of the planning agency to see that attention is paid to the research work and scientific and technical surveys necessary to make available this information. Such activities will involve the government in a substantial outlay of money but the results usually justify the expenditure.

133. In view of the orientation of the new SNA to economic analysis and planning needs, it has been possible to relate the data needs of the stages of development planning suggested in this paper to the accounts and tables of the SNA.

## II. ECONOMIC, SOCIAL AND DEMOGRAPHIC DATA

### A. Determination of the general rate of growth

#### (i) Economic statistics

134. These include gross domestic product series and its distributive share (compensation of employees, operating surplus and saving both gross of consumption of fixed capital) as well as the components of final demand - investment (public and private), consumption (public and private) and exports to enable the computation of the ratios. Similarly, there is need for information on gross domestic product at constant prices to make possible the determination and projection of real gross product. In addition to these, data on the financial transactions of the monetary system, external transactions and the activities of government are needed.

135. These data needs are covered by the consolidated accounts of the nation; the production accounts of Accounts II and the related tables, in respect of goods producing industries, transport and distribution; the income and outlay accounts as well as the production accounts of government bodies; the accounts on the income and outlay and gross accumulation of corporate and quasi-corporate non-financial enterprises and the capital finance account of financial institutions.

136. It should be noted that the consolidated accounts of the nation cover account one - gross domestic product and expenditure, account 3 - national disposable income and its appropriation, account 5 - capital finance and account 6 - external transactions.

137. These data needs appear to be the minimum for a meaningful first shot at development programming and in most countries, at the earliest stages of planning, most of them can easily be compiled. This is the case in respect of the activities of the government, external transactions, activities of non-financial corporate and quasi-corporate enterprises as well as financial enterprises, since these latter are usually few.

138. On the other hand, it is likely to be difficult to get reliable information on agriculture except perhaps the export sector, on transportation except rail, the leading road transport enterprises, ports and ocean going vessels if any and air transport and on distribution except the leading import and export enterprises. However, the difficult parts present a challenge to the statistical offices.

#### (ii) Demographic data

139. Information is needed on population statistics with analysis into sex and age-groups; vital statistics to enable projection of the population;

employment statistics especially in the leading production sectors of the economy to be able to have an idea about "productivity" changes. These data needs are covered by the section on the distribution of the population by age and sex, as well as births and deaths in the proposed system of an integrated demographic, manpower and social statistics and the table in the SNA on "employment by kind of economic activity" table 10.

#### B. Planning the main sectors

140. Although two sectors have been distinguished in the illustration given in this paper, there is no reason why this should be the only possible case. Depending on the particular problems facing the economy, many other classifications such as are mentioned in the body of the paper can be used.

141. In view of the need for consistency, completeness and realism of economic models, data on the rest of the economy are needed in addition to the details needed on the sectors delineated. Thus in addition to the data enumerated in A above the following are needed:

##### (i) Economic statistics

142. Detailed information is needed on gross output of all the producing sectors of the economy, analysing current inputs by source of supply - foreign and domestic; capital formation by type and economic activity; detailed coverage of production activities of households and private non-profit making organizations; capital stock analysed by industry and depreciation. Details of these variables are to be given in constant prices; hence related price index numbers for the components of demand and imports are required.

##### (ii) Demographic data

143. Information is needed on employment by type of skills and distribution into activities. In addition to the above, specific analyses will have to be done for the sectors delineated. Thus in the case of public versus private sector, the public sector will have to be disaggregated and the major accounts - production, consumption and capital formation as well as income and outlay compiled for each level of government. Similar analyses will have to be done for the private sector.

144. Or in the case of home versus foreign sector, the foreign sector may have to be analysed in terms of economic blocks or currency areas while detailed analyses of economic transactions will have to be made for the domestic sector.

145. It is difficult to lay down specifically the data needs for the main sectors planning approach. Each planning agency will have to decide what sectors to delineate and hence what the data needs are. This matter is admirably treated in the new SNA. The essential point is that the needs must be communicated to the statistical agency well in advance so that plans

may be made for their provision.

146. The data needs at this stage involve the gathering of the more difficult basic data. But they are urgently required. Apart from the specific needs for the specific sectors identified for analysis, these data are covered in the remaining parts of Accounts 2 of the new SNA as well as the more difficult parts of Accounts 3 - Income and Outlay and Capital Finance Accounts.

### C. Inter-industry analysis

147. With the scheme outlined in this paper, inter-industry analysis will become necessary when industry has reasonably developed. It has been suggested, merely as a working hypothesis, that countries whose per capita national income has reached US\$150 or in which the contribution of the industrial sector to the gross national product has reached 15 per cent are likely to have most of their cells of the input-output table filled.<sup>1/</sup> Not many countries in the African region can boast of such achievements at the present time and it may be said without fear of contradiction that most of the efforts and resources devoted in the past to planning comprehensively by using input-output techniques have not yielded good results as far as the use of the coefficients was concerned, although the advantages in pointing out the serious gaps still left to be filled in basic statistical series may have been considerable.

#### (i) Economic statistics

148. As already indicated, data needs for input-output analysis are considerable. But by the time they would have become necessary, the foundation would have been laid for the successful provision of these basic data.

149. These data needs include gross output and input of industries at constant and current prices, composition of capital formation by industrial use and type of asset including stocks for the producers of commodities and services and government, non-profit organization and domestic services; final consumption of households, government and non-profit institutions by purpose and object at constant and current prices and according to cost-composition; factor income by institutional sectors and full information on income and outlay and capital transactions for all the institutional sectors - non-financial corporate and quasi-corporate enterprises, financial enterprises, government, non-profit making bodies and households.

150. In sum, this is the last stage for the completion of the remaining accounts and tables of the new SNA and it is likely to take a long time, the main constraint being probably not shortage of statistical and planning

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<sup>1/</sup> See United Nations, New York. Industrialization and Productivity Bulletin 4, pp. 7-17.

personnel but financial allocations for field operations and processing activities.

(ii) Demographic data

151. A fuller inventory of labour availability by type of skill and by use than under B above would be necessary. Moreover, a comprehensive account of educational facilities in order to integrate them into economic planning needs will also be necessary.

152. These data are already covered in the document for integrated demographic, manpower and social statistics.

153. It must be confessed that it is difficult to classify manpower planning chronologically since educational development should be regarded as one of the objectives of social and economic development.

154. However, in the early stages of development when agriculture and other traditional activities predominate, the problem of education as an input into production is usually minimal. The main problem is usually that of providing education as part of private consumption and the decision is mainly political.

155. But since the ultimate aim is to change the structure of the economy by the application of techniques that will require educated people, the question of education in relation to economic development may be important right from the beginning. Hence, the need for information on natural resources becomes more urgent as this information will help in planning the educational sector.

156. In the end, individual countries will determine what emphasis to place on education as a component of private consumption vis-à-vis education as factor of production.

D. Regional (sub-national) planning

157. From the foregoing it is clear that regional planning comes under "the main sectors" approach.

158. In that case, apart from the need for information on the general features of the economy as exemplified by the aggregates of national accounts and demographic and social statistics, in order to be able to relate the particular conditions prevailing in the regions to the whole economy, data needs for regional planning will be specific depending on what the problems are, and these needs are covered by the discussion in the new SNA on supplementary classifications given in chapter nine of the document.

159. Hence, no specific suggestions for data needs for regional planning are given here.

### Recommendation

160. An analysis of the structures of the member states' economies has revealed that most of them are "pluralistic" broadly, they are characterized by a traditional sector with a substantial subsistence subsector containing the bulk of the population who still remain at a very low level of economic and social development after a decade of planned economic and social transformation and a modern sector comprising an indigenous monetized subsector and a foreign enclave whose main activities are based on exploitation of mineral or agricultural resources with very weak backward and forward linkages with and/or spread effects on the rest of the economy particularly the subsistence sector.

161. The situation is aptly described by the following quotation from the United Nations revised System of National Accounts. "A basic feature of many developing countries is the existence of what is sometimes called "dualism", that is the existence, side-by-side of traditional and more recent modes of living, social and economic organization, and carrying on production. The technology, organization and productivity of the two modes of production, and the attitudes, habits and institutional arrangements of the people involved, differ to such an extent that the situation may be described as the existence, side-by-side, of differing loosely connected economies and societies" <sup>1/</sup> In view of this situation, the secretariat has come to the conclusion that the core of the economic and social problem in the 1970's is the transformation of this subsistence sector by its complete integration into the modern sector. In this task, a heavy reliance is being placed on the public sector.

162. In terms of the stages of economic and social development programming outlined in this paper, the majority of the countries of the region are classified to be on "planning the main sectors" stage, the main sectors being the subsistence sector, the indigenous monetized sector and the foreign enclave.

163. The transformation process is going to be a reciprocating one. A deliberate attempt will be made to expand market for the subsistence sector's produce of raw foodstuffs and inputs into manufacturing and processing activities whose products of manufactured consumer goods and technical inputs into agriculture namely, implements, pesticides, fertilizers, etc. will go to meet the expected increase in and changed composition of demand for these goods not only by the subsistence sector but also by the indigenous monetized sector as productivity and income increase.

164. In order to effect this transformation, data on natural resources (human and material), manpower and employment, as well as the existing production, accumulation and consumption characteristics of the institutional

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<sup>1/</sup> United Nations, A System of National Accounts p. 208

sectors of the economy will be needed. These data needs are already covered under I, and II A and B above. However, in view of the characteristics of the model described here, the attention of the seminar is drawn to the relevance of Accounts IV, V and VI on pages 217 to 225 of the revised SNA.

165. In addition to these conventional series of economic and demographic data there is need for information on :

- (i) farming systems - land tenure system, cooperative activities, etc.
- (ii) existing Government services - extension services spelling out forms of and the personnel involved, coverage and farmers' participation, credit system, research activities to aid agriculture etc.
- (iii) social and other infrastructure amenities - electricity, water, health and social welfare, services, education, roads, mass communication media; etc.

in rest of the rural areas.



## REFERENCES

1. United Nations, Development Programming Techniques Series.
  - No. 1 Programming Techniques for Economic Development  
With special reference to Asia and the Far East.  
E/CN.11/535, Sales No. 60.00.F.3.
  - No. 2 Formulating Industrial Development Programmes  
With special reference to Asia and the Far East.  
E/CN.11/567, Sales No. 61.II.F.7.
  - No. 3 Problems of Long-term Economic Projections  
With special reference to Asia and the Far East.  
E/CN.11/629, Sales No. 63.II.F.6.
  - No. 4 Problems of Social Development Planning  
With special reference to Asia and the Far East.  
E/CN.11/663, Sales No. 64.II.F.10.
  - No. 5 Review of Long-term Economic Projections for Selected  
Countries in the ECAFE Region  
E/CN.11/674, Sales No. 65.II.F.6.
  - No. 6 Sectoral Aspects of Long-term Economic Projections  
With special reference to Asia and the Far East.  
E/CN.11/774, Sales No. 67.II.F.4.
2. United Nations, Analyses and Projections of Economic Development
  - I. An Introduction to the Technique of Programming  
(A study prepared by the Economic Commission for Latin America)  
E/CN.12/363, Sales No. 55.II.G.2.
3. Economic Commission for Africa  
Fourth Conference of African Statisticians, Addis Ababa,  
25 October-2 November 1965:  
"STATISTICAL DEVELOPMENT IN AFRICA"  
(Note prepared by the secretariat)  
E/CN.14/CAS.4/DEV/1/REV.1.
4. United Nations, A SYSTEM OF NATIONAL ACCOUNTS  
Studies in Methods, Series F, No. 2, Rev. 3.  
ST/STAT/SER.F/2/REV.3, Sales No. E. 69 XVII.3.

5. United Nations; Economic Commission for Africa; FOOD AND AGRICULTURAL ORGANIZATION  
Report of the UN/ECA/FAO Economic Survey  
Mission on the Economic Development of Zambia
6. United States Papers Prepared for the United Nations Conference on THE APPLICATION OF SCIENCE AND TECHNOLOGY FOR THE BENEFIT OF THE LESS DEVELOPED AREAS  
Volume VIII: Organization, Planning and Programming for Economic Development.
7. United Nations  
Economic and Social Council  
STATISTICAL COMMISSION  
Sixteenth session  
Item 4 of the Provisional Agenda  
AN INTEGRATED SYSTEM OF DEMOGRAPHIC, MANPOWER AND SOCIAL STATISTICS AND ITS LINKS WITH THE SYSTEM OF NATIONAL ECONOMIC ACCOUNTS.  
E/CN.3/394
8. United Nations, INDUSTRIALIZATION AND PRODUCTIVITY  
Bulletin 4, April 1961.
9. J. Tinbergen, Development Planning; World University Library, 1967.
10. African Development Manning,  
(Impressions and Papers of the Cambridge Conference on Development Planning, 22 September - 5 October, 1963).  
Editor - Ronald Robinson  
The Secretary Overseas Studies Committee,  
The Old Schools, Cambridge.
11. Earl M. Kulp, Rural Development Manning  
Systems Analysis and Working Method  
Draeger Special Studies in International Economics and Development, 1970.