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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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DATA REQUIREMENTS FOR INDUSTRY ANALYSIS AND PROGRAMMING [1]

by

Thomas Vietorisz
Professor of Economics
New School for Social Research
Director
Center for Economic Planning
New York

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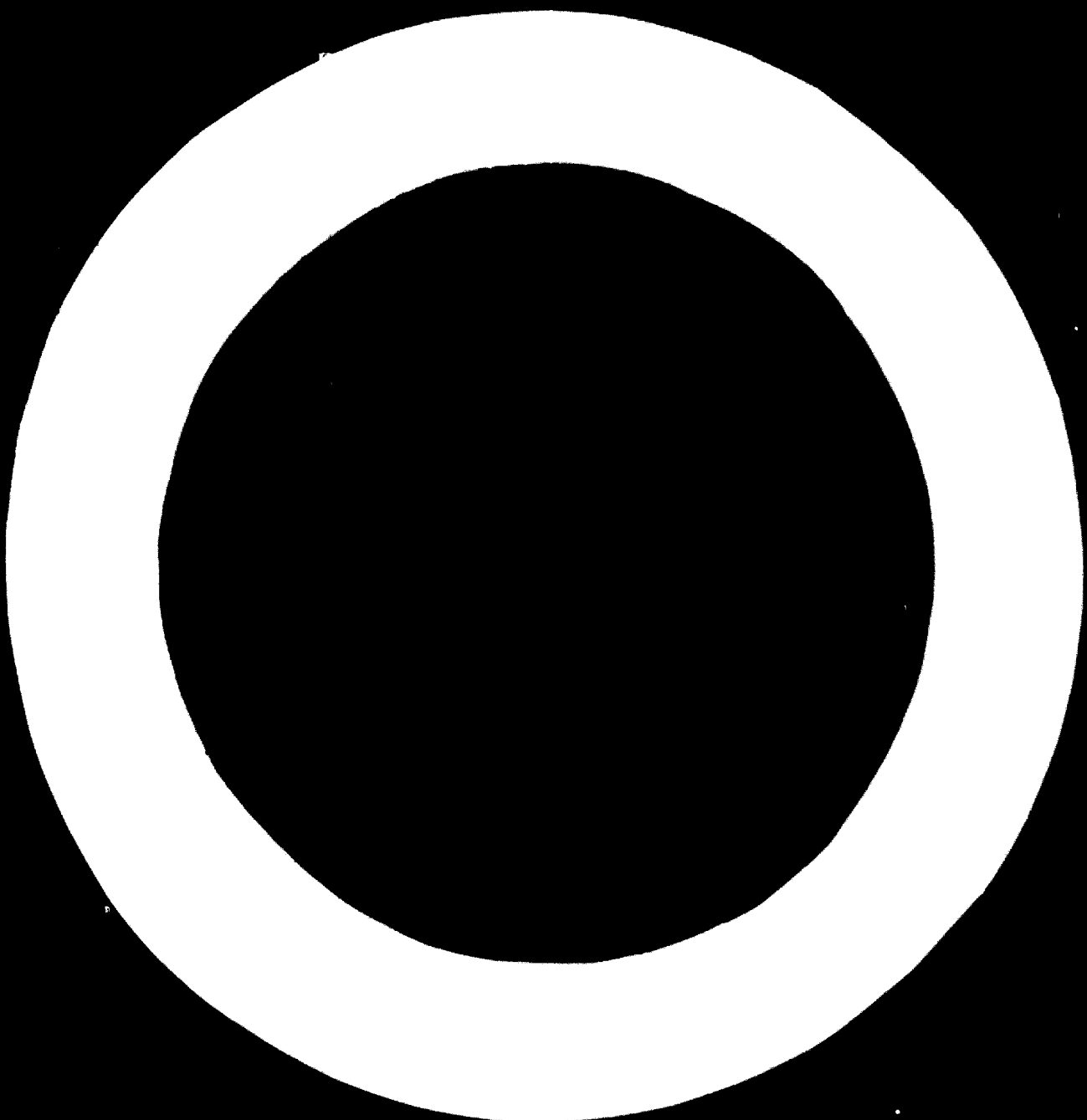

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DATA REQUIREMENTS FOR INDUSTRY ANALYSIS AND PROGRAMMING

This paper, originally written as a draft chapter for the UNIDO Industrial Programming Manual, has been reproduced as a background paper for the International Working Party on Industrial Programming Data.

Its purpose is twofold. First, it discusses the conceptual problems underlying the identification, collection and organization of empirical information that is used for economic studies and planning decisions pertaining to individual industries. Second, it surveys the available data sources.

The main tasks of industry studies in relation to economic development planning are the following:

(1) Diagnosis: the compilation and evaluation of background information for obtaining a panoramic view of the situation, trends, and potentialities of the sector and its branches.

(2) Plan formulation: target setting, the translation of targets into programmes, and the comparative evaluation of alternative programmes.

(3) Choice of policy instruments for plan execution: identification of the specific institutional means of converting paper programmes into executable plans.

The paper explores the data requirements and sources for each of these three main tasks.

A. Information requirements for diagnosis

The task of diagnosis is the compilation, systematization and evaluation of a wide variety of qualitative and quantitative information that is pertinent to the development of the industrial sector and its branches. In the course of diagnosis (1) the structure of the sector has to be described, (2) its evolution as a whole and by structural parts appraised and (3) all information evaluated in the light of its relation to overall economic and

industrial development.

Apart from traditional industrial statistics and national income accounts which will be discussed in more detail below, the sources vary from country to country. There will also be a great deal of variation according to the degree of completion of previous work in this area. In many countries, much of the pertinent information is not formalized and recorded. The task of diagnosis is to bring together all the available practical experience as well as statistical, institutional, and other formal information, and to organize this information in such a way that it may be kept up to date as a ready source of reference for the planning process. A Statistical Office operated along traditional lines is generally not suited either to the task of collecting or to that of keeping up to date a complete body of diagnostic information, since this material is so closely oriented to its utilization in the planning process that only the practical planner is both motivated and qualified to work with it.

In Exhibit 1, an outline is provided for the organization of information for the diagnostic process. This outline may also be used as a checklist of the kinds of information that are to be sought.[1/] Sources of specific kinds of information will be discussed further below.

1/ A similar checklist oriented to industry studies in the more highly developed countries will be found in Everett E. Hagen, Handbook for Industry Studies, The Free Press, Glencoe, Ill., 1958, pp.38-80.

EXHIBIT 1

OUTLINE FOR THE ORGANIZATION OF INFORMATION FOR THE PROCESS OF DIAGNOSIS

1. Description

(a) Structure of the sector and relation to the economy as a whole.

(i) Gross value of production, value added, employment, and investment by industrial branches. Breakdown of investment (sites, buildings, machinery and plant, working capital).

(ii) Installed capacity and its degree of utilization.

(iii) Sources and amounts of raw materials, fuels and energy consumed.

(iv) Destination of production; proportion of internal demand supplied by industry; exports.

(v) Industrial location; geographical dispersion.

(vi) Prevailing size of individual plants; number of plants by product.

(vii) Over-all table or partial studies of inter-industrial relations.

(b) Computation of coefficients indicative of efficiency (by branches).

(i) Capital-output ratio.

(ii) Ratio of sales to inventories.

(iii) Output per manhour.

(iv) Specific inputs per unit of product.

(c) Assessment of efficiency through the comparison of the structure of production costs locally and abroad, on the basis of the physical inputs per unit of product or other pertinent basis of estimation, for selected significant products. Identification of the fundamental factors underlying cost differences.

(d) Market structure and degree of monopoly control.

(i) Price levels and their comparison with prices in other

areas or countries. Price controls and methods of price determination.

(ii) Tariff protection, indirect taxes and subsidies; exchange rates bearing upon prices.

(iii) Standards of quality.

(iv) The distribution system and the degree of monopoly control within it.

(e) Financing of the industrial sector and the legal status of enterprises. Sources and uses of funds. The capital market for industrial ventures.

(f) Institutional aspects connected with industrial production:

(i) Taxation, legislation and regulation bearing on industrial production.

(ii) Prevailing industrial norms; quality and standardization.

(iii) Manufacturers' associations.

(iv) Industrial labour organizations.

(v) Institutes and other research bodies at the service of industry.

(vi) Governmental agencies connected with different aspects of industrial production.

(vii) Industrial manpower training.

(viii) Other aspects.

2. Historical evolution and rates of growth

(a) Construction of historical series and determination of growth rates:

(i) For the industrial sector, compared with the economy as a whole.

(ii) For the different industrial branches.

(iii) For different types of goods classified as:

a. final consumption goods, nondurable;

b. final consumption goods, durable;

c. capital goods (for agriculture, industry and transport;

d. intermediate goods.

(iv) For exports.

(v) For the production directed toward the satisfaction of internal demand.

(vi) For manufacturing production in relation to handicraft activities by branches of industry.

(vii) For average employment per plant.

(viii) For electrical energy and capital inputs per unit of product (mechanization).

(ix) For labour productivity.

(b) Analysis of the growth of the different branches of industry.

(i) Growth of the aggregate national product and the elasticity of demand for manufactured goods (income- and price- elasticities).

(ii) Demand for intermediate use, as a function of inter-industry relations and the growth of final demand.

(iii) Relative prices of domestic production and imports.

(iv) Positions of special advantage with regard to the cost of specific inputs, which might have led to exportation or to complete import substitution.

(v) Technical innovations.

(vi) Decisions to develop certain branches for reasons of economic policy.

(c) The effect of economic policy on industrial growth.

(i) Internal terms of trade for industrial and non-industrial goods.

(ii) Foreign-trade policy.

(iii) Monetary and fiscal policy.

(iv) Credit policy.

(v) Labour policy.

(vi) Policy with regard to monopolies.

(vii) State promotion in the industrial field.

(d) Analysis of the efficiency of manufacturing production.

(i) Structure of the market and of manufacturing production; monopoly situations in distribution, finance or production; indiscriminate protection; patents.

(ii) Integration of processes and industrial pools for the production of specific inputs at favourable scales. Vertical and horizontal integration of enterprises.

(iii) Standardization and quality; regulations.

(iv) The standards of the technical services which accompany given products; the cost of spare parts.

(v) Inflationary climates and credit policy.

(vi) Exchange policy; the possibilities of gain by taking advantage of different rates of exchange and double invoicing; difficulties in the importation of equipment and basic inputs.

(vii) Labour policy.

(viii) Taxation: incentives for the reinvestment of profits and others.

(ix) Factors affecting the efficiency of individual enterprises:

a. factors related to the internal affairs of an enterprise that can be influenced by the own efforts of the enterprise;

b. factors originating outside the enterprise and related to the overall productive system and the behaviour of other enterprises that can be influenced only by action along a broader front.

(x) Business initiative and the supply of managerial personnel.

(e) Labour productivity. (This ubject involves some duplication with the analysis of general efficiency under point 2-d.)

(i) Definition. The productivity of a single factor and the production function defined by a complete set of factors. Average and marginal productivities.

(ii) Factor substitution. capital versus labour; different grades of skill in the labour force. Capital intensities in the core and ancillary activities of given industrial production processes.

(iii) Labour and the administration of an enterprise. Separation of the effect of two factors: the intrinsic quality of the labour force (general education, discipline, habits), and the quality of management. Policies of maintenance and replacement of equipment. Pay incentives. In-service training of the labour force. Management training.

(iv) The influence of other enterprises or of the institutional system. External economies and diseconomies with regard to transport, energy, communications, warehousing, general vocational training, housing, public health, renovation, sales, regulations.

(v) Regularity of production (seasonal variations in demand; fluctuations in credit, exchange or tax policy; etc.)

3. Interpretation of industrial growth from the point of view of overall economic development.

(a) Industrial development and occupational structure. Here the following background information is required: evolution of the total, active, rural and urban populations; absorption of the active population in the manufacturing industry and in other activities (mining, agriculture and services); comparison of productivity in different sectors.

(b) Role of industry in import substitution and analysis of its corresponding incidence on the balance of payments. Influence on the capacity to import (contribution to exports and to the satisfaction of domestic demand) and to the propensity to import (intermediate and capital goods imports for industry). What would have happened if the import substitution effort had not been made? How would exports have developed?

(c) Structural changes resulting from industrial development. "Balanced development" versus notable specialization, in the concrete case under study. Flexibility due to the establishment of strategic industries. Interdependence of industrial development

with the development of other sectors (stimuli and restraints).

(d) Analysis and evaluation of the social costs and benefits of the industrialization process. What would have been the alternative destination of labour and other factors absorbed by industry directly or indirectly and what is, in consequence, the opportunity cost of industrialization? Quantitative appreciation of the transfers and the redistribution of income resulting from industrial development; identification of the income-receiving sectors that have been favoured or harmed. Possible social benefits derived from the formation or strengthening of an interpreneurial class and of the industrial working class. Tensions provoked by the energence of new groups with economic, social, or political influence.

B. Plan formulation: levels of planning and their data requirements

In the light of the diagnostic information, plan formulation takes its departure from target setting for the level of living (in part based on demand projection) and for the productive structure, with special attention to technological and organizational upgrading. Targets are then translated into specific final demands and activity levels, and a trial plan (programme) is formulated involving the complete specification of the productive structure and resource allocations. The exploration of alternative programmes leads to the identification of an efficient programme under the current set of targets. Finally, significant tradeoffs between targets are explored and, if required, targets are re-set in the light of this information.

Industrial plan formulation entails work at three levels of analysis, namely (1) the economy-wide, (2) the project and (3) the sectoral level which is intermediate between the former two. Each of these levels has its own distinct data requirements that also vary according to the method of approach which is being adopted.

1. The economy-wide level

At the economy-wide level analyses and projections are undertaken and plans are prepared in a number of alternative ways.

(a) By major national-income components only:[2/] consumption, investment, government expenditure, exports, imports; possibly with some sub-classification of each of these items, especially in regard to foreign capital flows. The data requirements include the major national-income series together with their supporting statistics, and some additional information on foreign loans and direct investments, interest and profit remissions and amortizations.

2/ See: United Nations, Economic Commission for Latin America, Analyses and Projections of Economic Development, I. An Introduction to the Technique of Programming, New York, 1955; and United Nations, Economic Commission for Latin America, The Use of National Accounts for Economic Analysis and Development Planning, Document No. E/CN.12 671, 16 April 1963, 54 pp. (mimeo). For a practical application, see: United Nations, Economic Commission for Latin America, Analyses and Projections of Economic Development, VI. The Industrial Development of Peru, New York, 1959.

(b) By sectoral breakdown employing input-output models or related techniques. The number of sectors[3] may vary from three or four major sectors[4] to an inter-industry classification of several hundred industries, such as the 450x450 input-output study of the United States.[5] In preparing such studies, projections, or plans, the formal methods of constructing an input-output table may be employed; alternatively, if data availability is restricted, a sectoral breakdown of the aggregates may be established by less sophisticated trend projection methods, and the interaction between sectors may then be taken into account only by means of a few major corrections reflecting the most important sectoral interactions. The data requirements for the formal input-output technique rest on the same statistical base as national income accounts, but involve a substantial expansion of the information pertaining to transactions between enterprises. In effect, the output of each enterprise has to be distributed for input-output purposes not only between households, government, the foreign account and other enterprises in the aggregate, but also between

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3/ In discussing input-output models, "sector" and "industry" are often used interchangeably. Thus "industry" is given a wide interpretation, and agriculture, services, etc. in the aggregate or by more detailed classification are often referred to as "industries".

4/ See Analyses and Projections of Economic Development, VI, The Industrial Development of Peru, op.cit., Table 32.

5/ The following bibliographies cover input-output materials: V. Riley and R. L. Allen, Interindustry Economic Studies, a Comprehensive Bibliography of Interindustry Research, Operations Research Office, Johns Hopkins University, No. BRS-4, May 1955; C. E. Taskier, Input-Output Bibliography 1955-1960, United Nations, New York, 1961; United Nations, Input-Output Bibliography 1960-1963, Statistical Papers, Series M, No. 39, New York, 1964.

enterprises distinguished by sectoral classification. On the other side of each account, expenditures likewise have to be distributed by sectoral classification within the aggregate of all enterprises. In undertaking these distributions, standard statistical data frequently have to be complemented by marketing and cost information collected by means of special studies concerning particular industries.

(c) By major resources of economy-wide planning importance, using the technique of commodity balances. The number of individual commodities accounted for at the economy-wide planning level may vary from as few as three (steel, copper, and aluminum, in United States planning practice during the Second World War[6]) to over a thousand, as in the current planning practice of the USSR.[7] The data requirements for commodity balances consist of technical norms, i.e., of standard input requirements of different commodities into the production processes of industries with specified outputs, complemented by a very wide range of qualitative and semi-quantitative information pertaining to production and consumption targets, capacities, and the degree to which the norms can be forced, i.e., contracted under emergency conditions to alleviate specific bottlenecks.

(d) By linear programming or more general mathematical programming models that unite the most attractive features of the input-output and the commodity-balance techniques. Such models resemble input-output tables in that they have a precisely specified mathematical structure and can be subjected to analysis by well-known computation

6/ On United States wartime planning practice, see D. Novick, M. Austen and W. C. Truppner, Wartime Production Controls, New York, Columbia University Press, 1949, and T. Scitovsky, F. Shaw and L. Tarshis, Mobilizing Resources for War, New York, McGraw Hill, 1951.

7/ For a discussion of the planning process in centrally planned economies, see United Nations, Planning for Economic Development, Vol.II, Studies of National Planning Experience, Part 2, Centrally Planned Economies, New York, 1965; United Nations, Economic Survey of Europe in 1962, Part 2, Economic Planning in Europe, Geneva, 1965; United Nations, Basic Principles and Experience of Industrial Development Planning in the Soviet Union, New York, 1965.

techniques; at the same time, they get away from the excessive rigidities created by the definition of single-product industries that are treated both as rows (resources) and as columns (economic activities). In linear programming models these "industries" are replaced by individual productive activities for the accounting of inputs, and by resources for the accounting of product distributions and other resource balances. Byproducts are permitted, alternative activities in an industry may occur, and there may also be an indefinite number of primary constraints, i.e., constraints of resources which are not produced within the model, e.g., unskilled labour. The most important additional data requirements of such models, as compared with input-output models, pertain to the specification of alternative ways of producing given outputs. In other words, while in an input-output model the productive structure is derived in a unique way from historical data, a programming model, by the very device of creating alternative activities, also imposes the burden of identifying such alternatives in an empirical way, even though the alternatives (for example, a new steel mill under consideration where no steel was produced before) may never have been actually utilized in the country in question. In such a case reliance has to be placed either on engineering data or on the transfer of data from other countries under conditions of less than perfect comparability. While the burden of model construction in such a case is large, the identification of alternatives is the only meaningful way of analyzing price relationships within a model.

2. <u>The project level</u>

At the project level the point of view of the analysis is the exact opposite of the economy-wide level. No claim is made to the derivation of comprehensive relationships that will permit an overview of the economy or even an industry as a whole, but the technical characteristics and the institutional setting of an individual investment project are explored in depth to yield supporting information for a specific decision that will commit financial funds and other resources to the practical execution of the alternative that is

chosen. Individual projects may be defined:

(a) On the basis of market (demand), cost, and institutional (financing, licensing, labour, etc.) studies, in the context of a predominantly free-enterprise or mixed economy where economic viability in terms of revenues and costs at market prices is the primordial criterion of project selection. A key element of the cost study in many instances is the undertaking of a detailed project engineering effort prior to the final decision to proceed with the execution of the project. For large projects, such as the building or expansion of an integrated steel mill, the supporting engineering and economic studies may represent several bulky volumes of documentation whose preparation requires the efforts of specialized engineering firms and may represent an outlay of millions of dollars. At the other extreme, simple projects may be supported by no more than verbal representations or a couple of sheets of figures prior to the investment decision.

Data requirements cover the following aspects of projects: (i) demand and market studies and projections; (ii) project engineering; (iii) size and location of projects; (iv) investments in the project; (v) income and expenditure budgets both in national currency and in regard to foreign exchange requirements; (vi) financing and organization; and (vii) environmental information for project evaluation, including interest and foreign-exchange rates, institutional factors (especially in regard to labour and transport) and pertinent government regulations.

(b) On the basis of studies of social impact that may be adduced as modifications of the underlying criterion of the viability of the project at market prices, in mixed economies. In other words, the contribution of the project to economy-wide objectives may be assessed; for example, its effect on national product or the foreign-exchange balance, its relative labour or capital intensity, its influence on regional or urban growth, its stimulating effect on the development of higher-order skills, etc. Among projects that meet the criterion of being able to survive at prevailing market prices,

preference may then be given (particularly from the point of view of public support) to projects that rank high on the criteria of favorable social impact. In specific instances public support may take the form of tariff or quota protection, subsidization, or similar action that changes the market environment of a particular project and directly influences its ability to survive at the resulting market prices.

The data requirements for the study of social impact pertain to the estimation of both the direct and the indirect effects of the project. Many of the effects that are of prime concern, e.g., on national product, the balance of payments, or the supply of bottleneck commodities such as fuels, can be assessed correctly only in an economy-wide context. If certain restrictions are met,[8/] the use of shadow prices derived from economy-wide models can be relied upon to evaluate with a good approximation the impact of particular projects on the capabilities and limitations of the economy as a whole. This particular data requirement for project evaluation creates a close link between project-level and economy-wide analyses.

(c) On the basis of technical and economic studies aimed at translating sectoral plan targets into concrete enterprise-level investment plans. When used in conjunction with the commodity balance approach at the economy-wide level, the emphasis of these studies is on engineering analyses of technical efficiency in meeting stated physical objectives, such as the production of a given tonnage of steel. The data requirements of such engineering studies are very similar to the data requirements of cost studies undertaken in a market context; the principal difference is that

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8/ These restrictions pertain to the mathematical notion of convexity which can be loosely interpreted as the feasibility of forming arbitrary weighted averages of given economic activities. See T. Vietorisz, Decentralization in Nonconvex Systems, Industrialization and Productivity, Bull.12, United Nations (in press).

the study of market opportunities as a function of selling prices is replaced by the fixed objective of meeting plan targets that are usually specified in physical (not value) units.

3. The sectoral level

The sectoral level is intermediate between the economy-wide and project levels. At this level it is desired to relieve the narrowness of perspective that necessarily attaches to project studies, and to obtain an overview of a wide range of alternative technical and economic development possibilities characterizing a reasonably large segment of the economy, yet without incurring the entire burden of a full economy-wide approach.

As a result of its intermediate position the sectoral approach encounters some of the difficulties of each of the two previous approaches. On the one hand it partakes of the technical complexity and the consequent need to draw on detailed engineering information that goes with project studies. Yet at the same time it covers such a wide field of economic interrelations that it cannot afford to take the point of view of an individual project, namely that the rest of the economic environment can be taken for granted and repercussions from the project itself or from the simultaneous execution of a set of similar projects need not be taken into account when the project is being defined. It goes without saying that even at the project level such a point of view may not be justified when the individual project becomes a large addition to the existing structure of production; thus the study of major individual projects rightly belongs to the field of sector analysis.

As contrasted with economy-wide analyses, sector analysis is simplified in that the interface between the sector and the rest of the economy can be regarded as pre-set for the purposes of sector analysis. This pre-setting may be achieved in one of two alternative ways. Either prices of certain resources, e.g., labor, foreign exchange, capital, and key extra-sectoral commodities (steel, fuel, power) are given as centrally fixed steering prices, or alternately there are central allocations of these resources to the sector in question. As against this simplification there is, however, a more than offsetting complication. Whereas in the economy-wide analysis the structure of technology can often be treated as largely linear within a tolerable margin

of error, at the sectoral level this is almost never the case. At the level of detail of sectoral studies considerations of fixed costs, indivisibilities, overhead shared between complementary processes, and other direct technical interactions are of the essence of the economic decision process, and they give rise to major analytical complications. Even the technical-economic description of the structure of a sector can become a complex task in the presence of these phenomena, as attested by the engineering industries sector in which a satisfactory set of empirical materials is still missing, in spite of several exploratory efforts.[9/]

(a) Process analysis. This technique has been defined as the construction and use of industry-wide, multi-indistry and economy-wide models which attempt to predict production relationships on the basis of technological structure.[10/] This very wide definition includes inter-industry, commodity-balance, and economy-wide linear programming models as sub-classes of process analysis. The significance of process analysis at the level of a sector is that there are no good alternative techniques for coming to grips both with the detail of technological structure and with the interrelationships between different technological processes. (The techniques to be discussed below as alternatives to process analysis are far less comprehensive in their approach.

The data requirements for process analysis consist in condensed technical-economic representations of the full engineering

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9/ See the materials of the United Nations Industrial Development Organization project, "Metalworking Industries as Potential Export Industries", especially: Center for Economic Planning, New School for Social Research, The Planning of Production and Exports in the Metalworking Industries, New York 1967.

10/ A. S. Manne and H. M. Markowitz, Studies in Process Analysis, Cowles Foundation Monograph No.18, New York, Wiley, 1963, p.4.

detail of the structure of production. Unfortunately, engineers are generally incapable of supplying these representations, since they are accustomed by training to focus on the detail of a given process rather than on the common features of a group of processes that are capable of generalization. Thus an engineer can give an excellent description of e.g., a given ammonia manufacturing process, complete with flowsheets, sketches of equipment, temperature and pressure conditions, kinds of catalyst used, etc., etc., but he is not likely to supply a handful of activity vectors that between them give an adequate shorthand description of the representative features of the entire technology of manufacturing ammonia. Of course, in asking for the "representative" features we already imply the exercise of economic rather than engineering judgement, since we are interested in precisely those distinguishing features of the various technological alternatives that make a significant difference for the outcome of the industry-wide (sectoral) technical-economic study. Thus e.g., when natural gas and fuel oil are distinguished as alternative raw materials for ammonia manufacture, while natural gas varieties with slightly different compositions are not,[11/] this implies the previous recognition of the economic fact that these two alternative raw materials may be available under radically different economic conditions; of the technical fact that they make a substantial difference in regard to process detail; and of the further economic fact that these differences in process detail are translated into sufficiently large differences in the descriptive activity vectors to affect the usual outcome of sectoral analyses. The task of technical-economic process description thus requires either economists with substantial insight into technological process detail, or engineers with con-

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11/ See United Nations, La Industria Quinmica en America Latina, New York, 1963; and T. Vietorisz, "Programming Data Summary for the Chemical Industry", United Nations, Industrialization and Productivity, Bulletin 10, 1966.

siderable training in the peculiar mode of thought of the economist that focuses on the order of magnitude of an individual effect while considering the interaction of a very large number of different factors defining a problem.

(b) Feasibility studies and industrial location studies. These approaches can be regarded as less formal variants of the process-analysis approach discussed in the previous section. The principal practical difference consists in that feasibility and locational studies often attempt to avoid a consideration of technological detail and thus focus on those aspects of the economic situation or the planning problem within a sector that can be relied upon to narrow the range of technical alternatives. Feasibility studies undertaken in the context of predominantly private-enterprise or mixed economies generally give an inordinate amount of attention to the forecasting of demand, since statistics supporting the study of this aspect are relatively easy to come by. In developing countries, for example, where import substitution is one of the main routes to industrial progress, the market of a new kind of activity can often be defined reliably on the basis of import statistics. These are usually available in adequate detail, since they are obtained as a byproduct of the collection of customs duties which have traditionally been a principal source of government revenues in many of the developing countries.

Industrial location studies[12/] pay close attention to the definition of market areas, raw material sources, transport costs, and other critical cost elements in analysing the locational pattern of an industry. Sites of cheap labor or low-cost power,

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12/ For a recent survey see United Nations Industrial Development Organization, Industrial Location Planning, International Symposium on Industrial Development, Athens, 29 November-20 December 1967, Document ID/CONF.1/12. See also, Walter Isard et al., Methods of Regional Analysis: an Introduction to Regional Science, New York, Wiley, 1960.

fuel, and other inputs are identified, and agglomeration economies are explored. The latter comprise both the economies of scale due to the concentration of a single process into a specific location and the economies due to the interaction between different processes, usually in an urbanized area, due to the sharing of a common labour pool, maintenance and other industrial services and social overhead facilities. In identifying all of these cost elements, locational studies generally have to go further in the direction of exploring technological structure than the typical feasibility study; in fact, early examples of process analysis have often grown out of the technological information requirements of locational studies. This is the case for example, for the chemical industry.13/

The data requirements of feasibility and locational studies are similar to the data requirements of process analysis models, but with considerably less depth of technological detail. In addition to market studies, the emphasis is on cost structures. Raw material costs, labour costs, transport and other costs are quantified and, in the case of locational studies, geographical variations in the prices underlying these costs are explored. The key difference from process analysis models is that the latter always attempt to segregate as much as possible the two key components of cost and revenues: physical inputs or outputs (e.g., manhours of labour of a specific skill and occupational classification) and prices (e.g., wage rates); while in feasibility and locational studies, for lack of a detailed technical-economic description of the productive process, costs and revenues are largely treated as aggregates.

13/ For a survey of locational studies for the chemical industry, see T. Vietorisz, "Programming Data Summary for the Chemical Industry", op. cit.

(c) Preselection. When analysing the structure of an industry or a sector by means of process analysis models, feasibility studies, or locational studies, the universe of potential economic activities subjected to consideration is far from complete, since in the very process of formulating such models or studies, a great many potential activities are excluded on a priori grounds. Since these grounds are often unsystematic or purely intuitive, it has been recognized for some time that much is to be gained by systematizing the orientation process that precedes the more detailed yet more selective model-building or study stage. This orientation is designated as the preselection procedure. Its data requirements consist of many different categories of loose order-of-magnitude information covering as complete a universe of potential economic activities as possible. Typical data of this sort include: minimum economic scales or typical size distributions of enterprises by industries and industrial branches; labour, capital, electric power, fuel, raw material and skill input requirements per unit of product; indicators of technological complexity and sophistication, such as engineers and technicians as percentage of the labour force, indicators of potential forward and backward linkages to other parts of the economy, such as domestic raw material requirements as percentages of total raw material requirements, domestically produced equipment requirements as percentages of toal equipment requirements, output sold for intermediate use to other domestic industries or enterprises, as a percentage of total output produced; other indicators of the effect on the balance of payments such as total foreign exchange requirements as a percentage of the value of the product; and a variety of qualitative indicators of external economies and diseconomies, such as rankings by engineers or economists as to the relative contributions to the training and upgrading of the labour force; similar rankings in regard to the effect on voluntary savings, etc.

The preselection procedure is often best undertaken in stages. At the early stages a very comprehensive universe of alternatives

is screened on the basis of rough criteria. At progressively later stages more and more detailed criteria are applied to a narrower and narrower range of alternatives. Eventually the stage is reached where the remaining activities can no longer be treated individually, since their mutual interaction becomes the key to further decisions concerning the structure of development. At this stage it becomes necessary to switch to feasibility or locational studies or to formal process analysis models.

(d) Complexes of projects. While the preselection procedure works so to speak from the top down, in that it starts with a high level of generality and works toward a lower and lower level of detail, a complementary approach is available that takes precisely the opposite tack. It starts with a promising individual project and builds around it a network of other projects linked to the original one by a web or forward and backward linkages, thereby defining a complex. If properly constructed, the complex provides mutual economic support between the individual projects within it, by increasing potential scales of production and thus capturing economies of large scale, by eliminating transport costs on intermediate products that are exchanged between members of the complex, and by providing economies due to the sharing of common ancillary and overhead facilities (steam and power generation, site development, maintenance and protection facilities, administration).[14/] The data requirements for the construction of complexes do not exactly coincide with the data requirements for the definition of individual projects. While the core project around which the rest of the complex is built might be defined in full engineering detail, this is not necessary; all that is required is a sufficiently detailed description of each component project to enable the exploration of the linkages between projects and the economic characteristics

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14/ See W. Isard, E. W. Schooler, and T. Vietorisz, Industrial Complex Analysis and Regional Development, Wiley, New York, 1959; and United Nations, Report on the Inter-Regional Seminar on the Role of Industrial Complexes in Economic Development, Committee for Industrial Development, Fifth Session, Doc. No. E/C.5/67, 23 February 1965.

of the complex as a whole. Thus the data requirements move away from detailed project engineering information and become more comparable to the data requirements of the process analysis approach. At the same time, the interaction of projects within the complex forces the abandonment of the narrow, isolated point of view characterizing the individual-project level of analysis.

(e) Very large individual projects. A "project" such as the building of an integrated steel mill that appears to be a single unit from an institutional point of view, is in reality almost always a complex in its own right. An integrated steel mill, for example, includes the following units: coke ovens, blast furnaces, open hearth or other steel conversion units; ingot and form casting; primary rolling (blooms, slabs); secondary and further rolling (billets, plates, sheets, rods, shapes); byproduct chemical processes; and numerous ancillary operations. In the latter category is the maintenance of the heavy steel rollers which require metal-working equipment capable of handling outsize workpieces and which, in a developing country, may be extremely valuable as a complement to the engineering industries; enormous electric power generating capacity; and major transport terminals and storage facilities. Coal or iron ore mining may be closely related to the steel mill and handled as part of the project; even the construction of major railroad links may fall within the same purview.

Very large individual projects can thus almost always be treated in the same manner as complexes and should in fact be properly analyzed as a part of sectoral-level studies if it is desired to avoid an excessively narrow view that will typically characterize a purely engineering view of the project. The data requirements are the same as those for the usual kinds of complexes, with the valuable difference that large projects almost invariably have a rich accumulation of supporting technical studies attached to them by the time they are considered for inclusion in an industrial development plan. The other side of the coin is that by this time they may also have acquired an institutionalized rigidity,

i.e., certain technical solutions may have been settled upon in preference to alternatives that appear more favourable under a broader economic point of view, and these narrowly technical solutions may have acquired powerful protagonists. It is, therefore, desirable to draw such projects within the purview of sectoral-level analysis at the earliest possible stage, even at the expense of some additional data problems.

Exhibit 2 presents a checklist of the major planning steps and programming procedures at the sectoral level.

EXHIBIT 2

CHECKLIST FOR SECTORAL PLANNING

1. Targets concerning the standard of living and public goods: implications for the sector
   - (a) Housing targets.
   - (b) Targets concerning privately owned transport equipment (bicycles, motorcycles, automobiles) and other consumer durables.
   - (c) Urbanization targets.
   - (d) Rural development targets (electrification, transport, communications).
   - (e) Targets concerning educational levels.
   - (f) Military targets.

2. Targets concerning technological progress
   - (a) General principles of technological upgrading for all industries.
     - (i) Mechanisation objectives.
     - (ii) Automation objectives.
     - (iii) Computerization objectives.
     - (iv) Objectives concerning the diffusion of chemical technology into diverse industrial branches.
   - (b) General principles of organizational upgrading for all industries.
   - (c) The setting of targets for technological upgrading by specific lines of industry.
     - (i) Higher standards for product quality.
     - (ii) More extensive integration of diverse technologies.
     - (iii) New products.
     - (iv) New technologies.
     - (v) Fast-changing technologies.
     - (vi) Integration of diverse systems in the design of objects.
     - (vii) Tighter restraints on lead time.
   - (d) Targets for the phasing-out of technologically obsolescent products and processes by specific lines of industry.
   - (e) Scientific research and development targets.

3. Production targets for the sector

(a) General analysis of the situation with regard to raw materials, energy and fuels, manpower and external economies.

(b) Determination of production targets for traditional commodities in accordance with the projection of domestic demand and with import substitution targets.

(c) Determination of export targets for traditional commodities.

(d) Production targets for new commodities taking into account import substitution and the possibility of exports.

4. Projection of demand for manufactured products

(a) Projection of domestic demand;

(i) For nondurable consumer goods;

(ii) For durable consumer goods;

(iii) For capital goods;

(iv) For intermediate goods (based on input coefficients).

(b) For each of the above cases, a study should be made to determine which goods are produced mostly domestically, which are both produced and imported, and which are entirely imported.

(c) Projection of foreign demand for industrial exports.

5. Preselection of candidates for new economic activities

(a) Survey of import statistics.

(b) Survey of production statistics; comparison with a detailed industrial classification (4-digit level), to determine products and processes related to industrial production already established.

(c) Survey of principal raw material, energy, fuel, skilled labour and other resources. Comparison with list of industries classified by intensity of specific resource use.

(d) Comparison of information compiled according to above points with production targets by major branches of industry or types of commodities.

6. Technical-economic description of the sector

(a) A suitable breakdown of each branch of the sector by productive activities and a general description of these.

(b) Input and output data in terms of physical units (not value units) for each productive activity.

(c) The establishment of functional relationships between productive activities, in accordance with variations in the following factors:

(i) Product quality;

(ii) The assortment of products produced jointly;

(iii) Types (or composition) of raw materials and intermediate products utilized;

(iv) Proportion of basic productive factors (capital, labour);

(v) Scale of production;

(vi) Investment lead time (Maturation period)

(d) Storage and inventory requirements in relation to production.

(e) Transport requirements and social overhead capital (or service) requirements in relation to production.

(f) Comparison of industrial project costs, as estimated, with the costs as actually realized in practice.

(g) Other items such as:

(i) Differences in productivity of manpower from one country to another;

(ii) Differences in per-capita consumption and demand elasticity for manufactured goods from one country to another;

(iii) Materials on the economy of handicraft activities;

(iv) Typical capacities of industries in diverse regions.

7. Programming for the sector (process analysis models or less formal method

(a) Construction of complexes of projects (activities) for the sector and determination of raw material, intermediate product, and capacity requirements.

(b) Survey of raw material, intermediate product, and capacity availabilities and costs. Selection of alternative locations for production.

(c) Construction of several alternative trial programmes for the sector, taking into account central resource allocations and steering prices

(d) Programme evaluation for current targets, allocations, and steering prices:

(i) First-approximation consistency checks (resource balances) and profitability estimates at social accounting or market prices.

(ii) Formal programming methods.

(e) Exploration of tradeoffs between sectoral targets and re-targeting.

(i) Exploration of tradoffs between sectoral targets.

(ii) Re-evaluation of targets in the light of financial, administrative, and political considerations.

8. Interface with economy-wide programming

Interation of the entire procedure with revised economy-wide targets and revised sectoral steering prices and resource allocations.

C. Information requirements for the choice of policy instruments

The choice of policy instruments involves the identification of specific institutional means whereby paper programmes can be translated into executable plans. In the course of this stage alternative policy instruments have to be investigated in the light of diagnostic background information and plan characteristics, and a precisely defined set of policy instruments has to be adopted.

Exhibit 3 provides a checklist of major policy areas in connexion with the execution of industrial development plans. In a number of these policy areas there is a choice between quantitative or price type policy instruments, as well as between general and specific controls. Exhibit 4 presents a survey and classification of policy instruments from these two points of view.

The choice of policy instruments overlaps to a significant extent with the task of plan preparation discussed in the previous section. The separation between the two areas is most complete under the institutional conditions prevailing in free-enterprise and mixed economies where detailed resource allocation plans, if any, often have a purely advisory or guideline function. In centrally planned economies, on the other hand, the plan has traditionally contained production and investment targets as well as detailed resource allocations for specific industries. Since such targets and allocations when used as control instruments are included in the area of policy choice, there is a substantial overlap between planning and plan execution policy. Even so, a number of policy areas remain that cannot be adequately covered by plan figures alone, especially in the areas of institutions, productivity, technological change, education, and labour. Moreover, in recent years there has been increasing reliance on selected features of the market as an instrument of decentralized control over plan execution in a number of centrally planned economies: this further increases the importance of the separate consideration of policy instruments.

The information requirements for the choice of policy instruments are met only in part by the information gathered for diagnosis and plan preparation. The diagnostic information is indispensable for background purposes,

but so far as specific policy instruments are concerned it rarely provides more than qualitative guidance. The stage of plan preparation at the same time relies on an essentially static accounting-type framework. This is equally true of input-output, linear programming, or commodity-balance type approaches, even if they cover a number of consecutive time periods. What is missing from these approaches is any allowance for the varying adaptation and selection processes characterizing the interaction between the many institutional components of an actual economic system; yet this is precisely the kind of quantitative information that would be most urgently required for a rational choice between policy instruments. By the same token the prices implied by such programming models represent (at best) but one of several functions of a practical price system, namely the function of weights in the evaluation of the effects of incommensurable resource inputs and outputs on the abstract choice between alternative economic activities. At the same time the models ignore the role of prices (and of many other concurrently operating control signals) in the dynamic processes of mutual adjustment (between firms, households, and government organizations) as well as their role in the selection of successful or declining enterprises, products, and methods of production.

Except for some materials pertaining to isolated firms in a predominantly private-enterprise context,[15] no dynamic models of economic behaviour in the above sense exist either for predominantly private-enterprise or for mixed or centrally planned economies. For the more developed countries there exists a body of economic theory on the impact of monetary and fiscal policies, foreign trade policy, and other general policies on the overall behaviour of the economy, but the operational parts of this theory refer to the aggregate national level and in any case they are oriented to the control of cyclical fluctuations rather than to the structural changes accompanying growth. It has been possible only in recent years to construct econometric models for these countries that have a tolerable predictive power for a few quarters ahead.[16] There exist only sporadic attemps at the construction of models

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15/ See Jay Forrester, Industrial Dynamics, M.I.T. Press, Cambridge, Mass.

16/ An example of such a model is the Wharton School Model of Professor Lawrence Klein, University of Pennsylvania, Philadelphia, Pa.

for developing countries that embody general policy instruments in such a way that the effects of these instruments on short-term stability may be traded off against their effects on growth.[17] All of these models, for advanced and developing countries alike, assume a given structural pattern and institutional context, in particular a given technology and a fixed set of ground rules for the interaction of the various institutional components, that do not change between the historical periods to which the model is fitted and the future periods for which conditional predictions are made on the effects of policy instruments. This approach can hardly be said to proceed much beyond the limitations of conventional programming models, and is in no case applicable to predicting the effects of policies which introduce major technological or organizational changes. An example of the latter changes is the introduction of selected market-type mechanisms in countries with centrally planned economies, in regard to which present-day economic theory is utterly incapable of providing even approximately correct quantitative predictions.[18]

Much of the information in the policy area is entirely heuristic. Since as a practical matter decisions are taken year after year, a learning process takes place among the decision-makers concerning the probable impact of alternative policy instruments. Unfortunately this learning occurs within a narrow compass and produces results that are almost never formalized and are difficult to transfer from one economy to another. At the moment the best way of dealing with these problems appears to be the case-study approach. Possibilities in this direction are discussed further below.

17/ See H. B. Chenery and M. Bruno, "Development Alternatives in an Open Economy, the Case of Israel," Economic Journal, March 1962; and M. E. De Prano and J. B. Nugent, The Effects of Long-Run and Short-Run Planning Goals on Economic Policy Instruments, discussion paper, Econometric Society meeting, Washington, D.C., December 1967.

18/ The tremendous gap in our knowledge pertaining to the choice of policy instruments has been consistently emphasized by the late Jorge Ahumada, Director of the United Nations Economic Development Training Programme in Santiago, Chile, who during a number of years of effort to achieve progress on this problem invited to Santiago several leading development economists. The survey of policy instruments inserted in the present text as Exhibit 4, is a result of these initiatives. It

EXHIBIT 3

CHECKLIST OF POLICY AREAS PERTAINING TO INDUSTRIAL DEVELOPMENT

1. General policy instruments
   - (a) Monetary policy
   - (b) Fiscal policy
   - (c) Foreign trade policy
   - (d) Policy concerning foreign investments
   - (e) Consumption/savings policy
   - (f) Labour policy

2. Specific policy instruments for particular industries
   - (a) Production
   - (b) Investment
   - (c) Consumption
   - (d) Foreign trade
   - (e) Manpower
   - (f) Natural resources

3. Institutional policy concerning relations between enterprises
   - (a) Concentration (size distribution)
   - (b) Combination (mergers, monopolies, antitrust policy)
   - (c) Specialization
   - (d) Co-operation (joint research, standardisation, trade associations)

4. Educational and labour training policy
   - (a) General education
   - (b) Advanced scientific and technical education

(Footnote continued)

is noteworthy, nevertheless, that the main outcome was an improvement of programming methodology rather than an exploration of the dynamic problems whose understanding is indispensable to the choice of policy instruments. For a clarification of my ideas on these latter problems I am greatly indebted to Janos Kornai who has spelled out the conceptual foundations needed for a new departure in two as yet unpublished monographs.

(c) Vocational education

(d) Apprenticeship and on-the-job training

(e) Worker retraining and adult education

5. Regional development policy

(a) Distribution of productive base between regions

(b) Inter-regional transfers

6. Measures to improve productivity

(a) Rates of utilization of available capital. Number of shifts in capital-intensive industries; seasonality; fluctuations of demand. Tax and other stimuli to full utilization of capital.

(b) Modernization of equipment and satisfactory maintenance policy: availability of capital for this purpose; interest rates; tax and other stimuli.

(c) The policy pattern with respect to marginal (small-scale and inefficient) producers, handicraft and home industries.

(d) Policy relating to the training of the industrial labour force at all levels. Dissemination of technical information.

(e) Policy relating to inefficient labour practices.

7. Policy relating to marketing and distribution

(a) Regulation of intermediaries and their mark-ups.

(b) Encouragement to competition; policy with respect to monopolies.

(c) Transport and distribtuion.

(d) Fixed capital investment to facilitate marketing (cold storage plants, etc.).

8. Promotion of industry

(a) Compilation and dissemination of data. (Consultants' and manufacturers' directories; prices; markets; raw material availability; transport rates; wage levels in different areas; summaries of government support and regulations.)

(b) Assistance in the preparation of draft projects.

(c) Assistance with regard to the establishment of new enterprises; kinds of services; tax exemptions and similar stimuli.

(d) Development corporations and similar institutions. Financing of new projects versus direct execution.

EXHIBIT 4. A survey and classification of some policy instruments

A. Price variables

Area of policy	Instrument	Variables affected */
GENERAL		
- Monetary	Interest rate	1) Level of investment 2) Cost of production
- Fiscal	Personal income tax	1) Consumption and saving
	Corporate income tax	1) Profits 2) Investment
- Foreign trade	Exchange rate General tariff level	1) Cost of imports 2) Price of exports 3) Balance of payments
- Foreign investment	Taxes on foreign profits	1) Level of foreign investment
- Consumption	General sales tax	1) Consumption
- Labor	Wage rates	1) Labor cost 2) Profits and investment 3) Labor income
SPECIFIC		
- Production	Taxes and subsidies price control	1) Profits and production 2) Investment
- Investment	Interest rates tax exemptions	1) Profits 2) Investment by sector
- Consumption	Specific sales taxes	1) Consumption by commodity
- Trade	Tariffs	1) Price to consumer 2) Profits on domestic production
	Export subsidies	1) Profits and investment
- Labor	Wage subsidy	1) Labor cost and use 2) Profits and investment
- Natural resources	Taxes and subsidies	1) Cost of production 2) Rate of exploitation

*/ All taxes offset government revenue and saving in addition to the variables cited.

EXHIBIT 4. - continued

B. Quantity variables

Area of policy	Instrument	Variables affected
GENERAL		
- Monetary	Open market operations	1) Money supply 2) Prices
- Fiscal	Government expenditure	1) National income 2) Prices
- Foreign trade	Exchange auctions	Exchange rates
- Foreign investment	Foreign loans and grants	1) Investment resources 2) Exchange supply
- Consumption	Social insurance, relief, other transfers	1) Consumption 2) Income distribution
- Labor	Emmigration and Immigration	Labor supply
SPECIFIC		
- Production	Government production	1) Level of production
	Government research and technical assistance	1) Cost of production
- Investment	Government investment	1) Level of investment
	Capital rationing	
	Restrictions on entry	1) Prices and profits 2) Level of investment
- Consumption	Government services (Health, education)	1) Consumption 2) Income distribution
- Trade	Import Quotas and prohibitions; exchange controls	1) Level of imports 2) Domestic prices
- Labor	Labor training	1) Supply of skilled labor
	Surveys, auxiliary investment, etc.	1) Rate of development

Source: H. B. Chenery, "Development Policies and Programs" United Nations Economic Bulletin for Latin America, Vol.3, No.1, March 1958, Table 1.

D. Data sources: I. Basic industrial statistics[19/]

Basic industrial statistics are the foundation of all diagnostic, planning, and policy-making tasks in the field of industrial development. They consist of infrequent comprehensive inquiries (usually censuses) and periodic surveys (annual or more frequent) of less comprehensive scope, covering production units of different classes and gathering information concerning personnel, wages, fixed assets, stocks, major categories of costs, revenues, gross output and value added. In addition to these key items which are included in the international recommendations adopted by the United Nations concerning industrial statistics,[20/] national statistical inquiries in different countries also include a variety of other information.[21/]

The importance of basic industrial statistics is attested by the fact that whenever the foundations are to be laid for an industrial study or plan in a developing country where no industrial census is available or, if available, is out of date or unreliable, the very first task is the establishment of a statistical base by a special inquiry aimed at filling this gap.[22/]

19/ The present section draws heavily on the following key references: United Nations, Studies in Methods: Industrial Censuses and Related Inquiries, Statistical Papers, Series F, No. 4, Vol.I-II, New York, 1953; United Nations, Economic Commission for Latin America, Seminar on Industrial Statistics for Latin America, 10-28 October 1960, Documents ST/STAT/CONF.8/L.1 through L.9. Excerpts from these sources are used freely in the text.

20/ See United Nations, International Recommendations in Basic Industrial Statistics, Statistical Papers, Series M, No. 17, Rev.1, 1960.

21/ For an item-by-item survey of the contents of national industrial censuses in a large number of countries, see: United Nations, Studies in Methods: Industrial Censuses and Related Inquiries, Statistical Papers, Series F, No. 4, Vol.II, New York, 1953. For more recent presentations of national industrial statistics on a comparable basis, see: United Nations, Patterns of Industrial Growth, 1938-1958 (1960), The Growth of World Industry, 1938-1961, National Tables, and The Growth of World Industry, 1953-1965, National Tables (1967). For a comprehensive listing of national data sources, see United Nations, Bibliography of Industrial and Distributive Trade Statistics, Statistical Papers, Series M, No. 36, Rev.2, 1965.

22/ For the methods of planning an industrial inquiry in a developing country, see: United Nations, Studies in Methods: Industrial Censuses and Related Inquiries, op.cit., Vol.I, Chap.VIII.

The historical roots of present-day industrial statistical systems that follow largely a common set of basic principles, go back to two types of early inquiries: (a) production censuses and (b) establishment censuses. The earliest industrial production censuses were taken in France (1669, 1778, 1840) and the United States (1809 and afterwards decennially except 1829). The first censuses gathered data on only quantity and value of production -- France for wool and the United States for all manufactured goods. To these items soon were added data on employment, machines utilized, and raw materials. The early industrial establishment censuses (Belgium, 1846 and Germany, 1875) were designed to cover non-agricultural establishments in order to supplement censuses of population and agriculture, and consisted of extensive inventories of the structure and resources of industrial and other types of economic units. In a modern system of basic industrial statistics the former two approaches which emphasize the role of flows (production census) or fixed resource structure (establishment census) are merged into a unified system.

1. The scope and frequency of the various types of inquiries

In the collection of basic industrial statistics all periodic industrial inquiries are treated, in so far as possible, as a single system of statistics. This permits using the infrequent but comprehensive inquiries as basic sources of reference which can be updated and corrected as need be on the basis of the more frequent but less comprehensive inquiries.

(a) The infrequent comprehensive inquiry is usually a census rather than a sample survey; in other words, an attempt is made to enumerate all producing units. The census is the cornerstone of the entire system of basic industrial statistics. It is designed to yield fundamental data on the role, structure, and activities of the industrial sector of the economy, and to provide the basis for the collection of more frequent or more specialised data on the statistical units it covers. This is accomplished by building up a definitive directory of all units. The data on the employment, output, and other aspects of the activities of these units serve to design sample or other surveys and to compute weights for index numbers on production, employment, or producer prices. The data also provide measures of the contribution of the industrial sector to the employment, output, or capital formation of the

economy, and of the relative importance in these respects of industrial units engaged in various kinds of activities or falling into various classes of size. Census data may also be utilized to measure the consumption of materials, fuels, and electricity by various kinds of producing units, and the relationships between various aspects of their activities, for example, the input of raw materials as compared to the output of products or the productivity of labour. Still another function of the comprehensive inquiry is to provide detailed data on the commodities making up the products and raw materials of each kind of industrial activity.

While the industrial census is in principle intended to cover all producing units, some omissions are at times justified. These include households and similar units producing entirely for their own use, and small industrial units which have ceased to exist between the reference period of the census and the time the census is taken. In a number of developing countries where very small units (e.g., those engaging less than five persons) account for a high percentage of employment (though not necessarily of output) the burden of identifying and enumerating these can be so high and the reliability so limited that this part of the work of the industrial census may be done as part of the census of population.

The frequency of the comprehensive inquiry, as recommended by the United Nations, is at least once every ten years.

(b) Annual or somewhat less frequent inquiries. The purpose of these is to follow important developments in the period intervening between the infrequent comprehensive inquiries, especially in regard to the economic viability and problems of the industries within the sector, and trends in their productivities, efficiency in raw material and energy use, and unit value of outputs and inputs. The coverage of these inquiries is typically not complete: the accent is on the larger producing units which typically account for a major, disproportionately large fraction of total output within each branch of the sector. Where this is not the case, for example in the food, clothing, or construction industries, the smaller units are generally also covered by means of a sample survey; in any event, such additional coverage improves the quality of the inquiry. For the purposes of the annual inquiries, best

practice is to maintain an industrial directory currently and to enumerate the selected units by mail.

(c) Monthly or quarterly surveys. These are required primarily to follow the short-run fluctuations in industrial activity. The key data required for this purpose refer to production and employment. Coverage of these surveys is generally limited to those units that can be successfully identified from a directory and enumerated by mail. Even when the field to be covered is restricted to relatively large establishments, sampling is often utilized to keep the work load manageable.

2. Statistical and tabulating units[23/]

The data resulting from each kind of industrial inquiry must be tabulated at least according to comparable categories of kind of industrial activity that are as homogeneous as possible. Furthermore, in the infrequent comprehensive inventories of industrial activity, classification of the results according to geographical subdivisions and meaningful categories of size of the tabulating unit are also needed.

Classification of the data resulting from industrial inquiries according to comparable and relatively homogeneous kind-of-industry classes is basic to delineating the structure of the industrial sector, ascertaining and analysing the differences in the experience and problems of each type of industrial activity, and tracing the inter-relations between these industries.

Four major types of statistical units are considered in connection with sources and uses of industrial statistics: (a) the establishment unit; (b) the enterprise unit; (c) the kind-of-activity unit; and (d) the technical unit. (Note that the statistical unit is the unit for which data are collected, as distinct from the reporting unit, from which data are collected.)

23/ This section draws on the following reference in addition to the references previously cited: United Nations, Economic Commission for Asia and the Far East, Formulating Industrial Development Programmes, Development Programming Techniques Series, No. 2, Bangkok, 1961, Chapt. IV, Sec.4.2. Excerpts from this source are used freely in the text.

(a) The establishment unit. This is the most common statistical unit. The establishment is the unit that distinguishes, to the extent that it is practical, between the different classes of activities in which the same owner(s) may engage as well as the different locations at which these activities may be conducted. Though the majority of legal entities -- i.e., the smallest owning or controlling units -- will consist of only one or predominantly one class of activity carried on at one location, this will not be the case for a number of large industrial enterprises. To be of practical use in infrequent as well as other types of industrial inquiries, the different classes of industrial activities and/or different locations of a legal entity are subdivided into separate establishments only to the extent that the pertinent records of the enterprise are so subdivided. In dividing an enterprise into establishment units, it is desirable that each such unit should be engaged in the production of as homogeneous a set of products or services and be confined to as limited a geographical area as is feasible in the light of the records that are maintained. According to this definition the establishment includes ancillary units such as offices, warehouses, machine shops and power plants as well as the unit which directly produces the goods and services sold. This approach avoids the difficulties of subdividing resources and costs between direct and overhead activities and contributes to the comparability of the data that are gathered with respect to both various establishments and various aspects of the activities and resources of the same establishment. An exception is made only in the case of relatively large ancillary units that serve more than one industrial establishment of the same enterprise -- for example, central warehouses, offices, or power plants. These central ancillaries are treated either as separate establishments in their own right or their relevant data are allocated between the establishments served.

(b) The enterprise unit. Statistical information can also be collected for and from the enterprise unit which may consist of one or more establishments. In countries with centrally planned economies generally the enterprise is the statistical unit, even though many data are also collected by establishments. With the trend toward the creation of large industrial enterprises comprising diverse establishments, consideration has recently been given at least in one of these countries to the desirability of changing from enterprise to establish-

ment units as a general practice, or at least to the wider use of the establishment as the statistical unit.[24]

In predominantly private enterprise and mixed economies it is necessary to consider alternative definitions of the enterprise. Under a narrow definition this coincides with a legal entity, while under a broad definition it comprises the group of legal entities bound together by ties of ownership or admitted control. One aspect of the structure of the industrial sector that needs to be delineated in comprehensive inquiries and the industrial directories built from these inquiries is the structure of ties between establishments and enterprises. For this purpose, the broad definition is preferable, but resistance may be encountered in some countries in attempting to trace ties between establishments which are wider than ownership by some legal entity.

Under a statistical inquiry based on the enterprise unit, financial data such as profit and loss are usually collected, supplemented at times by physical data such as production, raw materials, machinery, and employment. Since, however, some enterprises do not keep separate records for each establishment under their control, the enterprise inquiry is likely to be confined more to the financial aspects than to the physical aspects of industrial activity.

(c) The kind-of-activity unit. If classification of annual industrial data according to geographical area is not desired, it is possible to utilize in annual and more frequent inquiries a broader statistical unit than the establishment, i.e., the unit resulting from the removal of the restraint as to geographic area covered that is imposed on the establishment. This practice has been introduced recently in some European countries. In the comprehensive inquiry (census), however, the establishment is still retained as the basic statistical unit. The kind-of-activity unit makes the collection of annual and monthly or quarterly data easier and quicker, but it introduces complications into the maintenance of industrial directories and makes more difficult the comparison between different types of industrial inquiries.

24/ Otto Lukács and Lajos Ollé, Iparstatisztika, Közgazdasági és Jogi Könyvkiadó, Budapest, Hungary, 1965, p.17.

(d) The technical unit. For statistical purposes a technical unit can be defined as a physically connected set of processes producing a single kind of commodity group, with allowance for joint products. An establishment consists of one or more such technical units. Data collected by technical units would greatly improve the homogeneity of industrial statistics and their degree of comparability from country to country; however, by the very definition of the establishment unit, the technical unit is not covered by separate administrative records unless it coincides with the establishment. If more detailed administrative records did in fact become available for a technical unit, this unit would be treated as an establishment in its own right.

Note the key role of administrative records in the above definitions. Traditional industrial statistics are built on such administrative records. These are, however, by no means the only sources of primary data: such data can also be derived for the technical unit by engineering estimates or by reliance on technical records. The use of these other primary data sources, however, falls almost entirely outside the scope of traditional industrial statistics. For this reason, the latter have to be complemented from other sources of information or special-purpose inquiries whenever there is need for information at the level of the technical unit.

(e) Appraisal of the various kinds of statistical units. The choice of these units depends on the nature and purpose of the analysis. Technological studies on cost structure are largely based on data from the technical and kind-of-activity unit, and important commodities are also studied from this source. Interindustry analysis is also based in part on engineering data for important sectors rather than relying entirely on the data of establishment units. The technical unit, moreover, is the cornerstone of process analysis at the sectoral level, since it corresponds closely to the individual activity in such an analysis.

Since traditional industrial statistics do not cover the technical unit and since it is extremely difficult to expand special engineering and related studies of technical units to the entire field of industry, overall analysis including interindustry and the international comparison of cost data is usually based on the establishment unit. These data, however, present

serious difficulties in dealing with the larger multi-unit establishment because of the heterogeneity of the products, and because the component of Value Added is not well specified due to the inclusion of various overhead expenses.

Statistical information based on the enterprise unit yields more detailed data on the components of non-industrial costs such as advertising, accounting, legal, etc., which are often included in Value Added in the case of establishment-type inquiries. The heterogeneity of the products, however, becomes more serious and makes the study of manufacturing cost from this source almost useless, particularly for multi-unit enterprises.

3. The contents of a system of industrial statistics

While the precise contents of basic industrial statistics vary from country to country,[25] the essential core of these statistics is generally in conformity with a common set of basic principles. In this section we present this core following the International Recommendations in Basic Industrial Statistics[26] concerning the infrequent comprehensive inquiry. The contents of the annual, quarterly or monthly inquiries are progressively more limited. The best practice in formulating concretely and precisely the data to be gathered and compiled in a new basic statistical inquiry for a given country is to draft tables and questionnaires and to evaluate these in view of the requirements for data, the business records and practices of respondents, and the resources and costs involved in gathering and compiling the data.

(a) Characteristics of the statistical and tabulating unit. Key items of information in this regard are: the kind of major activity, the size, and the location of the establishment covered; the type of legal organization ((individual proprietorship, corporation, cooperative); the type of economic organization (single or multi-unit enterprise, factory or handicraft operation, etc.). For purposes of the industrial directory, information is also

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25/ See references cited in the introduction of Section D.

26/ Op.cit.; see notes to the introduction of Section D.

wanted on the name and address of the office reporting data on the establishment (which might differ from that of the establishment). In countries with centrally planned or mixed economies, a further important item of information pertains to the identity of the supervising authority (ministry, etc.).

(b) Employment and wages and salaries paid. Information is required on the number of persons engaged, broken down by functional categories (owners, employees; the latter by operatives and other employees) and giving detail pertaining to seasonal fluctuation; on the number of man-hours worked; and wages and salaries paid.

(c) The capacity of installed power equipment. This is a good proxy variable for the degree of mechanization as well as a crude measure of productive capacity - good measures of which are extremely difficult to devise within the universe of traditional industrial statistics. Breakdown by prime movers, electric motors, and generators.

(d) Capacity of other types of machinery. Because of more restricted uses and collection difficulties this item is not included in the International Recommendations on Standard Industrial Statistics; however, the Commission's recommendations on definitions do include measures of the capacity of particular kinds of machinery which it might be useful and practical to seek in fully developed comprehensive inquiries.

(e) Fixed assets. Only changes in the value of fixed assets are covered, not their total value in absolute terms. This is in part due to arbitrary methods of accounting for depreciation (which is also omitted) and in part to the absence of records or replacement costs which would be the most meaningful measure. The changes covered include: Total cost of new and used fixed assets acquired from others, total cost of new fixed assets produced for own use, total value of sales of fixed assets, and gross additions to fixed assets; each of these broken down by (i) machinery, transport and other equipment and (ii) buildings, improvements to land, other construction and land.

(f) Inventories. Value of stocks at the beginning and end of the inquiry

year is broken down by (i) raw materials, fuels and supplies, (ii) work in process, and (iii) finished goods produced.

(g) Input and output of goods and services.

(i) Electricity. A good proxy indicator for the level of industrial activity and an important datum for basic power supply; electricity consumption per person engaged or per employee is also a good indicator of mechanization and modernization in industry. Broken down by amount purchased, generated, and sold to others.

(ii) Inputs of raw materials, fuels, and supplies, and work sub-contracted out to others. Data on industrial costs other than purchased electricity are needed in computing Value Added. Statistics on raw materials and fuels consumed are also wanted in constructing commodity and energy balance sheets and input-output accounts and in evaluating quantities consumed and unit values for materials and fuels relative to quantities produced and unit values for output. For most of these purposes, data are needed on quantities and values of individual raw materials and fuels. The recommended detailed breakdown is as follows: a. Cost of raw materials, supplies, components, etc; b. Quantity and cost of individually important materials; c. Cost of goods to be sold in same condition as purchased; f. Cost of contract and commission work done by others; g. Cost of repair and maintenance work done by others.

(iii) Gross outputs of goods and services. The data requirements here are of a similar character as in the case of inputs, but have a higher degree of priority in the recommendations. The detailed breakdown is as follows a. Value of all products; b. Quantity and value of individually important products; c. Value of goods shipped in same condition as purchased; d. Receipts for industrial work done or services rendered to others; e. Gross output during the inquiry year.

(iv) Value added. This item as derived from establishment-based industrial statistics is not exactly equivalent to the contribution of industrial units to the Gross Domestic Product, since it is not net of the contributions of the service producing sectors (advertising, accounting, other consultants) to the output of industrial units.

4. Classification schemes for industrial statistics

In order to issue significant tabulations of the results of industrial inquiries, two key classificatory schemes are required: (a) classification of the statistical units according to kind of industrial activity, and (b) a commodity classification

(a) Industrial classifications. Tabulations of data according to kind of industrial activity are fundamental to the coordinated analysis and use of a wide range of statistics -- not only on industrial units but also on other kinds of business and on the employment of the population. A system of industrial classification should therefore provide the means for grouping together data that are consistent in coverage on various aspects of the resources and activities of similar economic units, i.e., units which engage in the production, in a similar way, of like commodities and services and which may be expected to have similar economic experience.

In the definition of classificatory categories there is a fundamental conflict between the objective of accommodating a wide range of consistent data, which tends to widen the scope of each category, and the objective of maintaining the highest possible degree of similarity within each category, which tends to narrow this scope. This conflict has been universally resolved by (i) making the scope of the narrowest categories of an industrial classification scheme consistent with the combination of activities occurring in most of the establishments or other statistical units of a country, and (ii) providing a hierarchy of categories of widening scope. The hierarchical structure of a classification can be conveniently represented by a numbering scheme for the classes in which the narrower classes are represented by a larger number of digits, the wider ones by a smaller number of digits. Given this general approach, an essential phase of formulating or revising an industrial classification system is investigating the actual combinations of activities --- i.e., the kinds of commodities produced and services rendered, and the process involved in this -- in the establishments or other statistical units of the country. An industrial classification, however, cannot be expected to provide detailed categories which separate from one another the different activities and processes ordinarily carried on in the same establishments or local units -- for example, spinning and weaving, captive

foundries in machine factories, or the sales functions of industrial units -- since for a lack of independent administrative records below the establishment level it would not be possible to gather consistent data on all the resources and work involved in each of these functions. Selected aspects, however, can and in fact are often covered by statistics, for example the quantity and value of individual commodities produced or the direct employment involved. The resulting data have to be classified by schemes that are tailored to the specifics involved, and are independent of and supplementary to the industrial classification.

The International Standard Industrial Classification of All Economic Activities (ISIC)[27] was devised as a guide to countries establishing or revising their industrial statistics, and as a framework for international comparisons of data from the industrial statistics of individual countries. The United Nations and other international organizations have recommended to Governments the use of the International Standard Industrial Classification in providing internationally comparable statistics classified according to kind of economic activity. The Statistical Office of the United Nations has a programme of publishing and analysing such internationally comparable national industrial statistics that are classified in conformity with ISIC.[28]

(b) Commodity classifications. These are required for presenting systematically the results of inquiries covering inputs and outputs of individually important goods and services that are collected from statistical units (see item (g), Section D-3). In addition, commodity classifications play a key role in foreign trade statistics.

27/ United Nations, International Standard Industrial Classification of All Economic Activities, Statistical Papers, Series M, No. 4, Rev. 1, New York, 1958.

28/ In addition to the references listed in a note to the introduction of Section D, see: United Nations, The Growth of World Industry, 1938-1961, International Analyses and Tables, New York, 1965.

Two major internationally used commodity classifications are the following:

(i) The Standard International Trade Classification (SITC).[29] In order to facilitate the matching of internationally traded commodities classified under SITC with principal industries of origin as classified under ISIC, the United Nations Statistical Office has prepared a correspondence entitled Classification of Commodities by Industrial Origin.[30] Such a correspondence in which each commodity item is shown within just one industry group is not the same as a cross-classification of commodity data by industry in which each commodity item may appear several times if that commodity is produced in several industries. For working purposes in defining ratios of imports to domestic production for specific commodities, constructing input-output tables, or establishing detailed commodity balances, a correspondence is a useful starting point for deriving a full cross-classification.

(ii) The commodity classification of the United Nations Statistical Office used in presenting internationally comparable commodity statistics based on the industrial censuses of individual countries.[31] This commodity classification uses a four-digit code whose first two digits coincide with the digits of the ISIC class which is the main industry of origin for the commodity in question; the remaining two digits represent a commodity code that is independent of the more detailed ISIC classification. Accordingly, in this classification a correspondence between commodity and industrial statistics is immediately established at the two-digit level.

29/ United Nations, Standard Industrial Trade Classification, Revised, Statistical Papers, Series M, No. 34, New York, 1961.

30/ United Nations, Classification of Commodities by Industrial Origin, Statistical Papers, Series M, No. 43, New York, 1966.

31/ Special supplement entitled "Commodity Production Statistics 1953-1964", in The Growth of World Industry 1953-1965, National Tables, United Nations, New York, 1967.

E. Data sources: II. Other statistical and institutional sources

The informational universe provided by basic industrial statistics must be complemented for purposes of industrial analysis and planning from two main additional data sources. These can be roughly classified as primarily statistical-institutional, to be discussed in the present section, and primarily technical, to be discussed in Section F. The statistical-institutional data sources are broken down into (1) national income accounts and their extensions; (2) Government records; (3) enterprise-level information; (4) materials from trade association, labour union, and related sources; and (5) materials from foreign sources.

The field of statistical-institutional data sources inevitably overlaps to some extent both with the field of industrial statistics and with the field of technical data sources. For example, interindustry accounts which are extensions of national-income accounts rely to some extent on technical data; and the information generated at the enterprise level and handled in the records of government organizations in centrally planned economies contains substantial technical components. The classification should therefore be regarded as representing an emphasis rather than a precise distinction, and is used primarily as an expository device. Moreover there is reason to believe, as discussed below, that with the spread of computerization in all economic activities, the borderlines between these different informational universes will be further eroded.

1. National income accounts and their extensions. 32/

The system of national accounts is a basic tool of economic analysis

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32/ This section draws heavily on the following document: United Nations Economic Commission for Latin America, The Use of National Accounts for Economic Analysis and Development Planning, E/CN.12/671, 16 April 1963, mimeog., 54 pp. Extensive excerpts from this source have been incorporated in the text. See also: United Nations, Studies in Methods: A System of National Accounts and Supporting Tables, Statistical Papers, Series F, No. 2, Rev.1, New York, 1960.

and projection of the structure of the economy at the aggregate level. It is not possible to approach the problems of industrial development in a rational way except within the framework and against the background provided by a consistent system of national accounts. The construction of such a system moreover provides an important focus for statistical work covering a wide range of economic activities and thus exercises a powerful unifying effect on the overall statistical effort within a country. Inter-industry (input-output) accounts are built on the foundation provided by the system of national accounts and can be regarded as a logical extension of these accounts. Other extensions of national accounts are flow-of-funds tables and national wealth statements.

To formulate a consistent and workable plan at the aggregate level a fairly detailed picture of the economic situation in the base year and of past development during a reasonably long historical period is needed. A quantitative assessment of general economic growth during recent and past years and of the contribution of the various industries and factors of production to this growth is required. To obtain an idea about the investment effort necessary for an increase in the product of a given magnitude it is necessary to know the share of total resources which in recent and past years has been devoted to the building up and renewal of the capital stock and to have an idea about the magnitude of this capital stock itself. National income and national accounts estimates also furnish the raw material for the construction of balances of total demand and supply by main components, which are indispensable in revealing the existence and sources of inflationary pressures on the balance of payments.

(a) The types of series. In the following, a number of national accounts are listed which are necessary for a fully developed system of long and short term planning and for economic analysis. The series listed under (i)-(viii) below may be considered as the minimum requirement. A less complete set of estimates would still be useful for some purposes, but without the series mentioned under items (i), (ii), (iii), (vi) and (vii) even rudimentary planning and economic analysis would be difficult. The series listed under (xi)-(xii) are highly important for planning, but their avail-

ability in developing countries will generally be limited even though it is desirable that they be included in a long-term effort aimed at improving the data base of planning.

(i) Gross domestic product by industrial origin at current and constant prices with a reasonably detailed sector breakdown.

(ii) Expenditures on gross national product at current and constant prices, classified by main items.

(iii) Breakdowns of gross fixed capital formation by type of capital goods, by public and private, and if possible by industry of use, at current and constant prices.

(iv) Private consumption broken down by main groups, at current and constant prices.

(v) Distribution of national income at current prices according to main items.

(vi) Government incomes, and current and capital expenditures, broken down by economic and functional categories.

(vii) International transactions.

(viii) A system of national accounts. This requires arrangement in systematic form of selected items from the earlier-mentioned series plus some supplementary information. An extension of the system in the direction of incorporating production accounts for the various industries as well as balances of supply and demand by commodity group for selected years are desirable for planning purposes, especially for locating bottlenecks in the supply of specific industries.

(ix) Input-output table. For purposes of analysing the effects on domestic production of an expansion of specific sectors of the economy, even tables which cover a limited number of industries, with heavy concentration on the manufacturing sector, are useful.

(x) Inventory of existing real capital. The annual data on

gross fixed capital formation provide only a partial picture of the importance of real capital for economic development. An inventory of existing real capital at depreciated replacement costs is a highly desirable addition, permitting an appraisal of the structure of capital stock and capital-output ratios by various industries.

(xi) Flow-of-funds analysis. A desirable financial supplement to statements in terms of transactions in goods and services.

(xii) Regional data. Of special importance to larger countries with uneven regional development.

(b) Estimation methods and supporting statistics.

(i) Rudimentary estimating method for a system of national income statistics. A total for domestic product is first arrived at by means of the so-called value-added or expenditure method, i.e., by summing up gross production values less inputs industry by industry. Alternately using the income method, gross national product can be arrived at by estimating factor shares (wages and salaries, profits, interest, rent), indirect taxes and depreciation industry by industry, and summing. The resulting totals form the central part of the whole national accounts structure. Breakdowns by expenditure categories, income shares, etc., are then arrived at by utilizing whatever further information is available: social security, wage and employment records, government accounts, foreign-trade statistics, and the balance of payments. A number of important items, like personal consumption, savings, income of households and unincorporated enterprises, are obtained as residuals, absorbing uncontrolled amounts of errors and omissions.

(ii) The commodity flow method. This method consists of an analysis of data on imports, exports, and domestic production, following each item or group of similar items from its origin to its final destination as inputs in

domestic industries or as consumption, capital formation, or exports. Appropriate trade and transport margins obtained by special surveys are added to ex-factory values and the items valued at purchaser prices are allocated by final destination taking account of the nature of the commodity. A number of more or less arbitrary decisions are involved both in deciding the mark-ups and particularly in allocating the various items by final use.

To apply the commodity flow method successfully, all existing data on exports, imports, and domestic production have to be analyzed in as great detail as possible. One of the reasons that the method is a forceful tool of national accounts estimation is precisely that, if effectively applied, it forces a full utilization and a critical survey of these data which are indispensable in themselves for economic policy and planning purposes.

(e) Basic data needed for the commodity flow method.

(i) Annual statistics on exports and imports in sufficient detail to group together commodities with similar uses. Detailed end-use classifications are of great help if built into these statistics.

(ii) Annual production statistics for agriculture, mining, energy and manufacturing classified in similar detail as the foreign-trade statistics.

(iii) Special annual information on the value of output of the construction industry is needed, as it is not possible to arrive at reliable figures for construction expenditures by the commodity flow method.

(iv) Annual data on value of services rendered by commerce and transportation, together with average trade margins, transport, and installation costs for various types of commodities.

(v) Annual estimate of total rents paid as a measure of housing services rendered.

(vi) Annual statistics for banks and financial institutions,

to estimate the value of paid and imputed services rendered.

(vii) Statistical information on private part of personal services rendered: educational, medical, recreational, professional.

(viii) Government: information on receipts and expenditures, not as budgeted ex ante, but as realized ex post, properly classified.

(d) Other data needed to complete the system of national accounts. The commodity flow method is applicable only to estimates of domestic product by sector of origin and by expenditure categories, and government accounts provide only part of the additional information needed to complete a system of national accounts and supporting tables. For the breakdown of national income by factor shares the following additional information is necessary:

(i) Wages and salaries, social security payments, and income in kind.

(ii) An independent estimate of corporate savings.

(iii) Depreciation: meaningful estimates of this item are practically impossible to obtain and therefore data may be presented on a gross basis only.

Additional items of information include the following:

(iv) Balance-of-payments statistics.

(v) Change in inventories. This information is needed independently, in order to check the necessarily arbitrary allocations of goods to this item by the commodity flow method. This is one of the most difficult items to estimate in the national accounts of any country.

(e) The construction of input-output tables.[23/] This follows the same procedure and relies on the same supporting information as the construction of national-income accounts by the commodity flow method, except

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23/ This section follows closely and excerpts extensively the following reference: United Nations, Economic Commission for Asia and the Far East, Formulating Industrial Development Programmes, op.cit., Sec.4.20-4.24.

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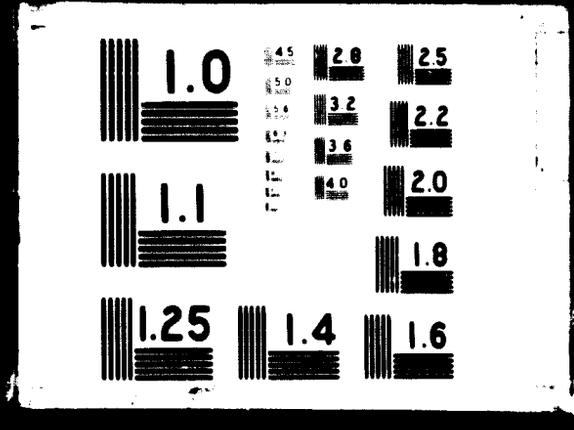

that more detail is required for deciding on allocations of commodities to specific consuming sectors. It is therefore customary to construct input-output tables for census years for which input information by purchasers, given at purchasers' prices, is available. This information is, however, not complete, and missing input data must be obtained by more-or-less arbitrary distributions of product values at producers' prices, using information from marketing and technical sources to fill statistical gaps. A separate estimate of services rendered by wholesale and retail trade is necessary to fill in the table; the usual way of doing this is to establish trade margins by commodity.

(i) Sectoral classification. In compiling an input-output table, the sectoral classification needs to be decided first, though it may be revised afterwards. The International Standard Industrial Classification[34/] of the United Nations usually provides the basic framework for this purpose. It is likely that this classification will need some adaptation owing to the differences in industrial structure of different countries. It is preferable, however, for the international comparability of the input-output coefficients that the sectoral classification be the same as the ISIC at least at the 2-digit level.

For analytical purposes, it is usually required that homogeneity be maintained for each sector as much as possible either for inputs or for the demand side. In other words, if both sides are heterogenous, the sector concerned should be subdivided. Otherwise, the estimates of the indirect effects, characteristic of interindustry analysis, may be biased.

The interindustry worker must compromise between this theoretical requirement and international comparability. (If the 3-digit level of the ISIC is adopted, the compromise is much easier.) Disaggregation is particularly important for a sector consisting of commodities with different import ratios, such as agriculture, mining, machinery, etc. Since the demand

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34/ Op.cit.

and supply patterns are different for domestic and imported goods, it is desirable to set up sub-sectors for the commodities with a high import ratio within the framework of international comparability.

(ii) Form of the table. The number of rows (i.e., commodities produced) need not necessarily be the same as the number of columns (i.e., consuming sectors). As in the Italian and Japanese studies, a rectangular table with a larger number of rows than columns is of advantage for both analytical and statistical purposes. Analytically it is useful for further studies of important commodities, particularly those with a high import ratio to total supply. This method may also be recommended for statistical reasons, because it facilitates the identification of the market pattern for certain commodities for which neither cost nor market data are available. Another form of rectangular table with a larger number of columns than rows might be profitably compiled, showing the existence of various alternative processes. This type of table would require engineering data for some of the processes in the relevant sectors.

The original input-output work-sheets, which provide the background for the final table, should be as detailed as basic data permit. It is common to find that the original tabulation contains as many as 200 to 500 commodities, whereas in the final table these are aggregated into only 30 to 50 sectors. However, there may be the case where, say, a 200 x 200 original table cannot be compiled, but 200 x 40 and 40 x 200 tables are not very difficult to construct. In such a case, these rectangular tables can be used as an intermediate stage and the final table of 40 x 40 can be easily cross-checked from both the input and output side without using a 200 x 200 original table.

Imported commodities require special attention. If the number of sectors is very limited and each sector contains commodities with differing import-output ratios, as shown

in the Japanese table for 1955 and in the tables for some Latin American countries, each sector should preferably be divided row-wise into domestic and imported products so that 2 (n x n) matrices can be obtained. This sort of table is particularly suited to the study of import substitution, since it leaves open the question as to the specific technical or behavioural relations that will be postulated between domestic production and imports (e.g., which imports will be treated as competitive and which are non-competitive) in the course of transforming the accounting table into an analytical model.

As indicated below , a "physical input-output matrix" can be compiled in terms of physical units for specified important commodities. This kind of table is based on engineering and statistical data. It is useful particularly for study of physical input-output coefficients and for detailed commodity balances. Partial tables of this kind can be made in countries that lack data for a comparable interindustry analysis.

(iii) Valuation. The first problem in valuation is the choice of purchaser versus producer price. The problem can be treated in a way quite similar to that of the conventional national income accounts. The market price valuation, i.e. valuation to include indirect taxes minus subsidies, is most common and is more practical in many countries because of the difficulty in eliminating completely the effect of taxes and subsidies from the interindustry table. (The complete elimination of these effects, i.e., a conversion from market to factor price valuation can be done only with an aid of the inverse of the original coefficient matrix after the completion of the table valued at market price.)

The second problem of the valuation of distributive cost is peculiar to the interindustry account. Since the table is concerned with the direct relationship between the consumer and producer, checking of the balance between total inputs and outputs requires consistent treatment of the trade margin and transport costs. In the case of purchaser's price

tables, these distributive costs are charged to the producer of the product but in the case of producer's price, to the purchasers of the relevant commodities. While the method of valuation at producers' price showing the differences in the pattern of distributive costs is more useful for industrial studies, use of the method of purchasers' prices may be dictated by considerations of practical convenience. The analytical deficiency of the purchaser's price method may be partially overcome by introducing a separate sector for retail trading or similar activities, which are usually different from ordinary distributive activities.

(iv) Data needed. Data requirements for the construction of inter-industry tables are much greater than those for national income estimation. In order to obtain national income estimates, one can proceed, if the data permit, by either the income method or the expenditure method, without bothering about industrial cost data. The application of the commodity flow method to arrive at national income estimates does not require a detailed classification of costs of different sectors of the economy; if it is possible to obtain reliable figures of total cost and total gross output for all the productive sectors (even if in the form of highly consolidated groups), one can arrive at fairly reliable estimates of national income.[35/] In the construction of interindustry tables, however, the choice of data is much more limited; in fact, they need all the data required by all the three methods of national income estimation and more. While national income estimates per se are broad aggregates, interindustry tables are matrices involving a detailed classification of the productive sectors of an economy. In actual practice, due to non-availability of data, a large amount of consolidation of sectors is unavoidable in the construction of interindustry tables, but if these consolidations are extended beyond certain limits, they are likely to defeat the

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35/ See Sec. B-1-b, (i) and (ii).

purpose of the table.

Ideally, there are two methods of compiling interindustry tables: either by tracing the flows of different commodities to their various uses and thus filling in the table row-wise (commodity flow approach) or by recording the inputs consumed by different sectors, necessitating the completion of the table column-wise (expenditure approach). If both kinds of data are available, one provides a valuable check against the other. In many countries, however, there is not much scope for choice, as the materials available are mostly in the form of cost data. In considering data requirements for interindustry tables, we are thus led to an intensive examination of the coverage and nature of cost data to point out the gaps which have to be filled in for planning purposes.

Construction of the interindustry table consists of four stages: (1) design of worksheet table; (2) estimation of control figures, such as output, export and import by industry in producer's and purchaser's price; (3) estimation of sub-control figures, such as value added, intermediate and final demand by industry, and checking the balance between total value added and total final demand; (4) estimation of sectoral breakdown and checking of balance between inputs and outputs by industry.

As for the final demand sectors, the data from household budget surveys and the administrative records of government budgets are used for interindustry studies.

(v) Physical input-output tables. While interindustry tables usually show value flows, the method of commodity balances involves the balancing of supply and demand in terms of physical quantities. In principle, there is no basic difference between physical input-output tables and the method of commodity balances, apart from the way of presentation. The construction of physical input-output tables requires a very detailed classification of sectors, so that the

commodities produced by each sector are sufficiently homogeneous and amenable to physical quantification. Usually, commodity balances are attempted for what are considered as key commodities, which in essence correspond to a partial physical input-output table.

Industrial cost and output data collected on the basis of census of manufactures or sample surveys should provide, whenever possible, physical quantities of outputs and inputs along with their values. Apart from these the main source of information for construction of commodity balances is provided by engineering data. Once the projects to be incorporated in the plan are formulated, standard engineering data adjusted to take account of local conditions may be fruitfully utilised in constructing an interindustry table for a future year.

(f) Flow-of-funds statements. These are accounts of financial transactions between various sectors of the economy, but with a different sectoring from that applied to real transactions. Whereas the industry classification of input-output tables refers to the kinds of productive activity, i.e., it is essentially an establishment classification, in a flow-of-funds statement sources and uses of funds have to be classified by institutional sector: incorporated nonfinancial enterprises, financial institutions, general government, and households, with preferably further breakdowns within these major classes. Two ways of estimating the required transactions are:

(i) Measurement of the net transactions in various types of financial assets and liabilities between these sectors during a year.

(ii) Measurement of changes from year to year in the balance-sheet position for the various types of financial assets and liabilities.

Data on government and financial institutions are fairly readily available in most countries; households and incorporated nonfinancial enterprises may however require special surveys. An integration of flow-of-funds statements with national accounts requires a reconciliation of the main magnitudes.

(g) Statements of existing real capital. The raw material for such statements comes in part from the censuses of agriculture, housing, mining, and manufacturing, especially if designed with this specific purpose among their objectives; indirect methods and surveys are however necessary to complete the picture for all sectors. One main problem in constructing estimates of existing real capital is the choice of a principle of valuation. This is because many of the assets to be evaluated do not regularly change hands and therefore do not have a current market price. One solution frequently applied is to choose depreciated replacement cost for reproducible assets combined with the market value for intangible assets for which a market exists, and the face value for other intangible assets. In order to establish a direct connexion between the national accounts and the estimates of existing real capital stock, the same sectoring has to be applied to the latter as to gross capital formation and product by industry.

2. Government records

Government records are an indispensable source of additional information for industrial analysis and planning. It has already been pointed out in the previous section that government receipt and expenditure records are required for constructing a system of national accounts. These data, however, are only a small part of the information available from government sources.

For the purposes of this discussion, these sources are divided into five classes: (a) general administrative records; (b) legislative records; (c) judicial records; (d) records of government agencies directly involved in the planning process; and (e) records of government enterprises. The last class will be discussed in the next section in connection with enterprise-level information sources.

(a) General administrative records. In the area of administrative records, the following are of major importance:

(i) Census records and other materials that are subject to disclosure limitations. In countries with predominantly private-enterprise and mixed economies the protection of

commercial secrecy is built into the very foundations of the statistical system. In such countries, the central Statistical service has extensive materials in the form of directories and individual returns for enterprises or households that cannot be released at all or unless merged into a total by tabulation. These materials can nevertheless be made accessible to special analysis where this analysis can be formalized so that it is performed under the control of the Statistical office itself and only the final results, which satisfy disclosure constraints, are released. The potentialities in this direction have been enormously increased by the electronic computer, since detailed programmes can be written by outsiders for use with a data storage medium (for example, a magnetic tape) that never leaves the physical control of the Statistical office, and where the latter office needs to inspect nothing but the final printout.

The same principle can also be applied to other confidential government materials besides census records. In countries with centrally planned economies, for example, various categories of economic and planning information may be subject to a hierarchical system of official secrecy; in all countries, information pertaining to military industries is privileged; tax and social security records, materials pertaining to licensing and regulation, etc., are also often limited with regard to disclosure. In all of these cases the information can be made accessible to non-privileged users, for many purposes that require only the intermediate use of sensitive detail without requiring its final disclosure. To this end the records have to be kept in a standard, computer-readable format and this format itself has to be known by potential users.

(ii) Monetary and foreign-exchange activities. Materials are typically available at the Central Bank or related institutions.

- Bank regulation and inspection: materials pertaining to the types of loans, reserves.
- Credit: regulation of household instalment purchases and commercial credit. Surveys, applications.

- Import licensing: applications for licenses with supporting materials.
- Foreign investments, loans, amortizations, profit repatriation. Operating data and profitability information on major enterprises.

(iii) Fiscal. Budgetary and de facto realized revenues and expenditures and related materials are typically available at the Finance Ministry, Budget Office, or related institutions.

a. Taxes and other revenue.
   - tax records for households and enterprises
   - customs duty receipts by commodity
   - indirect tax receipts by commodity
   - social security taxes and other records

b. Expenditures
   - government procurement by agencies
   - direct factor payments by agencies

(iv) Military. In a number of countries, the military controls complexes of military-oriented industries, generally centred on arms munitions, vehicles, aircraft, fuels, explosives and other chemicals. In many instances, the military is involved in construction activities with significant indirect commodity inputs. In still other cases, the military is at the focus of an extensive hierarchical contracting network involving activities that originate radical technological innovations. All of these activities generate massive data files that are of fundamental importance for industrial analysis and planning. For the latter purpose, military target-setting is also of importance since it interacts with the general level of industrialisation and education. The main categories to be considered are:

- military industries
- procurement
- construction: bridges, roads, airfields, harbours, hospitals
- military targets

(v) Public works. The Ministry of Public Works or related institution is responsible for extensive programmes that affect the level of many branches of industrial production. Past performance and targets are of interest to industrial analysis and planning, in relation to the following specific areas:

- general construction: roads, bridges, ports, airports, dams, flood control projects, parks, monuments, etc.
- housing
- public buildings, hospitals, schools
- urban facilities: streets, lighting, sewers, highways, urban transit. These categories are often handled not by a central Ministry of Public Works but by the corresponding departments of local administrative units, e.g., municipalities.

(vi) Education. The Ministry of Education or similar institution typically has extensive records on enrolment, staffing, procurement and construction in connection with past programmes as well as projections for future years. Specific categories within the total educational effort include:

- primary and secondary education, universities
- vocational and technical schools, labour training and retraining
- adult education
- scientific and technical institutes.

(vii) Labour. The Ministry of Labour or related agency generally is in charge of materials pertaining to

- detailed labour statistics
- strikes, arbitration
- social security materials

(viii) Health and welfare. The responsible agency typically keeps records on construction, procurement, staffing, and services rendered in the following fields:

- public and rural health
- hospitals, clinics, first-aid stations

- industrial safety
- social security records
- welfare payments and other transfers

(ix) Transport. The Ministry of Transport and related agencies, such as Departments of Motor Vehicles and the like have the following types of records:

- general regulation and licensing: trucks, buses, private automobiles and other vehicles, drivers
- public utilities licensing, regulation, and inspection: railroads, bus lines, airlines, trucking public carriers
- construction and operations under central authority

(x) Industry. The Ministry of Industry or related organ has the following types of records:

- general regulation and licensing: industrial license applications with supporting materials; inspection reports; conservation measure enforcement in regard to oil, mining, forestry, fisheries; fair trade and regulation of competition
- public utility regulation: electricity, gas, communications

(xi) Commerce. The Ministry of Commerce or similar agency keeps records pertaining to

- general regulation and licensing of wholesale and retail trade establishments
- insurance regulations and inspections
- trade regulations and margins

(b) Legislative records. In a number of countries extensive studies with a direct bearing on industrial development and planning are commissioned by the Legislature or Legislative Committees. Moreover, such Committees may hold hearings at which testimony is taken from industrial, commercial, and other sources that generate primary information not accessible elsewhere. This is the case for example in the United States.

(c) Judicial records. The records of judicial proceedings in cases involving industrial and commercial interests may generate primary information not accessible elsewhere. This is the case for example in United States anti-trust proceedings.

(d) Records of Government agencies directly involved in the planning process.

(i) City and regional planning agencies. Such agencies are found in many countries with predominantly private-enterprise and mixed economies where other forms of planning, e.g., economic planning, is not undertaken as such. The principal classes of information typically available at such agencies are the following:

- Land use
- Industrial location; directories
- Economic base studies for cities and regions with supporting materials
- Studies on urban transport problems: vehicular, public rapid transit
- Information pertaining to local governments

(ii) Economic development promotion (Fomento) or similar agencies; development banks. Since these agencies encourage business enterprises to address themselves to them with their problems and requests for assistance, especially in connection with new development projects, such agencies are likely to have a rich accumulation of case material pertaining to past and current applications, with supporting documentation. This body of information discloses both past trends and future lines of development, since many applications are typically part of the current backlog awaiting decision. The systematization of this material is often a prime source of sectoral planning information. For maximum usefulness each particular application or project should be abstracted in standard format as a first step of a systematic survey and analysis. The abstract should cover the aspects of a project listed in Section B-2-a. The principal types of applications on file at such institutions are:

- applications for financial assistance
- applications for tariff or other protection
- applications for import licenses

(iii) Economic planning organizations. In countries with centrally planned economies or in countries with mixed economies that have

significant degree of economic planning activity, the planning organizations themselves, at different hierarchical levels and by different functional (Ministerial) or territorial (regional) subdivisions, are logical sources of primary information pertinent to industrial planning. These institutions are repositories of all the types of information listed elsewhere in this chapter, but by virtue of their specific functions, they also generate, process, and transmit primary information of several types. In addition to enterprise-level material that will be discussed in the next section, this includes the following information covering a series of years:

- initial plan targets
- initial plan drafts at different levels
- revisions
- final, formally accepted plans
- plan revisions in the course of execution
- emergency allocations from reserves and other corrective measures
- extent of fulfillment of plan targets
- average degree of progression in planning norms by different industrial branches
- network of contractual relations between enterprises
- technical and other support to enterprises
- control instruments over plan execution and their degree of success: financial and other controls

3. Enterprise-level information

Enterprise-level information will be discussed under three headings: (a) information from private businesses; (b) information from Government enterprises; and (c) information generated at the enterprise level in countries with centrally planned economies.

(a) Information from private businesses. Enterprise-level information is restricted in countries with predominantly private-enterprise and mixed economies due to the prevailing norm of public respect for business secrecy. Thus a large

variety of records that are kept by enterprises in the normal course of business are not opened up for purposes of analysis and planning, and when key items are reported to central Statistical organs of the State, the confidential nature of the information, as mentioned in the previous section, is jealously guarded. At the same time the actual state of commercial and industrial intelligence is such that much of this supposedly confidential information, with the possible exception of some key technical data, is in the nature of an open secret within the narrow circle of close competitors in each line of business. We thus have the paradox that it is a poor businessman indeed who does not know the key facts about the operations of his close competitors, yet the public at large and industrial planning organizations in particular are not given access to this information, nor do they have the resources to buy it in the open market from intelligence organizations that exist for this specific purpose.

This impasse leads to a dearth of enterprise-level information. Apart from isolated academic studies of particular industries, the only valuable body of information in this quarter is the trade press.

While Census directories are not published since they would identify individual reporting sources, there are many commercially published trade directories. Some of these cover individual geographical areas and list all manufacturing and commercial establishments; others cover particular branches of industry; still others provide information on individual enterprises listing their plant or other establishment locations, their reported assets, profits, etc.; there are also purchasing directories that list, for individual products, all sources of supply. Many specialised periodicals carry annual or semi-annual surveys of selected statistical indicators covering a wide range of enterprises, based on privately conducted questionnaire or telephone surveys. These sources of course vary considerably from country to country, but they are readily accessible through a good reference library. In the United States, for example, the libraries of graduate schools of business have especially good collections of this type of material.

A final source of information from private businesses pertains to public utilities or companies that for one reason or another come under public regulation or scrutiny. In the latter category we have already listed the main types

of information available in the files of Government regulatory agencies. It should be further noted, however, that these channels of communication existing between Government and private businesses can be utilized for collecting additional information that is useful to the planning process. For example, if a particular business comes to Government for a favour such as financial support or special licensing, the resulting leverage can be used to extract information that would otherwise not be given out.

(b) Government enterprises. In theory, the information in the possession of these enterprises should be fully available to Government for any legitimate public purpose such as industrial planning. In practice, however, there will be many classes of resistance to the systematic collection of this type of information. Government enterprises are usually set up as autonomous entities that are closed at the working level to outsiders including personnel of other Government organizations. Communications in such a case must be funnelled through the top level of the hierarchy which automatically restricts the flow due to administrative delays and resistances. However, even in the case of working-level contacts there is the typical resistance of operating personnel to the collection of any information that is not directly related to improving the measured efficiency of the operation itself on the basis of which the merit rating of operating personnel is determined. This resistance is of a completely general nature and is equally encountered between planners and operating personnel within a single large private business, within government enterprises, and within state enterprises of centrally planned economies. If a given planning function is located outside the enterprise, the problems of communication across the boundaries of the enterprise are added on top of the inescapable friction between planners and operating people. The latter, incidentally, have a way of winning many of these battles since they are in direct possession and control. The best way of overcoming their resistance is to set up an information system that will not only provide the data needed by the planner but will also have an immediate tangible payoff for the operating man. Fortunately the modern techniques of automatic data recording and digital information processing are most efficient when organized into an integrated, comprehensive system which satisfies the former objective.

(c) Enterprise-level information in countries with centrally planned economies.

(i) Planning information. In countries with centrally planned economies, enterprises fall either within the public or the private sector. The latter includes mostly small trades and commerce, while the former breaks down further into cooperative and state enterprises. In the industrial sector, state enterprises are predominant. These enterprises are at the foundation of the entire planning process, since all higher-level plans must be ultimately translated into a consistent pattern of interlocking enterprise-level plans before they can be executed. Plans traditionally cover the following basic planning areas:

- production programme
- new equipment and techniques
- supply of materials and equipment
- manpower and wages
- production cost
- finances

It might appear that the enterprise-level plans that are prepared and passed up to higher-level planning organs, covering these basic planning areas in full detail, would contain all conceivable information that could ever be wanted in the course of the planning process. This is however not so, since the traditional technique of central planning focuses on the translation of overall plan targets into a consistent plan and can allow only marginally for the consideration of alternatives that are at the heart of the whole question of efficiency. By and large, questions of efficiency come into play in the traditional central planning process formally only by way of engineering or slightly wider technical-economic project studies that are undertaken when translating medium-term plans into annual production and investment programmes. This stage occurs after all major choices, e.g.,

between domestic production and imports or in regard to the time-phasing of major investments, have already been pre-set, and their results generally do not feed back upon these fundamental choices. Of course, questions of efficiency are of great concern in making choices, but they are not based on a systematically organized universe of planning data but are subject to informal and intuitive appraisal by the policy-makers. As such they can be very good or very bad, depending on the insight of particular individuals. What would be required for the formalization of choices involving questions of efficiency is systematically organized information on technical/economic alternatives at all levels, beginning with the enterprises. The presentation of fully operational alternatives would, however, go way beyond the existing practices of many enterprises, and might not only involve the rearrangement of the entire record-keeping system, but often also extended engineering studies verging on the tasks of research and development. This would involve severe uncertainties and the expenditure of much effort on working up alternatives whose majority would always be discarded. At the level of the enterprise, data pertaining to existing practice must therefore be treated on a different plane from data pertaining to potential alternatives. Planning models of the linear programming type ignore this distinction and are justly treated with reserve by practical planners.

If information on enterprise-level technical/economic choices is to be made available for planning purposes, this requires systematic provision for a new planning function within the enterprise. Such a function involves the setting up of a supplementary information gathering system focused both on the technical units within the enterprise and on relevant technical/economic information that has to be gathered from outside sources. Some of these functions required at the enterprise level are closely similar to Planning, Programming and Budgeting system studies now being intensively pursued in connection with various Government operations in the United States.

(ii) Publications. Technical publications in centrally planned economies reveal far more enterprise-level technical and economic detail than corresponding publications in countries with predominantly private-enterprise or mixed economies, since considerations of commercial secrecy are irrelevant. The industrial statistics of these countries cover a variety of detailed technical/economic indicators; moreover, much information is also available in engineering manuals, plant and factory design manuals, maintenance handbooks, spare parts and components listings, industrial programming handbooks, industrial economics texts and monographs, and proceedings of technical/economic symposia covering such topics as improvement of labour productivity or economising on metal and other raw material inputs.

4. Materials from trade association, labour union, and related sources

In predominantly private-enterprise and mixed economies valuable information may be gathered from these sources. Trade associations maintain directories and frequently gather confidential information from individual firms that is merged into larger aggregates and reported as such. Trade association libraries are repositories of a variety of qualitative documentation pertaining to the operations of the respective industrial branch.

Trade association statistics can be particularly valuable when the Census classification cuts across functional branches of industrial activity. Thus for example the extrusion of plastic products is not necessarily the dominant activity of many establishments that do a great deal of plastics extrusion. If these establishments are engaged in the manufacture of end products in which the extruded plastic material is just one of many components, the establishment will be classified on the basis of the end product, not on the basis of its plastics extrusion activities. Thus conventional industrial statistics cover only a fraction of the relevant universe for this activity. The same is true of metal-working operations such as casting or forging. Trade association statistics, however, often bring together material by the relevant activity categories. Another problem raised by Census data is that technically very similar products may be classified in widely divergent classes according to the end-use of the

product, while technically dissimilar items show up in the same end-use class. This problem is encountered in electronics as well as in engineering products. Here again trade association classifications and statistics are often more helpful for particular analytical and planning purposes than official Census figures.

Labour union sources, if accessible, are valuable for analysing the cost and profit picture of particular economic operations below the enterprise level, since published figures are seldom available for such lower-level subdivisions. Labour unions, for the purposes of contract negotiations, at times engage in very detailed technical and cost studies by prototype operations which are almost never released but which may contain a wealth of information gathered with a considerable expenditure of effort and funds.

Other potential sources of information and/or cooperation in the compilation of data are the following:

- Technical and professional societies and associations
- Chambers of commerce and related commercial promotion organizations
- Area development associations and related civic groups, e.g., groups promoting the development of a metropolitan area or a region
- Railroads and electric power companies that do industrial and commercial promotion work in order to attract new economic activities into their tributary zones, for the purpose of enlarging the market for their services
- Academic research organizations, particularly institutes of economic and business research
- Commercial firms specializing in economic research and development. The rates of these firms are, however, often out of reach for the public planning agency.

5. Materials from foreign sources

The three main classes of materials under this heading are: (a) information pertaining to the projection of exports; (b) world market price data; and (c) data and coefficients from the experience of other countries that are transferred to a given country in order to fill the gaps of available domestic information.

(a) Data for export projections. These projections can be subdivided into projections for traditional exports and projections for new lines of export. Traditional exports from the developing countries are in a relatively narrow range of commodities for which ample data are available on consumption trends in the major importing countries. Items used for final consumption (coffee, bananas, meat) can usually be adequately projected on the basis of income elasticities, while intermediate items (minerals, petroleum, metals, cotton, wool) are projected by coefficients of technical use and trends in the major consuming industries. The most difficult part of such export projections is usually not the definition of total use in the importing countries, but rather the appraisal of the share of the international market that the exports of a given country can hope to conquer and hold. For informed estimates on this matter it is necessary to study the production, quality, and cost conditions in the main competing countries in as much detail as possible. International publications often provide a starting point for such appraisals, but for a more definitive analysis it is almost indispensable to recur to expert opinion based on contacts in many countries.

The projection of potential non-traditional exports is even more difficult since the success of such exports hinges on promotional activities the quality and impact of which are often difficult to anticipate. There is, however, no doubt that direct access to the distribution network in the country of destination is of critical importance, since attempts to introduce new lines of export products via the conventional export-import firms are next to hopeless. This in turn requires extensive studies of the costs and institutional aspects of distributive chains, dealerships, and other forms of direct entry into the foreign market.

(b) World market price data. Apart from exports, world market price data also play a critical role in import substitution decisions. Since the effects of these decisions carry over into long periods of the future, it is essential to base them not only on currently prevailing price relationships, but also on anticipated price trends. This requires a projection of long-term price movements in the world market that can be based only on a careful survey of factors affecting both production and demand in this market. Price quotations for important commodities are generally available in the trade press of the industrialized countries from which delivered prices in various receiving markets can be

readily calculated on the basis of the structure of transport costs.

(c) Data for transfer. The data most commonly considered for transfer from one country to another include per capita consumptions, income elasticities and growth elasticities, import substitution ratios, input-output coefficients, and other technical coefficients including industry-by-industry capital/output and capital/labour ratios. Industrial statistic are now available from the United Nations on an internationally comparable basis,[36] and several internationally comparable input-output tables have also been constructed.[37] In the case of considering a coefficient for transfer, it is essential to survey the range of variation of this coefficient in a number of countries that show varying degrees of similarity to the country in question, in regard to selected aspects of development and resource endowment which can be considered critical for determining the numerical value of the coefficient to be transferred.

F. Data sources: III. Technical data sources

Statistical and institutional data sources alone are not sufficient to cope with the tasks of industrial analysis and planning. Technical data sources are required not only for the obvious purpose of setting targets in the crucial field of technological progress, but also for the purpose of exploring productive structure in depth and defining alternatives for choice without which there can be no judgment of efficiency.

1. The need for technical data sources

Economists have been traditionally wary of using detailed engineering information for broader industrial studies, since they have been conscious of

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36/ See Patterns of Industrial Growth, 1938-1958, op.cit.; The Growth of World Industry, 1938-1961, National Tables, op.cit.; and idem, International Analyses and Tables, op.cit.; The Growth of World Industry, 1953-1965, National Tables, op.cit.

37/ See H. B. Chenery and Paul Clark, Interindustry Economics, Wiley, New York, 1959; also H. B. Chenery and T. Watanabe, "International Comparisons of the Structure of Production", Econometrica, October 1958, pp.487-521.

the involved nature of this information, and of the correspondingly large number of alternatives which would present themselves for evaluation. Instead of trying to analyse and summarize such information directly, they have addressed themselves to the task of deriving indirect statistical estimates or of developing shortcuts of one kind or another. It is of course true that incorporating the level of detail encountered in engineering reports into the broader industrial development studies would constitute a task completely out of proportion with the resources typically available for such studies. Nevertheless, it is evident that the statistical approach is more instructive for viewing the past than for deciding about the future; and that none of the shortcuts that have been suggested by economists for getting around the need for summarizing and representing the relevant production relationships have given satisfactory results.

Industrial statistics focus on the establishment as the smallest unit for which adequate administrative records are available for treating the unit in a self-contained fashion, without the need for extensive allocations of technical overheads. An individual plant or a major self-contained division within such a plant can be readily treated as an establishment, but a machine shop may not be so easy to treat individually if it is an integral part of a sequence of operations organized for the production of a particular product, such as electric motors. At a still lower level, e.g., at the level of individual lathes, planers, milling machines, etc., the collection of meaningful data from administrative records becomes plainly impossible in the majority of cases.

For planning purposes, particularly in the context of rapid technological change such as characterizes both developing and industrialised countries, it is not sufficient to obtain data on resource groupings and their combined operations such as are gathered in connection with industrial statistics. Insight into the structure of production requires the determination of the patterns formed by three elements of the industrial process:

(a) commodities
(b) technical activities
(c) organizational entities.

(a) Commodities. In connection with commodities, there are two basic decisions: first, whether the commodity is required at all; and second, whether

it should be produced or procured (the make-or-buy decision). It will be convenient to start by discussing the latter.

The make-or-buy decision refers to whether a commodity should be produced in a given plant, industrial complex, region, or in the country as a whole, or whether it should be obtained at any one of these levels from outside sources. If the decision is to produce the commodity, the make-or-buy decision has to be faced again at a lower level, since all but the simplest commodities have sub-assemblies, components, or intermediate-product inputs. The lower-level decision then feeds back upon the decision at the higher level. Commodities are thus interrelated by chains of inputs and requirements. The interrelation is, however, not unique, since there are alternative ways of designing and producing given commodities. From the point of view of design, a commodity or any one of its components serves a specific function that can be satisfied in a number of ways, giving rise to alternative designs, manufacturing methods, and lower-order commodity inputs. There is thus no necessary correspondence between end commodities and inputs, even if the end-commodity is defined as a statistical class rather than as a unique product, two further sources of variation in the structure of inputs appear. First, individual products within the class may have different input requirements, therefore a change in product composition will affect the input structure. This is a well-understood source of variation, often referred to as the problem of aggregation. Second, functional requirements for individual products may change in the course of time, precipitating design changes. For example, automobiles or machine tools undergo continuous functional changes even within narrowly specified categories of use.

The discussion of alternative ways of satisfying a given function in the foregoing paragraph leads to the more fundamental question of whether a given end commodity is required at all. The end commodity no less than intermediate commodities is needed for fulfilling a function, and alternatives may exist at this level as well as at lower levels. The substitution between alternative ways of serving given functions reaches all the way up to ultimate plan objectives and targets.

(b) Technical activities. The decision about commodities is closely interrelated with decisions about technical activities. Different commodities

which drew on the same technical activity, e.g., machining, give rise to economies of scale in the machining process. Most activities have minimum economic scales; therefore no commodity in an interrelated group may be economical to produce unless the group as a whole makes efficient use of the minimum capacity of the shared activity. These interrelations are further complicated by technical and design alternatives in regard to individual commodities, since in the presence of such alternatives the combinatorial possibilities of sharing a given activity will increase sharply. While commodities are thus interrelated via shared activities, different technical activities, e.g., machining and casting, are also interrelated via linking commodities, i.e., commodities that require the complementary use of several technical activities. For example, a housing for an electric motor requires casting followed by machining; thus the decision about investment in machining capacity hinges on the complementary availability of casting capacity when electric motor production is being considered.

(c) Organisational entities. Both commodities and technical activities are further associated with organisational entities. The establishment as a statistical unit is an organisational entity that has a stable, legally recognised existence at a given location. There is, however, no necessarily stable correspondence between a given establishment and either the commodities it produces and utilises, or the productive resources it encompasses. A given establishment may be specifically designed for the production of a narrow range of commodities, but there are also many establishments with a great flexibility in their product assortments; moreover, even in specialised establishments there can be major changes over time in the nature of the predominant product. The association between establishments and productive resources, both plant and equipment and a skilled work force, has traditionally been more stable than the association between establishments and products, but even this is being progressively eroded by technological change:

> "To an increasing degree (in those industries that form a part of the leading edge of technological advance)...the major problem is that of integration of design which can and does occur in any location. The skill that is involved is primarily that of management, and only by way of a job is it associated with companies... The fabrication of metals is a process which is associated with skilled workmen and kinds

of machines, and only in this way is it associated with plants. Both workmen and machines can be moved and are reasonably mobile when there is a reason to do so. Other kinds of processes occur in the electronics area: zone melting in the preparation of transistors, polishing of lenses, etc. These involve special skills and equipment which develop at some locations, and disseminate to people and plants that are involved in innovation in these areas. With the fast changes in technology that are occurring, one of the most relevant aspects is the ability of a firm to enter new areas, rather than the industry it has been in or even the characteristic of its plants." 38/

While this description has been written about the technological frontier in the United States, it is in many ways directly applicable to the response elicited by the introduction of a relatively advanced technology in the developing countries; moreover, the organizational features of the industries that are today technologically most advanced will before long undoubtedly diffuse into more traditional industries as well.

(d) The evaluation of statistical and institutional data sources in relation to analysis and planning of the structure of industrial production. The survey of the characteristics elements of the pattern of industrial production, namely commodities, activities, and organizational entities, discloses that the information required for a proper definition of this pattern is much more fine-grained than the best that can be provided from sources such as basic industrial statistics or related traditional institutional sources. Ultimately all of these sources go back to administrative records that do not penetrate below the level of the establishment.

Some of the key deficiencies can be summarized as follows:

(i) Commodities. The input structure for the production of statistical classes of commodities is poorly defined and unstable. It does not allow the separation of individual products, alternative designs, and alternative production methods, and therefore it precludes the adequate exploration of economies of scale in production which are crucial both to the analysis of the pattern of production and to planning decisions.

(ii) Activities. Technical activities are not covered in a representative way by industrial statistics, since as a result of establishment classification requirements by predominant product,

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38/ Stedman B. Noble, Technological Change and the Impact of Defense Expenditure, unpublished manuscript, 1964. Emphasis supplied.

only a fraction of establishments engaged in a given technical activity are classified as falling into the class defined by that activity. (For example, a great many machining activities are subsumed under the manufacture of particular products, etc.) Even within the available inadequate representation, subclasses of technical activities and technical overheads at different levels cannot be distinguished, and economies of scale (related to both the length of production runs and the scale of productive facilities) cannot be properly defined.

(iii) Establishment classification. In the technologically advanced branches of industry, increasing ambiguities of establishment-based classification are introduced by changing technologies, the blending of various technologies, and the spread of integrated systems design that leads to products cutting across traditional classes.

2. The nature and contents of technical/economic data

By the technical/economic description of a sector we mean a collection of quantitative and qualitative data that permit first-approximation estimates of production costs, profitabilities, and supply for alternative patterns of development within the sector, in function of variations of local unit prices, markets, scales of opration, external effects, and other relevant factors.

Two essential elements of this definition should be noted. First, the degree of approximation required for the purposes of sectoral studies is far less exacting than that required for operational decisions of business firms or government entities. While the latter require full engineering detail and the consideration of the fine structure of alternatives for one given individual project, sectoral studies serve to open up a broad view of all the pertinent major alternatives in a given field of industrial development. In other words, engineering studies are called upon to support a final operational decision with regard to a very narrowly defined individual project, assuming that the local conditions pertaining to unit prices, markets, and the scales of operation of the various other industries and other activities of the economy remain fixed

and given. Contrariwise, sectoral studies are directed toward the objective of determining the major priorities between competing lines of industrial development within a sector in a given country or region, specifically taking into account the interrelations between various projects, possibly in widely divergent fields, which are to be executed simultaneously and which mutually influence each other through prices, market conditions, external economies and the like. Accordingly, the technical/economic descriptions of sectors must on no account be judged, simply on the basis of their reduced requirements of fine detail, as bases for second-rate engineering studies: on the contrary, they make possible an analysis of structural interrelations within the economy for which the usual engineering studies, hampered by their load of detail, are entirely unserviceable.

Secondly, the technical/economic description of a sector must allow the incorporation of local data, relating to unit prices, markets, scales of operation, external economies and diseconomies and other pertinent information, in the production cost, profitability and supply estimates. Thus simple priority lists derived from the experience of other areas (mostly the more highly developed ones) are not an adequate substitute for the information that is being sought. The possibility of incorporating local unit prices in the estimates is specially emphasized since this permits the evaluation of alternatives under two parallel criteria: on the one hand, market prices; on the other hand, social accounting prices (opportunity costs). In practical development decisions, these two criteria often go hand in hand.

What makes such technical/economic descriptions of sectors operationally feasible? First, the large field of technological variation is represented by a relatively small number of carefully selected unit production activities. For example, in the production of ammonia alone there are dozens of patented processes in current use, employing a great variety of raw materials; yet, it is hardly ever worth while to consider more than half a dozen alternative unit activities for this process at the level of approximation which is deemed adequate for sectoral studies. In one such area study, a total of some ninety unit activities were found sufficient for defining the overall locational structure of the basic chemical industry in the Latin American region.[39] Likewise,

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39/ United Nations, La industria química en América Latina, New York, 1965.

in the refining of petroleum for many purposes the tens of thousands of different crudes found in different parts of the world may be adequately represented by half a dozen to a dozen classes. Of course, the art consists exactly in determining what is an adequate level of detail for the purposes of general studies, and what is the most proper type of simplification and generalization.

Secondly, many complex technological alternatives can be well described by combinations of two or more hypothetical "building-block" activities. For example, the very complex technology of acetylene production from gas mixtures can be approximated neatly by defining conversion activities for pure gaseous feed components and taking arithmetical combinations of these "building-block" activities, even though in practice the latter are seldom encountered as individual entities.

Third, highly involved substitution relationships can often be handled in a simple fashion by defining certain fictitious intermediate products and fictitious conversion activities. For example, in petroleum refineries, typically many streams of varying composition are combined to form the input stream for catalytic cracking, yet the definition of as little as two classes of cracking feeds permits an adequate description of this process for area-study purposes. Consequently, if the fictitious intermediate products "cracking feed A" and "cracking feed B" are defined, together with fictitious activities which "convert" certain streams into one or the other of these "intermediate products", then it is not necessary to list separate unit activities for the catalytic cracking of dozens of streams, but only for the catalytic cracking of two streams.

These examples should suffice to indicate that a degree of complexity that is at first sight bewildering will yield to a systematic effort at simplification and generalization. The method available for the chemical-process type industries cited above can be extended with relative ease to other industries having processes of the same type, such as processed foods, beverages, oils and fats, sugar and starch, fermentation industries, leather, pulp and paper, ceramics and glass, and all fields of chemical metallurgy. For these industries, the production of basic chemicals may serve as a prototype of technical/economic description.

A different prototype is required for industries involving mechanical rather than chemical transformations. The metalworking-engineering industries serve as a suitable prototype for many such industries. In the technical/economic description of the metalworking-engineering industries, four principal problems arise. First, the diversity of important distinct products is enormous, since these products are distinguished not only by material composition but also by geometrical shape. Secondly, while in the chemical-industry prototype, production facilities are typically specific to individual products, in the metalworking-engineering industries the typical case is just the opposite, namely general-purpose production facilities. Third, while in the chemical-industry prototype economies of scale can be related to just one key indicator, namely plant size, in the metalworking-engineering industries economies of scale appear in at least two guises: plant size, and the length of the individual production run. Finally, in the metalworking-engineering industries there is an inter-penetration of the ordinary process of production with technological advance, since products are individually designed.

In many industries or industrial sectors, the two prototypes are combined. In basic metals, for example, there is a chemical metallurgy stage which is dominated by the first prototype, followed by a stage of rolling, extruding, and otherwise forming basic shapes that is dominated by the metalworking/engineering industries prototype. In simple consumer-oriented industries (food, textiles, apparel, furniture) we find varying combinations of processes following the two prototypes, with some additional features that are unique to given industries. In textiles, for example, the identification of the sources of labour productivity variation is the key to adequate technical/economic description. In a number of basic and intermediate industries other than the ones mentioned, chemical processes dominate in all but the final stages. An example is glass and ceramics. Finally, there are industries for which no other feature is as characteristic as their use of advanced and fast-changing technology (electronics, nucleonics, special metals).

In the present section the contents of technical/economic data are discussed under two headings: (a) technical/economic description of a sector; and (b) related estimating procedures.

(a) Technical/economic description of a sector. This involves three tasks: (i) the definition of functional relationships between inputs and outputs; (ii) the handling of ancillary processes; and (iii) special technical considerations.

(i) Functional relationships between inputs and outputs. In order to develop functional relationships between inputs and outputs, it is first necessary to develop a suitable breakdown of the sector, industry, or industrial branch by unit productive activities. These are the most elementary units of technology that are being taken into consideration for the purposes of analysis. In simple cases, the unit activity may coincide with the industry or industrial branch; in more complex cases, it may be a subprocess, a process step, an operation, or any other logical unit. In addition, the unit activity may be defined at different levels of aggregation. For some purposes, for example, entire petroleum refineries may be represented by single activities, while for other purposes, they may be broken down into subprocesses like distillation, cracking, product blending, etc. Initially a level of aggregation consistent with data availability should be aimed for. It can then be considered at a later stage whether the levels of detail achieved in different industries are consistent with each other from the point of view of industrial development programming.

Secondly, input and output data are to be given in engineering units (not value units), in so far as possible. For some categories, data may not be readily available in other than value units: for example, in the chemical industries, such items as depreciation, maintenance, indirect production cost, etc., are generally available only as fractions based on other costs. Such value data may be used initially where data in the desired engineering units cannot be obtained by a reasonable expenditure of effort. The same situation might also arise with product assortments which are often expressed in the form of aggregates.

Third, functional relationships are to be established between productive activities, in accordance with variations in the following factors:

a. product quality,
b. the assortment of products produced jointly,
c. types (or composition) of raw materials or intermediate products,
d. proportions of basic productive factors, primarily labour and capital,
e. scale of production (time rate),
f. for noncontinuous production: lot size (seriality),
g. maturation period of investment.

(ii) Ancillary processes. In a number of industries, it may be convenient to restrict exact quantitative representation, at least in the initial stages, to the core of each process, and to give somewhat less exact, possibly qualitative, consideration to the ancillary processes required in production. The latter comprise the generation of utilities (steam, power), storage and inventory handling, transport within the plant, loading and unloading, maintenance, repair, general services within the plant (such as heating and lighting), laboratory services, external transport needs, and related social-overhead-type needs. In addition, consideration must be given to cost factors such as office, general and administrative expenses and sales expenditures, in so far as they can be readily assigned to individual productive activities. A great many practical problems always arise in this area, therefore, no generalizations are offered at this stage. The best approach differs from industry to industry.

As an illustration, in cost estimation for chemical processes the following ancillaries are given explicit consideration: supervision, maintenance, payroll overhead, equipment and operating supplies, indirect production cost, general office overhead, depreciation, taxes (local), insurance and interest.

Each of these items is estimated as a fraction based, directly or indirectly, on operating labour and on plant investment. These estimates are most readily available from United States engineering publications. The estimating fractions are given in the literature only as percentage ranges, leaving the selection of an appropriate figure to the judgment of the individual estimator. Thus, in generalizing this procedure to conditions in the under-developed countries, it is necessary to separate the technical estimating factors from the implied price relationships which are valid only for the United States. In other industries, similar problems arise.

(iii) Special technical considerations. In each industry, there are certain technical peculiarities which can at times upset even the most carefully prepared estimates. For example, careful general calculations based on local iron ore deposits, showing production relationships for pig iron, steel, etc., can be thrown off completely if the ore contains small amounts of certain coloured metals, such as nickel or chromium. Similarly, some chemical processes are very sensitive to water purity. A technical expert can spot these trouble sources at a glance, but it is often not easy to have him specify in advance what might be important for technical feasibility. Nevertheless, an effort has to be made to cover these aspects, in order to make the representation of technology suitable as a working tool for the general industrial development analyst and planner.

(b) Related estimating procedures. Under this heading, a number of important categories of information are summarised which are closely related to the representation of technology or to the use that is to be made of the technical/economic information. Ideally, it might be attractive that technology be represented in such a way that the physical inputs and outputs of each activity, when multiplied by their relevant local prices (market prices or opportunity costs, projected to the year of the plan) should give individual revenue or cost contributions expressed in local currency or in dollars. In practice,

however, it is often hard to define the relevant local price, and the reasons may be partly technical in nature. For example in the appraisal of caustic soda production by electrolysis the price of salt is vital; yet it is almost never possible in developing countries to start with the current market price, as this is based on an entirely different kind of operation from the one required to support a modern electrolysis plant. In other words, to estimate feasibility for soda, one has to look into salt production. Another example is the transfer of textile labour input figures obtained from one country, to conditions that are prevalent in another country: here the technological summary has to be complemented by an estimating procedure for productivity variation.

It is not possible to give a comprehensive list of problems to be handled under this heading. The following items will serve as illustrations:

(i) Estimation of prices for important raw materials and fuels. The most important factors affecting the supply of each of these has to be given, together with the input coefficient that is a part of the technological data. For example, the world price structure of fuels, the trend of fuel prices, and the effects which ocean shipping costs have on these, are not a part of the technological description, but in industries which are heavy fuel users, these factors play such a critical role in the entire evaluation of the industry that at least a sketch of a suitable approach, together with an indication of where complete information can be obtained, is indispensable.

(ii) Estimating procedures for labour productivity variation. Same general observations as above.

(iii) Estimating procedures for investment cost variation. This includes at least a breakdown of purchased cost and erection cost of equipment, and the cost of buildings, together with information on estimating procedures for determining the freight charges on items of imported equipment. It is also desirable to develop a detailed breakdown of equipment needs, in order to separate domestically procurable items from imported items.

3. Primary data sources at the level of the technical unit

The primary sources of technical/economic description for an industrial sector are found at the level of organization which in ordinary statistical usage is designated as the technical unit. Since at this level by definition there are no administrative records on which ordinary statistics could be based and since such statistics in any case do not cover the most essential aspect of technical/economic description, namely the identification of functional alternatives, we have to recur to two other primary sources: (a) engineering and managerial estimates, and (b) technical records.

(a) Engineering and managerial estimates. The technical unit can be defined for these purposes at several levels of aggregation, corresponding to the level of detail at which individual activities are to be represented. (See Section 2.) There is a natural hierarchical structure in productive activities where technical units at a given level work together and are served by common ancillary or overhead processes. For example, machines in a machine shop permit parallel activities and can be individually described; they also need common facilities including a structure, heating, lighting, etc. The common facilities may be treated as separate activities in their own right, but at times it is preferable to allocate their input among the units served. The machine shop itself may operate in parallel with casting, forging, assembly, etc. shops or divisions within a plant; all of these larger units then also draw on common ancillary or overhead facilities at a higher level, e.g., power or steam generating, fire protection, etc. At a still higher hierarchical level, entire plants working in parallel in a given area need common ancillary or overhead type facilities such as docks, railroads and roads, worker housing, etc. In predominantly private-enterprise and mixed economies, where these overheads largely occur at an organizational level higher than the individual enterprise, they are at times regarded as having an intrinsically distinct nature from lower-level overheads and are designated as "social" overheads. From a technical/economic point of view, however, there exists no essential distinction between overheads at different hierarchical levels and it is a matter of convenience in relation to a given analytical or planning task, at what level we break into this hierarchy for the purpose of defining unit descriptive activities.

There are two ways of utilizing engineering and managerial estimates for the purposes of technical/economic description. First, special inquiries can be undertaken by means of careful questionnaire surveys in relation to existing industries. Second, for the purpose of defining alternatives to existing practice, special prototype processes can be designed in sufficient engineering detail to yield the required data, but still at a broad enough level of generality to keep the expenditure of resources and effort within reasonable limits.

Questionnaire inquiries at the technical-unit level are sometimes undertaken to generate supplementary information within the framework of the more traditional type of basic industrial-statistical effort. The main difference between the emphasis of such statistical surveys and the inquiries needed for defining the alternatives that characterize the full potential pattern of production is that in the latter types of inquiries the main emphasis has to be on the exploration of functional relationships between key variables. In other words, the significant information is not just that a given technical unit uses so many manhours of labour of a given grade of skill, but rather how this changes with the size of the unit, how a substitution of lesser skills affects the amount and quality of output, etc. Therefore the questionnaires cannot be left to be filled out within the customary administrative or technical routine of an enterprise, but have to be administered by engineers or economists with special training and a significant degree of insight into the key questions of productive structure. In effect the administration of the questionnaires partakes to some extent of the nature of independent prototype design, since many questions about the functional relationships between the data go beyond the given practice and probe for variations around the existing technical design. For the same reason the most efficient way of building up a body of such information consists of a thorough integration of the questionnaire approach with the prototype design approach. The administration of questionnaires anchors the collection of meaningful alternatives to the empirical base of the existing productive structure, while prototype design assures the consideration of radically as well as marginally different alternatives.

(b) Technical records. An increasingly important new class of primary data on technical units is furnished by technical records. These can be in the form of production paper, e.g., records accompanying each workpiece to a chain of work stations in an efficiently run machine shop, or in the form of the readings of instruments, sensors, counters, etc., stored in graphical, digital, or other form. The amount of information contained in technical records is expanding at a rapid rate with the increasing rationalisation and computerisation of industries. Since the borderline between administrative and technical records is not sharply defined and since to an ever increasing extent administrative records themselves are also collected, handled, and stored in computer-readable form, the entire traditional approach to industrial statistics is bound to be profoundly affected by these new developments.

If the range of operations of the technical units under study is sufficiently broad to provide examples of most of the alternative kinds of technical possibilities, the analysis of technical records alone may yield an adequate set of alternatives for defining the potential patterns of production. Generally, some integration with prototype design is, however, still likely to be of importance.

(c) A note on the systematic use of technical data sources. It has been pointed out earlier (see Sec. E-3-c-i) that the systematic collection of technical/economic alternatives within an enterprise or other organisational unit such a Government operating agency is best viewed as a new, major planning function that has to be integrated with higher-level planning functions within the same entity, especially target setting and budgeting. In this light, the collection of technical/economic data becomes one component within a larger information and decision system all of whose functions have to be related to each other. This is obvious since the available information influences critically the fields within which a rational analysis of planning alternatives can be undertaken, while the need for better planning decisions in critical areas feeds back upon the improvement of the information gathering and processing function in relation to these critical areas. These issues are being increasingly recognised in all major organisations in industrially advanced countries where systematic planning decisions have to be undertaken as a continuing process, and a clarification of fundamental concepts and relationships

having to do with large decisions systems and the nature of information gathering, storage, retrieval, and processing are exercising an ever-increasing influence on the day-to-day operations of such organisations. The underlying theory is often referred to as economic cybernetics or general systems theory, while the pragmatic approaches built up around elementary applications of these concepts, especially in the United States, are referred to as Planning, Programming, and Budgeting.

In relation to particular developing countries, the problem of providing data for industrial analysis and planning cannot be left at the level of traditional statistics, but rather the need for the largest possible integration between the information-gathering, planning, and budgeting functions, both within Government organizations and enterprises, has to be specifically recognised.

G. A partial list of reference materials for industrial analysis and planning

This section contains an annotated list of reference materils that are frequently useful for purposes of preliminary orientation and for the filling in of gaps in the primary data for industrial analysis and planning in a given country.

1. United Nations materials

The United Nations produces such a broad range of documentation that it is often difficult to identify items of particular importance to a given study. The United Nations Documents Index does not contain complete lists of the documents of the Regional Commissions. However, all the Commissions except the Economic Commission for Latin America issue either monthly or annual lists of their complete output. The listings of the Economic Commission for Latin America are unfortunately incomplete. One good way of tracing items of importance to industrial studies is to review the documents lists contained in the summary reports of regional symposia, conferences, and meetings of the Commission. For example, a number of documents covering important aspects of the metalworking industry that have been issued only as ephemeral conference documents, can be traced by reviewing the documents list given in Annex III of Problems of the Steel Making and Transforming Industries in Latin America, Vol. 1. Report of the Sao Paulo Meeting, New York, 1958. Repositories of Regional Commission documents are maintainted at the Headquarters of these Commissions and also at the Regional Commissions Section of United Nations Headquarters in New York. While mailed requests for copies of out-of-print ephemera are usually ineffective, personal arrangements can often be made to secure facsimile copies of such documents from the depositories.

(a) Industrial development: general materials and general industries.

(i) Expert Working Group on Industrial Development programming Data, New York, 17-19 May 1961. Report in Industrialization and Productivity, Bull. 5. Papers on chemicals, petroleum refining, cement, food products, and metalworking. First two papers published in Industrialization and

Productivity, Bulletin 10; paper on cement included in Cement/Nitrogenous fertilisers based on natural gas, 1963. Metalworking papers unpublished; unique copies in UNIDO Documentation Unit, Vienna. This Working Group represented the initial effort in regard to programming data compilation.

(ii) United Nations Seminar on Industrial Programming, Sao Paulo, 4-15 March 1963. Report published, 1964; documents list in Annex II. Papers on methodology and the following industries: metalworking, chemical, pulp and paper, textile, food processing, cement, aluminium, steel.

(iii) United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas (UNCSAT), Geneva, February 1963. The monstre documentation (some 2,000 items) includes many studies of importance for particular industries.

(iv) Symposium on Industrial Development in Latin America, Santiago, 14-25 March 1966. Document list in Annex III of report. Important materials on basic metals, engineering, chemical, pulp and paper, and textile industries.

(v) International Symposium on Industrial Development, Athens, 29 November-20 December 1967. Comprehensive coverage of methodology and studies on individual industries. Many articles covering programming data for individual industries and problems of general industrial analysis and planning will also be found in the periodic Bulletins of the United Nations Industrial Development Organization, Industrialization and Productivity.

(b) Individual industries. References pertaining to individual industries are too numerous to be listed here.
Among the more important United Nations conferences and symposia covering individual industries are: Interregional Symposium on the Application of Modern Technical Practices in the Iron and Steel Industry to Developing Countries, Prague, 11-26 November 1963; Interregional Conference on the Development of Petrochemical

Industries in Developing countries, Teheran, 16-30 November, 1964; and the Inter-Regional Symposium on the Development of Metalworking Industries in Developing Countries, Moscow, 7 September-6October 1966.

The United Nations has also started publishing three series dealing with individual industries: Studies in Economics of Industry,[40] UNIDO Industrial Planning and Programming Series;[41] and The Manufacture of Industrial Machinery and Equipment in Latin America.[42] Important isolated industry studies include Labour Productivity of the Cotton Textile Industry in Five Latin American Countries, 1955, and La industria química en América latina (The chemical industry in Latin America), 1963.

(c) Patterns of industrial growth and general statistical materials. References on internationally comparable industrial census materials including commodity statistics have been cited in Section D. International analyses and comparisons based on these statistical materials are included among the former set of references. Two additional references closely related to this work are the following: H. B. Chenery, Patterns of Industrial Growth, American Economic Review, September 1960 (the original paper embodying the methodology of international comparisons of industrial growth, with detailed industrial data) and a revision of this work based on expanded statistical materials published by the United Nations under the title, A Study of Industrial Growth, 1963.

(d) Foreign-trade statistics. The United Nations Computation Centre in New York maintains detailed internationally comparable foreign-trade statistics on magnetic-tape files from which printouts tailored to particular purposes can be produced at will; these materials can also be processed by suitable computer programmes employing various statistical techniques as desired. A large

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40/ No.1, Cement/Nitrogenous Fertilizers Based on Natural Gas, 1963.

41/ No.1, Techniques of Sectoral Economic Planning: The Chemical Industries, 1966.

42/ No.1, Basic Equipment in Brazil, 1963.

series of printouts in standard format based on these files has already been published. Unfortunately, industrial production statistics in similar computer-readable, internationally comparable, detailed format are not yet available. Foreign-trade statistics and related data will also be found among the extensive materials of the United Nations Conference on Trade and Development.

(e) Country studies. The United Nations Economic Commission for Latin America publishes the series, Analyses and Projections of Economic Development, which includes several major studies. Of especial importance for industrial development is No. VI. The Industrial Development of Peru, 1959, which contains projections based on an inter-industry analysis and detailed industry-by-industry studies of domestic production and import substitution possibilities. In many ways this volume can serve as a paradigm of industrial development studies based primarily on traditional (non-technical) sources.

The International Bank for Reconstruction and Development also has a series of country studies that contain much information, primarily of a descriptive-statistical nature, on individual industries.

(f) Technical Assistance reports. These pertain largely to individual industrial development projects investigated by experts of the Bureau of Technical Assistance Operations. Some of the reports have a broader range and may cover an integrated programme of industrial development. An example of the latter is A Proposed Industrialization Programme for the State of Singapore, with Annexes on shipbuilding, metalworking, electrical and chemical industries and industrial parks. Many of these reports are restricted and/or out of print. A complete set of reports is maintained on deposit at United Nations Headquarters.

2. United States Government and related materials

The body of United States Government and related publications that are in one way or another relevant to industrial development is as voluminous as the United Nations material. In some cases there is a doubt whether a particular set of references should or should not be included under this

heading: for example, the Harvard Economic Research Project is not a Government agency, but its inter-industry research is closely related to similar research performed within United States Government agencies; therefore it is bracketed with the latter. Similarly the National Planning Association has recently issued capital input coefficients that are closely related to earlier work by the Bureau of the Budget. Here again the decision has been to include this material under the present heading.

(a) Materials issued by the United States foreign aid programme. This continuing programme has operated under a series of designations and acronyms: Point Four Programme, Mutual Security Administration (MSA), International Co-operation Administration (ICA), Foreign Operations Administration (FOA), and Agency for International Development (AID). The main classes of documentation that are connected with industrial development are the following:

(i) Industry Fact Sheets; Industry Profiles. These Fact Sheets are issued in loose-leaf form by the Communications Resources Division of the Agency for International Development. Each Fact Sheet refers to a four-digit industry under the United States Standard Industrial Classification (SIC) and besides providing a product description, covers the following aspects:

a. Financial evaluation of investments. A descriptive discussion of principal requirements for successful operation.

b. Market aspects. This covers: sales channels and methods; geographical extent of market; competition; and market needed for plant as described in the Fact Sheet.

c. Production requirements. On the basis of stated annual capacity and stated operating characteristics (e.g., one-shift operation) the following cost figures are provided for typical United States conditions:

— Capital requirements. Fixed: land, buildings, equipment, furniture, and fixtures. Working capital.

-- Materials and supplies. Direct materials; supplies; note on availability of materials and supplies.

-- Power, fuel, water.

-- Transportation. Own transport; external transport facilities.

-- Manpower. Direct labour; indirect labour, note on training needs.

-- Total annual costs and sales revenue. Summary of cost data; revenue based on needed market.

4. Plant layout and work flow. Designates main items of needed equipment by name and at times by capacity; designates work flow by arrows.

This is generally a highly valuable reference for preselection and orientation purposes. Its limitations are the following. First, it is not comprehensive in industry coverage nor consistent or complete in input classification. Second, it tends to focus mostly on small-scale and simplified industrial operations that do not represent current best practice in the United States and may involve a built-in obsolescence. Third, it works with costs rather than with physical input figures. Fourth and most important, it does not provide a functional relationship between available alternatives with regard to size, raw materials, mechanization, etc.

(11) Studies of individual industries. A large number of industry studies, covering a broad range of detailed industry classifications, are available. They are of varying depth and quality. The following are the main series:

a. Case Study Data on Productivity and Factory Performance. Prepared by the Bureau of Labor Statistics of the United States Department of Labor for the Foreign Operations Administration, Industrial and Technical Assistance Division, 1951-54. Typical industries covered: Mens' dress shirts, wood furniture, brick and tile. These

are extensive reports on case studies of United States firms engaged in typical operations of each particular industry. Equipment and operating practices are described in sufficient detail to enable users to judge the short-comings of their own operations in regard to productivity. The reports are aimed primarily at European firms.

b. Small Industry Series: Cottage Industries Bulletins. Prepared for the Office of Industrial Resources, International Co-operation Administration, 1953-56. These reports survey the markets and potentialities of handicraft and manual industries in a number of countries including India, Indonesia, Greece, and Lebanon.

c. Operational Data Series. Prepared for the Technical Aids Branch, Office of Industrial Resources, International Co-operation Administration, 1956-58. These reports give detailed illustrated descriptions of operating equipment and practices and representative cost figures for a number of detailed industry categories. The average report has a length of 30-40 pages. Typical industries covered are: block ice making, rice bran oil, small leather tannery. This series is largely subject to the same reservations as mentioned in connexion with item a.

d. Plant Requirements Series, revised, 1959. Same issuing office, format, length, coverage, and (largely) contents as item c. above.

e. Capital Requirements, Techniques, and Operations Series, 1956-57. Contents not much different from item c. and d. above. Same comments.

f. Technical Inquiry Service Series. Prepared for Office of Industrial Resources, International Co-operation Administration, from 1958. Same comments as item a.

(iii) Project Data File. The Office of Industrial Resources of the Agency for International Development, in co-operation with the United States Department of Commerce, maintains a set of Project Data File Cards that are available in the Department of Commerce field offices in the United States. Backing each card is a large report with a complete description of the project, maintained on deposit in the Washington office of AID. The purpose of the Project Data File Cards is to provide summary information on each project, as an aid for the operations of United States private businesses abroad.

(b) United States Census materials. These materials are often used for orientation and preselection purposes in developing countries. The data contained in the Census can be used to define approximate minimum ranges for plant size in specific industries on the basis of the number of employees, to quantify approximate capital/output and capital/labour ratios in detailed industrial classes; to rank industries by intensity of raw material, fuel, labour, capital, and other expenditures; and for a great many other analytical purposes where some aspects of the experience of a highly industrialised country are held to be relevant or transferable to a developing country. The materials of the United States Census are superior in this respect to the comparable materials of other industrialised countries, since the industrial census series in the United States go back unbroken to the early nineteenth century and thus antedate regular censuses of most other industrialised countries by many decades. The developmental trends experienced by the United States in an earlier stage of its development are to some extent relevant to countries that are to-day in comparable stages of their growth; and by the same token, the present structural patterns and levels of living of the United States are often set up as targets of development by some of the developing countries. The regular publication schedule and easy accessibility of United States Census materials adds a further incentive to their widespread use as standards of

reference for industrial development. Much of the raw material of the Census is now on machine-readable magnetic tapes that, by arrangement with the Bureau of the Census, can be subjected to a wide variety of individualised manipulations by means of suitable computer programmes. As mentioned in Section E-2-a-1, such programmes may utilise confidential primary information provided that the final output does not disclose such information.

(c) Inter-industry materials. The major effort in this field, prior to the publication of the 1958 Study of Interindustry Sales and Purchases by the Office of Business Economics, United States Department of Commerce was the Interindustry Relations Study for 1947. This study involved the construction of a 450x450 working table aggregated to a final 200x200 matrix. There is an extensive body of documentation backing up the study, parts of which have been published in scattered form, while other parts are available only as internal working documents.[a/] The Harvard Economics Research Project at Harvard University is a depository for these as well as a great variety of other inter-industry materials.

(d) Capital coefficients. The work on the compilation of capital coefficients was started in connexion with the 1947 interindustry relations study, but has in the meantime acquired an independent momentum of its own. The original document by R. N. Grosse, Capital Requirements for the Expansion of Industrial Capacity, was based on Government records of investments during World War II and the Korean "emergency period". This volume, embodying detailed breakdowns both by industry of origin and industry of destination, was first issued by the Bureau of the Budget in 1953 and was reprinted

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a/ For references, see the three interindustry bibliographies and other references cited in Sections B-1-b and B-1-c. The entire 1947 study including unpublished materials (which are listed in a bibliography) has been surveyed in W. R. Bailey, An Appraisal of Input-Output Analysis based on a Documentation of the Interindustry Relations Study of 1947. George Washington University, Logistics Research Project, Document Serial T-185, 6 June 1956.

in 1964 by the Research Analysis Corporation of McLean, Virginia. The material in this compilation is by now seriously out of date, and contains significant inconsistencies, errors, and omissions. It has been superseded by a new compilation prepared by the National Planning Association (NPA), a private research institution. This volume, entitled Capacity Expansion Planning Factors - Manufacturing Industries (by R. M. Waddell, P. M. Ritz, N. J. Bew, and M. K. Wood, 1966), gives ratios of fixed capital to annual output capacity and detailed capital cost breakdowns (in terms of 1963 United States prices) by 289 individual input items and 7 groups of modules, covering equipment, buildings, auxiliary facilities and construction labour, for 252 industry groups.

(e) Department of Labor, Bureau of Labor Statistics. This Bureau compiles a great many primary statistics in the field of labour and is also involved in inter-agency economic research projects. Among recent publications is Industrial Profiles 1958-1965 (1967) which contains time series for industry broken down by four-digit SIC class, for 8 variables concerning employment, wages, value added, value of sales, capital expenditures, and 8 analytical ratios formed from the former variables.

(f) Department of Commerce, Joint Publications Research Service (JPRS). This is a remarkably comprehensive translation service for materials covering primarily scientific, technical, and economic references published in countries with centrally planned economies, and as such a great boon to persons who are not able to read these materials in the original languages. The sources include technical books, journals, trade papers and newspapers. The translations are available from the United States Department of Commerce and are listed in the United States Government Catalog of Publications. They are also available on micro-cards in a number of depository libraries around the United States, for example in the New York Public Library (United States Government documents collection in the Economics Division).

(g) Other United States Government and related materials. Substantial continuing research is carried on in a number of United States Government agencies, inter-agency research programmes, and State and municipal Governments in connexion with two major areas of interest. The first is a comprehensive economic model for the country as a whole whose purpose is the exploration of major structural changes. The second is the construction of Planning, Programming, and Budgeting systems for Federal Departments and State and local Governments. Most of the resulting materials are not being published, but the techniques of investigation and the basic components of the new informational universes that are now being opened up will sooner or later find their way into the public print, thereby contributing greatly to available reference materials for the planning of industrial development.

3. Materials from countries with centrally planned economies

As discussed in Section B-3-c-ii, publications in these countries are often valuable sources of reference with respect to technical and economic data that would be subject to limitations of commercial secrecy in countries with predominantly private-enterprise and mixed economies. Extensive English translations of these materials are available (see Joint Publications Research Service, Section C-2-f); also, a comprehensive collection of publications in the original languages is provided at the Library of Congress in Washington, D.C.

In countries with centrally planned economies very extensive collections of technical norms are compiled for planning purposes. These norms, both at the enterprise level and at the national planning level, would constitute an outstandingly valuable source of reference for the developing countries if they could be made conveniently available for their use.

Only a small part of planning norms is ever published.[hh/] There might be

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hh/ For example see J. Fekete, L. Nemes, I. Rudy and T. Rigler, Anyagfelhasználási normák a gépiparban (Material input norms in machine building), Közgazdasági és Jogi Könyvkiadó, Budapest, 1956.

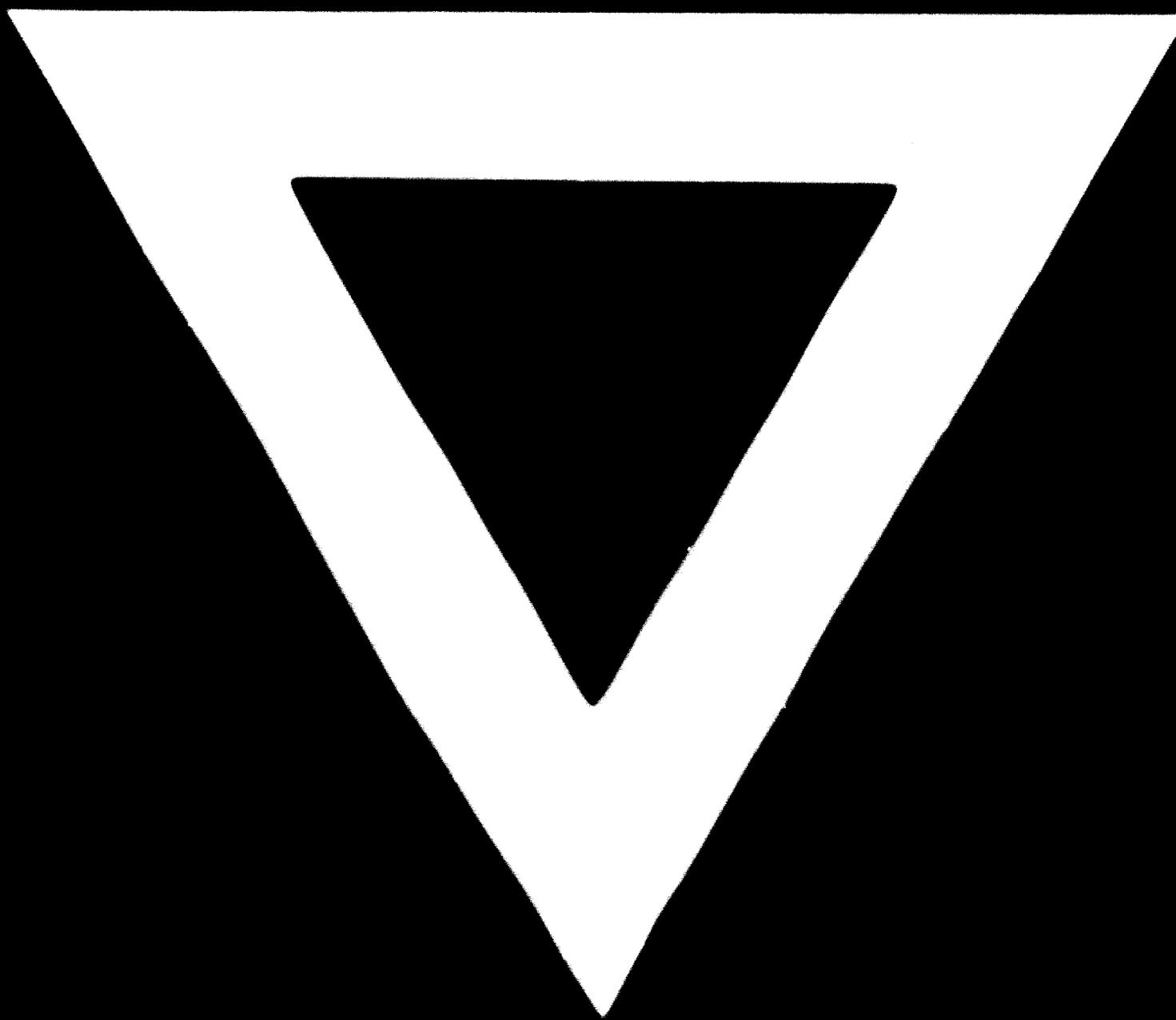
restrictions on the publication of such norms that have their origin either in security considerations or in a parallel to commercial secrecy that is due to international competition, but these are probably minor obstacles compared with the main impediment, namely the sheer bulk and constant change characterising this universe of information. In one of the Eastern European countries a centralised depository of norms reportedly consists of shelves extending over all the walls of a large room. The taks of distributing and keeping up to date an informational universe of this size would certainly require modern information processing techniques consisting at the very least of micro-card storage, and preferably of computer-readable data files stored on magnetic tape.

4. Other published sources

The three informational universes discussed in the preceding sections are illustrative of the variety of available reference sources. Information from Government sources other than the United States and countries with centrally planned economies have not been mentioned, nor has the extensive body of reference material been detailed that is available from the Organisation for Economic Co-operation and Development (OECD), the European Coal and Steel Community, EURATOM, the Food and Agricultural Organisation (FAO) and a number of other international organizations. The documents lists of these Governments and Organisations should be consulted for guidance.

There is also ample material in scattered private publications that cannot be reviewed here in detail. A number of sources on industrial economics and industrial planning, some of which include detailed descriptions for several industries, are listed in "Preliminary Bibliography for Industrial Development Programming", published in United Nations, Industrialization and Productivity, Bulletin 5. The International Bibliography of Economics, published annually by the United Nations Educational, Cultural, and Scientific Organisation (UNESCO) provides world-wide coverage of the periodical literature. The Index of Economic Journals (Irwin, Homewood, Ill.) and the Journal of Economic Abstracts of the American Economic Association likewise cover a wide range of economic references. A list of doctoral dissertations in economics, among which there are occasional excellent industry studies, is published annually in the September issue of the American Economic Review. Further references to industry studies will be found in E.E. Hagen, Handbook

of Industry Studies (The Free Press, Glencoe, Ill., 1958) and W. Isard et al., Methods of Regional Analysis, an Introduction to Regional Science (Wiley, New York, 1960).



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