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Distr.
RESTRICTED

UNIDO/IO/R.233
28 April 1986

ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

GUIDELINES FOR INDUSTRIAL PLANNING IN DEVELOPING COUNTRIES: BASIC PRINCIPLES AND PRACTICES*

Prepared by
Industrial Planning Section
Division of Industrial Operations

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V.86-55994

Preface

For a great number of developing countries the knowledge of how to formulate and implement industrial plans conducive to industrialization under the prevailing socio-economic conditions has become increasingly urgent. The experience of developing countries in industrial planning is rich in successes and provides together with those of developed countries a sufficient background for the preparation of appropriate guidelines for industrial planning in developing countries.

Drawing on these experiences and based on the results of technical co-operation activities carried out by UNIDO in the field of industrial planning, the Guidelines aim at enhancing the capacities and capabilities for planning and formulation of industrial policies and strategies in the developing countries.

The Guidelines focus on issues of industrial planning in developing countries and on the methodologies of industrial planning necessary for the formulation of realistic plans in developing countries, on the one hand, and the appropriate organization necessary for the elaboration and implementation of industrial plans in these countries, on the other.

Clarity of planning concepts and procedures on the one hand and the strengthening of national skills and institutional capabilities on the other hand are crucial requirements for the efficient allocation of available resources and over time for bringing about a process of self-sustaining industrialization and growth. Planners and those engaged in implementation stand to promote national objectives and consequently the responsibility which they face is challenging for it is they that should trigger the motive force of industry even though the problems appear immense and intractable in a global environment of economic crises, rapidly advancing technology and changing patterns of industrialization.

UNIDO's experience shows that industrial planners in developing countries continuously face the challenge of a multidisciplinary approach required for preparing industrial plans, formulating appropriate policies and implementing the different phases of the plan. The industrial planner has to consider complex socio-economic problems and organizational procedures for the elaboration and implementation of the industrial plan. Moreover, profound technological and economic knowledge is required for formulating consistent industrial plans. The complexity of the tasks continuously increases as the industrialization process advances with increased diversification of output and specialization and integration of production capacities.

Moreover, UNIDO found that due to the increasing complexity of this multidisciplinary exercise, individual industrial planners specializing in one activity are susceptible to welcoming basic knowledge in other related disciplines of industrial planning. This publication provides basic knowledge on those industrial planning principles and practices which have successfully been used in different countries and proved to be useful for the preparation and implementation of industrial plans. The Guidelines therefore neither substitute the knowledge contained in numerous textbooks on the subject, nor attempt to describe the most advanced theories on the methodologies and technical procedures which have not yet been broadly accepted in practice. Moreover, no one single solution is proposed for each individual step required for the preparation and implementation of industrial plans.

These guidelines are presently being addressed to planners, economists, administrators and engineers concerned with the preparation and implementation of industrial plans in developing countries, as well as technical assistance experts in the field of planning for their information and views.

Acknowledgement

The Guidelines were prepared based on contributions of consultants and experts. The draft of the Guidelines was prepared by Issam A. Sharif, UNIDO consultant, drawing on vast literature available on the key issues involved, the preliminary first draft prepared by S. Mohnot, UNIDO consultant, the contribution of the international experts and the staff of UNIDO as well as UNIDO's experience in the field of industrial planning.

In addition, valuable contributions were made by the following international experts who participated at the Expert Group Meetings on Industrial Planning in Vienna, 1 - 5 November 1982 and in Kiev, 21 - 25 May 1984: Fuat Andic (USA), Martin Breetzmann (GDR), Gerard de Bernis (France), Iehirou Inukai (Japan), S. Mohnot (India), G.K. Shirokov (USSR), K. Vencatachellum (Mauritius) and Vladimir Zerjavic (Yugoslavia).

Comments were also received from various substantive units of UNIDO which were thoroughly reviewed at an in-house seminar held at UNIDO Headquarters, on 4 September 1984 with the participations of Professors Gerard de Bernis of the University of Grenoble, Fawzi R. Fahmy of the Institute of National Planning of Egypt and A. Smyshlyaev of the International Institute for Applied Systems Analysis (IIASA). Appreciations are expressed to all these individuals.

The finalization of the Guidelines have drawn heavily on these contributions. The responsibility for the final version however rests on UNIDO and particularly the Industrial Planning Section of the Division of Industrial Operations.

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In general, the Guidelines are arranged in such a way as to facilitate their use as a practical reference work on industrial planning for people concerned with such planning in developing countries, on the one hand, and a textbook for UNIDO's training programmes on industrial planning on the other. Considerable attention has been given to problems of plan formulation. But because problems of implementation have been found to be most intractable in the planning experience of most developing countries, equal emphasis has been given to them. The role of the industrial private sector in the planning process of developing countries has also been covered.

Although theoretical points of view are presented for the topics covered, the approach in the Guidelines is essentially based on practical observations. Wide discrepancies between theory and practice were frequently encountered. In some cases the conclusions required proposals for changing the planning practice in developing countries, but in others it was more appropriate to work out some adjustments in the theory to suit the conditions of the countries concerned.

Although every effort has been made in the Guidelines to provide practical reference to the people engaged in planning in developing countries, it is not intended to reduce this document to a series of mechanical procedures, because industrial planning represents socio-economic decisions and the problems connected with it are so diverse as to allow simplistic mechanical procedures.

The Guidelines comprise six chapters: the first one lays the substantive foundation for the process of industrial planning and discusses the problems peculiar to industrial planning in developing countries. Chapter II deals with the problems of the establishment of an industrial planning process in developing countries, constituting an integral process of plan preparation and implementation. Chapter III presents a discussion of the industrial plan strategies in developing countries with the aim of ensuring the most rational utilization of available resources for industrial development. Chapter IV

deals with the main problems and informational pre-conditions of the elaboration and follow-up of industrial plans in developing countries. In Chapter V, basic tools of industrial planning have been introduced: and Chapter VI presents in a simple way the various steps required for the preparation of industrial plans in developing countries.

I. INTRODUCTION TO INDUSTRIAL PLANNING IN DEVELOPING COUNTRIES

1. Development planning concepts

The term "development planning" is often given varying shades of meanings in the literature on economic planning. Most of them view planning as a subjective process, in which the government directs the economy to influence the rate of growth. Occasionally, the term "development planning" is used to refer to any governmental activity intended to regulate some aspects of economic life. It is true that development planning presupposes a government involvement in economic activities, but it is certainly more than this. Attempts by the government to regulate the economy reflect the need for planning, but do not necessarily ensure a successful implementation of national plans or result in substantial benefits.

Socio-economic development in the current circumstances of the large majority of developing countries cannot occur spontaneously, nor by the government introducing policies to regulate some aspects of economic activities. This calls for the introduction of principles of planning in developing countries which reckon with the objective behaviours of different social forces and economic laws and attempt to combine the main economic variables in a way which will achieve voluntary and realistic objectives during the designated plan period. The state of no planning or of ignoring the objective aspect of economic factors in the plan usually causes further complications, bottlenecks and rigidities within the national economy. For example, failure to relate investment expenditures to physical resources during plan implementation leads to imbalances and bottlenecks which ultimately have a depressing effect on the economy, with a resultant low rate of growth.

Identification of the objective aspects of social and economic factors is of great significance for understanding the complexity of the process of production on the basis of which an efficient allocation of scarce resources could be made.

Definition of development planning and industrial planning

Taking these considerations into account, we can define "development planning" as a conscious activity exercised by society, and organized by the government, in compliance with ex ante identified objective behaviours of the main social and economic factors with the aim of guiding the national economy towards a steady and sustained socio-economic progress in the long run, in order to increase the level of satisfaction of the needs of the population, on the basis of a rational allocation of the country's labour, natural resources, financial resources, fixed assets, materials and energy.

Industrial planning is, in fact, the part of this activity which focuses mainly on the development of the industrial sector and its linkages with the other sectors of the national economy, as well as all processes required to organize and intensify the progressive transformation of all socio-economic structures through the introduction and adaptation of modern industrial production technologies.

2. The scope of industrial planning 1/

The process of comprehensive national planning deals with various levels of planning problems, e.g., with the economy as a whole; with particular sectors of economic and social activity; and with sub-sectors or branches

1/ The present Guidelines are basically confined to the sectoral planning for the manufacturing industry. However, an account is taken of the interlinkages with the other relevant sectors and sub-sectors of the economy.

thereof. The first of these levels involves the study of broad economic issues and goals, such as economic growth, population, employment and income distribution. The issues are defined and the goals and the approaches set by a national economic plan.

Sectoral planning encompasses both productive, economic and social activities: for example, the industry as a whole, specific industry groups and branches, commerce, communications, agriculture, housing, social facilities and other social and material services. For planning purposes, some of these sectors are subdivided to permit a more explicit analysis of sub-sectoral problems.

The national plan provides the perspective for and defines the objectives and the role of all sectors of the economy in the process of development, on the basis of a distribution of available financial resources, the labour force and natural resources, as well as the co-ordination of all sectoral targets. A national plan, therefore, in whatever depth, sets the framework for sectoral planning. Thus, in order to facilitate final co-ordination of targets within the national plan, an industrial plan should define forward and backward linkages of the industrial sector with the remaining sectors of the economy, such as agriculture, construction and mining.

3. Types of development planning

Development planning in the centrally planned economies differ substantially from that in mixed economies. The former is usually referred to as "Directive Planning", and the latter as "Indicative Planning".

(i) Directive planning

Directive planning is applied in countries which do not practice market economy. It is a detailed and centralized planning system of resource allocation and production based on a quantitative reconciliation of needs and available supplies and on the basis of balances and of an input-output analysis reaching down to every industrial enterprise and collective farm.

Under directive planning, the state controls, mainly through regulations, directives and incentives, the level of saving, of consumption and investment as well as the structure of prices. The central planning body is responsible for the preparation of the plan on the basis of the participation of the operating ministries, enterprises and relevant institutions in plan elaboration and setting of targets at different levels. The approved plan becomes law and has to be followed by the implementors of the component activities. Thus plan preparation is based on the informational inputs and expertise at varying hierarchial levels. Although political authority for the plan is vested in the final decision maker, in practice all the decisions are to be taken on the basis of iterative technique among various levels of the planning hierarchy:

What and how much is to be produced?

How is it to be produced and where?

What inputs and what sources (investment and operating) are to be used?

What are the technologies and from what sources are they to be employed?

How is the output to be distributed - including interactivity transfers?

Finally, it should be pointed out that there does not exist a "pure" system of directive planning. For example, in the directive planning system, indicative elements expressed in the form of various incentives, such as wages, taxes, prices, subsidies and moral incentives are also used.

(ii) Indicative planning

"Indicative planning is the use of policy determined targets to co-ordinate private and public sector investment and output plan. Decision making remains decentralized but sectors of the economy are encouraged to meet agreed targets. A major rationale of indicative planning is improvement in the flow of information within a market economy, and reduction in the uncertainty surrounding decision-making." 2/

2/ The Dictionary of Modern Economics. General Editor. David W. Pearce Macmillan Reference Books, 1983. P.204

A plan under indicative planning sets out the desired objectives, which are mainly not mandatory. Prices are determined primarily by market forces and the state regulates mainly through policies, incentives and other promotional measures. In the course of implementation, deviations from targets occur due to the influence of market forces under which indicative planning is practised. These deviations call for more frequent readjustments if serious imbalances are to be avoided or corrected.

In mixed economies, which characterise economic activities in practically all developing countries, indicative planning has a measure of directive aspects. The plan could be binding on the public sector where the government has varying degrees of control, but not on the private sector. Then, economic policy measures are mainly relied upon to influence the size and composition of private investments. For example, the French plans have been called mandatory in the public sector and indicative in the private sector. The Director General of the French Commissariat Générale du plan has been able to express this as follows:

> "French planning can be said to be less than mandatory and more than indicative. It can reasonably be defined as active planning." 3/

In comparing planning in developing countries and developed countries under indicative planning, several similarities and at the same time substantial differences will be found. In general terms, the main similarities lie in the fact that both practise market economy on the one hand and use the public policy instruments of government to influence the pace and direction of the economy through planning on the other. The main differences, however, lie in the objective function of planning. While in the developed market economy countries planning is considered necessary to avoid economic crises, in developing countries, on the other hand, it is a precondition for industrialization. In the former the main function of planning is rather to

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3/ Massé, Pierre, Planning in France. Planning Papers read at the Business Economist Conference at New College, Oxford, London, Business Economists Group 1962. April 5 - 8, 1962. P. 17.

maintain the overall balance between supply and demand. In the latter its main function is to restructure the productive forces, to expand the industrial sectors and introduce modern technologies into agriculture, constructions and other activities of the national economy.

Consequently planning approaches and instrumentals differ. The plans in the developed countries are mainly a forecast of global economic trends and recommendations on the adoption of some government policies for achieving economic stability in an economy with a dynamic private sector. Plans in the developing countries are instruments for industrialization.[4/] They must be based on principles which ensure the introduction of structural changes. For example, it is logical that if a developing country decides to introduce national key projects of basic industries, the planner must decide on the rate of investment, choose the appropriate technology and fix the prices of the products. These prices could, of course, differ substantially from those prevailing under unrestricted market conditions to permit infant industries to establish themselves.[5/]

(iii) Choice of planning system for developing countries

The choice and thrust of planning are determined by the degree of influence and control that government could exercise on the economic agents to meet the needs of the community at large. Where the economic agents are under the control of the planning authority then national objectives are met through a planning process which centrally allocates resources and implementation responsibilities. Where this is not the case, government would have to resort to suasion to influence economic agents to meet plan objectives by means of suitably designed economic policies, such as legislations, regulations, subsidies, incentives, taxes, customs duties and monetary policy.

4/ There is a significant distinction between industrial growth and industrialization. This problem will be dealt with as the discussion proceeds.

5/ "The unrestricted play of market forces is not the most suitable means of promoting industrialization on a world scale nor of achieving effective international co-operation in the field of industry..." (Lima Declaration and Plan of Action, Point 42).

Planning experience in a large number of countries in which the state owns some public enterprises under conditions of market economy show that even firms owned by the state cannot be put under effective governmental control. In these countries the managers are able to maintain a kind of concrete autonomy toward government: for example, if the manager is politically powerful or in cases where the plant is in a remote area or where the engineering capacities are at the disposal of the enterprise. Moreover, even in countries which do not practice market economy it is not possible to control all productive activities. For example, it is almost impossible to control peasantry and handicrafts. It is of extreme significance, therefore, that the planning authority in a developing country realistically assesses the degree of control or influence it could exercise over economic agents to ensure their full participation in the planning process and identify the sufficient and necessary conditions for implementation of plan targets.

Identification of the areas where government could exercise control or influence will permit to assess the following consequences of the planning process with respect to the division of plans:6/

(a) The part of the plan concerned with those activities of the economy that are owned and possible to be completely planned by the government will be "directive". "Directive" does not mean authoritative from top to the bottom. It is desirable that adequate procedures should be exercised to permit managers and workers to participate in the process of plan elaboration so as to ensure commitment on their part for plan implementation. This part of the plan is of extreme significance, since it usually constitutes the key production capacities in a great number of developing countries on the one hand and the only part which can virtually be implemented on the other. It should also be pointed out that the level of plan implementation of the other parts of the plan depend on the successful implementation of this part.

(b) The part of the plan concerned with those activities of the economy which are owned by the government but difficult to control will be "semi-directive" for it cannot be "directive" in the same sense as that indicated earlier. Here the government could use the means at its disposal in

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6/ The idea of dividing the plan was initially introduced by Professor G. de Bernis of the University of Grenoble. This has significant implications for improving plan preparation and implementation in developing countries as we will see in the following chapters.

order to foster better plan implementation. For example, the government can attribute or withhold funds, especially foreign exchange; it can persuade the workers or offer them incentives thereby exercising pressure on managers to fulfill the plan targets.

(c) The part of the plan concerned with the activities of the private sector will be "indicative". Here, the planning body can set specific objectives which are expected to be realized during the plan period following consultations with the private sector especially in regard to medium- and long-term plans. Therefore, the government could use all means at its disposal to direct the activities of the private sector towards achieving these targets, including licensing of new enterprises. Other inducements include:

- Investment in the infrastructure greatly determines the location of different economic activities;
- Price and taxation policies enable the government to encourage or discourage different activities to the extent required;
- Credit and customs policies are also decisive in encouraging desired activities to the necessary levels.

Taking into account the complexity of the planning process, it is evident that no state in the world is able to control all productive activities. Nor is there any country fully devoid of any element of state controlled or state-owned activity. It follows that any plan can only be a mixture of "directive", "semi-directive" and "indicative" elements. The proportion of the "directive" and "indicative" elements is dependent upon the existence of different ownership forms within the economy, on the one hand, and the extent to which the government can exercise its control or influence over the sector concerned, on the other.

What are the differences between the "directive" and "indicative" elements of a plan?

(a) These elements do not differ with respect to qualitative and quantitative aspects. All elements of a conerent plan have to obtain the same degree of realistic planning procedures, such as targets, means for realization of deadlines, without which no plan consistency can be established.

(b) The differences between these elements exist on two levels:

1. The preparation of a plan requires from the planning authority the organization of negotiations with both private activities and those state-owned activities which are difficult to control. Specific procedures of consultation with peasants, handicraftsmen and small enterprises are also required.

2. Proper plan implementation requires incentives and measures for private sector enterprises, and to some extent for those state-owned enterprises which are difficult to control.

4. The role of industrial planning in industrialization

(i) Industry and economic growth

Rapid economic growth is a relatively modern phenomenon. Prior to the industrial revolution the rates of growth of the economies changed slowly over long periods of time with very little development and not devoid of setbacks due to incidences of wars, diseases or natural calamities. In a much quoted essay, called the Economics of our Children, Lord Keynes once said:

> "From the earliest times of which we have recorded... down to the beginning of the eighteenth century there was no very great change in the standard of life of the average man... ups and downs certainly. Visitations of plague, famine and war. Golden intervals. But no progressive violent change... This slow rate of progress was due to the remarkable absence of important technical improvements and to the failure of capital to accumulate."

The coming of the industrial revolution, with its mechanical power and factory production, continuous technical change and accumulation of capital changed all that. As a result, the national income of the industrialized countries since the industrial revolution measured by per capita income increased by leaps and bounds.

(ii) Industrial growth

Industrial development is an integral part of economic development. It is, in fact, subservient to the latter and its success lies in the extent to which it serves the basic socio-economic objectives. Industrial growth by itself (number of plants and number of wage earners) is not an end in itself, nor can it necessarily be an indication of a successfull industrialization process. In dualistic economies, where the modern sector has little relationship with the domestic sector, it is possible to achieve industrial growth without development. The spread effect or trickle back benefits are negligible because of internal structural rigidities, the external locus of decision-making with regard to finance, markets and technology and inappropriate use of the factor proportion endowments of the developing countries in production. Industrial growth within such an economic enclave might also adverserly affect the traditional sector, food production and the environment. The main purpose of industrial planning, therefore, is to ensure that growth takes place hand-in-hand with development and that the industry sector play its assigned role for bringing about and sustaining a process of socio-economic transformation in the developing countries.

(iii) Industrialization

In order to draw clear distinctions between industrial development and industrial growth in developing countries, the following five basic and inter-connected questions have to be answered:

1. Who makes the production decisions?
2. What is to be produced?
3. For whom is it to be produced?
4. How is it to be produced?
5. Where is it to be produced?

The aim of industrialization is to raise the standard of living of people by means of increased domestic production of consumption, intermediate and capital goods thereby bringing about an expanding circuit of incomes, markets,

technology and employment [7/]. This calls for a careful assessment of resources, potentials and constraints, to formulate strategies; and to draw up industrial master plans to guide investments in productive facilities and support services including training within predefined time horizons. If the above questions are kept in mind in the planning process, then it should be possible over time to produce locally what is consumed locally and at the same time raise the domestic import capacity to consume what is not locally produced through an equitable trade system.

There is common agreement that industrialization is the only way of extricating developing countries from poverty and backwardness. This is because industry creates by far the best conditions for the efficiency of the whole economy, the volume of national income, the tempo of economic growth through enhanced capacity for domestic savings. With the help of industrialization, an extensive diversification of the pattern of the economy could be introduced utilizing modern technologies and techniques of production in various sectors of the economy. For example, the modernization of the agricultural sector could be brought about by the supply of agricultural and irrigation equipment, transport facilities, fertilizers and pesticides; and the modernization and expansion of infrastructures by the supply of transport and communication equipment and construction materials. Thus, industrialization does not only mean development of the manufacturing sector, but also through the introduction of industrial means of production into other sectors of the national economy, an increase of labour productivity in all other activities.

7/ "In formulation of industrialization plans and strategies ... social justice should be a guiding factor in achieving the objectives of raising the living standards and eliminating extreme social disadvantages and unemployment, particularly among young people. To this end, proper industrial development should permit such growth as is required for economic development. ... The equitable distribution of the benefits of industrialization among sectors of the population;" (Lima Declaration and Plan of Action, Point 58 (b) and (d)).

Finally, a country becomes industrialized as from the moment when (1) a certain degree of industrial self-reliance has been achieved; (2) the basic needs of the population have been satisfied by enhanced capacity for production and trade[8/]; and (3) a significant part of its economy and social structure has been transformed by a pattern of industrial production with strong internal linkages.

(iv) The role of industrial planning in the developing countries

In quite general terms, the introduction of planning principles provides an effective basis for identifying clearly the objectives and quantifying the targets of development; concrete ways and methods for achieving them; and mobilizing the resources required for both current and long-term development. Industrial planning, in effect, provides the means for fostering industrial development. It makes possible the clear definition of the optimal industrialization over time based on a nation's own efforts, supplemented by external inputs as well as the policy instruments and mechanisms required to achieve pre-defined objectives. It is these that constitute the very object of "industrial planning" in developing countries.

8/ "Basic needs as understood in the programme of action proposed by ILO, include two elements: first they include certain minimum requirements of a family for private consumption; adequate food, shelter and clothing, as well as certain household equipment and furniture; secondly, they include essential services provided by and for the community at large, such as safe drinking water, sanitation, public transport and health, education and cultural facilities .. A basic-needs-oriented policy implies the participation of the people in making the decisions which affect them through organization of their own choice." "Meeting Basic Needs, Strategies for Eradicating Mass Poverty and Unemployment". International Labour Office, Geneva. Conclusions of the World Employment Conference. 1976, p.24.

Industrial planning in developing countries must serve the following industrialization functions:

(a) Expansion of the industrial sector, including agro-based industries, to meet the following criteria in the long run (see also figure 1.1)

- Satisfaction of the basic needs of the population for manufactured goods and services in as much as possible through domestic production and through equitable trade where not feasible.
- Satisfying, to a large extent, the requirements of the national industry for manufactured intermediates.
- Production, where economically justifiable, to meet the requirements for means of production both for replacement and worn-out equipment and expansion of the industrial production capacity. These presuppose that industrial planning should aim at strengthening the self-reliant base of industrialization in an economy which would continue to benefit from specialization, complementarity and international trade.
- The rational exploitation of natural resources, especially minerals.

(b) Modernization and restructuring of the agricultural sector by the supply of agricultural and irrigation equipment, transport facilities, constructions materials, fertilizers, pesticides, etc.

It should be pointed out that without upgrading agriculture, mining, transport, educations, etc., industrialization cannot be successful. From this emerges the importance of industrial planning in the overall planning system of a country. It has an indisputed and central position in overall planning for through structural projection of industry it is possible to analyze and verify all sectors of the economy. A too rapid and unco-ordinated development of the industrial sector may also lead to a deterioration of other sectors of the economy, particularly the agricultural sector. Industrial planning must, therefore strike the necessary balance between industry and agriculture. The requirements of the agricultural sectors for industrial inputs necessary to trigger its structural transformation should be matched with the potentials of agriculture to provide the investment surpluses needed for sustaining industrialization.

The interrelations between industry and agriculture due to restructuring the latter usually takes the following forms:

(a) High agricultural productivity increases agricultural surplus production which in turn would lead to the following:

- Improvement of the standards of living so that the basic needs of the people can better be satisfied. Improvement in the living standards of farmers, e.g., progressively creates further demand for manufactured consumer goods, providing an increasing number of industrial jobs.

- Increase of agricultural input necessary for industrial processing, such as non-processed food stuffs, wool, cotton, timber, straw, bagasse, etc., thus contributing to the expansion of industrial output on the basis of local raw material resources availability.

- More possibilities for export of processed agricultural products in lieu of exporting commodities.

(b) The introduction of new technology into the agricultural sector increases labor productivity, thereby creating a further labour surplus in the rural population which could be absorbed by the expanding industrial sector. Industrial planning must, therefore, provide programmes for both the transfer and surplus rural population to industry and the required education, training and upgrading of skills. It is worthwhile mentioning here that the organization of the relationship between industry and agriculture constitutes the most critical area in industrial planning. (See figure 1.2).

Figure 1.1

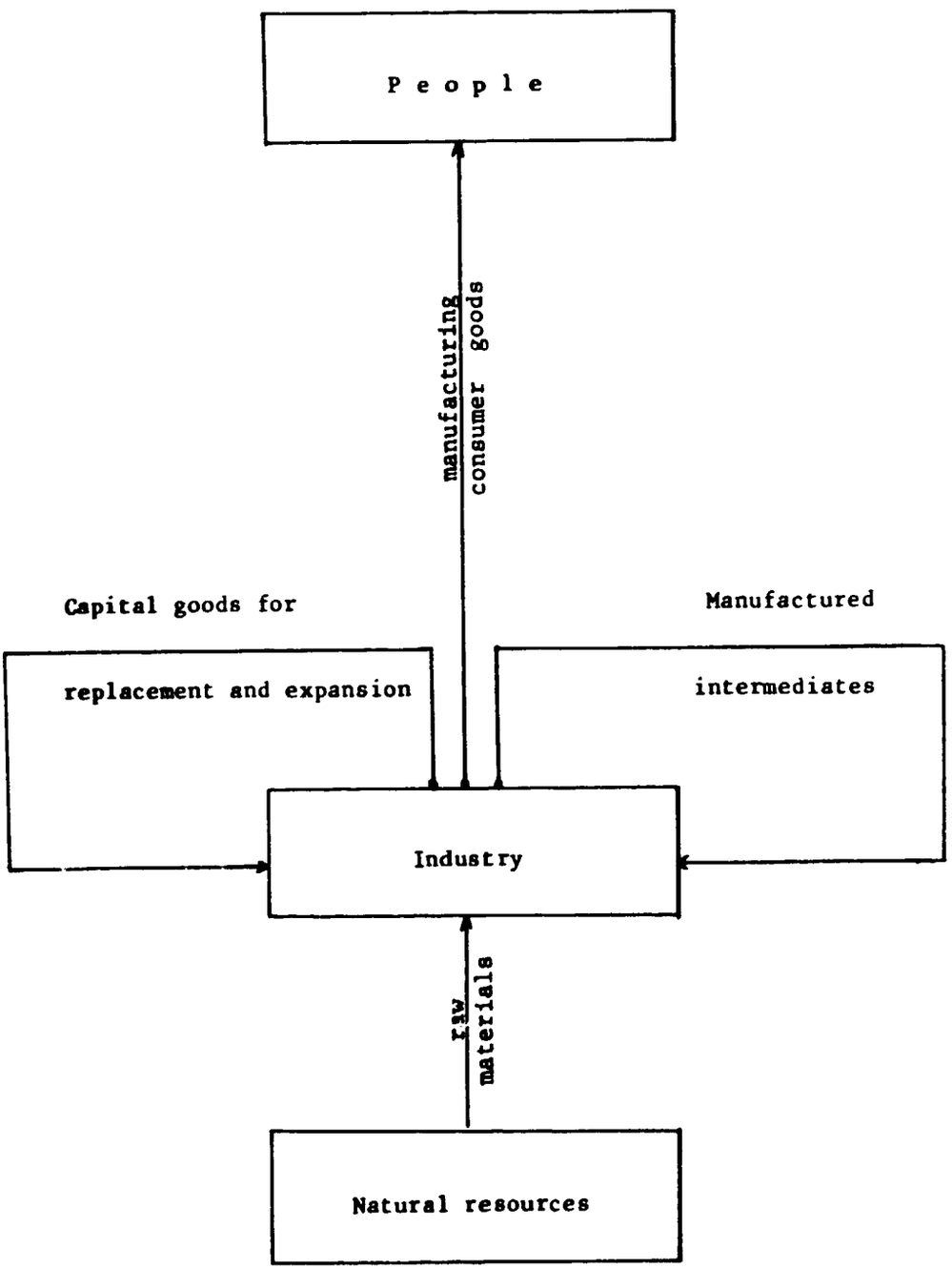
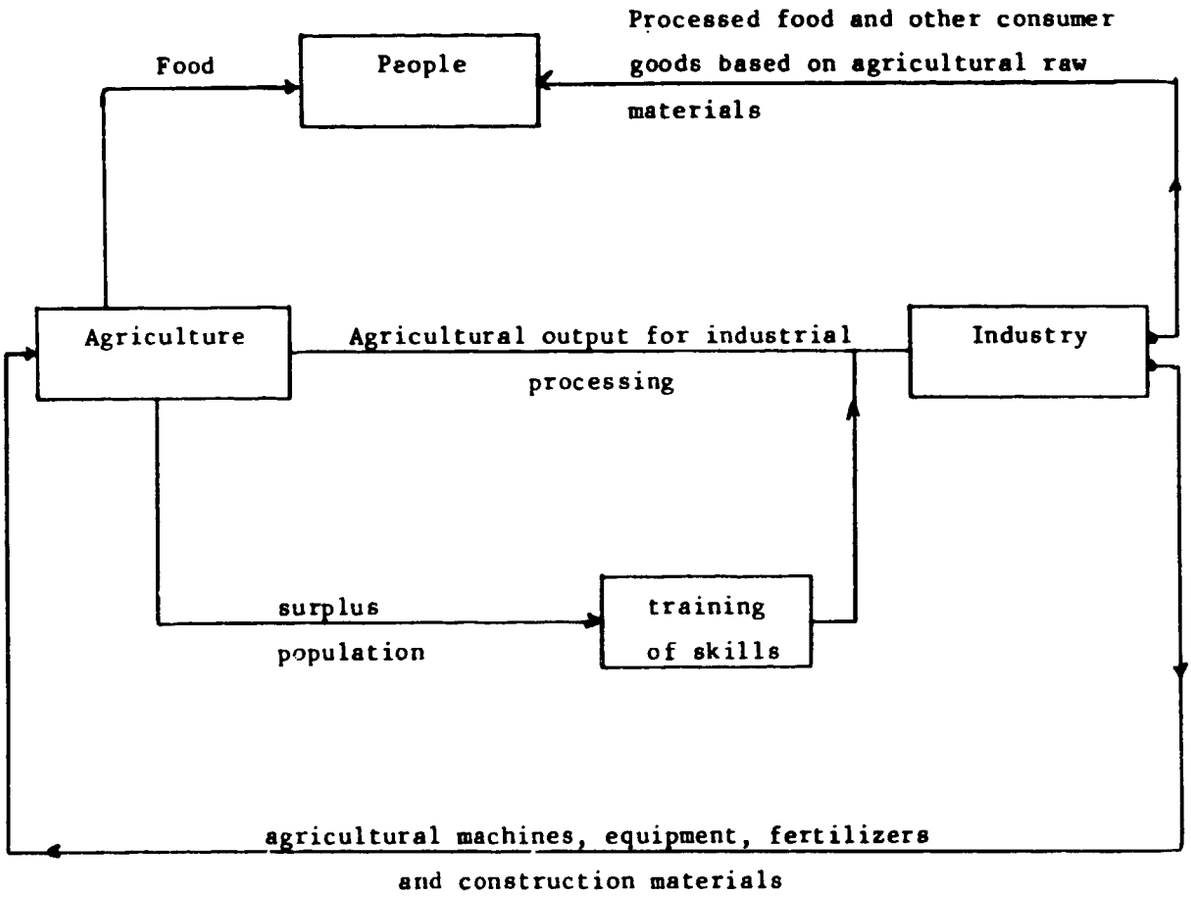

People
manufacturing consumer goods
Capital goods for
replacement and expansion
Manufactured
intermediates
Industry
raw materials
Natural resources

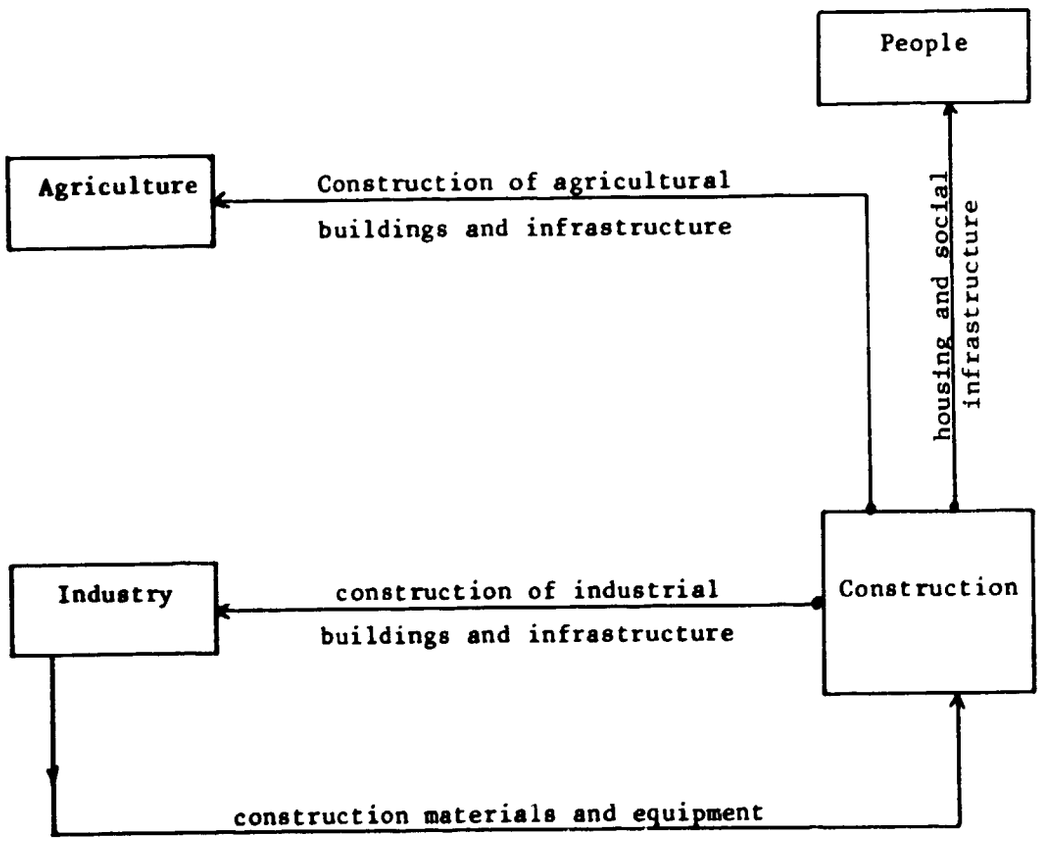
Figure 1.2



(c) Modernization of other sectors of the economy, such as construction, mining and service also plays a crucial role in industrialization. The relationship between industry and mining is of great importance; for some developing countries it is of almost equal importance as that with agriculture, particularly those countries which are rich with crude oil, copper, bauxite and other minerals. Modernization of the construction sector is also of extreme significance for industrialization and for improvement of standards of living. Construction in most developing countries is based on traditional methods with very low performance and productivity, and usually constitutes the main bottleneck in plan implementation. Even so it accounts for a major share of capital formation in many developing countries. The

industrial sector must, therefore, provide the construction sector with sufficient construction materials and equipment to upgrade the efficiency of the construction sector. Industrial planning must quantify the investment interlinkages and strike the necessary balance between industry and construction. (See figure 1.3).

Figure 1.3



Industrialization requires huge construction works, such as industrial plants and industrial estates, warehouses, roads, rails, bridges, ports and housing. The agricultural sector requires silos, dams and irrigation networks. Weak rural communication and badly maintained rural access roads hinder the further transportation of agricultural products, thus also calling for a strengthening of the construction sector. Even more urgent is the housing situation in developing countries. A high percentage of the urban population are living in unacceptable residential conditions. The urban housing situation in a number of these countries is deteriorating due to the overall population growth, rural/urban migration and the rising ratio of urban to total population, on the one hand, and a shortcoming in construction materials on the other. Investment in physical and social overheads is a basic issue to which industrial planning must address itself in terms of volume, timing and the conditions under which financial viability could be assured over time.

5. Internal and external factors that handicap development planning in developing countries

There has been growing recognition among developing countries that the achievement of economic independence, the overcoming of backwardness and the realization of the socio-economic transformation cannot be brought about without the intervention of the state. This is due to many factors, some of which are listed below:

(a) Low level of domestic capital formation in most developing countries.

(b) Weakness of the private industrial sector due to both the general weakness of industrial activity and the strong attraction of commercial and speculative activities in these countries.

(c) Dualistic nature of the economy in most of them.

(d) Concentration of economic and financial resources within the public sector, mainly from the taxes levied on various activities by the government, particularly on foreign trade, as well as direct revenues from the exports on

minerals and other commodities. Therefore and particularly in the initial states of industrialization, it is the state that can mobilize the financial resources necessary for the development of social and physical infrastructures and to a large extent for the creation of key industrial projects, where the pay-off periods are long and a substantial sum of the required capital should be paid in foreign currency.

(e) Foreign capital inflow for investment in the public, as well as the private sector necessitate government action in terms both of negotiating terms and conditions and also regulating the pattern and volume of the flow.

Thus the government in developing countries is not merely an organizer of the development process, but is also a direct participant. It consequently shoulders a central responsibility and plays a crucial role in planning and pursuing industrial activities. Notwithstanding this central role, planning experience in a great number of developing countries reveals that governments have not been able to impose their will upon all economic agents to achieve plan objectives. Observed divergencies between plan and plan implementation indicate the complexity of the planning process in assessing, forecasting and incorporating in the plan the most realistic behaviour and incidence of a number of internal and external factors.

(i) Problems of approaches and internal capacities for development planning

- Development planning first of all depends on social conditions: all social groups which exercise political or economic power have to agree upon the planning frameworks, the objectives and methods. If there arises political instability, e.g., then this precondition is far from being met. Above all, to be effective, development planning requires a serious commitment to the plan on the part of the policy makers in the country and the people who have to implement the plan. This is, in fact, the main prerequisite to successful planning in developing countries.

- In general, the lower the development level of a country so also is its administrative machinery for planning and plan implementation in view of the complexity of the process and the sustained and co-ordinated efforts

required for ensuring the achievement of plan objectives. The observed weaknesses in government administrative machinery are caused partly by lack of trained manpower and resources. It may also be historical in that the administrative system of government was originally established to meet conditions which differ completely from those prevailing at present, and has not yet been adapted and adjusted sufficiently to greatly changed circumstances.

(ii) Problems connected with the role of private sector in industrial planning

In most developing countries the government regulates the private sector to a certain extent through economic policies, such as taxation, price policy, protection, etc. However, these measures may not be sufficient to influence the pattern of investment desired by the plan in respect of the priority sectors and economic groups. The planner is consequently faced by the problem of how to induce and be assured of the effective participation of the private sector in a mixed or market economy situation. The desirable directions of change in private sector investment which the plan requires may include:

- Increase of private sector investment in industrial activities instead of speculative activites such as investment in real estate.

- Greater participation of small-scale and traditional entrepreneurs in industry where moreover investment opportunities would provide outlets for personal saving which would otherwise have been channelled into non-productive activities.

- Investment in processing industries of commodities which otherwise would have been exported in raw form.

- Investments which conform to objectives of regional balance and income distribution.

- Investment in high technology industries.

Policies, procedures and instruments for the effective and beneficial participation of the private sector must be clearly defined at the outset. These should be the result of negotiations with representatives of the private sector whenever feasible based on the potentialities of the industrial private sector and the possible constraints which impede its operations. Once the activities where the private sector would be in a position to contribute to the industrialization of the country have been defined, then it falls upon the planner how best to co-ordinate investments in these activities with those of investments in the public and traditional sectors to achieve plan objectives.

(iii) Problems connected with operation of transnational corporations

The strategy of transnational corporations is mainly formulated according to their large-scale operations within the framework of the process of internationalization of industrial branches. Hence, the choice of their operation sites, production and the technology used are defined according to this strategy. Transnational corporations have many alternative possibilities of operation. Therefore, they have no reason to bind their strategy (or make it less perfect from their point of view) in order to respond to the wishes of the host country. Thus, the interest of the host country could only in certain cases coincide with those of the transnationals. The planner, therefore, has here to deal with a variable that may prove unresponsive to plan objectives and control of plan implementation.

Notwithstanding these facts, the co-operation with the transnationals may prove indispensable in a number of cases. The need would, of course, differ from one country to another. This depends on the stage of industrialization of the country, its science and technological capacity, size and natural resources endowment. Here it is of great significance that the partnership is based on equitable considerations. The planner should investigate ways and means by which a country avoids a state of total dependence upon the transnationals. For example, in order to reduce technological tie-ups upon specific foreign corporations, the planner should investigate with the help of technicians to break down the technological

package of the projects and attempt to choose whenever possible standardized technologies for different components of the projects which may be available elsewhere in the world market, including some developing countries.

Moreover, the possibility of involving a number of competing firms for delivering different parts of the project should also be investigated so as to avoid falling in the grip of a single firm. Other examples for reducing dependence on transnationals would be to choose those products which are possible to produce on the basis of available resources in the country or other developing countries and do not require direct dependence on the transnationals for semi-processed intermediates and semi-finished components. Finally, the planner by deciding on the co-operation with the transnationals should closely examine all possible economic disadvantages and risks connected with their operation in the country, as well as to consider ways and means to exercise some control over their co-operation to ensure the maximum spread effect benefits of these investments are retained by the host country.9/

(iv) Problems related to international trade and investment decision-making

The planner faces hard choices in setting export targets and capacity to import in a global situation of changing terms of trade, fluctuations in commodity prices and instabilities in the international monetary system. Adverse trends have frequently resulted in the shelving of development projects or in costly delays in their implementation. These problems are more acute for countries which are dependent on mono-cultures which in effect justify diversification measures so as to be in a better position to withstand externally induced shocks. Some of the exogenous factors which inhibit industrialization in the developing countries are:

9/ "The activities of transnational corporations should be subject to regulation and supervision in order to ensure that these activities are compatible with the development plans and policies of the host countries, taking into account relevant international codes of conduct and other instruments" (Lima Declaration and Plan of Action, Point 42).

(a) The adverse terms of trade which tend to distort production patterns in the developing countries;

(b) Fluctuation in commodity prices which restrict the capacity to import and hence lead to the shelving of development projects;

(c) Tariff and other protection measures which inhibit the development of domestic capacities for the export of manufactures;

(d) Restrictive monetary and fiscal policies which reduce the profitability prospects of development projects in the developing countries;

(e) Debt and debt-servicing burden which curtails the ability to borrow and hence limits the rate of new investments and capital formation in the developing countries; and

(f) Restrictive practices in the transfer of technology and the high cost of its acquisition which results in a state of increasing dependence of the developing countries on the developed countries.

It is, of course, difficult to plan the industrialization process under the circumstances, where the situation on the world market mainly decides for developing countries what is to be produced and for whom it is to be produced and how it is to be produced. A long-term solution of this problem requires changes in the economic structures of these countries. Notwithstanding the magnitude of these problems, plan formulation should begin with an assessment of potentials and constraints of international co-operation, notably:

(a) Assessment of trends in relative prices of commodities and manufactured goods;

(b) Long-term prospects of restructuring world productive facilities and definition of the part of that potential which could be exploited by the country;

(c) Formulation of national measures to offset the negative effects of debt servicing and international monetary, exchange rate and fiscal policies;

(d) Assessment of long-term technological needs and formulation of plans, policies and programmes for technological development;

(e) Definition of policies, procedures and instruments to benefit from co-operation and co-ordination of efforts at the regional, inter-regional and global levels.

Conclusions

Concentration of economic and financial resources within the public sector especially in regard to investment in social and pysical overhead provides the government in developing countries with means to promote and plan the industrialization process. However, it is recognized that the benefits of industrial planning have not come up to the expectations of these countries, due both to internal and external factors. Internal factors are connected primarily with government machinery - too little discipline among policy-makers, an inappropriate approach to industrial planning and limitation of its planning activity to the public sector.

Reliance upon planning to promote industrialization urgently needs an appropriate environment within the government administration. This calls for, in the first place, commitment by the policy-makers to plan, improvement in the administrative machinery and improvement in the planning process. The administrative system may need to be reformed, restructured and reorganized to facilitate conditions necessary for a continuous planned industrialization of both sectors of the economy (i.e. public and private sectors).

The major external factors encountered in industrial planning in developing countries are: First, the operation of transnational corporations, which are firmly controlled by forces outside the country and usually follow objectives which differ greatly from those of national industrialization. Secondly, tne adverse terms of trade and the relative price system implicit therein plays a

decisive role in restructuring the economies of developing countries in a way different from that of their own industrialization strategies. This calls for policy mneasures that promote exports of manufactured goods at the same time as developing domestic productive capacity to meet domestic needs. It also suggests greater co-operation among developing countries. Thirdly, the problems connected with the fluctuation in the world market economy raise intricate and complex problems of planning which nevertheless have to be carefully examined with a view to pursuing measures which minimize their worst effects on plan implementation

This is the complexity of industrialization problems that developing countries face under the current situation. The problems are immense and constitute a constraint to industrialization. Past experience shows that industrialization cannot be achieved spontaneously in a situation dominated by unrestricted play of market forces; industrialization can nevertheless be achieved on the basis of scientific principles and within an appropriate socio-economic environment. These principles and other necessary ways and means for planning the industrialization process will be the object of these Guidelines.

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II. PRECONDITIONS FOR AND ORGANIZATION OF INDUSTRIAL PLANNING

1. Review of industrial planning practice

(i) Development of planning activities in developing countries

Planning activity in developing countries emerged practically after the end of the Second World War. India was a pioneer. Soon after national independence, an advisory Planning Board was set-up to propose measures for co-ordinating planning activities. In 1950 the Indian Planning Commission began the creation of an effective and comprehensive planning process. In the early 1950s, in addition to India, most Asian countries, which either had, or were about to become independent accepted the necessity of planning. Development planning in Asia received later new impetus through the formation of the Colombo Plan for Co-operative Economic Development in South East Asia.

The United Nations Economic Commissions for Africa (ECA) and for Latin America (ECLA) successfully advocated national planning for African and Latin American countries since the 1950s. A number of African countries have been among the first group of developing countries to prepare a national plan. In Latin American countries ECLA projections were the core of the planning activity. In fact, in 1953, ECLA started with the preparation, for illustrative purposes, projections based on assumed rates of growth for a series of Latin American countries. These efforts resulted in achieving the "Declaración of Punta del Este" (Uruguay) in August 1961, where it was agreed that participating Latin American countries would formulate a comprehensive and well-conceived programme for the development of their economy.

On the whole, developing countries have been giving enormous efforts since the 1950s in creating and improving planning activity and there is general agreement that industrial planning has helped to a certain extent to promote the industrialization process. Huge irrigation projects, cement, iron and steel industries and mechanical engineering complexes, as well as ports, power and communication facilities were visible evidences in many developing countries of the role of planning in changing the rate of investment in favour

of savings and of channelling the financial resources into the industrial and other activities necessary for bringing about structural changes. Nonetheless, the benefits from industrial planning could have been better in a large number of developing countries. In various developing countries there have been intensive discussions among policy-makers, economists, planners and planning experts about handicaps to planning and the measures needed to formulate realistic plans and to counteract activities and events which impede implementation of plans. The need for an appropriate planning environment, where plans could be realized, has also been stressed. Most of the analysis has been devoted to the internal content of industrial planning, such as planning techniques and models. The establishment of a planning process in developing countries, however, is a complex problem of plan preparation as well as of organization and management.

(ii) Approaches used in plan preparation

Most developing countries concentrate their efforts on the pre-planning stage to co-ordinate economic and financial policies with the aim of deciding upon the possible allocation of resources. Little attention is usually given to the actual plan implementation. Due to the fact that the plan as a document is regarded as the end of the planning process, the work on the plan is considered finished when the plan document has been officially approved. A development plan is regarded by some governments as a document required to allocate the revenue of the state to development projects. But is is also recognized that many developing countries have a better chance of attracting foreign financial assistance if they have development plans. Therefore, some of them produce unrealistic development plans within a short time in order to obtain foreign aid. In some other cases a development plan is used for political prestige and enhanced image. The industrial plan is sometimes drafted in a single operation by a few technicians sometimes assisted by foreign experts without much recourse to governmental administration. But it is not desirable to carry out industrial planning in this way. However, the planning experience of many developed countries has proved that planning is a continuous and iterative process. Therefore, it is impossible to draft national economic plans in one single operation. It would be completely unfeasible to formulate the plan solely at the central level or to draw it up by simply compiling the proposals submitted by the Ministry of Industry and other parties.

Moreover, in the great majority of developing countries, planning is regarded as a governmental task to be carried out solely by a specialized governmental agency, the central planning body, without co-operation and co-ordination within the state organs or with the private sector. A successful planning process requires a real and active participation of all elements of society that contribute to the industrial plan achievement such as the ministry of industry (or ministries of industry), industrial enterprises, and other relevant associations within the public sector, as well as the representatives of the private industrial sector and the labour force. All these parties should take part in elaborating the industrial plan. For this purpose, it has been proved necessary and appropriate to draft the plan in stages as an iterative process, and to involve economic bodies at all levels of management. There are, in fact, three different approaches to formulating plans in developing countries.

- The project-by-project approach

Developing countries which do not practice industrial planning have tended to use the project-by-project approach instead. Here, public investment projects are selected for the plan which usually have little relation to each other and no unifying concept. Except for being listed in the budget, these projects may never appear in a single document, or they may be combined to form ad hoc development plans or programmes for the public sector with little or no reference to the private sector.

The project-by-project approach has serious shortcomings, some of which are listed below:

(a) It takes no account of the necessity for relating the projects included in the list to each other or to the existing manufacturing sector. In fact the main requirement for internal consistency of the plan is simply that the sum of parts should equal the total. This lack of inter-sectoral co-ordination sometimes leads to serious imbalances and constraints.

(b) A plan prepared on this basis is mainly a financial document and does not usually take into account the real physical capacity of the country to carry out the listed projects.

(c) The capital budgets are exclusively concerned with the governmental part of the industry and do not take into account co-ordination with the private sector.

(d) It takes no account of the existing industrial and other sectors of the economy. Hence, the choice of a single project does not take account of the indirect effects resulting from interlinkages with various industrial sub-sectors and other sectors of the economy.

The capital budget is a necessary step in plan preparation but it is not enough. To confine the planning processes to preparation of capital budget might have a negative impact on industrialization, especially in the later stages of development when the return from alternative investment opportunities is not likely to be as apparent as they are usually at the beginning of the development process, and when the complexity of the objective economic factors requires highly sophisticated methods and an appropriate environment so as to be kept under control.

However, it should be pointed out that the project-by-project approach has nevertheless provided many countries at the initial stages of their development with means for laying a foundation for their development. Thus, it may be acceptable for a certain transitional period, provided the overall assessment shows that the projects do, in fact, contribute to national industrial objectives.

- Integrated public investment

An integrated public investment plan is a more advanced planning approach in comparison to the project-by-project approach. The preparation of a well-elaborated investment plan of this type begins with estimates of public investment resources which could be mobilized in local and foreign currencies. These resources are then divided among a selected group of sectors subject to public investment and finally ranked in order of priority.

Under integrated public sector planning, government action in the private sector is mostly limited to the adoption of clearly desirable measures designed to improve the climate for private investment, including the provision of credit facilities through development banking activities. Yet it

would be hard to find many countries with investment plans which meet all the requirements for a properly integrated public investment plan. In most developing countries, public investment plans fall somewhere between the project-by-project approach and the integrated investment plan, with most plans closer to the former than to the latter.

- Comprehensive planning approach

The comprehensive planning process covers the economy as a whole, including productive and social sectors of the economy. This approach, however, requires:

(a) An appropriate industrial planning machinery embracing a network of planning bodies and relevant planning units specialized in different economic activities which are interlinked with each other in such a way that facilitate the elaboration of the plan on the basis of iterative techniques so as to arrive at a consistent plan.

(b) Appropriate statistical information, particularly on the private sector as well as policies appropriate to the private sector, in addition to general policies so as to ensure that activities in the private sector are in harmony with plan objectives.

(c) Co-ordination between plan preparation and the operating management of the economy on the one hand, and harmonization of financial resources with physical capacities to carry them out, on the other. These problems, however, will be discussed in detail as the discussion proceeds where we will attempt to reveal the problems that impede comprehensive planning in developing countries and the system necessary to enable the country to shift to comprehensive planning.

Conclusions

Where governments in developing countries focus mainly on the plan document to allocate investments or to attract foreign financial assistance, the plans are made on a piecemeal basis, with little or no co-ordination of the component parts and with little or no account of the development of the private sector. Due to the fact that these plans are mainly financial documents, there is no certainty that they could be implemented in accordance with either the designated plan period or the allocated investments.

2. Implementation aspects of industrial plans

Until recently it was thought that the key element in industrial planning in developing countries was the formulation of a consistent plan. While the importance of a well-prepared plan based on clearly defined development objectives is indisputable, it is not generally realized that under the current circumstances of the majority of developing countries a consistent plan does not ensure implementation any more than an inconsistent one. The disappointing results of plan implementation in most developing countries have proved the need to pay much more attention to improving plan implementation.

In fact, in many developing countries, even as plan formulation methodology advanced, implementation remained inadequate and sometimes worsened. This gave rise to the view that the major problem in the industrial planning process for developing countries was not the plan formulation but plan implementation. This proved to be particularly the case in those developing countries where planners fixed plan targets solely on the basis of financial potentialities and failed to take appropriate account of plan requirements for physical, capital and technical skills, and construction capacities, or of managerial, administrative and political limitations. Such plan targets generally turn out to be beyond reach. Consequently, a great number of failures to implement planned programmes at scheduled time periods can also be traced back to inadequate plan preparation. The adjustment of the timing of execution of different projects is one of the most crucial functions of planning in order to start a dynamic process without any bottlenecks. The other most important function is maintenance of the target rate of implementation of sectors and factor proportions in the economy.

Failure to carry out industrial plans in developing countries may manifest itself in two ways: the first is extended delays in the execution of projects and programmes; and the second is higher costs than planned. Long delays in executing projects are frequent in developing countries, particularly in the public sector. Key projects, with very high investments, such as steel plants, heavy engineering, petrochemical and electrical plants may result in heavy losses if delayed. If interest charges during construction are included, every extension of the period of execution adds to the costs. In countries where inflation rates are high, extension of the scheduled construction period also raises costs above what they would be if

the projects were executed in time. There are many other ways in which costs may increase. For example, maintenance and repairs due to insufficient protecting of parts finished earlier, or changes both in the technology used and the original functions of the project. In addition, losses in production and foreign exchange if the project is export-oriented or is meant for import substitution, have to be taken into account. The same applies for under-utilization of the upstream and downstream capacities if the project has high backward or forward linkages.

It by no means follows, therefore, that failure to carry out industrial plans can only be attributed to deficiencies in plan preparation. Apart from inappropriate patterns of planning models and techniques used in developing countries, three main reasons may account for the difficulties in plan implementation. These are, separation of plan preparation from plan implementation, weak links between planning and management; and lack of control over internal and external factors of industrial growth.

(i) Separation of plan preparation from implementation

The state of preparing plans without planning their realization is usually referred to as the weak link between plan preparation and implementation; and it is one of the features peculiar to planning practice in developing countries.

Most industrial plans in developing countries are prepared mainly on the basis of the financial potentiality of the country and do not take into account the actual physical potentialities required to carry out the planned projects. In fact, in many cases these plans are but mere schemes of public expenditures or aid to private enterprises. This is of course, the first necessary but not sufficient prerequisite for planning which necessitates further efforts.

The funds allocated to the industrial plan are, of course, determined by the savings realized within the country and by loans received from outside, as well as by the distribution of such savings and loans among sectors of the national economy. Part of the funds allocated for industrialization are to be spent in local currency during the implementation period for the required

manpower, construction materials, transport and construction work, etc. The amount of such funds allocated in local currency in the industrial plan are determined by factors which differ completely from those responsible for the supply and distribution of productive forces within the country.

During implementation of projects, planners and policy-makers in developing countries usually reckon with a discrepancy between requirements for the allocated funds and available physical capacities for converting them into finished projects, particularly when bottlenecks emerge.

Experience shows that the requirements of the industrial plan for production factors in developing countries often exceed local supplies of construction materials and civil construction capacity. The same also applies to infrastructure. Plan implementation in developing countries is frequently affected by congestion and bottlenecks in ports, roads and other facilities of infrastructure. This is mostly the case when several projects are to be executed at one time in a given geographical area.

(ii) Weak links between planning and management

It may be that the preparation of plans in developing countries is carried out by a central planning body without due co-ordination with the operating management of the economy. The policies and programmes of the government's industrial operating establishments may have furthermore no relation to the industrial plans. Often the national central bank adopts its own lending programmes, while the ministy of industry proceeds in accordance with its own investment policy. Where a licensing system for private sector activities exists, it may be that these are not in strict conformity with the industrial plan. In other cases, industrial plans would have very little chance of being carried out if there is an absence of binding directives on the part of the decision-makers or because of ad hoc decisions which disrupt efforts to implement the plan.

(iii) Pressure of unfavourable conditions in the internal and external market

For the majority of developing countries, the state of agriculture and foreign trade is of crucial importance for their economic development and these are exactly the areas over which, though for different reasons, they have practically no control. Thus, the plan of industrial development, even if it is neatly constructed and perfectly administrated, can nevertheless be annuled by unforeseen developments, such as floods and droughts in agriculture or drastic reductions in price and demand for exported goods on the world market.

Conclusions

Until recently, it was thought that the key element in industrial planning in developing countries was the formulation of a consistent plan. However, disappointing implementation results have proved that although the importance of a well-prepared plan based on clearly defined development objectives is indisputable, it is of great significance that emphasis should be laid on plan implementation.

Difficulties in plan implementation in developing countries can mainly be attributed to the following factors:

(a) Separation of plan preparation from plan implementation.

(b) Weak links between planning and management.

(c) Pressure of unfavourable conditions in the internal or external markets.

3. Time frames and institutional set-ups for industrial planning

(i) Duration of industrial plans

In practice, industrial plans can be of any duration. However, since industrial planning is but an integral part of national economic planning, the duration of industrial plans should not differ from that of plans embracing the whole economy. There are principally three types of industrial plans: annual, medium-term and long-term. While all these plans represent instruments for achieving industrial development, the differences in their duration are related to the specific function which have to be exercised within specific time periods.

- Medium-term industrial plans

A medium-term plan is usually regarded as one which covers a four-to-six year period. In practice, the most typical industrial plan is one of five years, since experience shows that five years is short enough to permit reasonably accurate projections and estimates to be made. Medium-term industrial plans constitute the principal form of industrial planning. They comprise more details than both annual and long-term plans. They determine the major directions, objectives and tasks of industrial development as well as the dynamics of industrial growth. Moreover, they represent the principal link within the entire industrial planning process. Therefore, they must ensure an organic continuity together with annual and long-term plans. In fact, each medium-term plan must be conceived as a necessary step for the realization of the first phase of a new long-term plan. This, of course, requires the employment of the same methodology for all these plans, on the one hand, and unity in the content of the major sub-sectors, on the other. Along these lines, medium-term plans must serve as a means to specify and correct long-term plans; and annual plans must, in turn, serve as a means to correct and adjust medium-term plans.

- Short-term industrial plans (2 - 3 years)

In some developing countries medium-term plans are substituted by short-term plans lasting for two to three years. This is due mainly to two reasons: (a) markedly unstable economic conditions due to recent major

(political or economic) development or expected development; and (b) an absence of adequate statistical data in the early stages of planning.

Though they may appear necessary, short-term plans are not desirable under normal conditions. They are too short to permit reasonably accurate projections and estimation or to embody long-range objectives of industrial development; their role in influencing industrial development is limited, since they do not provide adequate opportunities for mobilizing resources and cannot be used effectively to bring about basic structural changes.

Because of the limitations of short-term plans, the central planning body in developing countries where no medium-term and long-term industrial plans exist must make serious efforts to create the necessary prerequisites for an early shift to medium-term and long-term planning.

- Long-term industrial plans

Planning experience shows that long-term plans are of extreme importance for two major reasons. First, they envisage qualitative changes in the industrial sector, hence giving perspective to the medium term plan. Secondly, a number of projects cannot be fixed into medium-term plans because the gestation period needs longer planning periods.

Long-term plans have fewer targets and contain less details than medium-term plans. Their targets are based on only rough approximations in order to indicate priorities and enable planning authorities to concentrate upon the most effective industrial sub-sectors when preparing medium-term plans. They can also indicate well in advance in what areas research studies and surveys are required before specific projects and programmes are formulated, or shortages that might constitute serious bottlenecks to long-term development and which require corrective action.

A few developing countries adopted long-term plans at the start of their planning experience, but almost all of them turned out to have been inaccurate for the later years of the plan period. Because of the high level of uncertainty which is attached to the longer-term plans, projections so far ahead become imprecise. In many developing countries it was found more convenient to reduce long-term plans from a 20-30 year period to 10-15 years.

In fact, a period of 10-15 years is widely accepted as appropriate for long-term plans in these countries. It is worth mentioning here that it is not advisable to develop a long-term industrial plan if long-term plans for the country as a whole cannot be prepared. A long-term plan of fifteen years defining the growth of population, national income, savings, public consumption and investment or the allocation of means according to economic sectors in order to set priorities can to a certain extent cover sectoral planning needs and is very useful for the preparation of medium- and long-term industrial plans.

- Annual industrial plans

As medium-term plans indicate investments for the entire plan period and the targets to be achieved at the end of the plan period, they cannot be used as programmes of action in the intermediate years. This task is given to annual plans, which are indispensable as an instrument for detailing exactly what must be done to convert existing medium-term plans into programmes of action.

Few developing countries prepare annual plans because of lack of sufficient experience and the required statistical information. Annual plans in developing countries are usually replaced by a state budget which determines the main investment allocations. However, a state budget is not an adequate substitute for annual plans.

Long-term, medium-term and annual plans are not distinctly separate exercises; they are essential steps of the same planning process which should be carried out at each level of the planning hierarchy: for example, industrial sub-sectoral plans or industrial plan and other sectoral plans, as well as the national plan.

- Rolling plans

The medium-term plan is rolled if it is revised at the end of each year, as the first year of the plan is dropped. In this connexion, the planner must make new estimates, set new targets and add new projects to the last year of the plan. Thus a five-year plan for the period (t_o - t_5) would be revised at the of the year (t_o) and a new detailed medium-term plan issued for the

period (t_1 - t_6). A similar procedure would be followed at the end of each further year; the plan would then be renewed and the number of years would remain the same.

Planning experience where rolling plans have already been introduced has proved that this is a difficult and unnecessary exercise for developing countries. A much better way of updating a medium-term plan and making it operational is through the annual plans. Because of continuous revision and adjustments, these plans have to be renewed and prolonged. This does not mean, of course, that long-term and medium-term plans should be re-issued yearly in the same way as rolling plans, since the revisions would be indicated in the annual plans. However, on the basis of these revisions the projections for the medium-term and long-term plans can be readjusted within an appropriate time span so that there are always plan targets for several years ahead.

Conclusions

A well functioning industrial planning process requires three types of industrial plans: annual, medium-term and long-term plans. These plans must ensure an organic continuity. They must be unified in respect of content and methodology.

The differences in the duration of these plans are related to their specific functions. Medium-term industrial plans constitute the principal form of industrial growth. Long-term industrial plans are required for an overall perspective and for the formulation of the strategy of industrialization, while annual industrial plans are necessary in order to convert medium-term plans into programmes of action.

(ii) Industrial planning machinery

Due to the fact that efforts should generally be co-ordinated through an annual financial budget, the budget office, usually located in the ministry of finance becomes, at the initial stages of development in most developing countries, the centre from which industrial development is more or less monitored. However, practically all countries eventually establish a separate, relatively autonomous central planning authority.[10/]

- The central planning body

The experience of many developing countries shows that the establishment of a central planning body does not substantially alter the existing practice of fund allocation nor contribute significantly to the efficiency of industrial plan implementation. The mere addition of a central planning body to a government administrative apparatus without a concomitant reorganization of the overall administrative system cannot by itself improve the efficiency of the planning process. The planning functions to be performed by such a body must therefore be clearly defined in order to facilitate plan preparation, elaboration and implementation. The absence of such clearly defined functions weakens the operations of the central planning body. The situation would still be more complicated if there exist more than one main planning authority in the country because of the greater incidence of overlaps and inter-departmental rivalries which could arise

- Authority of the central planning body in developing countries

The realistic targets set in industrial plans should be attained as scheduled. This, in fact, constitutes a necessary condition for sustained economic growth and requires for its success both appropriate public management of the plan and compliance to its directives. Where the power and leadership of the central planning body is weak, even properly prepared plans

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10/ In the present Guidelines we will refer to the higher planning authority in the country as the central planning body, whether it is a ministry of planning or a planning commission, or by whatever name it is called.

cannot always be implemented. Here subjective causes could lead to poor plan implementation, especially when other, stronger forces act to alter plan priorities or fail to abide by prior decisions made. Such would not be the case where the central planning body has a well-defined and generally accepted authority to oversee and provide specialized guidance to operating ministries and other public institutions. Alternatively, plan compliance could also be achieved by means of well-defined mechanisms and systems of shared responsibilities for plan implementtion. By these means, mandatory compliance could be expected from public agencies concerned for meeting plan targets which are under the control or supervision of the government. It would be unrealistic, however, to give binding directives to that part of the plan concerned with activities of the economy which do not fall under the supervision and control of the government. This part should, therefore, be covered only by appropriate mechanism of industrial regulations, incentives and sanctions.

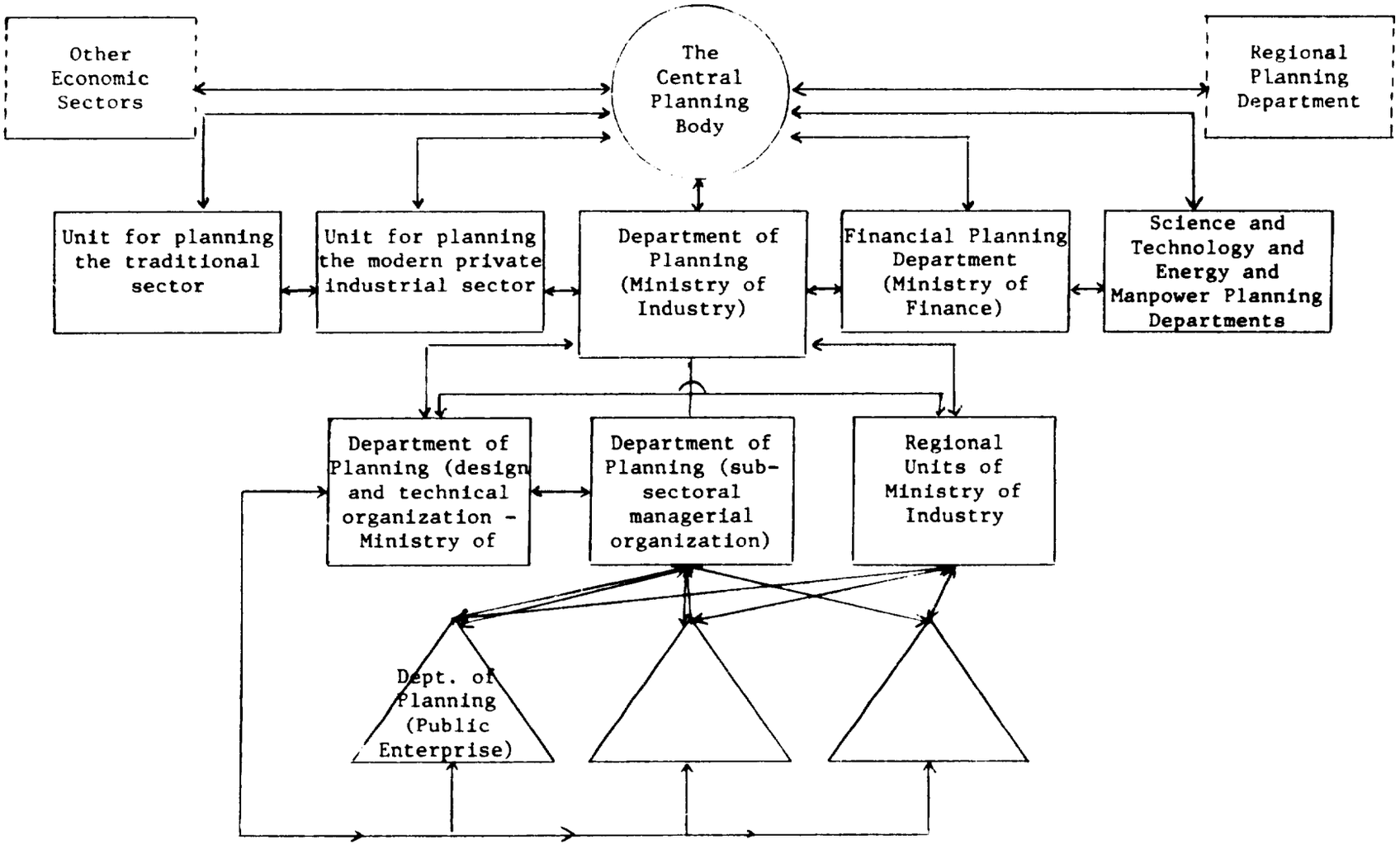
- Industrial planning bodies and relevant planning units

The setting-up of a central planning body is a desirable first step in planning but does not mean that the planning process has already been established. This is due to the fact that planning is not the concern of one single organizational body but of an entirety of operating organizations within both the public and private sector as well as of the labour force. The effective formulation and implementation of an industrial plan requires that every unit of the public industrial sector, as well as representatives of private industrial sector, contribute to the process. Therefore, it is extremely necessary that all these parties are mobilized in the process of planning and assigned planning tasks within their area of competence. The planning functions should ideally be distributed among them in conformity with the structure of the industrial sector. This of course necessitates the establishment of special planning bodies within government departments and public sector organs at all levels of the management of the industry in compliance with the structure of the industrial sector, as follows: (See also figure 2.1)

- Planning department (or departments) at the industrial ministry level.

Figure 2.1

The appropriate organization of institutional industrial planning system in developing countries



- Departments for planning the industrial sub-sector, for example, construction materials, chemicals, textiles, engineering industries, etc.[11/]

- Planning department at the level of each public industrial enterprise.

- Planning units to cover the establishment of new projects.

- Regional planning units.

- Planning units for the private modern and traditional industrial sector at the country level.[12/]

In addition to the industrial planning bodies, industrial planning requires inputs from manpower, financial, technological and energy departments which call for close interaction of the government departments, financial institutions, R & D set-ups and training institutions concerned.

(iii) The organizational set-up and the respective distribution of industrial planning functions

In order to enable the planning machinery to function efficiently it is necessary to build up an appropriate overall planning structure. The planning structure must be designed in such a way as to facilitate a coherent, consistent and iterative planning process, from the highest to the lowest planning bodies and from the lowest to the highest.

11/ For developing countries where these sub-sectors have not yet been developed and there is scarcity of experienced planners, these and the following units could at first be included in the planning department of the ministry of industry. Then, step-by-step with the development of industry, they could be developed as separate units.

12/ These units could be located in the Chambers of Commerce and Industry or the associations for manufacturers or any other institution which is in a position to represent the interests of the private manufacturing sector.

- Functions of the central planning body

The central planning body is the key planning organization in the country responsible for:

- The formulations and revision of long-term, medium-term and annual national plans;

- The co-ordination of the sectoral plans within the central planning body;

- The preparation of annual operational plans for implementating medium-term plans;

- The follow-up of plan implementation including periodic reporting and evaluating of the progress of plan implementation;

- The recommendation and formulation of policies, instruments and other measures required to mobilize financial, material and human resources for implementing that part of the industrial plan dealing with the public sector;

- The formulation of means and policies in order to direct the activities of private sector towards achieving plan targets such as price, credit, customs policies;

- The development of methodologies of planning to promote comprehensive organization of all planning activities and compliance thereto; and

- The sensitization of policy-makers, engineers, administrative officials and the labour force as well as dissemination of information to the people concerning the plan's targets and difficulties facing plan implementation.

- Functions of the industrial planning body

Each of the industrial planning bodies must be responsible for the following in its field of operation:

- Formulation and revision of long-term, medium-term and annual plans.

- The preparation of an annual operational plan for implementing the medium-term plan.

- Plan implementation and follow-up activity.

The needs and specific functions of each industrial planning body are as follows:

(a) Planning departments at the level of public industrial enterprises

Planning departments at the level of public industrial enterprises constitute basic industrial planning units in economies with pronounced public sector activities. Their plans consist of the following:

- A plan of production (output, costs and profit)
- A plan of investment and depreciation of fixed assets
- A plan of labour forces and labour productivity
- A plan of technology
- A plan of economic utilization of inputs
- A plan of social and infrastructural investments
- Evaluation of efficiency and plan indicators.

These plans are to be submitted to the sub-sectoral planning departments.

(b) Planning departments of technical organizations

The functions of technical organizations within the ministries of industry include the tentative selection of project, choice of technology, integration of proposed new capacities with existing ones, co-ordination of new projects with the relevant economic activities and their locations, as well as fitting projects into the long-term plans in respect of output, inputs, employment and investment requirements. In cases of expansion of existing production, these functions are carried out in collaboration with the planning departments of the public enterprises and sub-sectoral economic managerial organizations.

(c) Planning departments of the sub-sectoral economic managerial organizations

Managerial organizations for each industrial sub-sector, for example, an economic managerial organ for mechanical engineering, or for construction materials, or for chemicals and petrochemicals are responsible for the preparation and implementation of sub-sectoral plans aiming at integrating the activities of industrial public and private enterprises as well as traditional production units. Thus these organizations are responsible for the co-ordination of the plan of all production units of the sub-sector in question. They must also co-ordinate their work in respect of long-term plans both with the planning departments or the technical organizations in connexion with the planned projects of the sub-sector and with the planning units in private and traditional industrial sectors. The sub-sectoral plans are thence submitted to the planning department in the ministry of industry in the preparation of the industrial plan of which they constitute the main inputs.

(d) Planning unit for the private traditional sector

To integrate handicrafts and cottage industries in the process of plan elaboration, promotion and development organizations are set up either within ministries of industry or planning or as separate entities. The planning units of such organizations are responsible for revealing the problems of the traditional sector, such as prices and availabilities of inputs or prices of the competitive local and foreign products; for investigating the best ways for promoting production in the sector; for co-ordinating plan preparation with the planning departments of the sub-sectoral economic managerial organizations as well as for fostering effective co-operation; for disseminating information on legislation and policies covering the traditional activities; and for investigating the system of relative prices and rural economic and social infrastructures necessary for improving the functioning of the traditional sector, as well as possibilities for creating partial-time manufacturing activities in regions where partial-time agriculture is dominant.

(e) Planning units for the private modern industrial sector

Planning units for the private modern industrial sector play an important role in defining the potentiality of the private sector and the constraints which impede its development. They monitor expansion possibilities for the private sector and negotiate with the ministry of industry and the central planning body over government policies required for the effective participation of the private industrial sector. The outcome of consultations are reflected in position papers which are submitted to the planning unit of the ministry of industry and/or to the central planning body as appropriate.

(f) Regional planning units

Regional planning units have a significant role to play in planning the location of industrial production and the regional structure of the economy, both of which have substantial effect in fostering the regional balance of the entire economy. Regional planning units are responsible for analysing in each region two groups of specific development functions, namely (a) the geographical distribution of population, mineral, soil, water and agricultural resources, etc.; and (b) the social conditions of location, such as the degree of industrial concentration, specialization and co-ordination of material production and services. These permit the units to play considerable role in the choice of location of new industrial projects through the rational co-ordination among industries within a single region, and the redistribution and restructuring of industrial capacities, industrial inputs and development of infrastructures in accordance with geographical division of labour and natural resources endowments. They also report on difficulties and bottlenecks encountered in plan implementation.

(iv) The unity of planning and management in industry

The unity of planning and management is the corner stone of the planning process. The managerial set-up mentioned above which link the central planning body with all other industrial planning bodies, creates the necessary prerequisite for mobilizing national economic agents and the administrations of industrial operating units in the planning process through preparation, elaboration and follow-up of plan implementation. Further possibilities for strengthening co-ordination between the central planning body and the ministry of industry (or ministries of industry) and other industrial operating units need also to be explored by the industrial planner at the outset of the planning process with a view to fostering the integrity of the planning process. For example, experience in developing countries shows that in order to closely link activities of the ministry of industry and other key industrial organizations and institutions in the planning process, the central planning body could benefit from an advisory panel which is formally made up of the ministers or managers concerned.

(v) Structure and content of industrial plans

The structure of industrial plans in developing countries should reflect the following:

(a) The type of ownership and the extent to which the government can exercise control over the activities under its ownership.

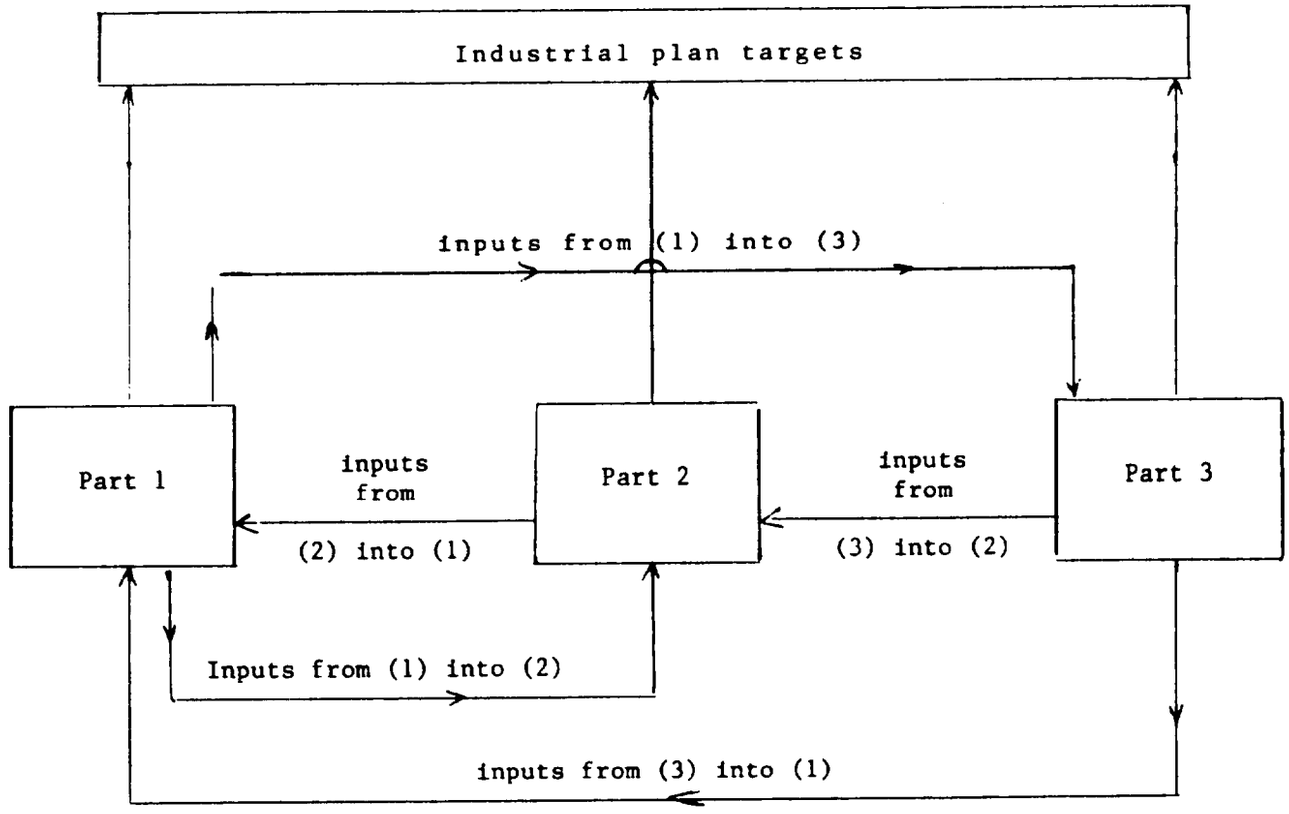
(b) The division of labour within the industrial sector and the managerial system used.

(c) The regional distribution of the labour force and the natural and material resources targeted for utilization.

Thus, the industrial plan in developing countries comprises of three parts (see figure 2.2):

Figure 2.2

The appropriate structure of industrial plans in developing countries



(a) The first part relates to those activities for which the government has primary responsibility for initiating and implementing. This usually covers the activities of the public sector and industries which are considered as strategic for self-sustained industrialization or for reasons of safeguarding national interest. It falls upon government to justify economic viability, negotiate investment conditions and install suitable managerial and operational systems.

(b) The second part of the industrial plan concerns those activities of industry which are partly owned by the government and for which it shares responsibilities for performance with the private sector. The plan should spell out the necessary conditions for these activities to contribute to plan objectives and targets.

(c) The third part of the plan is concerned with the private modern and traditional industrial sectors for which the plan should pronounce the policy and incentive measures required for the sectors to meet plan targets.

The weights in the overall economy of these parts will vary from country to country. In countries where the public sector is dominant, the share of the first part will be very high, whereas in countries where a government cannot exercise state control over all industrial activities within the public sectors where the share of public sector is rather small, the industrial plan will consist mainly of the third part.

In order to ensure fulfillment of plan targets there must exist effective linkages between the enterprises at the three levels. The part of the plan dealing with strategies, policies and instruments must ensure these linkages and promote coherence, consistency and mutuality of action.

The industrial plan is further sub-divided by sub-sectoral plans (see figure 2.3) to indicate specific areas and corresponding actors. For example, a plan for construction materials or a plan for textiles, etc. These plans in turn are further sub-divided by plans for enterprises - plans of the enterprises of engineering industries, for example. Finally, regional industrial plans are necessary so as to ensure the distribution of manpower

and materials and to avoid possible bottlenecks in infrastructures and support services. Such a disaggregation of industrial plans facilitates a wide participation of managers, administrators and the labour force at the level of each industrial enterprise. In this way developing countries can greatly improve the quality of their industrial plans, by jointly finding the best solutions for industrialization in general and each sub-sector or enterprise of responsibility in particular. This requires, of course, an appropriate course of planning to facilitate the drawing up of a coherent industrial plan.

(vi) The course of planning

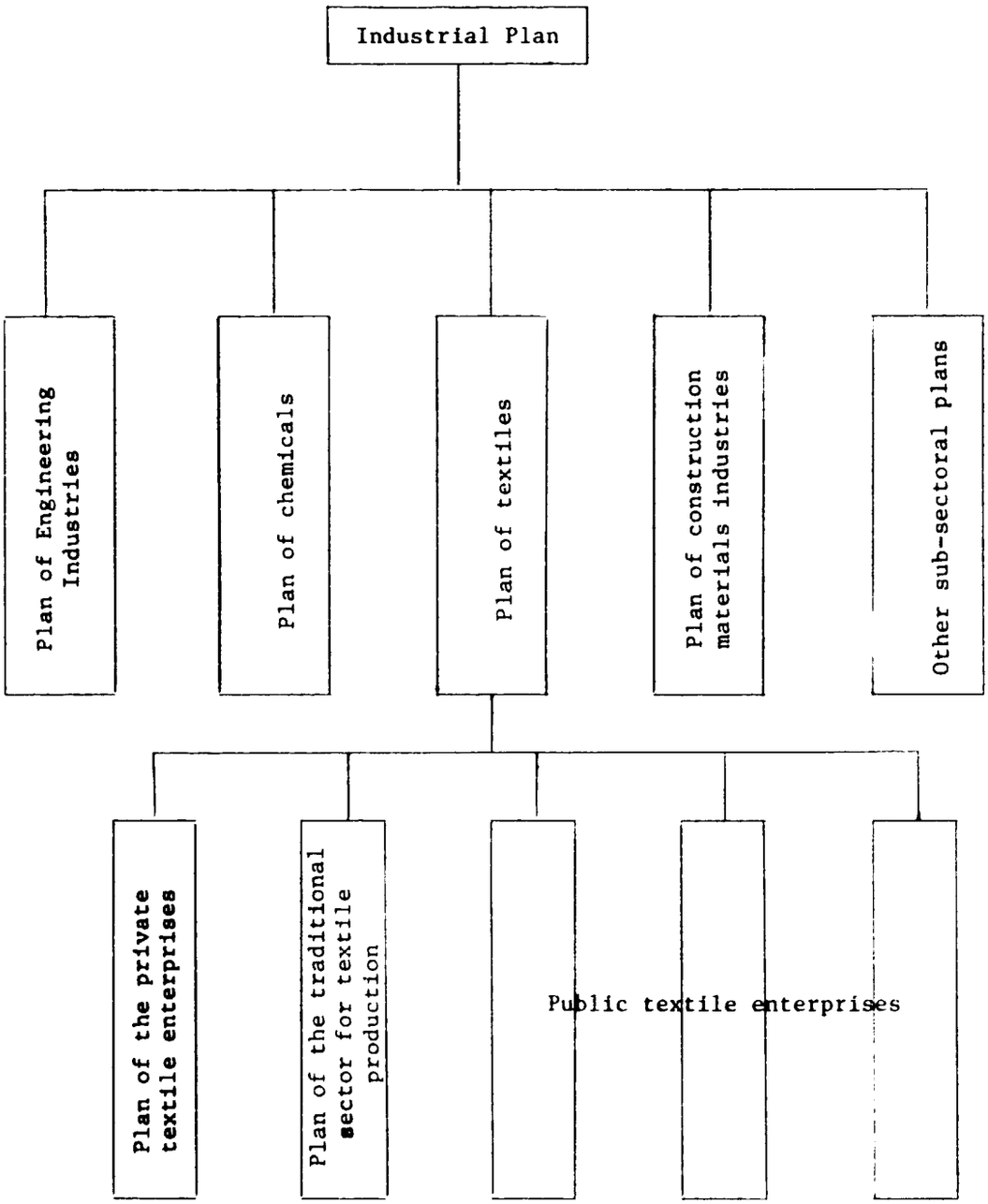
The course of industrial planning in general must be designed in such a way as to ensure a proper sequence of action and an interlocking of the different steps in industrial plan elaboration. The course of planning usually proceeds as follows:

- The central planning body prepares the first draft of a national plan on the basis of past experience and in accordance with a determined number of macro economic aggregates, such as growth of GDP and population, distribution of income on private consumption and public investment, etc. The draft is prepared on the basis of analytical surveys of the existing production structures and capacities of the economic sectors including the traditional sector; assessment of natural resources, manpower and state of the arts in technology; capacity review of infrastructure facilities and support services; evaluation of policy measures, instruments and mechanisms; assessment of savings and investment rates, exports and imports capacities. The first draft of the economic plan is then sub-divided by economic sectors in accordance with their assigned roles. The industrial plan should then be sub-divided in accordance with its structure, as has been mentioned above.

- Within the above framework and based on the assessment of the various economic factors, the elaboration of the industrial plan proceeds with plans for enterprises and plans for sub-sectors at the level of the planning department of the economic managerial organs. These plans, together with the plans of the private industrial and traditional sectors are elaborated and co-ordinated within the planning department of the ministry of industry which

Figure 2.3

The appropriate structure of an industrial plan



is responsible for producing sub-sectoral and sectoral master plans accompanied by the policy measures and instruments required for its implementation.

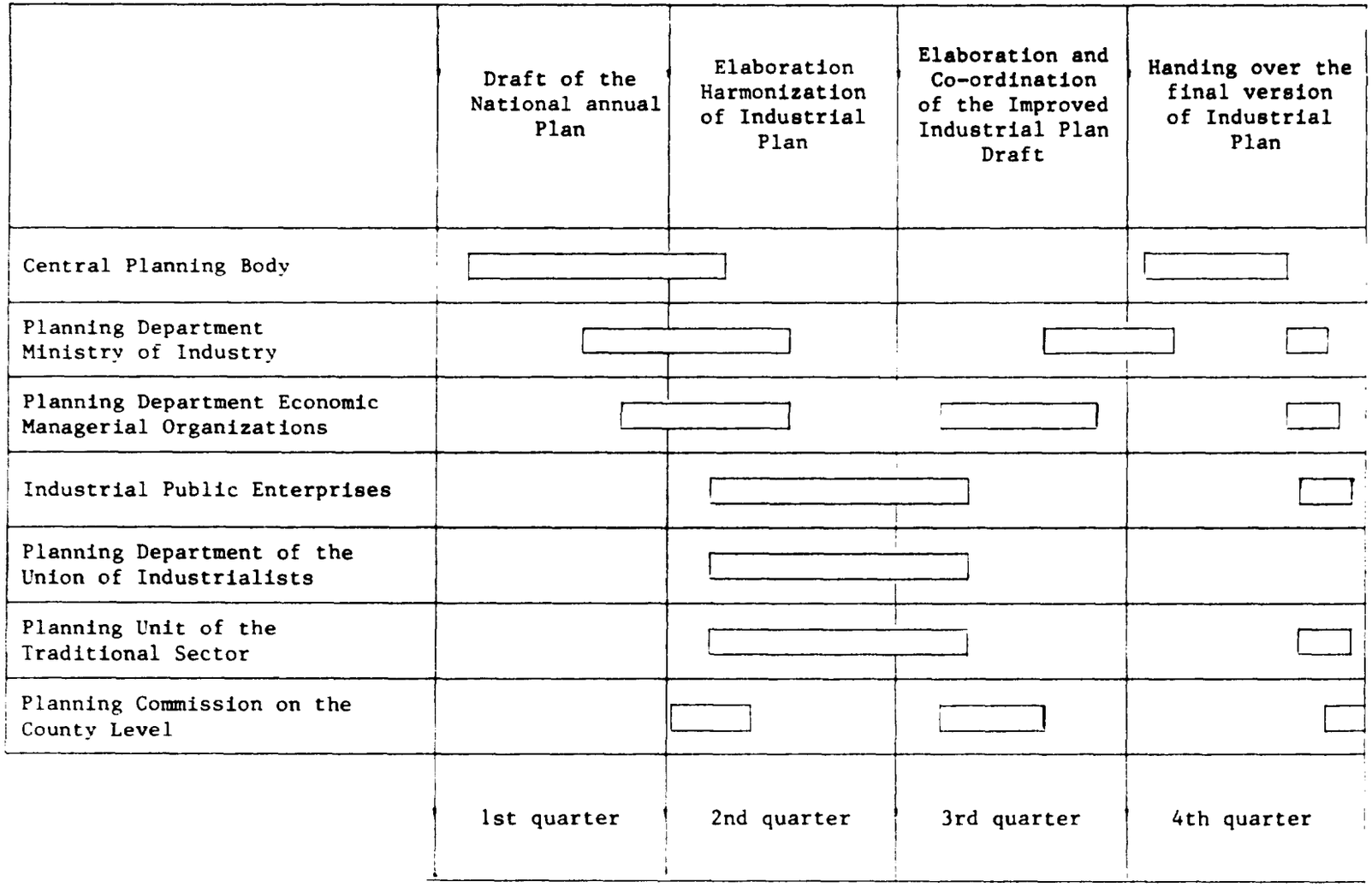
- The course of industrial planning comprises vertical and horizontal relations. Vertical industrial planning relations cover the stages between enterprises and the economic managerial organs of the sub-sector on the one hand, and between the latter and the ministry of industry on the other. Horizontal industrial planning relations cover the harmonization between enterprises within the same sub-sector (public or private). Harmonization should also exist at the level of planning departments of the economic managerial organs and their counterparts within other state organs. Of great significance is the mutual co-ordination and integration of projects of sectoral and territorial plans and programmes into a single industrial plan. This is a necessary condition and the basis for carrying out a unified industrialization policy within the designated plan period.

- The elaboration of an industrial plan in this way facilitates the economy-wide mobilization of resources and factor inputs. This kind of elaboration calls for repeated revision of sectoral targets due to the complexity of interlinked activities and of target co-ordination. The repetition of computations of the interlinked activities at each stage leads to optimum results from which plan targets are derived. This process of repetitious and step-wise approximation is referred to in planning practice as the iterative process.

- The targets of each enterprise or sub-sector can be contradictory in one way or another to other enterprises within the same sector or other sectors of the economy. This is why it is impossible to cover all relevant interdependent targets of the plan by one single course of planning or one single planning body. The practice of countries with planning tradition shows that during the course of plan elaboration, plan drafts are often reformulated then examined and made more precise during the next planning stages.

Figure 2.4

The Course of Industrial Planning for Annual Plans



4. Public management of industrial plans

(i) Follow-up of industrial plan implementation

In the first section of this chapter it has been shown that plan implementation in developing countries constitutes the major bottleneck in the industrial planning process in developing countries. The need for continuous and sustained monitoring of plan implementation stems simply from the fact that non-achievement or inconsistent achievement of plan targets will cause disproportional and interrupted industrial development. The preparation, implementation and follow-up of plans are organical phases of the perpetual process of planning. It is impossible to plan simply by preparing and implementing plans from time to time. Planning requires constant attention on the part of the planners and a systematic follow-up and analysis of the failures and successes.

The implementation of industrial plan in developing countries is usually decentralized in a number of sub-sectoral, functional and entrepreneurial operating organizations under the aegis, guidance and supervision of the ministry or ministries of industry, whereas evaluation of a plan's progress is centralized in the central planning body. Such evaluation depends on complete, accurate and timely reports on the progres of the execution of industrial projects, based on the respective responsibilities defined in the plan for achieving targets. The establishment of new productive capacities calls for the completion of preinvestment studies in accordance with the time frame indicated for start-up of production. Monitoring of this by the ministry of industry reveals causes of delays incurred in respect of both the public and private sector so as to make it possible to take timely corrective action. Increased production from existing enterprises is the responsibility of managers and consequently it falls upon them to monitor implementation and report on difficulties and bottlenecks encountered. With regard to the private sector, the central planning body relies on an appropriate system of consultations as well as regulations, penalties and incentives in order to ensure that the rate and level of implementation adheres to the plan.

Follow-up of industrial plans must cover both the plan of the existing enterprises and of the enterprises under construction. The latter are of extreme significance for developing countries, particularly in the initial

stages of industrialization. Follow-up offices must therefore be established within the above mentioned planning units. Moreover, experience shows that in order to improve the implementation of new industrial projects in developing countries it is important that the capacity of the construction be strengthened in order to reduce the gestation periods and costs of industrial project implementation.

To facilitate the follow-up of plan implementation it is necessary that a plan specify targets and responsibilities assigned to enterprises, economic managerial organizations and design and technical organizations, planning units of private modern and traditional sectors, the ministry of industry and the central planning body. The planner and decision-makers can then evaluate the extent to which the plan targets have been achieved during plan implementation. In this connexion, plan control means a systematic follow-up in the form of a statistical analysis comparing planned and actual figures. The report on the implementation of the plan must be based on the same indicators as those of plan elaboration (See figure 2.5)

In order to facilitate a proper follow-up of implementation of industrial plans and to avoid possible delays in execution, a reporting system must be established among the industrial planning bodies. The reports must permit identification of potential bottlenecks as early as possible; determination of their causes; evaluation of the extent to which deviations threaten the achievement of plan targets; and formulation of recommendations on corrective measures required.

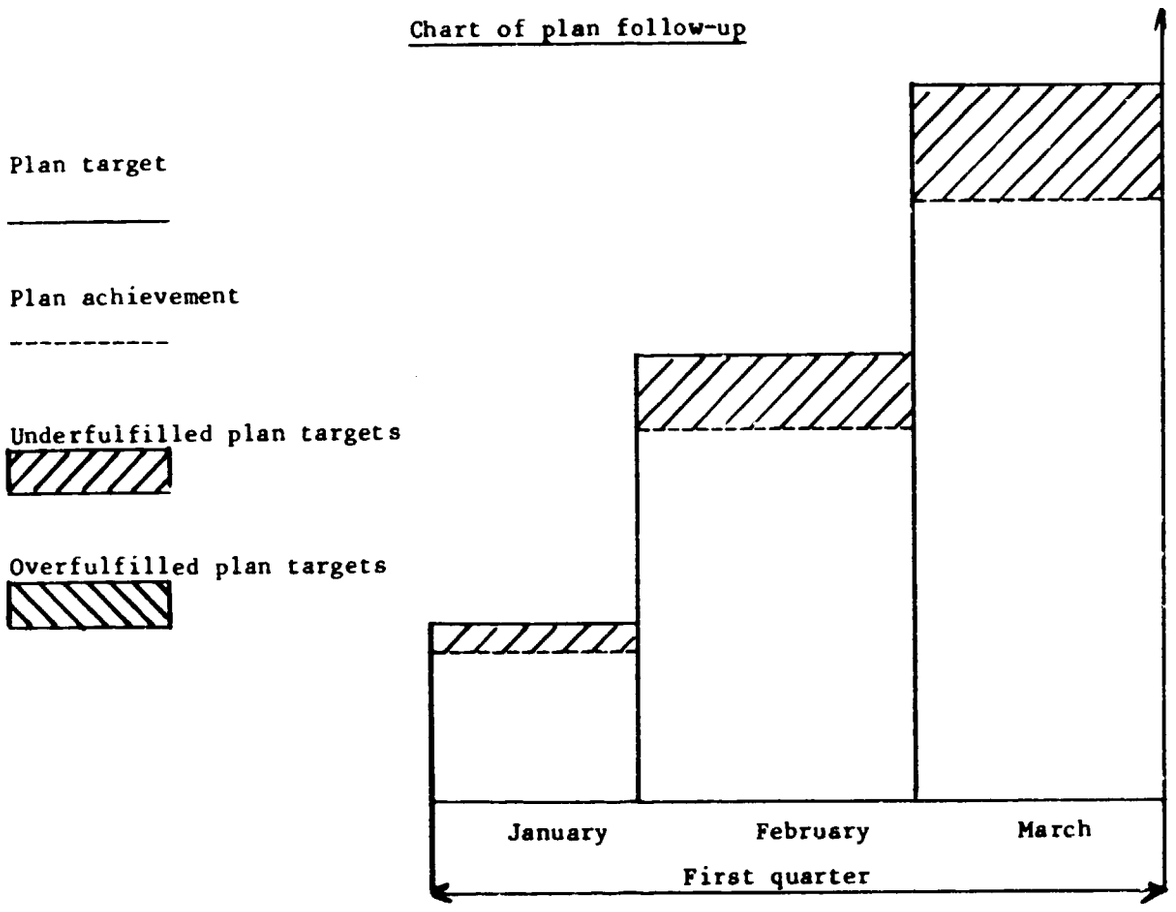
To enable a comparison of performance with planned schedule, a reporting system must take account of the following requirements:

(a) The reports must be made at least quarterly; they must be standardized, simple, short and expressed in physical and monetary units.

(b) The quarterly report on the implementation of new projects must indicate the progress made, in physical and monetary terms, as well as bottlenecks and constraints encountered.

Figure 2.5

Chart of plan follow-up



(c) The quarterly reports on planned production targets in existing enterprises must include information on the utilization of capacities, the rational use of materials and adherence to the cost plan.

(d) The central planning body must itself publish a quarterly report on the basis of reports received from industrial planning bodies and other bodies, indicating the potential bottlenecks and their causes and suggesting measures for plan adjustment.

(e) The central planning body must also prepare a comprehensive implementation report covering the period of medium-term plans, with a detailed description of past trends, and problems and constraints that have occurred during the period in question.

(f) Follow-up reports must be made public so as to mobilize public support and participation in project implementation.

(ii) Policy instruments for the implementation of an industrial plan

Taking into account the complexity of the socio-economic aspects connected with the achievements of plan targets, it is evident that the planning authorities require two categories of policies.

General policies

- Policies for popularization of the plan and organization of the active participation of the people concerned in each field of activity.
- Measures to be taken by the government for implementing the plan, such as incentives and penalties.
- An appropriate price policy for the whole economy.
- Appropriate policies concerning foreign trade, foreign exchange and foreign investment policies.
- Credit policy.
- Manpower policy (wages, training, conditions of labour, status of women and other related social policy elements).

- Technological development policies. It should be pointed out that due consideration should be given here to environmental protection.

Specific policies

All policies mentioned below have implications on the state budget. It is crucial therefore to rank them in such a way that the current budget is at least balanced.

- Specific policies for administrative institutions:
  - to create or streamline institutions as necessary in order to facilitate and/or speed up implementation of the plan;
  - governments should ensure that the targets specified in the plan are fulfilled at the level of the respective ministries and governmental bodies.

- Specific policies for the private sector, both modern and traditional, in addition to general policies, so that the activities in the private sector are in harmony with the plan objectives such as licensing policies and incentives measures in connexion with credit policy, sectoral, sub-sectoral and orientation, the technology utilized and the contracting policy with the public specifying the policies for domestic and foreign investment.

- Specific policy measures to upgrade the socio-economic conditions of the traditional sector, such as, among others, extension services, entrepreneurship development, production and marketing co-operatives, training, design and product development, etc.

- Specific policy mesures to increase the linkages between the industrial and agricultural sectors, such as:

  - the creation of conditions conducive to socio-economic development;
  - the organization of storage, transportation and marketing of agricultural products;
  - the supply of necessary inputs;

- the encouragement of the development of different types of co-operatives;
- the organization of off-seasonal activities to complement and supplement agricultural activities and incomes; and
- the organization of extension services.

The objectives of industrial policy could thus be promoted through several instruments. Higher income and employment generation could be attained through the investment process itself but wages and fiscal policies may be required to attain balance of payments equilibrium and taxation for income distribution goals. Tariffs, controls and multiple exchange rates are used to expand and protect domestic industry. The level of tariff protection may vary from one industry to another depending on a country's perception of the degree of self-sufficiency it wishes to attain based on the size of its domestic market and availability of natural resources. Administrative controls which comprise of such instruments as investment licensing, import licensing and foreign exchange permits are used because market prices cannot be relied upon to ensure allocative efficiency.

The planner would need to analyse the effects of these policy instruments on income distribution, employment, the rate of savings, imports and exports and the balance of payments. Some have argued that promotional measures such as incentives, export subsidies and multiple exchange rates are superior to mere protection of encouraging industry. Gross differences in foreign exchange yields per unit of domestic resource investment among import-replacing and export-producing activities may convey the impression that considerations of comparative advantage are being neglected unless refuted by a showing of substantial external economies, a demonstration that domestic resource inputs have low social cost, or by an evidence that the activity in question is an infant industry that would grow to robust maturity.

The arguments for restrictive commercial policies versus promotional measures are well documented in the economic literature. The choice between them and the extent to which they would be applied have to be determined in the course of preparing the plan. Developing countries have by and large derived experiences from the application of various policy instruments with varying degrees of success. Each country faces a different set of problems and potentials for resolving them depending on its size, stage of

industrialization and degree to which it considers it feasible to adopt inward- or outward-looking industrial policies or a mixture thereof. This aspect of the problem is discussed in the ensuing chapter of the Guidelines, i.e. Chapter VI. What needs to be underlined here is that the planner should identify in the process of plan formulation the choice of the set of instruments to be used to pursue the attainment of industrial policy aims based on an evaluation of the policy instruments used in the past and their potentials to meet the requirements of industrialization objectives in the future.

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III. STRATEGY OPTIONS IN INDUSTRIAL PLANNING

Industrial plan strategies

Industrial development strategies constitute the overall framework within which industrialization must take place and the goals towards which it should be oriented to bring about a self-sustaining process of industrial development. In a great number of cases, failure to formulate and implement industrial plans in developing countries is indirectly attributed to the lack of clearly defined and explicitly stated development strategies. However, there does not exist a universally applicable set of strategies for all developing countries, due primarily to the diversity of developing countries in respect of their stages of development, per capita income, economic structure, population and factor endowment. Each country will have to adopt its own strategy based on it priorities and a realistic assessment of what it could achieve in the short- and long-term time frame. Strategy options could vary widely in accordance with the level of industrialization attained, a country's endowment of resources and factor inputs, and its potentials for mobilizing the external technological and financial resources to supplement and complement its own efforts.

In general terms, countries could be grouped in accordance with the following criteria:

(a) Those that have an important internal market and are seeking to industrialize making use of that market;

(b) Those that are highly export-oriented in manufactures;

(c) Those that are primary goods manufacturers: agro and other processing industries; and

(d) LDCs whose main source of production is agriculture.

The first group of countries generally consists of all those countries which have passed through the entire state of import substitution for finished consumer goods and have entered the stage at which they are now able to

combine the export of manufactures with a fairly advanced substitution of imports, including the domestic production of a range of equipments. The second group consists of countries which, without having passed through any significant import-substitution phase, have begun to export, mainly to the developed countries, with reliance on their cheap labour and a high degree of dependence on foreign sources for the input and equipment required by their manufacturing activities. The third group of countries are those which have introduced important industrial productive facilities based on their natural resources but which have yet to widen and diversify their industrial structures. The fourth group of countries consists of all those endowed with meagre natural resources and lacking the entrepreneurial, technological and infrastructural prerequisites for industrialization.

Due to the great differences among developing countries, therefore, the planner in each country must envisage an appropriate set of strategies and must also readjust these strategies from one industrial plan to another. Some of the specific characteristics of strategies for different groups of developing countries will be indicated while discussing the individual strategies.

1. Basic industries strategy

In order to ensure a sustained industrial growth in developing countries, the basic strategic sectors of the economy should be given priority. These sectors are of great significance for industrialization because they give rise to backward and forward linkages in domestic production thus strengthening the process of self-sustaining industrialization

The basic industries strategy presupposes a highly integrated pattern of industrial development whether in relation to group (a) countries individually or other developing countries in the framework of regional and multinational

industrial co-operation arrangements or on the basis of well-identified natural resources or needs for essential consumer goods. The plan must identify the sub-sectoral priorities and core-projects for which a country wishes to develop internal capacities and capabilities of skills and technology so as to develop the strategic products necessary for its industrialization.

The basic industries strategy approach does not imply an autarchik system aimed at complete self-sufficiency. There is neither the need, nor in most cases the possibility, to create immediately an industrial basis enabling complete self-reliant development. It is not for that purpose that the policy-maker and planner singles out this strategy in the plan but with the aim of diversifying the country's industrial structure by fostering the optimal utilization of natural resources and interlinked production of capital, intermediate and consumer goods. The plan must identify the progressive share which the country would wish to acquire and that part which it intends to meet through domestic production. The objectives of self-reliant and self-sustaining growth require built-in mechanisms for organic growth, tending to restructure the economy in terms of increasing the internal physical capital potential and strengthening internal intersectoral relations, thereby progressively enhancing the internal dynamics of growth.

The strategic objectives which the planner has to address himself to, in this context, include the following:

(a) The achievement of total mastery of the technology of producer goods such as machine tools, heavy power-generation equipment, capital goods for the consumer and intermediate goods industries and a range of the required common facilities equipment;

(b) The development of the capital goods industry which meet the country's needs, its potentials and its long-term development prospects in the context of co-operation with other developing countries with the aim of fostering specialization, complementarity and trade;

(c) The harnessing of the entire national industrial potential to supply agriculture, at reasonable prices, with insecticides, fertilizers and heavy and light farm machinery. As for heavy agricultural equipment, original

prototypes must be developed as far as possible. The building and transport sectors must also be provided with the inputs and equipment they require;

(d) The development of domestic capacity for the provision of essential needs in respect of education health and housing;

(e) The export of finished industrial consumer products with a high value-added content and of industrial intermediates and equipments to both the developed and developing countries;

The size of the market is crucial to the strategy of basic industries, for the size of market for the capital and intermediate goods industries matters far more than it does in the case of consumer goods and agro-based industries. The size constraint here means that developing countries which have a large population and markets are more able to follow this strategy than medium and relatively small and smallish developing countries.13/

In order to clearly identify the possibilities for relatively smallish and small developing countr s in establishing capacities for different groups of basic industries, it is necessary that the planner carry out in-depth investigations, inter alia, of the following:

(a) Calculate the minimal economic size of production of major groups of basic industries and for different stages of production on the basis of the country's specific requirements. In this way the planner can identify processes and stages which could be economically justifiable. For example, in many relatively small and smallish developing countries, the establishment of small re-rolling mills for the main steel products has been shown to be economically justifiable.

(b) Examine the possibilities of efficient small-size units for basic industries, such as steel mills, as well as alternative products which require less capital-intensive methods and small size of production. Brick, tile and lime kilns are also generally small, dispersed, low in capital cost, fuelled

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13/ We may define small developing countries as those with a population of up to one million and of low per capita income, and smallish between one and ten millions, as well as those with less than one million, but of relatively high per capita income.

by oil, wood, peat or coal, whichever is available and economical, and serve a quite limited market radius. Another example is to encourage light engineering workshops for rural areas and small-scale mechanical engineering units for metal-work repairs and the production of certain spares and simple products. For island developing countries, repairs for sea-related activities is of importance.

(c) Examine the possibilities for co-operation among developing countries, especially on the regional and sub-regional basis. Given that some countries do not dispose of the resources to establish such industries, while others do not have large enough markets, by pooling resources and establishing multinational industries which benefit from economies of scale, they would not only overcome the current constraints upon their industrial development but would also contribute to the realization of collective self-reliance and self-sustained industrialization.

2. Import substitution strategy

Industrial growth, particularly in the initial stages of industrialization, is in most developing countries closely linked with import substitution, i.e., with the introduction of the domestic production of articles previously imported. In this sense, the import substitution strategy overlaps with the basic industries strategy. The latter is in fact, to some extent, also import substitution of capital and intermediate goods which were previously imported.

A number of factors have contributed to the emphasis given to this strategy by several countries in their industrialization plans. Firstly, import substitution implies that demand already exists. Secondly, import substitution provides new industrial undertakings in developing countries with substantial advantages due to the high costs of overseas freight, insurance and other related expenses entailed in importing finished products. Thirdly, import substitution has the advantage of reducing the continuous outflow of foreign exchange, if the intermediates could be produced locally. Above all the strategy is pursued for the possibilities it offers to foster industrialization through the learning-by-doing process i.e., the infant industry argument for tariff protection.

Import substitution strategy has, however, obvious drawbacks. First, it might lead to a distortion of consumption and production patterns and consequently to inappropriate allocation of scarce resources. The real costs might outweigh the real benefits. Secondly, it might result in an entrenchment of technological dependence, particularly where the import substitutes are of the final processing type. In these cases the domestic added value generated in the country is small and might even be negative at world prices because of the continued import of semi-processed intermediates and components of relatively high value. This problem is more pronounced in the LDCs where the intermediates required cannot be manufactured domestically either because of their small markets and/or because of the requirement of the mother company or owner of the branch to adhere to quality norms of the final product which obviates changes in product design. The shifting of imports from the product to the intermediates creates backward linkages with suppliers abroad instead of having the freedom to purchase the final commodity from various sources, thus tending to perpetuate dependency.[14/] Thirdly, the import substitution strategy might result in an industrial structure which lays first claims on domestic and foreign exchange resources even if it is recognized that its economic costs outweigh its benefits.

The planner, therefore, faces difficult choices. He must satisfy himself that the import substitution product singled out for domestic manufacture meets the criteria that would make possible for it to contribute to plan objectives, in terms of (a) net national benefits from the vantage point of the national economy; (b) allocation efficiency of scarce investment resources; (c) net savings of foreign exchange over the life-time of the project; or (d) the potentials that the investment offers for the acquisition of technology and the prospect that it would give rise to an expanding circuit of markets, incomes and re-investment.

These concerns suggest, therefore, the need to subject each import substitute project to close scrutiny prior to it inclusion in the planner investment programme. A system of project evaluation and screening should be an integral part of the planning process to ensure commercial and economic

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14/ For further details see the Annex (shifting from import of final products to their intermediates).

profitability criteria are met. If that should not be case, then the justifications for including the project should be explicitly stated: learning-by-doing, merit want, job creation or income distribution objectives. Even in these cases, the planner should attempt to assess and project that in the long-run the economic benefits would outweigh costs.

3. Export promotion strategy

This approach is universally sought in order to alleviate the foreign exchange constraint on industrialization. As a country industrializes, the foreign exchange gap widens because of the increasing volume of imports of industrial raw materials and producer and intermediate goods to which the process gives rise. Commodity exports cannot by themselves cope with the needs of foreign exchange for sustained growth and industrialization. The case for export promotion strategy lies on the absolute and comparative advantages existing in the developing countries to develop capacities and capabilities in manufacturing for exports.

The export of manufactured products from the countries producing the raw materials results in greater employment opoortunities besides considerably increasing the amount for value added derived from partial or complete processing of raw materials into semi-finished or finished industrial products. The export of manufactures from basically industrialized countries such as those in group (b)[15/] calls for greater internal integration of their export-oriented industrial sectors, such as textiles and electronics, so that domestic production of industrial inputs and capital goods are attained.

The selection of the components of the export sector calls for in-depth analysis and evaluation. In conducting the analysis, necessary adjustments have to be made, on the one hand, for support extended in the form of remission of import duties and concessional prices of infrastructural services

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15/ See page 69.

and, on the other, for transfer burdens which the export sector carries without getting the refunds paid as import duties on capital and equipment. Moreover, the industrial planner should reckon with the following problems connected with the creation of additional production capacities for exports:

(a) The intensification of exploitation of non-renewable mineral resources necessary for the processing of commodities for export could lead to their depletion;

(b) The export of processed agricultural products might create serious food shortages at home;

(c) The export of manufactured products entails cost components in foreign exchange, such as technology, machinery and equipment, and spare parts, as well as costs for the import of intermediate, semi-processed products and foreign skills. These could offset the benefits from exports;

(d) International markets are subject to substantial variations. Therefore, if the market penetration cannot remain stable, the new capacity created might remain idle, thereby creating additional cost burdens;

(e) Protectionism in developed countries tends to reduce the eventual advantage obtained by building up extra capacities for export.

In the area of export build-up, co-operation among the developing countries could play an invaluable role. The countries could enter into bilateral, triangular or multilateral agreements. For example, a country having rich deposits of bauxite could produce alumina; one having excessive energy sources could convert alumina into aluminium; one having a developed metal working and engineering industry could produce the down-stream fabrication and products. This type of co-operation could be helpful in the installation of large-scale plants taking full advantage of economies of scale in addition to factor endowments.

4. Resource utilization strategy

Resource-based industrialization offers possibilities for strengthening inter-sectoral and inter-industry linkages in the national economy, whether pursued under an import substitution or export promotional strategy. Thus in terms of the objectives of self-reliant and self-sustaining growth, the development of resource-based core industries are of great significance for developing countries [16/]. Of particular significance are agro-based industries. These industries must be given priority among consumer goods and intermediate industries for they can directly meet the basic needs of the population and contribute to the integration of different sectors of the economy. They have a significant impact on the pace and pattern of economic growth and industrial development, particularly in least developed, land-locked and island developing countries.

The planner should define the conditions under which the strategy would best contribute to plan objectives. To do so, in-depth assessments would have to be carried out. First, each country needs to survey its industrial raw material resource base, which comprises minerals, agriculture and forest products, biomass, livestock, fish and poultry; inland water resources and ocean resources; and renewable and non-renewable energy resources.

Secondly, in order to gear industrial production to resource supply in the country, it is of extreme significance that planners choose the appropriate commodities which could be produced on the basis of available, particularly abundant domestic resources, i.e. product choice, product design and the inputs required for their production. For example, textiles could be produced on the basis of different technologies ranging from hand looms to highly automated looms. They could be produced in different forms and from different materials, for example, natural or artificial fibres.

16/ Resource based core industries are defined as industries using domestically available resources. They constitute a nucleus providing basic inputs into industry and other priority sectors and/or producing goods and services to meet basic needs. UNIDO, Fourth General Conference of UNIDO, Vienna, 2 - 18 August 1984. Item 6. The Industrial Development Decade for Africa. Review of Progress and Proposals on Ways and Means to Attain its Objectives. Background Paper, P.12

To be sure, a countless number of possibilities exist for mutual substitution, not only among inputs necessary to produce a certain commodity but also among commodities of a certain value. The scientific technological revolution has widened substantially the number of such alternative variants of inputs and commodities. For example, the use of abundant wheat or rice straw for paper production, particularly in areas where timber is imported or insufficient, or the use of bagasse as energy source for the production of bricks and other construction materials. Another example would be the use of naphta or associated gas with oil to produce sponge iron instead of importing coal.

Thirdly, the planner should identify and define the range of possibilities for linking as many industrial capacities as possible to the abundant raw materials existing in the country. For example, in cases where timber is sufficiently available, the planner must encourage through different measures the utilization of timber to produce construction materials, furniture, paper and other commodities. In cases where huge electrical power could be generated from hydro-power stations, energy-intensive industries and processes could be justified, such as iron and steel and aluminium production as well as other metallurgical industries.

The strategy could equally be applicable to developing countries which dispose only of few or undiversified industrial raw materials for new industrial capacities could also be created based on imported raw materials. There are a number of examples where countries have industrialized without disposing of diversified industrial raw materials. The planner should establish whether the new manufacturing processes would meet the requirement that the ratio of domestic manufacturing value added to the gross value of output is relatively high, and that they would have the capability to export part of the industrial output so as to meet the bill for imported raw materials. Here again, joint co-operation among developing countries in the pooling of resources and the establishment of multinational industrial capacities can be of great importance in processing raw materials within developing countries.

5. Strategy for the appropriate choice of industrial technology

One of the most crucial problems in planning the industrialization process in developing countries is deciding upon the pattern of production methods to be used in industry, namely the choice of appropriate technology. In the matter of choice of technology for the industrialization process, the planner must deal with a number of connected issues, such as mobilization of resources, especially surplus labour, the order of priority to be assigned to different industries or sectors, their relative rates of growth at particular periods and the choice of methods of production in the industry, namely the choice between labour-intensive and capital-intensive types of technology.

(i) Labour-intensive technology

Labour intensive technology is characterized by a relatively high incremental labour-capital ratio ($\Delta L/I^n$)[17/], which means that the application of this technology would offer more employment opportunities for a given amount of investment than would be the case with capital-intensive technology. The use of labour-intensive technology has been favoured in many cases to immediately maximize employment. Thus, for instance, instead of supplying a relatively small number of mechanical looms, it would be more urgent from the point of view of immediate employment to supply a host of hand looms capable of employing a lot of labour at relatively low level of productivity. This statement is misleading for, as we shall see later, output and employment can also grow larger on the basis of capital-intensive technology [18/]. The importance of labour intensive industries, such as handicrafts and cottage industries for developing countries stems mainly from

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17/ See annex: planning indicators of resource allocation.

18/ The problem of employment in connexion with the choice of technology should not be regarded solely within the direct productive activity. For employment usually grows much faster within the industrial and social services that are built around industry. In some countries the ratio of labour force on the latter to those in direct production is 8/1. What really matters here is the substitution of capital by labour due to the scarcity of capital in the initial stages of industrialization. This problem will be elaborated upon as the discussion proceeds.

the fact that they can play an important role in satisfying part of the basic needs of the population for consumer goods on the basis of local raw materials and simple production tools which are also produced by and large by local handicraft.

(ii) Capital-intensive technology

Capital-intensive technology consists of highly productive, up-to-date machinery and equipment which require relatively high capital for furnishing one working place (high incremental capital-labour ratio $I^n/\Delta L$), and it is characterized by high incremental output-capital ratio $\Delta Y/I^n$ and high output-labour ratio Y/L as compared with the labour-intensive technology. Modern technology is always oriented towards higher output per machine and worker during a fixed time as compared with traditional technology. In modernizing production technology the volume of output does not vary in linear proportion to the cost of the machinery. In fact, output increases faster than investment costs. For example, the materials and labour required to produce an outdated lathe do not differ greatly from those required for a modern lathe except for the electronic accessories. Whereas the output of the modern lathe (especially the semi-automated or fully automated) may be a hundred times higher than the outdated lathes.

Thus, investment in capital-intensive technology would always use less labour and less capital per unit of output than would the process with low capital-labour ratio. This means that it would be possible to produce more output with the same amount of investment in fewer production units with much less employment if capital-intensive technology were applied. This, in fact, explains why the capital-labour ratio tends to increase as a result of technological improvements in accordance with the economic law of concentration of production and capital.

The application of labour-intensive technology lies mainly in consumer goods industries. Basic industries require certain machinery and equipment for processing, such as lathes, forging machines, furnaces and cranes. Iron, steel and petrochemical materials cannot be produced on the basis of handicrafts methods. Mechanical engineering requires certain levels of

mechanization so as to ensure minimum levels of quality. On the other hand, some basic products can still be produced on the basis of labour-intensive methods, for example, building materials, such as bricks and lime.

The fact that labour-intensive technology is applied primarily to the consumer goods industries means that such industries are preferable to basic industries and hence tends to foster a faster growth of consumption and slower growth of investment. Other things being equal, this means a slower increase of output in the long run and little chance of establishing the basic industries required for a self-reliant and self-sustaining growth. If basic industries are chosen, then the supply of capital goods will grow faster causing a higher investment ratio. The increased physical capital would then be used to stimulate further additions to the labour force. Thus, capital-intensive technology could, in the long run, maximize output and employment.19/

(iii) Choice of appropriate set of technologies

For each developing country there must be an appropriate technology to produce certain groups of products in accordance with the country's economic indicators. The appropriate technology must ensure practically the best combination of available labour force, available investment resources in the form of financial means, particularly foreign exchange; and natural resources, in order to optimize the industrialization process. In addition, in deciding on the appropriate technology for a given product in a given country, the planner must deal with a number of other problems, such as the choice of the type of technology which would prove economically justifiable in respect of the size of the market as well as the introduction of technological innovations to improve the efficiency of production with relatively small capital requirements.

19/ See the annex: Some analytical observations on the choice of technology.

The latter is of particular importance for improving the efficiency of agro-based industries. For example, the introduction of the emerging technologies applied in this field, such as biotechnology and genetic engineering, can play a decisive role in improving the productivity of labour and capital. It should be pointed out that the appropriate technology changes with the development of the country. Very important from the point of view of dynamic development of technology is the fact that technological development must increase the productivity of labour and capital. Output increases due to improvement of the technology, which, in turn, causes labour and capital productivity to increase. In this connexion, developing countries which desire to increase the level of employment must examine the labour-intensive technology. A labour-intensive technology which does not provide surplus revenues cannot be recommended in the long run, except, maybe, for certain regions, since only savings can create opportunities for new investments; otherwise the economy could remain stagnant.

- Issues influencing technological choices

In dealing with the problem of combination of labour and capital, the planner has to tackle the problems of the proportion of capital-intensive to labour-intensive capacities in the industry concerned. This proportion will, of course, vary from country to country. In the case of developing countries with a very high per capita income, such as small OPEC countries, where national income exceeds by far the countries' development and current requirements, there is, of course, no place for labour-intensive technology. Conversely, in developing countries with a very low per capita income, high surplus population and well established traditional sector for consumer goods, the planner could follow the following concept:

(a) The introduction of capital-intensive technology in such a country should preferably, in the first stages of industrialization be limited mainly to the basic and capital goods industries. Here the limited savings in foreign exchange and aid resources available should primarily be channelled to the sectors of industry that can expand the domestic physical capital potential.

(b) The traditional sector, which is labour-intensive, could maintain its role in the economy, but efforts are needed to upgrade its efficiency. Research institutions and information services, both at national and regional levels are probably fruitful ways of encouraging more appropriate R + D.

(c) Moreover, in such a country basic consumption needs should be met as much as possible from labour-intensive processes. Here the patterns of consumption should be changed to facilitate more labour inputs. For example, instead of producing consumer durables, such as automobiles, washing machines and air-conditioners which need capital-intensive production, it may prove more appropriate for the country to produce bicycles, laundry machines and coolers which need less capital-intensive technology.

(d) Certain capital goods and intermediates could also offer possibilities for introducing less capital-intensive processes. For example, in rural areas and some urban areas lime, bricks and wood should be used instead of cement; and roof tiles instead of galvanized iron or synthetic roofing.

(e) Another way of encouraging the labour-intensive technology would be to focus on goods and processes that have a comparative advantage in world markets because of the high labour content of the industry concerned as has been witnessed by the performance of some newly industrialized countries in textiles and electronics.

For countries with surplus labour in fields where the introduction of capital-intensive technologies is indispensable, particularly in the basic industries, it is extremely important that the planner should attempt to overcome the contradiction between capital-intensive technology and unemployment by stretching the capital-intensive technology to the level of employment required. The planner must therefore focus on ways and means that would encourage engineers, technicians and skilled workers to explore possibilities for stretching the capital-intensive technology to the level of employment required. In fact, there are always possible ways in which labour can be efficiently substituted for capital even if a capital-intensive technology must be applied. During Japan's early industrialization, for example, when wages were comparatively low, machinery in textiles and other

industries were utilized more intensively by running extra shifts. This caused more frequent halts for repair, but repair was again a labour-intensive activity and hence the overall effect was greater labour intensity and greater efficiency in the use of all resources.

Thus, even in a process in which mechanization is necessary, double and triple shifts greatly decrease the overall capital-labour ratio. It should be pointed out here, however, that stretching the capital-intensive technology requires a proper maintenance and repair capacity, otherwise the costs will affect the benefits. Similar capital-stretching labour-intensive techniques are currently being used in some South-East Asian countries in textiles, electronics, wood working and other industries.

In fact, there does exist considerable scope for the use of more labour-intensive methods in countries with surplus labour through the appropriate choice of product mix. The range of choices are far from complete on both the production and product side. It is the task of the planner to spread awareness among engineers and technicians so as to increase this range. Even for products in which there may be technical rigidity in some main production processes, there are always peripheral processes, such as materials handling and packaging which can be done efficiently with labour-intensive methods, so that the overall production could still consider greater labour-capital substitution. Moreover, there are a number of assembly operations where more labour can be introduced if organized on a sub-contracting or auxillary industry basis. It has been found feasible to do so in the electronics industries in some labour-surplus countries.

Finally, the planner should bear in mind that there is a close relationship between process adaptation and product adaptation. In many cases adaptation of the processes requires production adaptation, making fine distinction less critical and frequently lowering the general quality of the product. In this respect, the potentials available within the developing countries could be considered. Some inventions and adaptations do occur in developing countries, and there are a great number of cases where developing countries have altered developed countries' machinery or processes to suit their particular conditions.

- Integration of technological planning and industrial planning

Technology planning is a vital component of the industrial planning process. Most developing countries, particularly least developed countries lack experience in the field of technological planning. The introduction of technological planning in these countries is a complicated task calling for a number of necessary preconditions and organizational procedures, some of which are outlined below:

(a) It is necessary to integrate science and technology in the overall management and planning process. This requires, above all, the establishment of a central planning board or agency for science and technology to advise and co-ordinate its work with the central planning body in plan preparation and implementation. This board can play an important role in avoiding duplications in research and development and in harmonizing efforts, as well as in promoting the process of innovation and the introduction of new production methods and new products.

(b) Research and development centres should be established within the major industrial complexes and estates in order to master, maintain, modify and possibly develop or copy imported technology and to facilitate the production of required spare parts.

(c) The great majority of developing countries face the problem of spare parts for industry. This is due to the absence of domestic capital goods industries and dependence upon numerous sources of supply. There is, therefore, a need for a central management of spare parts production and supply to foster standardization and to co-ordinate efforts in order to produce some parts or to introduce changes in the design of production equipment.

The technological plan should be prepared in advance of the production plans, in order to decide upon the choice of technology, including the types of product to be produced and the appropriate inputs and technologies for producing such products. In addition, the technological plan must include sections on standardization and spare parts, as well as stimulation measures

and the creation of an appropriate structure of industrial production to gear output to domestic resources in those countries with relatively diversified industrial raw materials.

The planner should also explore and define the possibilities of acquiring and adapting industrial technology by means of co-operation among developing countries in the field of technology.

The emergence of technological advances could easily lead to increased dependence of developing countries on external sources. They share common problems in regard to information collection, forecasting, assessment, selection, acquisition, endogenous development and the application of new technologies. An exchange of information on policies and experiences in this field is therefore necessary. Co-operative programmes could extend beyond the exchange of information to a collective negotiation and acquisition of technologies and the setting up of common production facilities, technological institutions and programmes. Equally important, the developing countries may have to consider a collective strategy for their response to technological changes.

6. Economies-of-scale strategy for the promotion of large-scale plants

In the industrialized countries, production has been concentrated in large-scale plants which are characterized by the utilization of modern capital-intensive technology and by the need of large capital investment and a continuous supply of raw materials, energy, labour and vast markets. The introduction of large-scale plants led to an unprecedented increase in the output-capital, the capital-labour and output-labour ratios, due to the fact that physical capital, labour, energy and raw materials increase more slowly than output. Some expenditures, such as design costs, civil engineering, buildings, and links with power and transport networks, etc. are to a large extent independent of the scale of production.

Moreover, physical capital itself does not vary in linear proportion to productive capacity. In the chemical, iron and steel, food processing and cement industries and many others, capital equipment is in the form of tanks, compressors, furnaces, gas holders and columns. The costs of such equipment are mainly a function of the materials used in enclosing a given volume, that is to say, of the surface area of the item in question; whereas output is a function of volume. In other industries, the larger the capacity the more specialized, more productive and more labour-saving is the equipment. Specialized equipment cannot be utilized effectively in small-scale production because of the limits in output and because of the flexibility necessary for producing a wider variety of products. The introduction of specialized equipment in large-scale production, however, increases the tempo of production faster than the cost of equipment.20/

Economies of scale result also from the use of similar production equipment, thus removing bottlenecks and achieving appropriate proportions among capacities of different production units and at different production stages within a single integrated production process. Moreover, the benefits from economies of scale are not only confined to the main production units but also occur in different industrial services, such as the provision of steam, repair shops or storerooms, as well as in industrial infrastructure such as access roads, railroads, freight stations, ports, electric power installations and the sewage system.

It should be pointed out here that, in calculating the advantages of economies of scale, the planner must also take into account the losses connected with the increase of production capacities, such as transport costs of raw materials and finished goods, which usually set economic limits to the scale production.

The introduction of large-scale plants in developing countries faces three major constraints. First, the establishment of large-scale production presupposes the existence of a sufficiently large and easily accesible market,

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20/ See the annex on the relationship between the industrial capacity and production costs.

which is practically non-existent as far as many products in a large number of developing countries are concerned, particularly in the small developing countries.

Secondly, modern large-scale production can function properly only if there are a number of allied sectors which provide power and necessary intermediates, process the by-products and transport the output. In order to establish large-scale production these facilities would have to be created in developing countries, with the result that the absolute amount of capital required for each enterprise would be high. Hence, the introduction of large-scale production in countries with sufficient markets but with low level of savings would be at the expense of diversification of industrial production.

Thirdly, developing countries frequently fail to properly utilize production capacities in the modern sector of the industry because of a lack of skills and of deficiencies in the organization and management of production, as well as insufficient inputs for industrial processing or an insuffient demand for the final products, in addition to operational problems. The standing idle of capital intensive means of production within large-scale production units results in enormous economic losses.

(i) Planning for large-scale plants

In order to make use of economies of scale, the planner in a developing country must carry out market analyses of the major groups and key products which are preferably produced in large-scale units, especially those with strong forward linkages. If the size of the market for certain products permits investment in large-scale projects, then it may be preferable to invest in one or a few large-scale projects instead of fragmenting investments among a large number of small projects. Here the planner must take into account the external factors, such as transport costs of raw materials and finished goods in the case of heavy products, as in some cases (for example, cement) transport costs could affect the economies of scale due to a concentration of capacities at fewer sites.

In addition, it may be preferable that large-scale industries in developing countries be constructed in stages, so as to avoid imbalances and

bottlenecks in respect of labour, physical and social infrastructure and diversification of production, etc. It is important that attention is given to producing a design of large-scale projects which is capable of implementation in stages by adding horizontal and vertical units of main production and industrial services, as well as physical and social infrastructure.

There are many possibilities in this respect, for instance, by including the main downstream or upstream operation step-by-step. A common example in this respect are iron and steel complexes, where blast furnaces, steel-making furnaces, rolling mills, foundries, as well as different units for processing a number of necessary inputs and of by-products can be built in stages and in accordance with a predefined schedule.

Another possibility for further benefiting from economies of scale is to install capacities of similar processes within single sites, for example, the creation of a complex to produce all kinds of different electrical equipment. A country can add new capacities to the complex in each medium-term plan so as to produce additional types of electrical equipment to meet further demand. Such complexes must be planned carefully, and account should be taken of the non-productive aspects of the projects, such as the necessary expansion in the infrastructure, housing, social services and pollution.

In planning large-scale industries in a developing country the planner must take account of the appropriate technology. As has been mentioned in Chapter I, there has been a tendency among many developed countries to confine production and hence exports to highly sophisticated technologies. In many cases developing countries were not able to master or acquire those technologies, which require certain specialized experience and highly skilled labour, as well as the necessary R + D facilities and other institutions that are built to provide integrated technical, commercial, financial and scientific know-how. These technologies are usually patented and represented in the form of "closed packages". They are rather expensive and lead to direct dependency.

Technological tie-ups are, of course, connected with additional costs for maintenance, spare parts and other critical intermediate products. Moreover, difficulties connected with the problem of mastering the technology result in

a low level of capacity utilization. Developing countries need standardized methods of production and standardized products, which can be acquired from various sources in the world market, including newly industrialized developing countries. Standardized technology is much more easier to master, adapt and further develop.

Moreover, the planner must take into account the capacity for training which is required for large-scale industries. For example, the construction of large-scale industries must provide "on-the-job training" for construction workers so as to enable them to run the production later. This is not always possible to realize at present. However, where the preferred form is to conclude contracts with developing countries for the supply of very modern technologies on a "turn-key basis", skilled labour and material supplies are usually bought from foreign sources.

7. Strategy for the development of small-scale and cottage industries [21/]

Small-scale and traditional industries are of great significance for the industrialization of developing countries. This is mainly due to the following factors:

(a) They acquire a relatively low level of initial capital investment per enterprise. This is of special importance for developing countries with a low rate of domestic savings. Investment opportunities in these industries may provide an outlet for personal savings at relatively low income levels which would otherwise be channelled into other activities, thus enabling local entrepreneurs to set up small-scale and traditional establishments. Where the demand for scarce foreign exchange is low, such as cottage industries, they

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21/ Small-scale industries are production units utilizing capital-intensive technology. Therefore they differ from tradional industries, such as "cottage industries" and handicrafts which are based on labour-intensive technology.

can play a significant role in supplying basic needs and possibly also of intermediates for industry, at reasonable levels of domestic resources relationship to foreign exchange costs.

(b) Small-scale and cottage industries do not require large markets. Therefore, they could be easily introduced in the smaller developing countries. Their production could easily be geared to local industrial raw materials, particularly agricultural raw materials. In this connexion agro-based industries are of particular significance because of their direct role in improving the standard of living by processing cereals, oils and fats, dairy products, fish, meat, fruit and vegetables, alcoholic and non-alcoholic beverages and sugar. This can also play a significant role in producing the necessary intermediates for other consumer goods industries, for example, cotton fibres, wool, hides and skins, wood, timber, etc.

(c) Unlike medium-scale and large-scale enterprises, small-scale and traditional enterprises do not depend largely on public utilities, repair services, transport facilities, industrial buildings, etc. Very small and traditional establishments generally provide their own power (mechanical, hand or generator) and can adapt to different types of physical location. For this reason it is possible to establish them in small towns and villages. This is of extreme importance for the industrialization of developing countries, particularly least developed countries. Thus location of small-scale and cottage industries, particularly agro-based industries, in rural areas would help bring about a balanced social and economic development of rural areas and the rural population, which makes up 50 - 70 per cent of the total population of most developing countries. The promotion of agro-based industries in rural areas can foster strong linkages with agriculture and avoid excessive movement of labour from rural to urban areas and, at the same time, increase production within the rural areas, thus generating income and employment in the rural sector.

These benefits can only be gained under specific conditions, which require appropriate organizations, policies and measures. Above all, it is necessary that the industrial planner in a developing country identifies the areas where the operation of these industries can be effective from the

overall point of view of a country's development, on the one hand, and organizes these industries in a way to improve their efficiency on the other. These include:

(a) Organization of linkages and mutually supportive relationships between modern capital-intensive and small industries. It could be that the introduction of capital-intensive technology could reduce the potentials of job creation in the small and cottage industries particularly in the initial stages of development. For example, the establishment of a shoe factory in a certain African country created 100 jobs but put out of jobs 5,000 craftsmen. It is, therefore, necessary that the planning unit for the private traditional sector clearly identify the fields and possibilities for small-scale production within the modern sector. The plan for this sector must be co-ordinated with the plans of the modern public and private sector. For example, in planning the supply of footwear, the part of the demand that could be covered by the traditional sector must be estimated exactly. The rest should be covered by the modern sector.

(b) Organization of division of labour between small-scale and large-scale industries. It is necessary to identify at the sub-sectoral level in each country the possibilities and economies of scaling down production in normally large-scale industrial activities. In general, many industries, particularly consumer goods industries, are usually medium- and small-scale industries due to several factors, such as storage costs, distribution costs, market conditions, etc. But even within certain commodities of basic industries, it would be possible to economically utilize large- and small-scale production units. For example, the cement industry is at present promoting 4 sizes of plants:

Very large	-	3,000 tonnes/day (or more)
Standard	-	2,000 tonnes/day
Mini	-	200 tonnes/day
Tiny	-	20 tonnes/day

Each of these scales of production could be economically viable under certain conditions. A number of similar examples could also be drawn from the mechanical engineering sector. In many other cases, planning authorities

decide on small-scale units to produce strategic products, even if it is uneconomic at the beginning. For example, the introduction of a central forging unit into the mechanical engineering sector; here, the planner must calculate the direct and indirect benefits in the long-run, such as training of skills, encouraging and intensifying domestic processing, increasing demand for forging, and the possibilities of a step-by-step expansion of this unit into a medium- or large-scale operation in the future.

(c) Organization of co-operation of production between small-scale and traditional industries, on the one hand, and between these industries and the large-scale industries, on the other. Within such a co-operation scheme, the small-scale and traditional industries could be organized to undertake special operations or through sub-contracting arrangements with large-scale plants. For example, small-scale industries could produce parts for automobiles, motors, TV sets, bicycles and sewing machines for subsequent assembly. In many cases there are also possibilities for handicraft units to participate in some of these operations. This method, however, requires some effort on the part of the government in order to train and form the necessary skills.

(d) Organization and establishment of industrial estates. Such estates must be connected with railroads and highways and must provide the industries with fresh water, electricity and steam from a central generating plant. Moreover, industrial estates must have training centres to service a number of occupational trades represented in industries in the district, and R + D facilities to provide technical services, and have access to loans on concessionary terms. In this way, small-scale and traditional industries can benefit from the economies of scale of industrial infrastructure and industrial services. Thus industrial planning can induce industrial growth at selected locations where it can be shown that optimum advantages exist from the overall economic point of view for decentralizing industrial activity via small scale industries.

ANNEX

Planning indicators of resource allocation

In the following pages we will introduce some important planning indicators which can be used to closely examine the problems of resource allocation and growth in industry. These indicators are widely used in planning practice and with their help it is possible to identify the dependence of the growth in manufacturing value-added on investment and employment in different industrial sub-sectors and the types of product and input required therefore. Some of these ratios are also employed as criteria for evaluating the economic effectiveness of individual projects.

The capital-output ratio: (K/Y)

The capital-output ratio or sometimes called the investment-output ratio expresses simply the relation between the value of total capital used (K) and the value of net output in one year (Y). It will vary from industry to industry and will also change over a period of time, e.g., as a result of technical change. As a ratio for a country as a whole it represents an aggregate of numerous different ratios for particular industries and other sectors of the economy, and one has always to remember that this aggregate ratio may be high or low according to which industries predominate in the country in question. The ratio may be affected by the intensity with which capital equipment is utilized. If some equipment is standing idle or is only used intermittently (in other words, if there is excess capacity) the ratio will tend to be low.

Incremental capital-output ratio ($I^n/\Delta Y$)

The incremental capital-output ratio ($I^n/\Delta Y$) expresses the relation between net investment or new investment (I^n) and the value of the additional output in one year over and above that produced during the previous year (ΔY).

Capital-labour ratio (K/L)

The capital-labour ratio (K/L) expresses the relation between the value of capital used (K) and the amount of total manpower employed.

Incremental capital-labour ratio ($I^n/\Delta L$)

The incremental capital-labour ratio ($I^n/\Delta L$) expresses the relation between net investment or new investment (I^n) and the amount of additional employed manpower in one year over and above that employed during the previous year (ΔL).

Labour-output ratio (L/Y)

The labour-output ratio (L/Y) expresses the relation between the amount of active labour force (L) in the country and the value of net output in one year (Y).

Input-output ratio (W/Y)

The input-output ratio (W/Y) expresses the value of inputs (W) needed to produce net output (Y) in one year. The smaller the input-output ratios, the larger the net output; for the lower the consumption of inputs during the production process, the larger is the net output, so leading to a direct growth of industrial output.

The reinvestment ratio (I^n/K)

The reinvestment ratio (I^n/K) expresses the relation between the value of net or new investment (I^n) and the total value of capital used (K).

Shifting from import or final products to their intermediates

The negative impact of increased intermediate imports as a result of substituting the import of the final product could be demonstrated on the basis of the following equation:

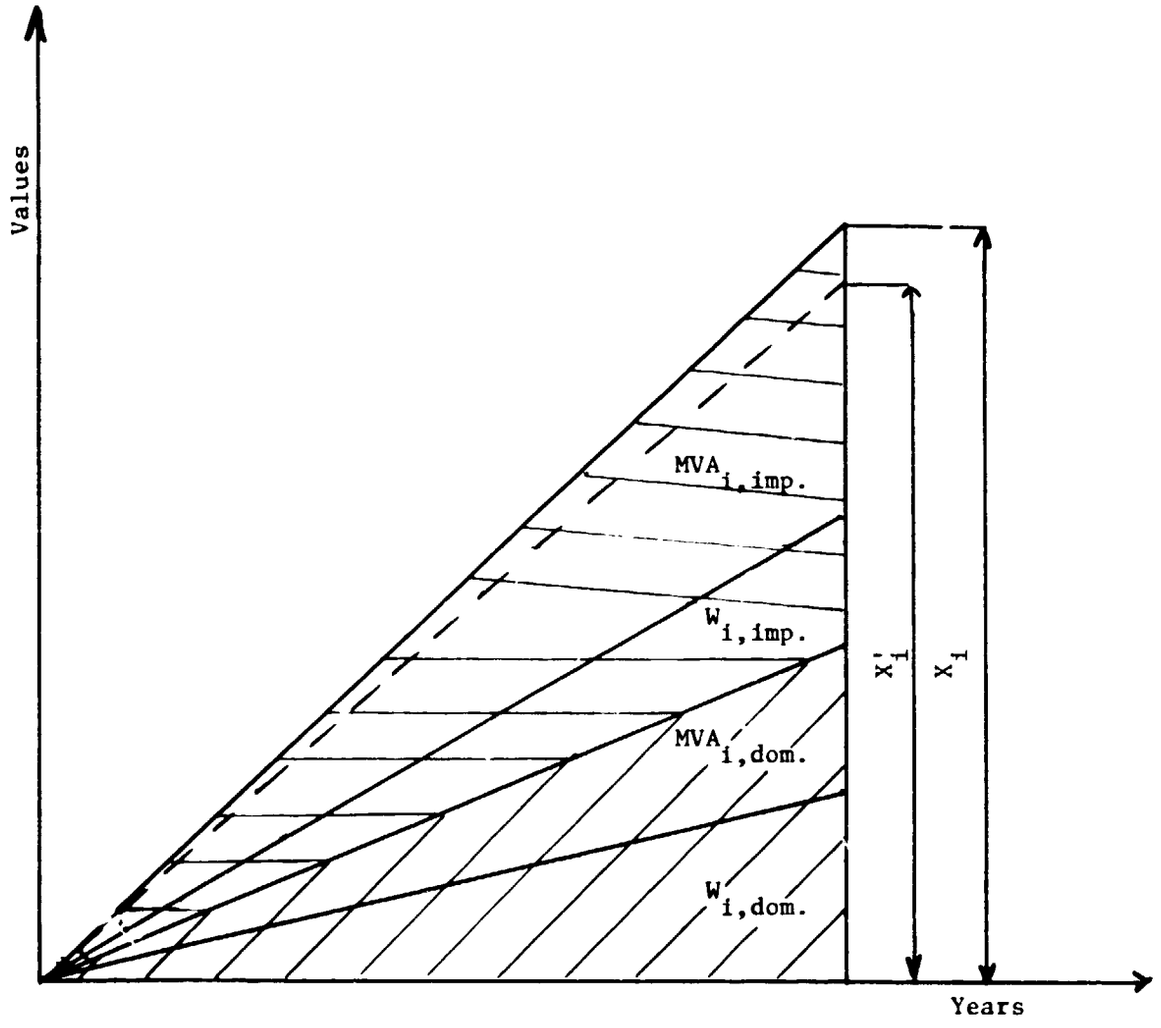
$$X_i = MVA_i + W_i \qquad \ldots \qquad (3.1)$$

where X_i is the domestic value of output of the sub-sector (i), MVA_i the manufacturing value added originated in the sub-sector (i) and (W_i) the value of intermediate consumption of the sub-sector (i). Part of the intermediate consumption is imported $(W_{i,imp.})$ and the other part is produced domestically $(W_{i,dom.})$. The value added originating in the sub-sector (i) contains different components in foreign exchange, such as depreciation of imported machinery and wages for foreign skills. Thus, here again we have value added originating from domestic sources $(MVA_{i,dom.})$ and manufacturing value added originating from imported sources $(MVA_{i,imp.})$

Now we asume that the value of the substituted product on the world market is (X_i'). This value (X_i') might be smaller or larger than the domestic value of such products (X_i) because both values are determined independently. Moreover, the direct benefit from import substitution is equal to the value added originating from domestic inputs. The direct benefit would be maximum if the imported components were zero and would diminish with an increase of the latter, as shown in the inequality below (see also Figure 3.1)

$$0 \gtreqless X_i' - (W_{i,imp} + MVA_{i,imp}) \qquad \ldots\ldots \qquad (3.2)$$

Figure 3.1



Some analytical observations on the choice of technology

The analysis of the choice of technology must start with the ratio of output of means of production to that of consumer goods. This ratio determines the allocation of net output (Y) to both consumption (C) and accumulation. For convenience we assume that accumulation is totally used in new investment (I^n).

$$Y = C + I^n \quad .... \quad ... \quad (3.3)$$

If basic industries are chosen then the supply of capital goods will grow faster than that of consumer goods, causing thereby higher reinvestment ratio (B).

$$B = \frac{I_o^n}{K_o} \quad .... \quad ... \quad (3.4)$$

$$I_o^n = Y_o - C_o \quad .... \quad ... \quad (3.3^a)$$

$$B = \frac{Y_o - C_o}{K_o} \quad .... \quad ... \quad (3.4^a)$$

Where (o) indicates the base year (t_o). In the numerator the difference between net output and consumptions would be higher in the case of basic industries than labour intensive industries due to the increase of capital goods output which are physical investment sources, and relatively lower requirements for labour and thus relatively lower wages and consumption. Thus the investment ratio could change in favour of investment if the output were higher.

Let us now assume that the duration of the gestation period is one year. Then in the next year (t_1) an investment of $I_o^n = BK_o$ is added to the initial stock of capital K_o. Therefore, the stock of capital in that year (K_1) would be:

$$K_1 = K_o + I_o^n \quad ... \quad ... \quad (3.5)$$

$$K_1 = K_o + BK_o \quad ... \quad ... \quad (3.5^a)$$

$$K_1 = K_o (1 + B) \quad ... \quad ... \quad (3.5^b)$$

From equation (3.5^b) it is obvious that channelling investment into basic industries will lead to expansion in stock of capital. This virtually means expanding factories, roads, ports, etc., and therefore, facilitating more production.

The net output or income in the next year (Y_1) will be:

$$Y_1 = Y_o (1 + r) \quad \ldots \quad (3.6)$$

where Y_o is the value of net output in the base year.

$$r = \Delta Y_o / Y_o \quad \ldots \quad (3.7)$$

$$r = I_o^n / Y_o : I_o^n / \Delta Y_o \quad \ldots \quad (3.7^a)$$

Substituting the value of r in equation (3.6) we arrive at the following:

$$Y_1 = Y_o [1 + (I_o^n / Y_o : I_o^n / \Delta Y_o)] \quad (3.8)$$

From equation (3.8) it is obvious that investment in the capital-intensive tecnnology leads to a higher growth of net output because of the relatively small value of incremental capital-output ratio ($I^n / \Delta Y$).

Finally, the number of jobs in the next year (L_1) will be:

$$L_1 = l_o (1 + r_L) \quad \ldots\ldots\ldots \quad \ldots \quad (3.9)$$

where (L_o) is the number of jobs in the basic year.

$$r_L = I_o^n / Y_o \cdot \frac{\Delta L_o / I_o^n}{L_o Y_o} \quad \ldots\ldots\ldots \quad \ldots \quad (3,10)$$

$$L_1 = L_o \left(1 = I_o^n / Y_o \cdot \frac{\Delta L / I_o^n}{L_o / Y_o}\right) \quad \ldots \quad (3.11)$$

(L_1) could also be calculated on the basis of the following equation:

$$L_1 = \Delta L_o / I_o^n \cdot K_1 \quad \ldots\ldots \quad \ldots \quad (3.12)$$

$$L_1 = \Delta L_o / I_o^n \cdot K_o (1 + B)$$

Because of the low incremental labour-output ratio of capital-intensive technology in the initial stages of industrialization, less labour would be required as compared with the labour-intensive technology. However, with the development of industry, the total capital and investment ratio will increase faster causing higher employment rates in the future.

The relationship between industrial capacity and production cost

In practice the six-tenth rule is usually used for comparing investment costs required for different capacities. If, for example, Y_A and Y_B are the capacities of two plants A and B, and I_A and I_B the respective investment costs, then:

$$\frac{I_A}{I_B} = \left(\frac{Y_A}{Y_B} \right)^x \quad \ldots \quad \ldots \quad (3.13)$$

where (x) is a coefficient representing economies of scale. For example, in the case of spherical container area varies with the volume and thus the capacity to the power of 2/3.

Example:

The capital investment required for the construction of a steel mill with an annual capacity of 100 thousand tons is 100 million monetary units.

Required

1. Calculate the capital investment required for a mill with an annual capacity of 200 thousand tons.
2. Calculate the capital-output ratio for both mills.

Solution of part 1:

$$\text{Ln } I_{200} = \text{Ln } (100) + 2/3 \, [\text{Ln } (200) - \text{Ln } (100)]$$

$$\text{Ln } I_{200} = 4.6052 + 2/3 \, (5.2983 - 4.6052)$$

$$\text{Ln } I_{200} = 4.6052 + 2/3 \, (0.693147)$$

$$\text{Ln } I_{200} = 5.067298$$

$$I_{200} = 158,744,800.0 \text{ monetary units}$$

Solution of part 2:

$$I_{100}/Y_{100} = \frac{100,000,000.0}{100,000.0} = 1000.0 \text{ monetary units/ton}$$

is the capital-output ratio of the first mill

$$I_{200}/Y_{200} = \frac{158,744,800.00}{200,000.0} = 793.724 \text{ monetary units/ton}$$

is the capital-output ratio of the second mill

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IV. THE BASIS FOR INDUSTRIAL PLANNING

1. Plan goals, objectives and targets [22/]

There can be no rationality in choice of resources and their combination if there are no goals toward which purposeful actions are directed. Therefore the normal course of plan preparation is to start with the setting up of goals. Many goals of the national plan serve as goals for the industrial plan, for example "economic independence", "more equitable distribution of national income" and "improvement of standard of living". Goals must be compatible with one another, i.e. no goal or set of goals should contradict another.

For the preparation of medium-term and long-term plans, goals must be transferred into objectives after analyzing the capability of the economy to carry them out. For example, the objective necessary for meeting the goal of improving the standard of living, would be an increase in industrial output of basic goods required by the population, an increase in productive agricultural and industrial employment, and an increase in food production (indirectly through modernization of the agricultural sector).

In terms of developmental time horizons, goals are almost constant over a long period of time, whereas objectives are subject to change from time to time. This is because goals are to be achieved in the long run, while objectives must be achieved within foreseeable planning periods; hence they correspond to the relevant development state of the country. However, in the long run the successive realization of objectives must lead to their convergence with the goals.

22/ Goals are the ultimate tasks toward which planning efforts are directed. They must express the long-term aspirations of the society in question and be expressed in qualitative terms. Objectives are medium- and long-term tasks of planning which are derived from the goals and are consistent with them. They are designed in accordance with both the state of development of a country and its capacity to carry them out. Targets are quantified objectives. Targets and objectives are not worked out *a priori* but on the basis of an assessment of the existing level of development, the previous course of planning in the country and the achievements of previous plans.

To the extent that objectives can be made concrete, they act as a guideline for the preparation of a plan. The most effective way of giving objectives concrete meaning is by quantifying them whenever possible, thereby translating them into targets. Otherwise, if objectives are largely expressed in terms of qualitative indicators alone the effectiveness of planning in guiding a process or production is reduced. For in such cases it is not possible to reflect only general trends of socio-economic development and not specific outcomes. Such objectives always contain an element of uncertainty which often makes it difficult and sometimes even impossible to guide industrial processes in the corresponding areas through planning.

A textual description of a planned objective can also sometimes be sufficient to identify its quantitative aspects. For example, "to completely remove unemployment", implies attaining a 100 per cent employment level. On the whole, the industrial planner should quantify as many as possible of the objectives. Even qualitative objectives which are not directly susceptible to quantification such as the achievement of a more diversified industrial output may be reflected directly in investment targets for the production of a few commodities or in the inputs required for these commodities.

In addition to the target of manufacturing value-added, an industrial plan may have investment, employment, export of output, import of input and other targets. Targets may be set for the region, the sub-sector or for individual industries, projects or commodities; they may be set in physical units of output or input, such as kilo, ton, kwh, as well as in units of value such as dollar, pound and franc. Finally, the plan is a document comprising both the quantitative attainable targets within a given period and the means, such as the physical, financial and human resources for their achievement.

(i) Setting the goals and objectives in practice

> Industrial planners must bear in mind that by setting clearly defined goals and objectives which are in complete compliance with a country's needs and circumstances in the initial stages of industrial plan formulation, they are virtually laying a sound foundation of the whole process of industrial planning.

Precisely defined industrial goals and objectives are logically the first component of an industrial plan, since they constitute the basis for the establishment of a system for allocating investment resources among competing demands. Without a definition of industrial development objectives, the projects and processes are likely to be chosen arbitrarily, and the policies and measures adopted to implement a plan are likely to be contradictory.

The planners must constantly improve the design of objectives on the basis of experience gained from plan implementation and from problems arising from poor or unsatisfactory performance of the economy. Moreover, planners have to avoid possible ambiguities when setting goals and objectives, such as listing objectives which are mutually inconsistent, failing to give a good objective hierarchy or confusing objectives with the strategies necessary for their achievement and which lead to uncertainties concerning what is to be expected from a plan.

Planners must also find the necessary coherence between strategies and objectives. For example, in a country with a very low per capita income and surplus labour a strategy of "basic industries" could be contradictory to the objective of "a large increase of employment", although each of them is logical by itself; because concentrating on heavy industries which use less labour than light industries will lead to a restriction in the number of available jobs. In this case, the planner must find a solution so as to maintain the necessary coherence between the strategies and objectives. For example, the choice of techniques in basic industry has to be such that a relatively large number of jobs will also be created. This choice must also take into accout the current skills of available workers and relate to progress in manpower training programmes.

Thus, realistic planning calls for a sufficient knowledge of the behaviour of the objective economic factors to relate future actions to objectives.

(ii) Definition, choice and priorities of goals, objectives and targets of industrial plans

Who must be responsible for the choice of goals, design of objectives and quantification of targets?

Industrial development goals and objectives may be economic, such as those mentioned earlier, or political, such as the improvement of a country's capacity in the defense industries. Because industrial planning goals involve such political and economic considerations, the choice of goals and their priorities must be the responsibility of policy-makers. The planner must advise policy-makers and inform them of the importance and implications of each goal, as well as of contradictions that are likely to occur between different goals. In this way, the planner will be able to take account of the concerns of the policy-makers in plan preparation, on the one hand, and tie them with plan implementation on the other.

The directives given by a country's policy-makers are generally stated in broad terms and mainly limited to goals of the plan. It is, therefore, the duty of the planners to go on from these goals into the set of objectives for both long-term and medium-term plans. Thus, while a country's policy-makers assign to the planner the goal of achieving economic independence, the planner, in formulating the industrial plan, sets the objective of a restructuring of the industrial sector which is related to the programme for developing the share of domestic basic industries to consumer goods industries.

In practice, it would not be realistic to attempt the formulation of objectives and their quantification and elaboration at the level of a central planning body. The central planning body should set objectives and tentative targets for the draft national plan including also global sectoral targets. However, the planning department of the ministry of industry and the relevant planning units responsible for elaborating the industrial plan should elaborate a more detailed breakdown of objectives and targets. Therefore, the quantification and precision of targets should involve all levels of the hierarchy of industrial management, as has been shown in Chapter II. The calculation of targets is usually not done in a single operation, for their magnitudes depend by and large upon many other targets and inputs. The final values of the targets which are consistent in practice can only be determined on the basis of an iterative technique among various levels of the planning hierarchy (see table 4.1).

What is the best approach to designing objectives for industrial plans in developing countries?

To facilitate preparation of a realistic industrial plan under the prevailing socio-economic conditions in developing countries, four types of objectives could be recognized and quantified:

(a) Directive objectives for the first part of the plan, covering industrial activities owned and possible to be controlled by the Government. It is possible to realize such objectives because these activities lend themselves to effective government control and the plan under which they operate has the backing of the law.

(b) Semi-directive objectives for the second part of the plan covering industrial activities owned by the government but difficult to control. The fulfilment of these targets requires additional persuation, incentives or penalties.

(c) Oriented objectives for the third part f the plan covering the private sector. Oriented objectives are those expected to be realized during the plan period. Therefore they may be expressed either in the form of qualitative indicators (i.e., textual description of the nature and main trends of development the given process within the planned period) or else in the form of parameters, which may include the quantitative characteristics of the process expected to be realized during the plan period.

(d) Estimated objectives for autonomous processes related to industrial activities, for example, exports of manufacturing goods or the agricultural output required for industrial processing. Such magnitudes are dependent upon factors which are difficult to control, therefore, estimation is the only possible way to quantify and link them to targets. The achievement of estimated objectives is connected with a degree of uncertainty, however, for an estimate of what will happen is dependent either upon existing circumstances (the ceteris paribus clause) or on the changing magnitudes of influencing factors.

The actual nature of each of these four groups of planned objectives reflects the specific characteristics that are peculiar to a given country. In cases in which possibilities for guiding socio-economic development are limited even within the public sector, the major objective of planning may initially be confined to economic policy. In such cases, the plan will largely refer to a diversity of organizational and economic measures aiming at a centralized regulation of the public industrial sector and at some control development of the private sector. All remaining objectives will then be of a forecasting nature. In cases where the state can exercise more control over the public sector and where the public sector is relatively dominant, the plan could comprise a larger set of directive objectives in addition to various oriented and estimated objectives.

In practice the number of objectives and targets would depend on the stage of development of a country, its size and its factor endowments. Finally, the determination of industrial plan targets must be done in co-ordination with other sectoral plans so as to ensure an internal consistency of the national plan. For example, the determination of targets connected with the industrial output destined for agriculture, such as agricultural and irrigation machinery, fertilizers and pesticides must be

calculated on the basis of the expected needs and absorptive capacity of the agricultural sector during the plan period. This applies also to the determination of industrial output targets that are dependent upon agricultural outputs such as food processing, textiles and leather which must also be calculated on the basis of the expected agricultural output of the relevant goods.

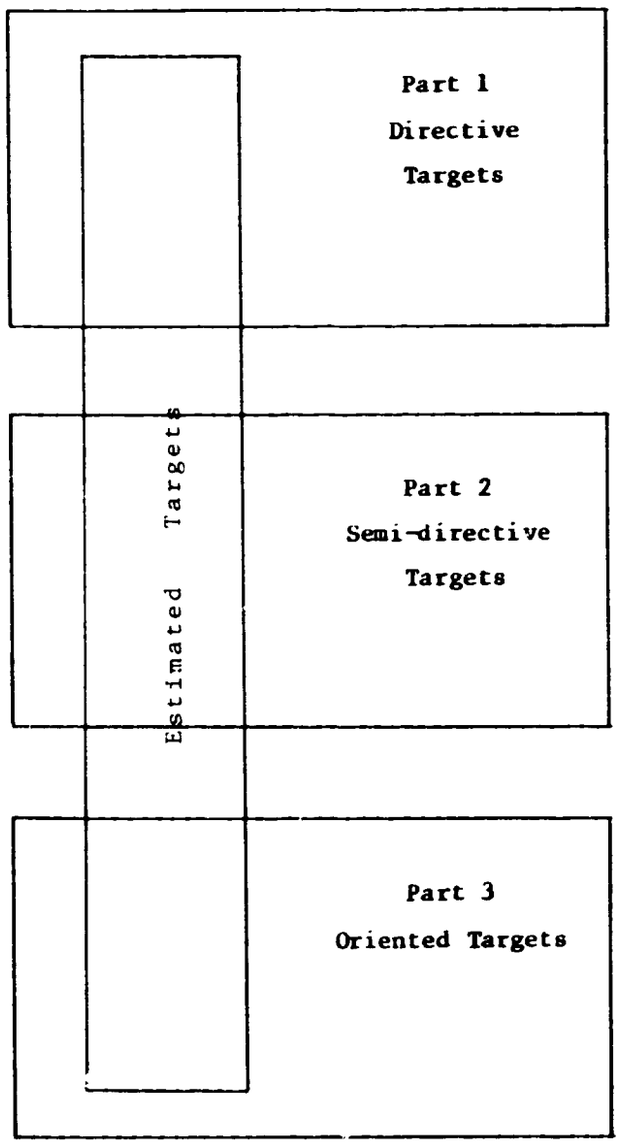
Table 4.1

Example of the sets of goals, objectives and targets of an industrial plan 23/	
Goals (long term)	1. Achievement of economic independency. 2. Improvement of standard of living. 3. More equitable distribution of income.
Objectives (medium and long-term) However, long-term objectives are subject to changes in future	1. Restructuring the industrial sector. 2. Increasing productivity in the traditional sector and small-scale industries. 3. Increasing employment in industry. 4. Increase industrial output of goods required by large majority of population. 5. Increasing export of manufacturing goods. 6. Increasing of manufacturing value-added.
Consistent targets (for medium-term plan)	1. Achieve ...% growth in the industry. 2. Raise the share of industrial sector (manufacturing) in GDP to ...%. 3. Increase employment in the industrial sector by at least ...%. 4. Improve productivity in the traditional and small-scale industries by at least ...%.

23/ The precision of target values proceeds on the basis of iterative technique.

Figure 4.1

The nature of targets for the industrial plans in developing countries



2. Information system for industrial planning

The process of developing industrial plans consists of a number of stages that are closely linked with each other. The first of these is the pre-planning stage, which consist, primarily of preparing the informational and statistical base. Industrial plan preparation requires in the first place a comprehensive statistical basis to analyse past and current industrial activities and evaluate necessary indicators. Moreover, implementation of plans also depends on up-to-date indicators to help evaluate progress and introduce readjustments.

Thus statistical data about past and current activities constitute the necessary initial materials for designing the industrial plan. Moreover, the higher the quality and scope of available statistical information and the greater the extent to which it is expressed in operational terms, the more it contributes to the quality of the industrial plan, particularly in ensuring its internal consistency as well as coherence among different objectives and real possibilities of industrial development.

(i) The status of statistical information in developing countries

Planning in the majority of developing countries is to some extent handicapped by the lack of a comprehensive informational and statistical base. In many countries there is a lack of reliable up-to-date information about national income, consumption, accumulation investment, capital formation and employment. It is even more difficult to find relevant data on sectoral activities such as industry, mining and agriculture and records on roads and road traffic.

Even in cases where some relevant data are available, it might be quite inadequate for planning purposes. For example, data on national income sometimes includes gaps, breaks in continuity and time lags. In many other cases the quality and scope of statistical information available is not sufficient to make long-term projections with the minimum degree of confidence required. The population figures are sometimes overestimated for various reasons. In general, such unreliable data is attributed to the inexperience of statistical personnel.

(ii) Industrial planning and the problems of inadequate data

The questions facing the planner in developing countries where no adequate data are available, is whether to start planning immediately or whether planning should be postponed until improved information in sufficient quantity is obtained. Some planning experts do, in fact, recommend not to start planning until accurate and sufficient data has been obtained. However, the planning process itself can generate additional data and qualitative information. Therefore, postponing the planning process might also risk postponing the collection of data. To avoid the risks connected with planning on the basis of insufficient and inaccurate data, the country in which the requisite data for a plan are not available should, during the preparation of initial plans, launch an appropriate programme to carry out a population and industrial census and assessments of national resources including geological surveys, which are of extreme importance for the location of industries such as paper, sugar and cement and building materials.

(iii) Problems related to information and data requirements for industrial planning

Planning is a perpetual process which can never be completely perfect; hence the informational and statistical data base required for planning is also never complete. The established minimal information and data base for starting the planning process should, therefore, be developed so as to meet future planning needs. This should, in any case, be computerized.

In this connexion, some organizational efforts are required to facilitate a proper collection, flow, storage and retrieval of information.

- Co-ordination of the flow of statistical information

In many developing countries there is a lack of co-ordination within the governmental apparatus to produce unified data. This is often partly due to the existence of more than one statistical body and partly to the absence of a central statistical office. But even in cases where a central statistical office exists, no real organization is to be found to co-ordinate statistical

activities at different levels. Thus, frequently parallel government offices produce figures without checking with one another and the figures released are often not comparable with each other.

The need for co-ordination is great, not only to eliminate duplication and improve comparability but also to bring about a free flow of information within a government. Therefore developing countries need to strengthen their statistical services through the creation of central statistical offices where these do not exist and other statistical units at different levels, such as ministries, departments and large-scale enterprises, as well as regional statistical offices; and to co-ordinate their work in such a way as to facilitate better access to data and a better flow of information. The following list indicates some typical sources of data for industrial planning, other than statistical offices, which must be included in the statistical network:

(a) Operating industrial enterprises;
(b) Government administration at all levels;
(c) Foreign trade organizations;
(d) Chambers of commerce and industry;
(e) Associations of manufacturers;
(f) Plan executing agencies;
(g) Investment agencies;
(h) Special task forces, working groups and consultants involved in specific development studies;
(i) Organizations managing infrastructural facilities;
(j) Central banks and commercial banks;
(k) Labour organizations;
(l) International organizations such as OECD and, especially, those within the UN system including the UN Statistical Commission, United Nations Industrial Development Organization (UNIDO), Food and Agricultural Organization (FAO), International Labour Organization (ILO), United Nations Conference on Trade and Development (UNCTAD), and the World Bank.

- Integration of central planning body and central statistical office

Experience shows that there are significant advantages if the functions of the central statistical office are integrated within those of the ministry of planning in developing countries:

(a) The heavy dependence of planning upon statistics requires close co-operation between planners and statisticians and statistical services in order to prepare data in a suitable form for planning and to improve its quality and quantity.

(b) Since planners are the main users of statistical data, they are likely to do much for the improvement of its quality and quantity if the functions of the central statistical office are integrated.

(c) In order to facilitate the improvement of the process of data preparation and to avoid delays in the preparation of information which can strongly impede the planning process, some countries have aggregated the central planning body and the central statistical office, so that measures can be taken within the central planning body to overcome difficulties in the preparation of necessary data or so that priorities can be decided upon.

- Upgrading the efficiency of statistical work

The effectiveness of statistical work depends on a number of factors, some of which are listed below:

(a) To improve the stock of planning information, the programme of information must be fitted to the particular needs of the planning process so as to avoid any possible waste in the efforts of the statisticians. In this respect, the planner must take into account the scarcity of statisticians in the first stages of establisning the statistical information base and must decide precisely upon the kind of data and information they need in the future so as to permit statisticians to provide data in an organized way.

(b) Training of statisticians should be provided on a continuing basis to upgrade skills and to maintain a fully efficient service including the introduction of computers and other modern equipment and facilities for processing, storage and retrieval of data.

(c) Statistical work requires continuity and should be followed up by the central planning body and other governmental organs to ensure the following: first, the accumulation of reliable statistics in the long run; secondly, adaptation of statistical work to more advanced planning techniques, such as computers; thirdly, expansion of the field of statistical activity to cover more aspects of economic and social activities.

(iv) Data required for industrial planning

The specific requirements of the industrial plan for statistical data depend to a great extent on the nature of the plan, socio-economic conditions and the length of the planning period. Nevertheless, it is possible to indicate a number of general requirements:

(a) From the statistical point of view, two types of data would be required to formulate and elaborate the plans; time series and cross section data. Time-series data are required for an examination of past trends and for predicting the future. Statistical offices at different levels in developing countries may forward estimates to planning bodies, as well as calculated indicators. For example, a description of the manufacturing activity on the basis of time series data is always useful and sometimes indispensable for effective industrial planning. A description in the form of estimates over a period of time can also be made for different industrial sub-sectors to reveal relative importance, similarities and differences. Cross-section data is required for determining the behaviours of different factors, for example, consumer preferences for estimating demand for different consumer goods on the basis of family budget samples. This is of great importance for industrial planning in some developing countries where final demand is largely influenced by market forces.

(b) From the technical point of view, industrial planning requires a great number of data in the form of "technical norms". Technical norms are indispensable for working out balances and establishing input-output tables, as well as in the application of different mathematical methods for the preparation of different stages of the industrial plan[24/]. Industrial planning requires different norms for intermediate consumption of key products, such as steel, chemicals and petrochemicals, refined products, cement, etc. In addition, industrial planning requires other kinds of norms, for example, the average requirements of human beings for calories and protein in order to set long-term targets to meet the modernization requirements of agriculture through industry.

(c) From the organizational point of view statistical data must be fully adjusted to the requirements of plan preparation and implementation. Therefore, it is necessary to provide the data in a developing country in such a way that it follows the targets of the plan. According to the experience of most industrial planning experts in developing countries, it would be most suitable to disaggregate the industrial sectoral plan into sub-sectors or branches in accordance with the ISIC 4-digit classification, and to collect industrial statistics and data for the same branches. Some countries may go into a more detailed breakdown in accordance with the details of their industrial plan, for example, by adopting a 5 or 6 digit. The minimum should be 4 digit because 3 digit classification is mixing too many branches under one code number and, consequently, does not enable a proper analysis of the sub-sector specific problems involved. This can be well seen from the following comparison:

3 digit	4 digit	
311/312	food manufacturing	
	3111	Slaughtering, preparing and preserving of meat;
	3112	Manufacturing of dairy products;
	3113	Canning and preserving of fruits and vegetables;
	3114	Canning preserving and processing of fish, etc.

24/ For definition of "technical norms" see the section on balances in Chapter V.

- Data required for industrial plan preparation and elaboration

In cases where information and data required are insufficient or unreliable, it would be highly desirable to launch an industrial survey to collect and organize as much relevant data and information as possible. The data requirements are generally:

(a) Time-series data on the national economy, such as GDP, national income, consumption, investment and capital formation.

(b) Every plan requires data about human resources. This is of great significance due to the fact that people are the primary beneficiaries of any plan as well as the source of both manpower and market demand. In this connexion industrial planning requires two kinds of data. First, information about the nature and growth of population, the size, consumption and sectoral employment of the labour force, the nature and availability of skills, rural and urban unemployment. Secondly, information about family expenditures at different income levels and locations, for example, rural and urban in order to estimate potential demand.

(c) Detailed data on each industrial sub-sector such as available capacity utilization, employment and productivity, output, export of manufactured goods, capital formation and depreciation, breakdown of intermediates consumption such as energy, semi-finished materials and other intermediates from local or imported sources, employment and skills (national and foreign).

(d) Detailed data on the traditional sector are also needed. Here data on output, employment and productivity and input requirements are of great significance.

(e) Data and information about natural resources required for industry, such as the location of the mineral deposits, size and quality of the deposits and agricultural production, as well as agricultural inputs required for industrial processing.

(f) Data and information about other relevant sectors and projects, for example the locations and capacities of hydro-electric stations, water networks, availability of water for industrial purposes, requirements of agriculture, construction and industry.

(g) Data on exports and imports (quantities and prices) of manufactured consumer and capital goods. This is necessary for evaluating the structure of foreign trade, the investment ratio, consumption patterns, as well as estimating marketing possibilities for projects involving the expansion of production for export or for substitution of imports. In addition, information about market conditions and their future outlook, as well as costs of production abroad is also needed.

(h) Fiscal data including estimates of revenues and proceeds of foreign and domestic loans and grants help to determine the public expenditures for investment and current expenditures associated with a plan. Information about funds available for private investment is also necessary so as to set targets for the private sector.

(i) Data about each planned industrial project is required in order to enable the planner to estimate the investment, in national currency and foreign exchange, and the physical requirements for construction materials, machinery, equipment, supplies, manpower and skills.

- Data required for plan implementation

The nature of statistical information required for control of plan implementation is determined by the plan's objectives and targets. However, whatever the differences between the objectives and targets of various plans might be, every plan requires two kinds of statistical information for control of the implementation process. The first is information concerning follow-up of the implementation progress of new industrial projects. The second is information about the development of the operational performance of existing industries during the plan period.

Moreover, data required for plan implementation must permit identification of potential bottlenecks as early as possible so as to facilitate the determination of their causes, evaluation of the extent to

which deviations threaten the attainment of plan targets and the taking of effective measures for plan readjustment. It is of great significance, therefore, for a proper functioning of the follow-up activity, that data be provided without any delay.

Follow-up activity requires data concerning the development of existing industries during the plan period. These data are necessary for identifying the major trends of industrial development in both private and public industrial sectors in the course of plan implementation as well as the extent to which they meet the general objectives and principles of the state economic policy that underlies the plan. Here again, the statistical information must be provided without delay to permit the planner to monitor deviations and take necessary corrective measures or to change some policies, for example, to raise duties on similar imported commodities or to remove bottlenecks in the supply of strategic intermediates.

- Price indices for planning

Statistical data serving industrial planning must make it possible to identify major industrial developments and relevant socio-economic trends during the preceding period and must also provide an initial basis for meeting the plan's requirements for internal consistency.

Inflation within the national economy and in world market prices makes calculations based on current prices quite useless. In addition, changes in the prices of individual groups of commodities and services are often of an irregular nature and result in substantial discrepancies between magnitudes of corresponding values. Therefore, the use of constant prices in plan preparation is of great importance for the establishment of internal consistency. For, with changes of prices at different rates, even the consistent plan can turn out to be unbalanced.

In this connexion the preparation of price indices is of great importance for deflating time-series data, which are expressed in current prices. Deflation of time series data by the relevant price indices makes it possible both to identify the actual indicators and to make the necessary readjustments in the course of plan execution in order to avoid imbalances in the development of the national economy.

Data expressed in current prices can be highly misleading and give a distorted picture of progress in the execution of planned industrial projects. This is particularly true in those instances where the development plans are to a great extent investment programmes. Measuring plan progress on the basis of expenditures due to price increases oftern results in a situation in which capital investment plans appear to be fulfilled or even over-fulfilled if expressed in current prices, while the actual projects to which they refer continue to be largely unfulfilled. This must also be taken into account in setting up a reporting system.

3. Indicators for industrial planning

The significance of indicators for planning stems from the necessity for quantification of plan objectives. In fact, planners at each level of the planning hierarchy need a number of appropriate indicators in order to elaborate the part of the plan within their field of activity. Moreover, indicators are indispensable for co-ordinating the partial plans so as to arrive at a final set of targets as well as for follow-up of plan implementation.

Industrial planning practice in developing countries shows that the use of indicators varies greatly from one country to another as regards their number, quality and functions. Nevertheless, almost all of them have in common in their plans the growth rate of GDP and of manufacturing value-added for periods covered by the medium-term plan, as well as a few other indicators relating to industrial growth in general, such as the share of manufacturing industries in the gross domestic product and the growth of industrial employment. The limited use of indicators in relation to the production process reduces the scope of industrial plan and the elaboration as well as the precision of plan targets.

The development of a system of indicators from the quantitative point of view depends upon a number of factors, such as the level of industrial development, its structure and diversity. From the qualitative point of view, the system of indicators which is to be included in planning should be in line with the following principles:

(a) Uniformity

All indicators which refer to the same economic phenomena must be based on a uniform regime to permit aggregation, disaggregation and harmonization among different targets. This can be illustrated on the basis of the following example:

Example No. 4.1

Aggregation and disaggregation of the indicator "capital-output" ratio

(a) Capital-output ratio = K/Y ..... (4.1)
(on the level of national economy)

Where: K is the value of total capital (or total stock of capital).
Y is the GDP

(b) Capital-output ratio on the level of enterprise which is in conformity with the aggregate capital-output ratio is as follows:

Capital-output ratio = K_i^h / Y_i^h ..... (4.2)

Where: K_i^h is the fixed assets of enterprise (h) or sub-sector (i).

Y_i^h is the gross value added of enterprise (h) of sub-sector (i)

The indicator of capital-output ratio for a single industrial enterprise permits the industrial planner to compare the capital intensity of different enterprises of a given sub-sector, for instance, among textile enterprises.

By aggregation of the capital-output ratio of all enterprises of the sub-sector, we arrive at the capital-output ratio of the sub-sector. In order to illustrate the calculation let us assume that sub-sector (i) comprises (m) enterprises. Thus the capital-output ratio of the sub-sector can simply be calculated as follows:

Capital-output ratio = ... (4.3)

Where: K_i is total capital of sub-sector (i)

Y_i is gross value added originating in sub-sector (i)

On the basis of the capital-output ratio of different sub-sectors, the planner can make comparison between different sub-sectors to facilitate investment decisions.

Finally, by aggregation of all sub-sectoral and sectoral capital-output ratios, we arrive at that of the national economy:

$$K = \sum_{i=1}^{n} Ki \quad \text{.....} \quad (4.4)$$

$$Y = \sum_{i=1}^{n} Yi \quad \text{.....} \quad (4.5)$$

(i = 1, 2, 3, ..., n)

Average capital-output ratio = K/Y

(for national economy)

(b) Stability

The indicators must be kept constant over quite a long period of time (at least during one or two successive medium-term plans). This is necessary to permit the flow of required information and its processing and transmission, on the one hand, and assessment of past performance on the other. For example, the availability of time series data on capital-output ratio permits the evaluation of development of capital intensity at the level of enterprises, sub-sectors and the whole economy. A typical example is the stability of GDP, gross value-added originating in the sub-sectors (i) and major industrial enterprises (h) (see the hypothetical time series in table 4.2).

Table 4.2

Hypothecical time-series of index number of GDP during the past 10 years

Years / No. of sub-sectors	-9	...	-6	-5	-4	-3	-2	-1	0
1	100.0	...	134.8	139.9	152.3	157.9	171.9	179.9	189.8
2	100.0	...	127.9	133.2	141.6	144.2	152.0	162.4	171.0
3	100.0	...	132.6	143.1	149.8	159.9	168.1	180.2	189.8
4	100.0	...	111.4	113.0	116.1	117.6	122.1	123.7	128.0
.	.	...	.	.	.	.	.	.	.
.	.	...	.	.	.	.	.	.	.
.	.	...	.	.	.	.	.	.	.
n									
G (total)	100.0	...	134.8	145.1	151.9	160.3	172.9	181.3	193.8

Moreover, the scope of planned rate of growth of GDP cannot be used for making conclusion in terms of assessment. This is only possible when they are compared with actual figures. In this connexion, a comparison of the planned and achieved growth of manufacturing value added of different industrial enterprises, sub-sectors and the whole industrial sector is extremely useful (see table 4.3)

Table 4.3

Comparison of planned and achieved growth rate of GDP

Industrial sub-sector	Planned growth rate %	Achieved growth rate %	Deviation % ±
1	8.5	6.0	-2.5
2	9.0	5.0	-3.0
3	7.0	6.0	-1.0
4	6.5	2.5	-4.0
.	.	.	.
.	.	.	.
.	.	.	.
Industry (Total)	8.2	6.1	-1.9

Comparison on this basis reveals over- and underestimations of the performance of the economy as a whole and in different sectors, sub-sectors and enterprises; and calls for analysis to specify causes and devise necessary measures to avoid further deficiencies.

(c) Consistency

Indicators refer to complex phenomena and must be consistent to facilitate appropriate control. This can be illustrated on the basis of the following example:

Example 4.2

Consistency of gross output

Gross output is a complex indicator which consists of gross value-added and intermediate inputs. Moreover, gross output at market prices is equal to gross value added at factory prices plus intermediate inputs plus direct taxed minus subsidies. Thus, consistency requires the following balance at all stages of aggregation.

X_i = $V_i + U_i$ + direct taxes on the sub-sector (i) - subsidies for the sub-sector (i)

$(i = 1, 2, 3, \ldots, n)$

Where: X_i is gross output of sub-sector (i)

U_i is intermediates consumed by sub-sector (i).

$$\sum_{i=1}^{n} X_i = \sum_{i=1}^{n} V_i + \sum_{i=1}^{n} U_i + \text{direct taxes - subsidies (on the national level)}$$

Where: $\sum X_i$ is gross value of production

$\sum V_i$ is GDP

$\sum U_i$ is total intermediate consumption

(d) Flexibility of combination

In order to permit a manifold economic analysis, industrial planning indicators must allow different combination possibilities so as to quantify targets as much as possible with a relatively limited number of indicators. For example, on the basis of a combination of GDP with capital, we can calculate capital-output ratio; on the basis of the number of employed persons we can calculate labour productivity:

$$\text{Labour productivity} = \frac{\text{GDP}}{\text{number of employed persons}}$$

Another example is the combination of GDP with the intermediate consumption that enables us to calculate the ratio of intermediate consumption (w) to GDP. The ratio of intermediate consumption to GDP = $\frac{W}{V}$.

(e) Differentiation

Industrial planning indicators are to be differentiated according to the plan periods and stages of planning. The longer the period of planning, the smaller the number of indicators required. Those indicators which are very important for preparing a long-term industrial plan are, among others:

Gross value of production, at market prices
Gross value added at factor costs
Value of total intermediate input (imported and from local resources)
Indirect taxes and subsidies
Investment (from foreign and local resources)
Value of exports of industrial goods
Salaries and wages of employed personnel
Number of employed persons (foreign and local)
Energy consumption by kind.

The number of indicators can vary from one country to another, but those mentioned above are also essential for aggregation purposes into a national plan. Moreover, on the basis of these indicators a manifold analysis can be made, such as growth of total output, growth of GDP, productivity, (ratio-percentage of value-added to intermediate input), incremental capital output ratio, balance of foreign trade for industry, changes of level of wages and salaries per employee; and others.

In a medium-term plan, target indicators should be shown on a year-to-year basis and not only for the end year, because the requirements for their fulfillment in financial and physical terms also vary.

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V. TOOLS OF INDUSTRIAL PLANNING

1. Balances

(i) Uses of balances in industrial planning

In quite general terms, the tools of planning are basically common among all countries. The differences, however, lie in the possibilities for application of one or another tool under the conditions prevailing in a particular country. The possibilities for introducing more sophisticated tools vary from one country to another, depending on the availability of statistical information, the stage of development and the complexity of the economy.

Balances are a combination of indices, ensuring a comparison between economic needs for definite types of resources or commodities and the availability of various local or imported inputs to satisfy such needs. Balances have the flexibility to be applicable in long-term, five-year and annual planning, although with varying degree of detail. Moreover, on the basis of balances, the following planning purposes can be achieved:

(a) Formulation of industrial plan targets at different levels of the planning hierarchy.

(b) Co-ordination of plan targets of the industrial sector with those of other sectors of the economy.

(c) Allocation of available human, natural, material and financial resources in compliance with the objectives and targets of national and industrial plans.

(d) Analysis of the allocation of the labour force and its geographical distribution. Due to the fact that balances can easily be carried out for different geographical areas, they can, therefore, reveal a surplus or shortage of different levels of skills in different regions.

(e) Allocation of capital for depreciation and new investment in all industrial sub-sectors within different regions.

(f) Comparison between estimated targets and the possibilities for their achievement on the basis of different allocations of available resources for industrialization.

What are the particular advantages of application of balances in developing countries, especially in the LDCs?

- Balances are relatively simple, flexible and effective planning tools which can be introduced easily and gradually into the planning activity in developing countries to upgrade their planning process.

- In cases were statistical data and information are lacking or do not cover a wide range of economic activities, particularly in the initial stages of industrialization, the introduction of balances can be limited to the most strategic natural resources and products so as to reveal shortages or surplus, bottlenecks and constraints and unemployment, on the one hand, and to enable a better allocation of natural resources, materials and different skills, on the other.

- The introduction of balances can facilitate the gradual introduction of more sophisticated planning tools. For example, with the accumulation of statistical data and information, along with the development of a network of balances, input-output tables can easily be introduced into the planning activity; first in respect of the key products which have strong forward and backward linkages and then step-by-step, to cover a wider range of products.

(ii) The technique of balances

Balances can be used to estimate a number of economic indicators such as GDP and national income, resources and products. The technique of balances on the basis of product balances is demonstrated below.

Product balances are worked out for intermediate products, capital goods and consumer goods. With their help it is possible to set up the material proportionality of an industrial plan with regard to the pattern of consumption and production. The product balances have a general outline as shown in Table 5.1.

Table 5.1

Product Balance Sheet for Intermediates, Capital Goods and Consumer Goods during the year (t)	
Sources	Uses
+ Inventory and stocks as per the first of January of the year (t)	+ Private and public consumption
+ Total production during the year (t)	+ Gross investments during the year (t) (i.e., replacement of worn out capacities and new investments)
+ Import during the year (t)	+ Intermediate consumption of the national industry during the year (t)
	+ Balance of reserves on the 31 December of the year (t)
Sources (total)	Uses (total)

Balances may be expressed on the basis of both monetary and physical units, such as kg., ton, kwh, m^2 and m^3. The following represent the equations of monetary and physical product balances:

$$X_i + \sum_{k=1}^{m} M_{ik} + R_i^{1.1} = W_i + I_i + C_i + \sum_{k=1}^{m} E_{ik} + R_i^{31.12} \quad \ldots \quad (5.1)$$

$(i = 1,2,3, \ldots\ldots, n)$

$(k = 1,2,3, \ldots\ldots, m)$

Where:

X_i value of industrial output of product group (i)

M_{ik} value of imported products of group (i) from sources (countries k)

$R_i^{1.1(t)}$ and $R_i^{31.12(t)}$ values of stocks and reserves of the products of group (i) as per 1.1 and 31.12 of the year in question (t).

W_i value of intermediate consumption for producing the products of group (i).

I_i value of goods used for gross investment of group (i).

C_i value of consumption of products of group (i).

E_{ik} value of exports of products of group (i) to destinations (countries K).

$$Q_i + \sum_{k=1}^{m} M'_{ik} + R_i'^{1.1} = W_i + I_i' + C_i' + \sum_{k=1}^{m} E'_{ik} + R_i^{31.12} \quad \ldots \quad (5.2)$$

Where:

Q_i is the volume of industrial output of product group (i) expressed in physical units, such as kg., ton, and m^2. The other components are analogous to those in equation (5.1) but expressed in physical units.

The left side of the equation (5.1) and (5.2) shows the sources of products of group (i). These originate either from national industry, imports from other countries or from the reserves left over from the previous year. The right side of the equation shows the uses of the products of group (i). These could take the following forms:

(a) Intermediate consumption in the industry. For example, the use of output of the coal industry in blast furnaces to produce pig iron. Coal in this case is an intermediate product.

(b) Investment goods to replace worn-out capital equipment and used up stocks or to install new production capacities, for example, lathes, tractors, furnaces, etc.

(c) Private consumption. For example, consumption of different consumer goods as well as electricity and fuel.

(d) Social consumption. This is consumption by society in different forms through the social infrastructure. For example, hospital requirements for electricity, heating, drugs, food, etc.

(e) Exports.

(f) Unused available products of the group (i) on 31 December of the year in question (t) [i.e., $R^{31.12\ (t)}$]. These are stocks and reserves which will be part of the sources during the next year (t+1), [i.e., $R^{1.1(t+1)}$].

It should be noted that in the case of consumer goods or capital goods the right side of equations (5.1) and (5.2) can be reduced to cover the items in question. For example, in the case of the heavy mechanical equipment, we will have ($W_i = C_i = o$). Conversely, in the case of food, for instance, we will have ($W_i = I_i = 0$).

(iii) Technical coefficient

Part of the available products of the group (i) will be consumed by industry in order to produce final products. The total intermediate consumption of products of group (i) can be expressed as follows:

$$W_i = x_{i1} + x_{i2} + x_{i3} + \ldots + x_{in} \qquad \ldots \qquad (5.3)$$

$$W_i' = q_{i1} + q_{i2} + q_{i3} + \ldots + q_{in} \qquad \ldots \qquad (5.4)$$

Where $(x_{i1}, x_{i2}, x_{i3}, \ldots x_{in})$ $(q_{i1}, q_{i2}, q_{i3}, \ldots q_{in})$ are consequently the values and quantities of required intermediate consumption of industrial sub-sectors (j) from products of group (i) to fulfill their production programme.

$(i = 1, 2, 3, \ldots, n)$

$(j = 1, 2, 3, \ldots, n)$

W_i and W_i' are the total intermediates required from product (i) in monetary and physical terms respectively:

$$W_i = \sum_{j=1}^{n} x_{ij} \quad \ldots. \quad (5.3^a)$$

$$W = \sum_{j=1}^{n} q_{ij} \quad \ldots. \quad (5.4^a)$$

x_{ij} and q_{ij} are calculated on the basis of the following equations:

$$x_{ij} = a_{ij} X_j \quad \ldots. \quad (5.5)$$

$$q_{ij} = b_{ij} Q_{ij} \quad \ldots. \quad (5.6)$$

Where a_{ij} and b_{ij} are the "technical coefficients", or "norms". By technical coefficients we mean the value of inputs required from industry (i) to produce one dollar's worth of the output of a given industry (j).

$$W_i = \sum_{j=1}^{n} a_{ij} \cdot X_j \quad \ldots. \quad (5.7)$$

$$W_i' = \sum_{j=1}^{n} b_{ij} \cdot Q_j \quad \ldots. \quad (5.8)$$

In the above equations (5.7) and (5.8) the values of a_{ij} and b_{ij} are known and the values of X_j and Q_j are planned targets. They could first be set tentatively on the basis of the proposals of industrial enterprises and the ministry of industry or on the basis of forecasts. However, during the iterative process of planning, these values can be further adjusted in co-ordination with relevant targets of the national plan in order to achieve harmonious plan targets.

Example No. 5.1

In a certain developing country there exist three cement factories with the following indicators in the year (t).

No. of factory	Q_c (output) tons of cement	q_{ec} consumption of electricity million kw/h	q_{lc} consumption of lime stone ton
1	100,000	11,500,000	126,000
2	200,000	22,800,000	290,000
3	300,000	34,400,000	369,000
Total	600,000	68,700,000	785,000

On the basis of the above mentioned data, we can calculate the technical coefficients of both electricity and lime stone consumption per one ton output of cement as follows:

$$b_{ec} = = \frac{687,000,000}{600,000} = 114.5 \frac{\text{kw/ton}}{\text{h}}$$

$$b_{lc} = = \frac{875,000}{600,000} = 1.30 \text{ ton/ton}$$

Where b_{ec} and b_{lc} mean that in order to produce one ton of cement it is necessary to provide 114.5 kw/h or electrical energy and 1.3 tons of lime stone.

"Technical coefficients" or "norms" for consumption are of great importance for planning in order to facilitate an evaluation of past consumption levels and an estimation of basic needs and the means for achieving them. For short-term purposes, private consumption can be calculated on the basis of the past average annual per capita consumption of the product in question. For an accurate estimation of private consumption, cross-section analysis is necessary for determining the behaviour of consumer preferences and estimating demand for different consumer goods on the basis of family budget samples. This is of great importance in countries where final demand is largely influenced by market forces.

In cases where the central planning body can plan consumption by the population in the long run, the planner must estimate private and public consumption on the basis of clearly analyzed targets which represent the satisfaction of the people's basic needs. This problem will be dealt with in greater detail in Chapter VI.

Example No. 5.2

In a given country in the year (t-1), the planned output of the cement industry for the year (t) is estimated at 1.6 million tons. On the basis of the following information, a calculation of the cement for the country during the year (t) is required:

(a) The (constant) price of cement is 60 dollar/ton.
(b) The available stocks and reserves on 31.12 (t-1) are estimated at 0.1 million tons.
(c) The government decides to maintain a minimal stock and reserves of cement of 0.2 million tons as of 31.12 (t).
(d) The cement industry in the country supplies three groups of construction materials industries, with the technical norms as shown in table (5.2).

Table 5.2

Group of construction materials (j)	1	2	3
a_{ij} 25/	0.50	0.40	0.20

25/ (i) is cement industry in this case and a_{ij} is the value of cement in dollars necessary to produce one dollar worth of construction materials of each group (j).

(e) The allocated investment for the public sector in the year (t) is 1,000 million dollars, of which 700 million dollars are for five major public projects and 300 million dollars for all other projects.

(f) The estimated investment of the private sector during the year (t) is 500 million dollars.

(g) The blueprints of the five major public projects show the following requirements for cement and other products of the above mentioned groups of construction industries during the year (t). (Table 5.3)

Table 5.3

No. of project	Allocation for the project in million dollars	Requirement for cement in million tons	Requirements for inputs of other groups of construction materials in million dollars		
			1	2	3
1	200	0.30	2.0	3.2	2.4
2	150	0.20	2.0	4.0	0.08
3	150	0.12	1.6	3.6	2.4
4	100	0.10	1.0	1.6	1.2
5	100	0.08	0.8	1.8	1.0
Total	700	0.80	7.4	14.2	7.8

(h) The average cement requirements per one dollar construction and per one dollar of the other groups of construction materials, for both the public and private sector are presented in table (5.4) below:

Table 5.4

Sector	Requirement per dollar construction			
	Cement dollar	Group of construction materials dollar		
		1	2	3
public	0.10	0.010	0.018	0.012
private	0.08	0.004	0.006	0.004

Calculation of cement used during the year (t)

(a) Direct investment requirements for cement (in monetary terms I_{cem} and physical terms I'_{cem}):

I_{cem} = 0.10 x 300.0 + 0.8 x 60 + 0.08 x 500.0

I_{cem} = 118 million dollars. This is the direct investment requirement for cement during the year (t).

$$I'_{cem} = \frac{I_{cem}}{\text{price per ton of cement}} = \frac{118}{60} = 1{,}967 \text{ million tons}$$

(b) Cement requirements for intermediate consumption (W_{cem})

$$W_{cem} = a_{cem.1} X_1 + a_{cem.2} X_2 + a_{cem.3} X_3$$

Where $a_{cem.1}$, $a_{cem.2}$ and $a_{cem.3}$ are the average requirements per one dollar of the first, second and third group of construction materials.

In the following we calculate the values of gross output of the groups of construction materials X_i (i = 1,2,3).

X_1 = 0.01 x 300.0 + 7.4 + 0.004 x 500.0 = 12.4 million dollars
X_2 = 0.018 x 300.0 + 14.2 + 0.006 x 500.0 = 22.6 million dollars
X_3 = 0.012 x 300.0 + 7.8 + 0.004 x 500.0 = 13.4 million dollars

W_{cem} = 0.50 x 12.4 + 0.40 x 22.6 + 0.20 x 13.4

W_{cem} = 17.920 million dollars

$$W'_{cem} = \frac{W_{cem}}{\text{per ton price of cement}} = \frac{17{,}920}{60} = 0.299 \text{ million}$$

0.299 million tons of cement are the intermediate requirements of the groups of construction materials

(c) Drawing up of the cement balance:

$$Q_{cem} + \sum_{k=1}^{m} Q^{m}_{cem.k} + R'^{1.1}_{cem}$$

$$= W'_{cem} + I_{cem} + \sum_{k=1}^{m} E'_{cem.k} + R'^{31.12}_{cem}$$

Let us assume that the country has no export commitments for cement during the year (t), i.e., $\sum_{k=1}^{m} E'_{cem.k} = 0$

Thus:

$$1.6 + \sum_{k=1}^{m} Q^{m}_{cem.k} = 0.1 = 0.299 + 1.967 + 0.2$$

$\sum_{k=1}^{m} Q^{m}_{cem.k} = 0.766$. This is the import requirement of the country for cement in the year t.

The tentative balance sheet for cement is presented in table 5.11.

Table 5.5

Tentative balance sheet for cement (in million tons)

Sources	Uses
+ Inventory as per 1.1 (t): 0.100 + Estimated total production during the year (t): 1,600 + Imports: 0.766	+ Intermediate consumption during the year (t): 0.299 + Investment requirements 1,967 + Inventory and stocks as per 31.12(t): 0.200
2,466	2,466

The cement balance for the proposed national investment programme shows that the supply of cement will be short of demand by 0.766 million tons in the year (t). However, on the basis of relevant balances the planner must evaluate the following:

(a) The degree of priority to be given to the cement industry in order to cope with the growing development demand for cement.

(b) The possibility of increasing cement prices so as to shift part of the demand for cement to other alternative materials.

(c) The possibility of reducing dependence upon cement by changing the civil engineering designs of the major projects and other public construction programmes. While this could cause delay and result in increased costs, in the short run in balances for longer periods it could easily be done.

(d) The availability of funds in hard currency and the degree of priority to be given to the import of 46.02 million dollars worth of cement. This must be dealt with in the balance of exports and imports.

(e) The physical capacities required for importing 0.766 million tons of cement. Here, the planner must calculate on the basis of other balances the load and capacities of ports, roads, railroads and other means of transport.

(f) The possibility of postponing one of the major projects in accordance with established priorities.

The usual process of planning involves the calculation of relevant balances, for example, the balance of energy and the balance of limestone and clay. The balance for energy can reveal the possibility of the energy sector to cope with the demand for electricity from all industries, including the cement industry, as well as other activities of the national economy and private and public consumption requirements. The balance for limestone can reveal the foreseeable life-span of the cement industry.

Balance sheet for durable consumer goods in the year (t)

Balances of durable consumer goods, such as tractors and machines, differ from the non-durable ones because the former are used longer than one year, the period which the balance usually covers. For example, the life time of a machine is usually ten years a' it might be forty years for a building. Therefore, the demand for dura . . ds, in the form of fixed assets, is either, on the one hand, to replace . . -out fixed assets or, on the other, to expand or create new ones.

The demand for durable goods which are used in relatively large numbers, such as agricultural pumps, machinery and appliances, as well as lathes, tractors and lorries, could be balanced as follows:

Table 5.6

Sources	Uses
+ Inventory and stocks as per 1.1(t) + Total production during the year (t) + Imports during the year (t)	+ Local requirements in the year (t) + Exports during the year (t) + Inventory and stocks as per 31.12 (t)
Sources (total)	Uses (total)

The calculation of local requirements differs from one type of durable goods to another. For those durable goods that are used in large numbers, such as tractors, lathes and lorries, we must have, first, statistical information on the number of each operating type $S_i(t)$ (e.g., the number of operating tractors in the country); secondly, the average lifetime of the durable good in question, usually referred to as the flow conversion factor (h_i); and thirdly, information about the planned technical coefficients of using the durable good (i) in question in different sectors of the economy (j), i.e., (k_{ij}).

In the following we introduce the formula for calculating the local requirements for a durable good (i).

$$Q_{Li}(t+1) = \sum_{j=1}^{n} \frac{h_i \cdot k_{ij} \cdot X_j(t+1)}{P_i(t+1)} - \left[S_i(t) - \frac{S_i(t)}{h_i}\right] \quad \ldots (5.9)$$

Where:

$Q_{Li}(t+1)$ is the amount of additional local requirements for the durable good (i) in the year (t + 1).

k_{ij} are the technical norms. They denote the depreciation value of durable goods (i) per unit output of the sector (j).

$P_i(t + 1)$ is the estimated price of the product (i) in the year (t + 1)

In equation (6.12) the terms $[S_i(t)/h_i]$ is the number of replaced units of durable good (i) during the year (t). The term $[S_i(t) - \frac{S_i(t)}{h_i}]$ is the number of available units of durable goods (i) as per 1.1(t + 1). The term $[k_{ij} \cdot X_j (t + 1)]$ is the value of depreciation of durable goods (i) based in sub-sector or sector (j) in the year (t + 1). The term $[h_i \cdot k_{ij} \cdot X_j (t + 1)]$ is the value of units required to be operating in the sub-sector or sector (j) in the year (t + 1).

Example No. 5.3

Let us assume that in the country in question in the year (t) the following information concerning tractors is given:

Table 5.7

Power of the tractor (KN)	6	9	14	Over 20	Total
No. of operating tractors S_t	10,000	30,000	20,000	5,000	65,000
ratio of each type to total %	15.39%	46.15%	30.77%	7.69%	100%
lifetime in years	---------- 8 ----------				
expected prices in the year (t + 1)	100 dollars per KN				

Table 5.8

Sector j indicator	Agriculture	Services	Industry	Mining
K_{ij}	0.10	0.006	0.003	0.005
$X_j(t + 1)$ in \$	150,000,000	50,000,000	60,000,000	70,000,000

Required: the local demand in the year (t + 1). For convenience we will convert all different types of tractors into 9 KN because it is the most common one in use.

Table 5.9

KN	6	9	14	over 20	total
S_i	2500	8500	5000	1250	-
Conversant factor	0.666	1	1.555	2.222	-
S_i (calculated in terms of 9 KN)	1667	8500	7778	2778	19723

$$Q_{1i}(t = 1) = \frac{8 \times 0.010 \times 150,000,000}{900} + \frac{8 \times 0.006 \times 50,000,000}{900}$$

$$+ \frac{8 \times 0.003 \times 60,000,000}{900} + \frac{8 \times 0.005 \times 70,000,000}{900}$$

$$- \left[19723 - \frac{19723}{20} \right] = 2960.41$$

Thus the local requirement for tractors in the year (t + 1) calculated on the basis of the 9 KN tractor, will be 2960 units. If the same structure of tractor types is maintained then we can calculate the demand for each type as follows:

Table 5.10

Power of tractor KN	6	9	14	over 20	total
Ratio of each type of the total (%) in the year (t)	15.39%	46.15%	30.77%	7.69%	100%
Demand in the year (t + 1)	455	1366	911	228	2960

The balance sheet for tractors can be completed in the same way as it was done in the case of cement.

(iv) The aggregation and tabulation of key balances

A very important characteristic peculiar to product balances, if expressed in monetary units, is the possibility of aggregation or disaggregation. Disaggregation is necessary in order to permit a detailed analysis of certain products. In this connexion it is advisable that developing countries in the initial stages of industrialization concentrate on disaggregated balances of key products. Aggregation should also be made in some cases, for instance of all kinds of textiles and leather industries. This is necessary for the planner to have an overall look on the level of the satisfaction of all these products.

The tabulation of key balances, expressed in monetary terms is of extreme significance for industrial planners for it permits comparison among the different key products in regard to their production capacity, demand for them and export possibilities. Moreover, the table indicates total imports and exports which could reveal a bottleneck in imports in the case that these exceed the export capacity of the country.

Table 5.11

Tabulation of key balances in monetary units

Material	Domestic demand	Exports	Total use Total supply	Production	Imports
Cement Steel Aluminium Electricity Coal . . .					
Total					

3. Input-output analysis

Planning experience shows that balances provide a convenient means for establishing a proportional production and foreign trade structure for the national economy, particularly in the initial stages of industrialization. However, further analysis of the economy, especially industry, requires the utilization of input-output tables so as to identify bottlenecks that might occur during the expansion of production and to establish the necessary production structure to satisfy the planned configuration of final demand. This is due to the advantages offered by input-output analysis for assessing direct and indirect intermediate consumption needs.

An input-output table shows how the available products of each group are distributed among other sectors (or sub-sectors) to produce products of different groups. At the same time it shows the inputs to each sector (or sub-sector) from other sectors (or sub-sectors). Thus the input-output table

covers the availability and utilization of all products in both forms, intermediate and final. The general simplified structure of an input-output table is illustrated below.

The simplified outline of the input-output table

		1	2	3	.	.	.	n	
1	X_1	x_{11}	x_{12}	x_{13}	.	.	.	x_{1n}	Y_1
2	X_2	x_{21}	x_{22}	x_{23}	.	.	.	x_{2n}	Y_2
3	X_3	x_{31}	x_{32}	x_{33}	.	.	.	x_{3n}	Y_3
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
n	X_n	x_{n1}	x_{n2}	x_{n3}	.	.	.	x_{nn}	Y_n
		V_1	V_2	V_3	.	.	.	V_n	
	X	X_1	X_2	X_3	.	.	.	X_n	

Where:

X_1 is the value of output of products of group (i) (or sub-sector (i)).

x_{ij} is the share of industry (i)'s output consumed productively by industry (j); for example, x_{12} means the value of products of group (1) necessary to produce X_2 dollars worth of products of group (2).

Y_i is the final demand for products of group (i).

V_i is the gross value added of sub-sector (i).

Each row (reading from left to right) shows the output sold by each sub-sector. Each column (reading from top to bottom) shows the purchases made by each sub-sector along the top of the table from the left-hand side. Since this is a square table, there is one row to correspond to each column.

n is the number of product groups or sub-sectors included in the table.

To illustrate, consider the relationship between sub-sector 3 (row 3 and column 3) and sub-sector 2 (row 2 and column 2). To find the share of sub-sector 3's output sold to sub-sector 2, read across row 3 until it intersects column 2. We see that sub-sector 3 sold x_{32} dollar's worth of goods (for intermediate consumption) to industry 2 during the period covered by the table (usually one year). To find out how much sub-sector 3 buys from sub-sector 2, go over to column 3 and read down until this column intersects row 2. We see that sub-sector 3 bought products worth x_{23} dollars from sub-sector 2.

In order to ensure the proportionality of the production process at the level of the national economy, it is extremely important to plan and balance the sources and the uses of gross national product, GDP and national income. This process encompasses, of course, all individual products or groups of products, as well as the material structure of the gross national product and the internal flows of products (interlocking of the production process of the economy). The input-output table for the gross national product is illustrated by table (5.13). In this table (W_1) is the total use of products of group (i) in the form of intermediate consumption; whereas (U_j) is total intermediate consumption of sub-sector (j) of products (i); (I_i) is the value of goods of group (i) used for gross investment; (C^P) and (C^g) are private and public consumption; (E_i) and (M_i) are exports and imports of products of group (i); (Z_i) is the availability of products of group (i).

In the following we introduce some remarks on the make-up of the input-output table of gross national product (see tables 5.13 and 5.14):

(a) Production (product group). This part of the table is also called internal interlocking. It contains the sectors and sub-sectors producing goods and services, such as agriculture, various manufacturing sub-sectors, construction, communications and the service industries.

(b) The final consumption (second quadrant). The final consumption part of the table is of special importance because changes in their values transmit further effects throughout the rest of the table.

(c) The value of product components (third quadrant). This part of the table shows the building of production value. Sometimes advantage is gained by having a detailed breakdown of the components of gross value added, for instance wages, depreciation, profits, etc.

Analysis of the table

The square matrix which covers the first quadrant is of significance for the input-output analysis. It is also called the "square matrix of intersectoral flows".

$$\begin{bmatrix} x_{11} & x_{12} & x_{13} & \cdot & \cdot & \cdot & x_{1n} \\ x_{21} & x_{22} & x_{23} & \cdot & \cdot & \cdot & x_{2n} \\ x_{31} & x_{32} & x_{33} & \cdot & \cdot & \cdot & x_{3n} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ x_{n1} & x_{n2} & x_{n3} & \cdot & \cdot & \cdot & x_{nn} \end{bmatrix}$$

The sum of each row of the square matrix of intersectoral flows is equal to the total intermediate consumption of each product group (i).

$$\sum_{j=1}^{n} x_{ij} = W_i \qquad \ldots\ldots \qquad (5.10)$$

Whereas the sum of each column is equal to the intermediate consumption of sub-sector (j) of products (i).

$$\sum_{i=1}^{n} x_{ij} = U_j \qquad \ldots\ldots \qquad (5.11)$$

However:

$$\sum_{i=1}^{n} x_{ij} \neq \sum_{i=1}^{n} x_{ij} \qquad \ldots\ldots \qquad (5.12)$$

Moreover, on the basis of each row of the input-output table (see the simplified outline of the input-output table above) we can construct the following equation:

$$X_i = \sum_{j=1}^{n} x_{ij} + Y_i \qquad \ldots\ldots \qquad (5.13)$$

(j = 1,2,3, ...,n)

$$X_i - \sum_{j=1}^{n} x_{ij} = Y_i \qquad \ldots\ldots \qquad (5.13^a)$$

$$\sum_{i=1}^{n} X_i - \sum_{i=1}^{n} \sum_{j=1}^{n} x_{ij} = Y_i \qquad \ldots\ldots \qquad (5.14)$$

$$X - W = Y \qquad \ldots\ldots \qquad (5.14^a)$$

Where:

X is the gross product

W is the total intermediate consumption

Y is the GDP.

On the basis of each column of the input-output table (see table 5.6), we can construct the following equation:

$$X_j = \sum_{i=1}^{n} x_{ij} + V_j \qquad \ldots\ldots \qquad (5.15)$$

$$X_j - \sum_{i=1}^{n} x_{ij} = V_j \qquad \ldots\ldots \qquad (5.15^a)$$

$$\sum_{j=1}^{n} X_j - \sum_{j=1}^{n} U_j = \sum_{j=1}^{n} V_j \qquad \ldots\ldots \qquad (5.16)$$

Where:

U_j is the total intermediate consumption of subsector (j).

Therefore:

$$\sum_{j=1}^{n} U_i = W \qquad \ldots\ldots \quad (5.17)$$

and

$$X - W = \sum_{j=1}^{n} V_j \qquad \ldots\ldots \quad (5.17^a)$$

(j = 1,2,3, ...,n)

Thus:

$$\sum_{j=1}^{n} V_j = Y \qquad \ldots\ldots \quad (5.18)$$

The equation (5.18) shows that GDP is equal to the sum of gross value added originated in all sectors of the economy.

On the basis of equations (5.13^a) and (5.17^a), we conclude that the input-output table of the gross national product is a detailed balance sheet of gross national product. This could easily be shown on the basis of the last row at the bottom of the table (see table 5.12).

$$M + X = W + R + I + C^p + C^g + E \qquad \ldots\ldots \quad (5.19)$$

or $$M + X = W + R + I + C + E \qquad \ldots\ldots \quad (5.19^a)$$

While the left side of the equation (5.19^a) represents the availability of gross product, the right side represents its utilization (See also table 5.14).

Table 5.12

Input-Output Table of Gross National Product

Outputs → j / Inputs ↓ i	Production (product groups) 1	2	3	.	.	n	Total intermediate consumption of each group	Final consumption: Addition in Gross Inventory	Investment gross	Private Consumption	Public Consumption	Exports	Total Final Consumption	Total utilization= Total availabilities	Sources: Imports	Local Production
1	x_{11}	x_{12}	x_{13}	.	.	x_{1n}	W_1	R_1	I_1	C_1^p	C_1^g	E_1	Y_1	Z_1	M_1	X_1
2	x_{21}	x_{22}	x_{23}	.	.	x_{2n}	W_2	R_2	I_2	C_2^p	C_2^g	E_2	Y_2	Z_2	M_2	X_2
3	x_{31}	x_{32}	x_{33}	.	.	x_{3n}	W_3	R_3	I_3	C_3^p	C_3^g	E_3	Y_3	Z_3	M_3	X_3
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
n	x_{n1}	x_{n2}	x_{n3}	.	.	x_{nn}	W_n	R_n	I_n	C_n^p	C_n^g	E_n	Y_n	Z_n	M_n	X_n
Total intermediate consumption by sub-sectors	U_1	U_2	U_3	.	.	U_n										
Gross value added	V_1	V_2	V_3	.	.	V_n										
Production	X_1	X_2	X_3	.	.	X_n	W	R	I	C^p	C^g	E	Y	Z	M	X

Table 5.13

Division of Input-Output Table of Gross National Product

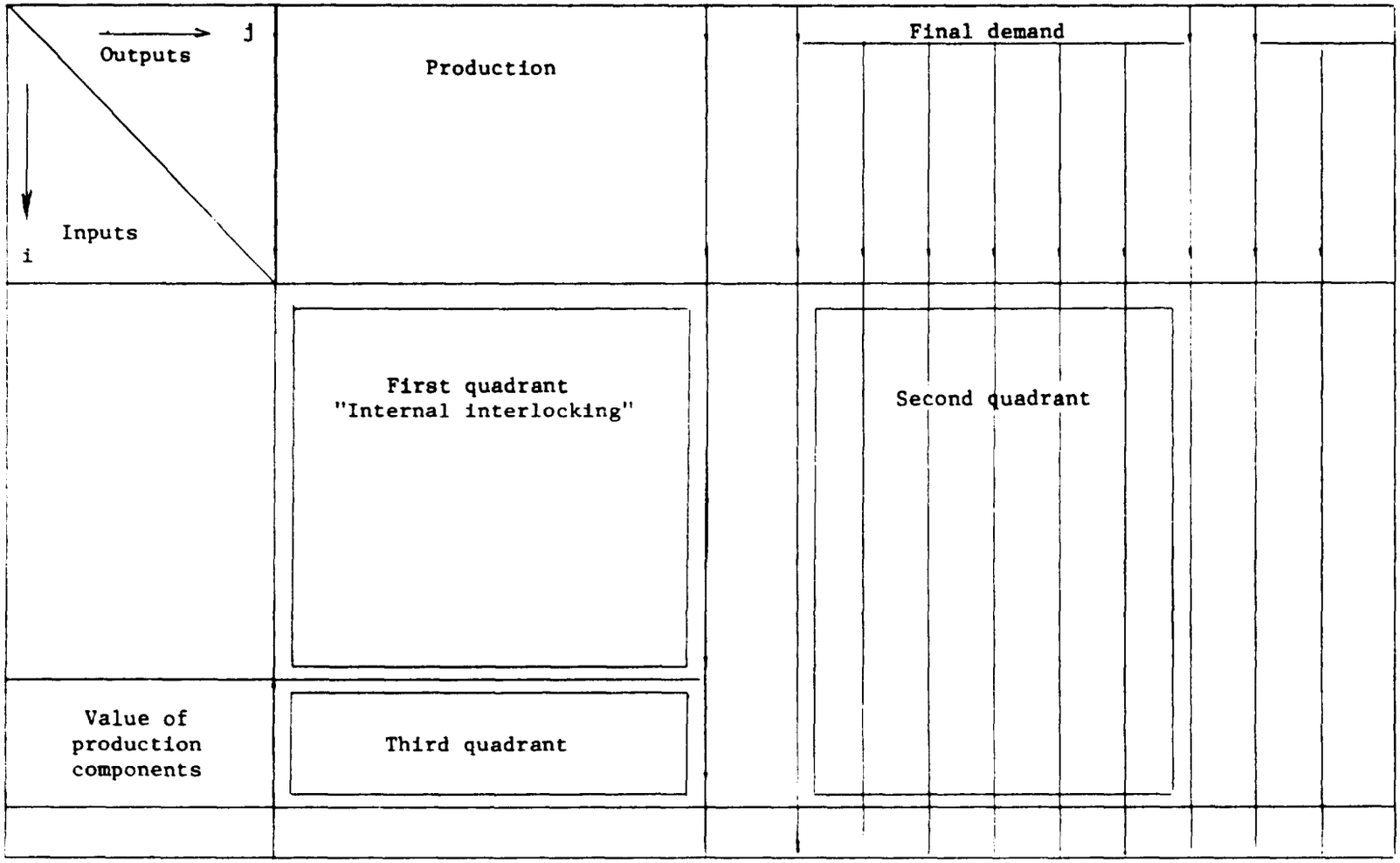


Table 5.14

Balance sheet of the gross national product	
Availabilities	**Utilization**
o Gross inventory at 1.1(t) $[R^{1.1(t)}]$	o Consumption of intermediate product (W)
o Intermediate Product (W)	o GDP for domestic use of which: o Private consumption (C^P) o Public consumption (C^g) o Accumulation; of which: o Gross investment (I) o Gross inventory at 31.12(t) $[R^{31.12(t)}]$
o GDP originating in all sectors of the economy $(\sum_{i=1}^{n} V_i)$	
o Imports	o Exports (E)
Availabilities (total)	Utilization (total)

(ii) The internal consistency of programmes

By internally consistent plan we mean the one which is devoid of bottlenecks or surplus capacities. This requires first of all, the calculation of the technical coefficients. The easiest way of calculating the table of technical coefficients is by dividing all the entries in each sub-sector's column by the gross output of that sub-sector (X_i). For this purpose, we repeat equation (5.5).

$$x_{ij} = a_{ij}X_j \quad \text{.....} \quad (5.5) \text{ repeated}$$

$$a_{ij} = \frac{x_{ij}}{X_j} \quad \text{.....} \quad (5.5^a)$$

It should, however, be pointed out here that one of the major problems involved in consistent forecasting on the basis of input-output tables is that changes in the structural coefficients are allowed for, particularly in the circumstances of developing countries. For short term forecasts, i.e. for period of one or two years, it is fairly reasonable to assume that input coefficients will not change, or that they will not change significantly. In making medium- and long-term projections, however, for five- to ten-year periods or longer, one cannot assume that input-output coefficients will remain constant. For such projects, it is necessary to use estimated technical coefficients. In fact, in the case of developing countries the estimated technical coefficients must form the basis of estimation for all zero entries or for sectors where interlinkages are not yet properly developed. These coefficients will change substantially in a long-run forecast; for example, when it is expected that agriculture will use more chemical fertilizers. The coefficients could be estimated on the basis of the targets of the long-term plans or on the basis of engineering studies and technical analysis.

Example No. 5.4

In the draft of the long-term plan of a particular developing country, the following tentative targets have been set:

(a) The output of agriculture in the year t_{10} should amount to 100 million dollars, i.e., $X_A = 100$, in order to meet basic needs for agricultural products.

(b) To achieve this target, agricultural experts estimated that the average use of fertilizers should amount to 0.2 dollar per dollar of agricultural output, i.e., $a_{FA} = 0.2$. In order to permit detailed analysis for a more efficient combination of resources, the experts must give different combination of technical coefficients necessary for achieving the above target of agriculture in respect, for example, of fertilizers, pesticides, irrigation and agricultural equipment, energy, etc.

Once the technical coefficients have been estimated, the internal consistency can then be computed on the basis of equation (5.13^a), as follows:

$$X_i - \sum_{j=1}^{n} x_{ij} = Y_i \qquad \text{.....} \qquad (5.13^a)$$

repeated

$(i = 1,2,3, \ldots,n)$

$(j = 1,2,3, \ldots,n)$

Substituting equation (5.5) in equation (5.13^a) yields:

$$X_i - \sum_{j=1}^{n} a_{ij} X_j = Y_i \qquad (5.20)$$

The above (n) equations could be rewritten as follows:

$$X_1 - [a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + \ldots + a_{1n}X_n] = Y_1$$

$$X_2 - [a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + \ldots + a_{2n}X_n] = Y_2$$

$$X_3 - [a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + \ldots + a_{3n}X_n] = Y_3$$

.
.
.

$$X_n - [a_{n1}X_1 + a_{n2}X_2 + a_{n3}X_3 + \ldots + a_{n3}X_3] = Y_n$$

Or more compactly as:

$$X - AX = Y \qquad \text{.....} \qquad (5.20^a)$$

$$[I - A]\, X = Y \qquad \text{.....} \qquad (5.20^b)$$

Where:

$$[I - A] = \begin{bmatrix} (1 - a_{11}) & (- a_{12}) & (- a_{13}) & \ldots\ldots\ldots & (- a_{1n}) \\ (- a_{21}) & (1 - a_{22}) & (- a_{23}) & \ldots\ldots\ldots & (- a_{2n}) \\ (- a_{31}) & (- a_{32}) & (1 - a_{33}) & \ldots\ldots\ldots & (- a_{3} \\ . & . & . & & . \\ . & . & . & & . \\ . & . & . & & . \\ (- a_{n1}) & (- a_{n2}) & (- a_{n3}) & \ldots\ldots\ldots & (1 - a_{nn}) \end{bmatrix} \qquad (5.21)$$

The matrix I - A is usually called the "technical matrix of production". This matrix is of extreme significance for a consistent plan, for it provides a general solution for an input-output problem.

(iii) Calculation of direct and indirect intermediate consumption

As has been mentioned earlier, input-output analysis has the advantage of showing direct and indirect intermediate consumption. This is of importance for establishing consistency within the industrial sector. In the following paragraphs we will examine this problem more clearly and derive the necessary equations therefore.

The Input-Output table shows the direct intermediate consumption by a given sub-sector of all other sub-sectors for each dollar's worth of current output. But this does not represent the total addition to output resulting from additional increase in the final demand. An increase in final demand for products of group (i) will lead to both direct and indirect increases in the output of all sub-sectors. If, for example, there is an increase in the final demand for the products of industry (2), there will be direct increases in intermediate consumption of products of groups 1,2,3 and so on. But in addition, when sub-sector (1) channels more of its output to sub-sector (2), sub-sector (1)'s demand for the products of industries (3), (4), etc., will likewise increase and these effects will spread throughout the whole economy.

A significant part of input-output analysis, therefore, is the construction of a table which shows the direct and indirect effects of changes in final demand. This can be done mathematically by multiplying both sides of equation (5.20^b) by the matrix $[I - A]^{-1}$ which yields:

$$X = [I - A]^{-1}Y \qquad \ldots\ldots \qquad (5.22)$$

The above equation could also be rewritten as follows:

$$\begin{vmatrix} X_1 \\ X_2 \\ X_3 \\ . \\ . \\ . \\ X_n \end{vmatrix} = \begin{vmatrix} A_{11} & A_{12} & A_{13} & \cdots\cdots & A_{1n} \\ A_{21} & A_{22} & A_{23} & \cdots\cdots & A_{2n} \\ A_{31} & A_{32} & A_{33} & \cdots\cdots & A_{3n} \\ . & . & . & & . \\ . & . & . & & . \\ . & . & . & & . \\ A_{n1} & A_{n2} & A_{n3} & \cdots\cdots & A_{nn} \end{vmatrix} \begin{vmatrix} Y_1 \\ Y_2 \\ Y_3 \\ . \\ . \\ . \\ Y_n \end{vmatrix}$$

Where A_{ij} are the coefficients of the matrix $[I - A]^{-1}$.

Equation (5.22) may be rewritten as follows:

$$X_i = \sum_{j=1}^{n} A_{ij} Y_j \qquad (5.22^a)$$

$(j = 1,2,3, \ldots n)$

By partial derivation of (X_i) with respect to a given final demand for products of group (Y_k) we achieve:

$$\frac{\partial X_i}{\partial Y_k} = A_{ik} \qquad \cdots\cdots \qquad (5.23)$$

(A_{ik}) is the required direct and indirect intermediate consumption products of group (i) other things being equal, in order to expand the output of products of group (k) by one dollar.

(iv) Treatment of imports and exports in input-output analysis

It is of extreme importance that the planner takes into account the imports and exports of commodities in input-output analysis. The formula for calculation of the imports of commodity (i) can be shown on the basis of table (5.12). The sources of commodity (i) are imports (M_i) and local production (P_i), whereas the uses can be in the form of intermediate consumption and final consumption. Final consumption can be in the form of addition in gross inventory, gross investment, private and public consumption and exports. The

total sources and uses of commodities is reflected in equations (5.19) and (5.19^a). In order to calculate the sources and uses of each commodity (i) we first break down the sources (X_i) into imports (M_i) and local production (P_i) and substitute into equation (5.13):

$$P_i + M_i = W_i + Y_i \quad \ldots \quad (5.13^b)$$

$$P_i + M_i = \sum_{j=1}^{n} A_{ij} X_{ij} + Y_i \quad \ldots \quad (5.13^c)$$

Equation (5.23) could be rewritten in detail as follows:

$$\begin{bmatrix} P_1 + M_1 \\ P_2 + M_2 \\ P_3 + M_3 \\ \cdot \\ \cdot \\ \cdot \\ P_n + M_n \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & A_{13} & \cdot & \cdot & \cdot & \cdot & A_{1n} \\ A_{21} & A_{22} & A_{23} & \cdot & \cdot & \cdot & \cdot & A_{2n} \\ A_{31} & A_{32} & A_{33} & \cdot & \cdot & \cdot & \cdot & A_{3n} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ A_{n1} & A_{n2} & A_{n3} & \cdot & \cdot & \cdot & \cdot & A_{nn} \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ \cdot \\ \cdot \\ \cdot \\ Y_n \end{bmatrix} \quad (5.13^c)$$

The estimation of the indicator of the share of imports to domestic production should be elaborated further on the basis of availability of the necessary raw materials and semi-manufacturers for processing and priorities of imports in addition to other factors, such as required skills and economies of scale.

The net imports and exports of the commodity (i) could be calculated on the basis of equation (5.13) and by breaking down the final consumption (Y_i) into its components:

$$M_i + P_i = W_i + R_i + I_i + C_i + E_i \quad \ldots \quad (5.13^d)$$

$$P_i = W_i + R_i + I_i + C_i + (E_i - M_i) \quad \ldots \quad (5.24)$$

$$P_i = W_i + R_i + I_i + C_i + e_i \quad \ldots \quad (5.24^a)$$

Analogous to equation (5.20) we could write the following equation:

$$X_i = \sum_{j=1}^{n} a_{ij} X_i + R_i + I_i = C_i + e_i \quad \ldots \quad (5.25)$$

e_i are the trade variables. When positive they indicate that they are used to meet foreign demand for the commodity (i); and when negative, they represent additional imports to supplement domestic supply. The complete set of equations could be rewritten as follows:

$$\begin{bmatrix} P_1 \\ P_2 \\ P_3 \\ \cdot \\ \cdot \\ \cdot \\ P_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \cdot & & & & \cdot \\ \cdot & & & & \cdot \\ \cdot & & & & \cdot \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix} \begin{bmatrix} P_1 \\ P_2 \\ P_3 \\ \cdot \\ \cdot \\ \cdot \\ P_n \end{bmatrix} + \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ \cdot \\ \cdot \\ \cdot \\ I_n \end{bmatrix} + \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ \cdot \\ \cdot \\ \cdot \\ C_n \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ \cdot \\ \cdot \\ \cdot \\ e_n \end{bmatrix} \qquad (5.25^b)$$

It should be pointed out here that transactions with foreign countries involve many difficulties. A complete exposition and treatment of these problems are beyond the scope of this publication. But it is important to note that exports and imports have to be adjusted to a valuation basis consistent with that chosen for other entires in the input-output table. In addition, there are sometimes conceptual and statistical problems associated with the trade entries in the production accounts which can produce large imbalances when reconciling supply of and demand for resources.[26/]

(v) The dynamic input - output model

The main focus of the dynamic input-output model is on the investment and growth. In order to develop the dynamic input - output model we first introduce the technical coefficient for investment (k_{ij}). Investment in its physical form constitutes capital goods required for maintaining and expanding the stock of capital in the economy (K). Capital goods can be used in the form of durable capital goods and intermediate goods necessary for expanding the production capacity and output.

26/ For detailed information see Victor Bulmer-Thomas' Input - Output Analysis in Developing Countries; Sources, Methods and Applications. John Wiley and Jons, 1982. Chapter 7.

Thus, gross investment in the year (t) will be channelled into different sectors of the economy in order to expand production capacity and output.

$$I_i(t) = \sum_{j=1}^{n} \Delta X_{ij}(t) \qquad \ldots \qquad (5.26)$$

Where:

$I_i(t)$ is the gross investment produced in sector (i).

$\Delta X_{ij}(t)$ is the part of $I_i(t)$ channelled to sector (j) for expanding its capacity and output.

The requirements for additional gross investment produced in sector (i) in order to expand the value of production output of sector (j) can be calculated as follows:

$$\Delta X_{ij} = a_{ij}(t+1)\, h_i\, [X_j(t+1) - X_j(t)] \qquad \ldots \qquad (5.27)$$

Where:

$[a_{ij}(t+1)]$ the technical coefficient for the year (t+1).

(h_i) is the average life time of the capital good (i). In the case of durable capital goods $h_i > 1$. In the case of non durable goods $h_i = 1$. For the sake of simplicity we will refer to $[a_{ij}(t+1)h_i]$ as (K_{ij}). K_{ij} represents the partial investment - output ratios.

From the above it follows that total gross investment of sector (i) can be calculated as follows:

$$I_i(t) = \sum_{j=1}^{n} \Delta X_{ij} = \sum_{j=1}^{n} K_{ij}\, [X_j(t+1) - X_j(t)] \qquad (5.28)$$

$(j = 1, 2, 3, \ldots, n)$

The complete set of equations can be rewritten as follows:

$$\begin{bmatrix} I_i \\ I_2 \\ I_3 \\ \cdot \\ \cdot \\ \cdot \\ I_n \end{bmatrix} = \begin{bmatrix} k_{11} & k_{12} & k_{13} & \ldots & k_{1n} \\ k_{21} & k_{22} & k_{23} & \ldots & k_{2n} \\ k_{31} & k_{32} & k_{33} & \ldots & k_{3n} \\ \cdot & & & & \\ \cdot & & & & \\ \cdot & & & & \\ k_{n1} & k_{n2} & k_{n3} & \ldots & k_{nn} \end{bmatrix} \begin{bmatrix} X_1(t+1) - X_1(t) \\ X_2(t+1) - X_2(t) \\ X_3(t+1) - X_3(t) \\ \cdot \\ \cdot \\ \cdot \\ X_n(t+1) - X_n(t) \end{bmatrix} \qquad (5.28^a)$$

or

$$I = K\,[X(t+1) - X(t)] \qquad \ldots \qquad (5.28^b)$$

The solution for the increases in output in individual sectors of the economy can be found using the technique of matrix inversion by solving the equation

$$X(t+1) - X(t) = K^{-1} I \qquad \ldots \qquad (5.29)$$

The complete set of equations can then be rewritten as follows:

$$\begin{bmatrix} X_1(t+1) - X_1(t) \\ X_2(t+1) - X_2(t) \\ X_3(t+1) - X_3(t) \\ \vdots \\ X_n(t+1) - X_n(t) \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{1n} \\ r_{21} & r_{22} & r_{23} & r_{2n} \\ r_{31} & r_{32} & r_{33} & r_{3n} \\ \vdots & & & \\ r_{n1} & r_{n2} & r_{n3} & r_{nn} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ \vdots \\ I_n \end{bmatrix} \qquad (5.29^a)$$

Where (r_{ij}) is the inverse element of the K matrix, and represents the increase in the value of output of sector (j) in the year (t + 1) as result of the investment of one monetary unit of products produced in sector (i) in the year (t). Thus,

$$X_1(t+1) - X_1(t) = \sum_{j=1}^{n} r_{ij} I_j \qquad \ldots \qquad (5.29^b)$$

or $$X_1(t+1) = X_i(t) + \sum_{j=1}^{n} r_{ij} I_j \qquad \ldots \qquad (5.29^c)$$

and:

$$\frac{\partial X_i(t+1)}{\partial I_k(t)} = F_{ik} \qquad \ldots \qquad (5.30)$$

Where (F_{ik}) represents the increase in the value of output of sector K in the year (t+1) other things being equal, as results of the investment sector (k) in the year (t) in one monetary unit.

(vi) The semi input-output model[27/]

The semi input-out method is designed for developing countries with open economies. It distinguishes, therefore, between domestic sectors (D) and international sectors (F), where the output of the former can enter into international trade while the latter cannot, for example construction. The splitting of the (N) productive sectors in (F) international and (D) national sectors (F + D = N) is facilitated by the following two equations which are derived from the basic input-output model.

$$x_F = H_{FF} x_F + H_{FD} x_D - \bar{J}_{oF} + f_F + e_F \quad \ldots \quad (5.31)$$

$$x_D = H_{DF} x_F + H_{DD} x_D - \bar{J}_{oD} + f_D \quad \ldots \quad (5.32)$$

Where:

x_F and x_D are vectors of increases in output in international and domestic sectors respectively during a planning period.

f_F and f_D are vectors of increases in sectoral final demand other than for investment and export goods of national and domestic sectors respectively.

H_{FF} and H_{DD} are matrices of technical coefficient (r_{ij}) which show the deliveries on both current and capital requirement for producing one monetary unit of output of international and domestic sectors respectively.

J_{oF} and J_{oD} are vectors of the level of sectoral deliveries of investment goods from existing capacity at the beginning of the planning period of the international and national sectors.

H_{FD} and H_{DF} matrices of technical coefficients of the type (r_{FD}) and (r_{DF}) which indicate international inputs into national sectors and national inputs into international sectors respectively.

e_F vector of changes in sectoral exports minus imports. It appears only in the balance equation of the international sector.

27/ For detailed information see (1) Victor Bulmer-Thomas, Input - Output Analysis in Developing Countries; Sources, Methods and Application. John Wiley and Sons, Chapter 15; and (2) UNIDO, Industry and Development No. 5.

The general solution for the increases in output of the national sectors, including the complementarity indirect production effects on the national sectors caused by planned production expansions x_F in the international sectors can be found using the technique of matrix inversion by solving equation (5.32).

$$x_D = [I_{DD} - H_{DD}]^{-1} (H_{DF}x_F - \bar{J}_{oD} + f_D) \quad \ldots \quad (5.33)$$

In this way when an investment takes place in an international sector, for example to promote exports, it may make demands on the output of the other international sectors through the system of inter-industry linkages, although these demands could be satisfied through imports. Demand for the output of the national sectors, however, must be met by increased domestic productin which requires complementary investments in those sectors. This additional investment must be added to the original investment in the international sector in order to determine the total capital required for export promotion or import substitution.

Because increased demand for the output of the international sectors could be met by imports, the semi input-output model excludes their investment needs from total capital requirements. Each international sector can then be evaluated in isolation, with complementary investments in the international sectors only added to its own capital requirements.

(vii) Partial input-output model

In most developing ocuntries, input-output and semi input-output models could not yet be used for determination and co-ordination of the indicators due to insufficient information base. It is important therefore that developing countries develop the statistical information necessary for the construction and analysis of input-output tables.

Partial input-output analysis has been used successfully in industrial planning in a number of developed and developing countries. This is due to the relatively limited requirements for statistical information which are confined mainly to the subsectors in question.

Partial input-output analysis enables the planner to quantify interrelated objectives within the industrial sector, as in the case of the chemical industry where the inputs and outputs of many chemical reactions are strongly interlinked, as well as among certain industrial sub-sectors and other sub-sectors of the economy.

Example No. 5.5

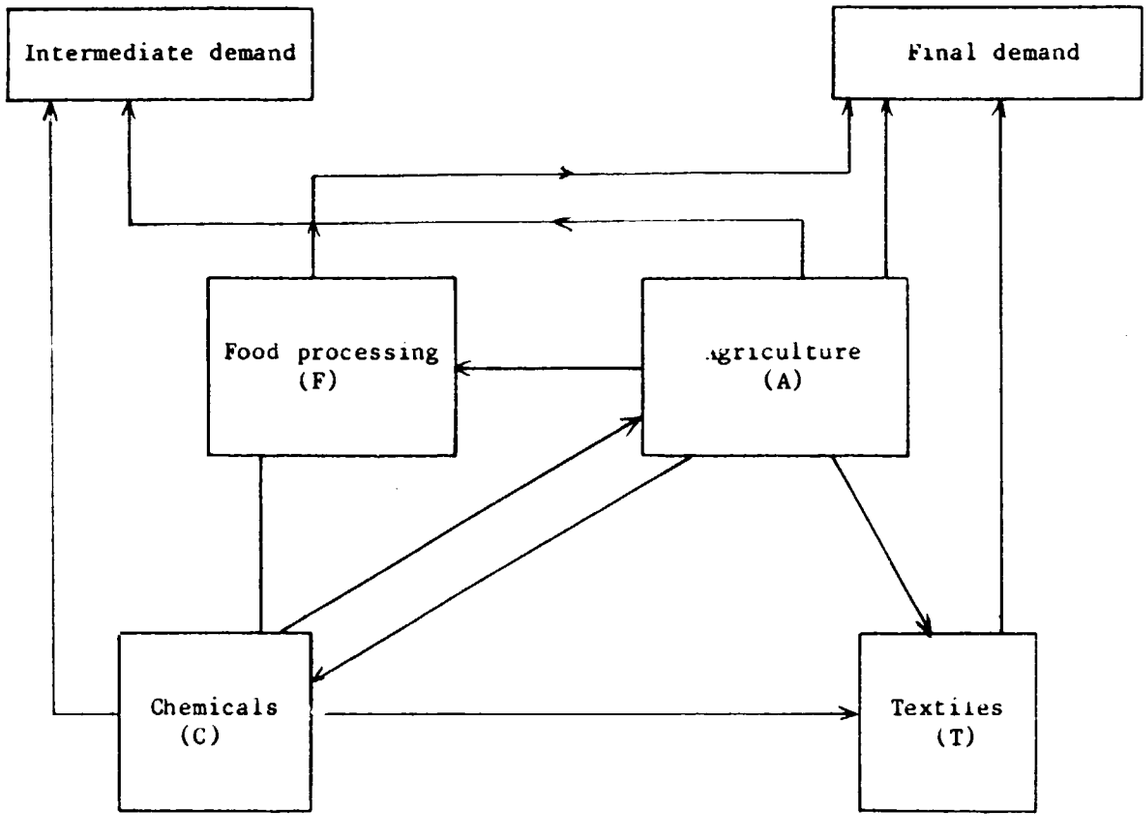
Consider the following interrelationships among three industrial sub-sectors (food processing, chemicals and textiles) and agriculture (see also figure 5.1). Hypothetical values of final demand for these industrial subsectors and agriculture are given in table (5.15).

Table 5.15

Sub-sector or sector	Final demand (Y_i) million dollars[28/]	Total gross output (X_i) million dollars
T	50	50
F	40	50
A	50	100
C	15	90

28/ Intermediate consumption beyond the dimension of partial input-output is in fact final demand from the point of view of the system in question.

Figure 5.1



The first step toward finding a solution to the table is the setting of final demand and an estimation of technical coefficients. Both have to be estimated on the basis of the preliminary targets set in the draft of the industrial plan. For example, food processing in the year t_5 must increase by 20 per cent compared with the level of the year t_0 (see table 5.20). Another example would be the preliminary target of achieving utilization of an average of 0.2 dollars of fertilizer input (produced by the chemical sub-sector) per one dollar output of agriculture (see table 5.16). Other preliminary targets could also be taken from the national plan or plans of other sectors, for example, the increase in final demand for agricultural products by 25 per cent in the year t_5. The estimated technical coefficients (preliminary targets) are presented in table 5.16.

Table 5.16

	T	F	A	C
T	0.2	0	0	0
F	0	0.2	0	0
A	0.3	0.4	0.1	0.06
C	0.3	0.2	0.2	0.3

The second step is the computation of the technical matrix of the production matrix [I - A]. The results are shown in table 5.17.

Table 5.17

(0.8)	(0)	(0)	(0)
(0)	(0.8)	(0)	(0)
(-0.3)	(-0.4)	(0.9)	(-0.06)
(-0.3)	(-0.2)	(-0.2)	(0.7)

The third step is the computation of direct and indirect requirements per dollar of final demand on the basis of inverting the matrix [I - A]. The results are presented in table 5.18.

Table 5.18

	T	F	A	C
T	1.25	0	0	0
F	0	1.25	0	0
A	0.461165	0.5906148	1.132686	0.0970873
C	0.6674757	0.5258899	0.322624	1.456310

The inverted matrix represents the direct and indirect requirements for each input. These differ greatly from the direct requirements presented in table 5.16. For example, direct and indirect requirements of one dollar of agricultural output from the chemical sub-sector amount to 0.322624. This means that in order to increase the agricultural sector output by one dollar it is necessary to increase the fertilizer output of the chemical sub-sector by 0.322624 dollar. Furthermore, these calculations show how the plan should be elaborated. For example, the target of using 0.2 dollars of fertilizers in agriculture by the year t_5 leads to the elaboration of further plan targets such as fertilizer production, which can now be quantified as (0.233624 x 125).

The inverted matrix of the table can be used to forecast the total impact of the system due to changes in final demand in one or more components of the system. We will illustrate below how such a table can be used for industrial development planning forecasts. To do this, we must list the tentative targets of the final demand in the year t_5 for each of the components in our hypothetical example (see table 5.19).

Table 5.19

	Assumed changes in final demand for commodity (i)		
	Original demand in the year (t_o) (million dollars)	Estimated targets of final demand in the year (t_5) (million dollars)	Per cent change
T	50	60	20%
F	50	65	20%
A	100	125	25%
C	90	130	45%

Finally, we calculate the total projected gross output on the basis of equation (5.22), as follows:

$$X = [I - A]^{-1}Y$$

$$\begin{bmatrix} X_T \\ X_F \\ X_A \\ X_C \end{bmatrix} = \begin{bmatrix} (1.25) & (0) & (0) & (0) \\ (0) & (1.25) & (0) & (0) \\ (0.461165) & (0.5906148) & (1.132686) & (0.0970873) \\ (0.6674757) & (0.5258899) & (0.323624) & (1.4563106) \end{bmatrix} \begin{bmatrix} 60 \\ 65 \\ 125 \\ 130 \end{bmatrix}$$

$$\begin{bmatrix} X_T \\ X_F \\ X_A \\ X_C \end{bmatrix} = \begin{bmatrix} 75,000 \\ 81,250 \\ 220,267 \\ 304,005 \end{bmatrix}$$

Table 5.20

Estimated changes in total demand for the commodity (1)

	Original total demand in the year (t_o) million dollars	Estimated total demand in the year (t_5) million dollars	Per cent change
T	50.000	75.000	50%
F	50.000	81.250	62%
A	100.000	220.267	120%
C	90.000	304.005	237.8%

From table 5.20 it can be seen that the increase in total output is much higher than the required increase in the final output. This is due to the intermediate requirements, which grow strongly as a result of direct and indirect effects. This analysis shows clearly why planning on a piecemeal basis cannot be consistent, for no account can be taken of the created intermediate demand, with the result that in most cases further bottlenecks in the economy are created.

The process of computation and co-ordination of targets on the basis of balances and input-output techniques (partial or overall) is complementary. They are usually used together in elaborating industrial plans in order to assess precisely the targets, which are based on the relationship between supply from domestic and imported sources and demand for semi-manufactures and manufactures in respect of a number of processed products and other commodities. Assessments of possible domestic production derived from these materials balances must be compared to demands resulting from an overall disaggregation of demand as shown by the preliminary projection of the gross domestic product and its major elements. Differences in relevant estimates are eliminated through a process of successive approximation and thus a co-ordination of plan targets can be achieved at the aggregated, sectoral and project levels.

Due to an insufficient information base, developing countries frequently apply the following method instead of the input-output technique. First, they elaborate a "balance" between the total savings and total investment and between export and import, then they determine aggregate objectives for the growth of the gross domestic product and targets for the manufacturing industry by means of incremental capital-output coefficients. The growth rate of manufacturing industry is determined in relation to the growth rate of domestic product in the past or a comparable coefficient is taken from empirical studies in other countries at similar industrialization stages.

This procedure is useful for development of the first draft of a national plan. However, for development of a consistent and efficient industrial plan, it is necessary to introduce further elaboration in order to quantify and co-ordinate objectives. This will be dealt with in Chapter VI.

Statistical and econometric methods

(i) Introduction

Statistical and econometric methods are of great significance for the preparation of industrial plans. On tne basis of these methods the industrial planner could either estimate final plan indicators or estimate tentative ones for further iterative procedures.

The application of statistical and econometric methods in the preparation and elaboration of industrial plans requires a good knowledge of statistics on the part of the person applying them and a firm grasp of economic theory. A good knowledge of economic theory is in any case required for the analytical work connected with industrial plan preparation and elaboration. The industrial plan indicators are calculated on the basis of magnitudes of economic variables, such as output, value of intermediate inputs, investment, value of exported or imported manufactured goods, salaries and wages, prices, etc. The importance of the economic theory for the analysis and quantification of industrial plan indicators immanates from tne fact that it provides analyses and explanations on the objective behaviour of the various economic variables. In fact, the entire body of economic theory constitutes a collection of relations among these variables based on certain assumptions or empirical statements.

The precondition for the application of statistical and e onometric methods is the availability of sample data on the economic variables in question. The sample data necessary for inferences are of two kinds:

(a) cross-section data and
(b) time series data

Cross-section data consist of observations on the economic variable in question at a given point in time, or, more particularly, during a given interval of time.

In order to illustrate the observations of the cross-section data, let us assume that in a certain country there exists ten soft drinks factories. In this case, the output of each factory during one year represents an observation, and the output of the individual factories during this year represents a total sample of ten observations.

Time-series data, on the other hand, consist of observations of a variable at different points in time or during intervals of time. Each successive observation is separated from others by its occurrence at different times, rather than its occurrence in a different place. An economic variable such as employment, savings, production and cost, whose values are ordered with respect to time is called an economic time series.

(ii) Regression Analysis

The major tool for statistical and econometric methods is a regression equation model which postulates a causal relationship between a dependent variable and one or more independent variables. A dependent variable is functionally dependent on the independent variables, for example quantity demanded for a certain product may be regarded as a function of price, disposable income and prices of related commodities.

The regression model attempts to explain observed changes in a dependent variable as being caused by changes in the independent variables. Moreover, a form widely used to express the causal relation between a dependent variable and independent variables is the linear form. The linear causal relation between the dependent and independent variables may be expressed as follows:

$$Y_t = \beta_o + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \ldots + \beta_k X_{kt} + U_t \quad \ldots\ldots(5.34)$$
$$(t = 1,2,3,\ldots,n)$$

Where:

Y is the dependent variable

X_{1t}, X_{2t}, X_{3t}, ... X_{kt} are the independent variables

β_o, β_1, β_2, β_3 ... β_k are the parameters of the equation

U is a stochastic variable. It indicates the amount by which the sample observations of the dependent variable in question exceed or fall short of the mean value of all possible observations at certain levels of the independent variables.

The main focus of statistical methods is to quantify the model above on the basis of the given empirical data. This estimation is done usually on the basis of least squares. The estimated equation is expresse as follows:

$$\hat{Y} = \hat{\beta}_o + \hat{\beta}_1 X_{1t} + \hat{\beta}_2 X_{2t} + \hat{\beta}_3 X_{3t} + \ldots + \hat{\beta}_k X_{kt} \quad \ldots \quad (5.35)$$

Where:

$\hat{Y}$ is the estimated value of Y

$\hat{\beta}_o$, $\hat{\beta}_1$, $\hat{\beta}_2$, $\hat{\beta}_3$ ... $\hat{\beta}_k$ are the estimated values of the parameters of the equation.

It should be pointed out here that we refer to a regression equation with more than one independent variable as a multiple regression, and to one with one independent variable as a simple or bivariate regression. The simple or bivariate regression equation is expressed as follows:

$$Y_t = \beta_o + \beta_1 X_{1t} + U_t \quad \ldots \quad (5.36)$$

Since the least squares method is sufficiently described in literature on statistics and econometrics, only its main features and application to the field of industrial planning are presented below. Interested readers can refer to the books suggested in the list of literature which provides the complete mathematical derivation.

The principle of least squares estimation involves minimizing the sum of squared deviations of the observed values Y_t from their estimated values $\hat{Y}_t$. That is we have to find the values $\hat{\beta}_o$, $\hat{\beta}_1$, $\hat{\beta}_2$, ... $\hat{\beta}_k$ that make the required sum as small as possible.

$$S = \sum_{t=1}^{n} (Y_t - \hat{Y}_t)^2 \rightarrow \min. \quad \ldots \quad (5.37)$$

The result is a formula to compute each estimated parameter in terms of the observed Y_t and X_{it}.

(iii) Time series analysis

Analysis of trend

One use of the time series analysis is to smooth a time series. The smoothing of a time-series consists of reducing the period to period irregularities. One technique is to remove all out linear variation. This is called trend analysis. It seeks to establish an average line between quantities used over a certain number of years. The future behaviours of the variable in question can be estimated according to the trend shown by this line. The trend line is determined on the basis of least squares method described above, where the linear trend is estimated on the basis of the following equation:

$$\hat{Y} = \hat{a} + \hat{b}_t \qquad \ldots \qquad (5.38)$$

Where:

- $(\hat{Y}_t)$ is the estimated value of the variable in question
- (t) is the time (in months or years)
- $(\hat{a})$ is the estimated value of intercept of the estimated trend line with the Y axis
- $(\hat{b})$ is the trend. It shows the amount by which the variable in question grows during one period (month or year)
- $\hat{a}$, $\hat{b}$, and t are $\hat{\beta}_o$, $\hat{\beta}_1$ and X_1 of the least squares model above respectively

In the following we will demonstrate the application of trend analysis in industrial planning:

Evaluation of past development

Trend analysis is of great significance for the evaluation of past development of different industrial sub-sectors and for making comparisons among them with regard to the movement over time of value added, cost of inputs, installed capacity, utilization of installed capacity, output, employment, productivity, energy consumption per output, etc.

The analysis of past trends of economic variables could be done for an industrial sector, for an industrial sub-sector, or even for an individual industrial enterprise. In this way, it provides industrial planners on different levels of responsibility with necessary preliminary information about the dynamic and structure of the industrial sector.

It should be pointed out here that evaluation of past development in this way is just indicative and does not provide the planner with information on the real causes of the development of the variable in question within the observed time period.

Due to the fact that the above-mentioned variables grow over time the examination of past growth rates is rather important. The general formula for estimating the compound growth rate is the exponential function.

$$Y_t = A(1 + r)^t e^{Ut} \quad \ldots \quad (5.39)$$

Where:

(Y_t) is the variable in question

(A) is a constant (the initial value of the variable in question).

r is the compound growth rate

t is the number of years

One way to derive r is to take the natural logarithms of equation (5.39) and estimate the following equation:

$$LnY_t = LnA + t \cdot Ln\ (1 + r) + U_t \quad \ldots \quad (5.40)$$

For convenience, we will assume the following:

$$LnY_t = Y_t'$$

$$LnA = a$$

$$Ln\ (1 + r) = b$$

Thus, equation (5.40) can be rewritten as follows:

$$Y'_t = a + b \cdot t + U_t \qquad \ldots \qquad (5.40^a)$$

The parameters (a) and (b) are then estimated as shown above in section (ii).

Projection of industrial plan indicators of autonomous processes

In general, most of industrial plan indicators are determined by known factors, for example, the factor which determine the demand for cement within the country could be the price of cement and the price for alternative construction materials and investment. These factors are usually known for the industrial planner or possible to predict. The factors determining the demand for the national cement in the international markets, however, are difficult to predict.

As has been indicated on page 114 a number of processes related to industrial activities are difficult to quantify and the estimation of their indicators is the only way for linking them to targets. The estimation of these indicators could, among others, be done on the basis of extrapolation of trend.

It should be indicated here, however, that such extrapolation is an exception to the rule for industrial plan targets cannot be designed on the basis of extrapolation of time trend. This is contradictory to the principles of planning which aim at restructuring the economy in question in order to enhance socio-economic progress in the long-run. The quantification of targets on the basis of the projection of trends is to suggest that the previous factors will continue to determine the development within the previous structural framework. The quantification of targets for the five years plan should proceed on the basis of balances and iterative techniques, in particular they should respond exactly to the overall targets of the development plan, for example if the plan decides on increasing the industrial output by X per cent of which metallurgy by X_m per cent, engineering by X_{elc} which should meet the development requirements of all these industries as well as other sectors. The increase of the generating capacity of the electricity in this case will, of course, differ from that estimated on the basis of projection of time trend.

The use of trend projection in long-term planning

Trend projection can be used in many cases in long-term planning, for such planning focuses mainly on broad targets rather than on precise details. Moreover, any deviation that might occur could be corrected during the continuous short-term planning process.

A number of variables could be examined on the basis of trend projection in preparing long-term plans, for example availability of specific types of labour, the life span of mineral deposits, the industrial demand for water, the danger of pollution, etc.

In applying trend projection in long-term planning, the industrial planner has to examine the best fitting. This could be linear or exponential as in the case of compound growth. But it could take other shapes. There are a number of models that reflect the different changes of the magnitude of the variable in question in different periods of time. An example in this respect is the quadratic model:

$$Y = C_1 + C_2 t + C_3 t^2 \qquad \ldots \qquad (5.41)$$

Of great significance for long-term planning is the saturation model and the logistic curve which are presented below respectively for they could tentatively envisage the levels of saturation over a long period of time. The saturation model is formulated as follows:

$$Y_t = e^{\alpha - \beta/t} \qquad \ldots \qquad (5.42)$$

Where:

e^{α} represents the saturation level and the point of inflection where $t = \beta/2$. To the left of this point, the slope increases with t, to the right of it the slope diminishes. As $t \to \alpha$. $Y \to e^{\alpha}$.

The logistic function is formulated as follows:

$$Y_t = \frac{a}{1 + be^{-ct}} \qquad \ldots \qquad (5.43)$$

Where (a) represents the saturation level and is called the parameter of saturation. The initial value of the logistic curve is $\frac{(a)}{(1 + b)}$.

In the application of trend projections it is necessary to note that the time trend is beset by some statistical and economic deficiencies. The implicit assumption of this method is that the factors which ahve determined the growth rate of production and consumption in the past will continue into the future, i.e., that their average effect on the activity in question will be the same as in the past. This hypothesis, which might be called the hypothesis of mutually compensating effects, implies that possible changes in factors affecting the variable in question cancel out, so that their combines effect is the same as in the past. The hypotheis is on the whole rather indicative and of doubtful validity.

Experience shows that extrapolation of time-series data can work reasonably well in the case of a few "well-behaved" time-series, such as population time-series or those which are closely correlated with population growth or rising income during periods of stability.

(v) Econometric models

A complete exposition of econometric methods and models is beyond the scope of this publication. We will, therefore, confine ourselves here to defining their aims and will briefly show their application in connexion with industrial planning.

Econometric models are an abstract representation of the operation of economic forces in the "real world". They tend to be more accurate than time-series analyses, since they are based on economic theory and consist of explanatory variables which reflect their individual impact on the independent variable in question. They enable the planner to quantify the influence of

economic factors on this variable in the economy of a country. With the use of econometric models, the reflection of actual features of the economy, its links, structure and tendencies to change can be traced.

Economic relationships stipulated in advance by economic theory considerations can be expressed by single or simultaneous equations (a system or set solved all at once). In this way, both the resulting estimated parameters and model prediction are consistent with the economic thought.

When applying these methods, the procedure is as follows:

(a) Study of the variables which explain the variation in the variable in question, for example, manufacturing value added can be strongly affected by GDP, the ratio of investment and exports.

(b) Construction of an explanatory model, estimation and testing of the model to determine the degree of confidence that can be placed in these relationships for the purpose of their implementation.

The industrial planner needs in the first place, models to analyze factors affecting the demand for different manufactured goods. He also needs to analyse factors affecting growth of manufacturing value added of single sub-sectors or the whole industrial sector. Models can be used to assess new developments in technology. In addition in industrial planning practice, forecasts on the basis of econometric models can serve long term planning by investigating and revealing possible factors for determination of long-term targets, as well as providing information which might be useful for solving future economic tasks.

Of special significance for industrial planners is the estimation of elasticities, for they provide a measure to calculate interdependent targets. As an example in this respect is the elasticities of output with respect to capital and with respect to labour. These elasticities can be estimated on the basis of a regression analysis of the Cobb-Douglas function. The equation for time-series data usually takes the following form:

$$P_t = aK_t^{\alpha} \cdot L_t^{\beta} e^{Ut} \qquad \ldots \qquad (5.44)$$

Where:

P_t is the output or value added of the industrial sector, sub-sector, or individual enterprise in physical units, or monetary units respectively

a is constant

K_t is the value of stock of capital of the industrial sector, sub-sector or individual enterprise in monetary units

L_t is the size of labour force measured in man hours

α is the elasticity of output in respect of capital, which is interpreted as follows: "If the stock of capital is increased by one per cent, other things being equal, then the output will increase by (α) per cent".

β is the elasticity of output in respect of labour, which is interpreted as follows: "If the number of employed encreased by one per cent, other things being equal then the output will increase by (β) per cent".

The elasticities of output with respect to capital and labour can be estimated for the industrial sector, for different sub-sectors and for individual enterprises. On the basis of these elasticities the planner can estimate the required additional capital and labour to increase the output of suggested output targets.

Another typical example is the analysis of the relationship between demand for a given manufactured good, its price, income and prices of alternative commodities. This relation could be estimated on the baiss of the following equation:

$$D_I = KC^a P_I^{-b} P_{II}^d \quad \ldots \quad (5.45)$$

Where:

(D_I) is the demand for the commodity in question

(K) is a constant

(C) is the income (overall or per head)

(P_I) is the price for the commodity in question

(P_{II}) is the price for the alternative commodity

(a) is the income elasticity which is interpreted as follows: "If the income increases by one per cent, other things being equal, the demand for this commodity increases by (a) per cent".

(b) is the price elasticity of the commodity in question, which is interpreted as follows: "if the price of the commodity in question increases by one per cent, other things being equal, the demand for this commodity falls by (b) per cent".

(d) is the elasticity of the commodity in question with respect to the price of the alternative commodity which is interpreted as follows: "if the price of the alternative commodity increases by one per cent, other things being equal, the demand for the commodity in question will increase by (d) per cent".

The significance of elasticities for the industrial planner can be seen from these examples. For instance, on the basis of the income elasticity he can get an idea about how an additional dollar in income would be spent. On the basis of the price elasticity of the commodity in question he can set an appropriate price policy or other relevant policies, such as tariff and tax policies, since these are price components. On the basis of the price elasticity of the commodity in question with respect to the price of the alternative commodities, the planner can decide on price policies so as to shift consumption towards preferable alternative commodities, for example, towards commodities that are possible to produce on the basis of local raw materials or by the traditional sector. The relationship between the demand for a certain commodity and its price, price of the alternative commodities and income could take a linear form.

$$D = h + ac - bP_I = dP_{II} \qquad \ldots \qquad (5.46)$$

Where:

(h) is a constant

(a) shows the increase in demand due to income increase by one monetary unit, other things being equal; and

(b) shows the decrease in demand due to price increase by one monetary unit, other things being equal; and

(d) shows the increase in demand due to price increase in the alternative commodity by one monetary unit, other things being equal.

The average elasticity of prices and demand for the period under study could be calculated as follows:

$$E_{P_I} = b \frac{\bar{P}_I}{\bar{D}}$$

$$E_{P_{II}} = d \frac{\bar{P}_{II}}{\bar{D}}$$

$$E_C = b \frac{\bar{C}}{\bar{D}}$$

Where:

(EP_I) is the price elasticity of the commodity in question

(E_{PII}) elasticity of the commodity in question with respect to the price of the alternative commodity and

(P_I) is average of price observations, i.e.,

$$\bar{P}_I = \frac{P_I}{n}$$

P_{II} is the average of the price observations of the alternative commodity

$(\bar{C})$ is the average of income observations and

$(\bar{D})$ is the average of demand observations.

By analyzing price time series the planners must make sure that they use constant prices, for inflation within the national economy and in the world market makes estimations based on current prices quite useless. In this connexion, developing countries should encourage the preparation of price indexes for deflating time-series data which are expressed in current prices.

There is a wide scope for estimating different elasticities in the everyday work of the planner, provided he has sufficient and relatively reliable statistical data on the treated economic variables.

Finally, it should be noted here that econometric models should not necessarily be carried out by planners. The planner, however, should instruct the statistician and econometrician what is needed so as to benefit from the outcome of econometric analysis.

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VI. STAGES IN THE PREPARATION OF INDUSTRIAL PLANS

1. Evolution of the industrial plan from the draft national plan

As has been indicated, a national plan, in whatever depth it is presented, is a prerequisite of an industrial plan, for it defines the overall objectives and the role of each sector of the economy in the process of development on the basis of distribution of the available financial resources, labour force and natural resources, as well as co-ordination of sectoral targets. In order to facilitate sectoral planning, the draft national plan must provide at least the following indicators for ten to fifteen years:

(a) Growth of population and labour force, as well as distribution of the labour force among different sectors of the economy.

(b) Growth of national income and development of the share of consumption and of savings in the national income.

(c) Estimation of financial resources and investment allocation among sectors of the economy.

(d) Growth of stock of capital and its main structural components and changes in the capital-output ratio.

(e) Growth of exports and imports.

A decisive factor in calculating growth is, of course, the savings rate of a country. Savings are a prerequisite for expanding productive capacities. They are defined as refraining from using parts of national income for consumption purposes. But it is also possible that countries can borrow savings in the form of loans and grants from other countries or can receive them as gifts. Savings occur when some part of the national income is not used up in current consumption but in expanding national production, or is kept in inventory to be consumed later. Savings can be hoarded or loaned out; they can also be used immediately for capital formation purposes.

The part of savings required for adding to the existing stock of capital (K) and for working capital during one year is called "current investment" (I^n), or "new investment". For convenience, we will assume that savings are equal to new investments. Then we can express the national income as follows:

$$Y = C^p + I^p + C^g + I^g + E - M \quad \ldots \quad (6.1)$$

Where (Y) is national income, (C^p) private consumption, (I^p) private investment, (C^g) government consumption, (I^g) government investment, (E) exports and (M) imports.

$$B = E - M \quad \ldots \quad (6.2)$$

Where (B) is the savings from abroad.

Thus, new investment could be then expressed as follows:

$$I^n = I^p + I^g \quad \ldots \quad (6.3)$$

$$Y = C + I^n + B \quad \ldots \quad (6.1^a)$$

Where (C) is the total consumption.

If we add to both sides of equation (6.1^a) the value of provision for consumption of fixed capital (I^r), i.e., investment required for replacement of worn-out fixed assets, we get the following:

$$Y + I^r = C + I^n + I^r + B \quad \ldots \quad (6.4)$$

$$N = C + I + B \quad \ldots \quad (6.4^a)$$

Where (I) is gross national investment and (N) gross national income.

The higher the ratios (I^n/Y) and (I/N) are, the more investment that can be channelled into capital formation. The central planning body must estimate the above mentioned ratios as well as the availability of foreign loans, repayment of foreign debts and debt servicing in order to estimate financial resources that would be available for national development in general and the industrial sector in particular, in local and foreign currencies, for both public and private sectors (see tables 6.1 and 6.2).

Table 6.1

Item	Year
(in million dollars at t_o prices)	t_o t_1 t_2 . . . t_{10} t_{11} t_{12} t_{13} t_{14} t_{15}
Gross domestic capital formation Gross domestic investment in fixed capital Increase in inventories Financing of capital formation Gross national savings o Provision for consumption of fixed capital (I^r) o Net savings in private sector (I^p) o Net savings in public sector (I^g) o Savings from abroad (B) (net position in current balance of payments account)	

Table 6.2

Estimation of investment for the industrial sector

Sector	Year t_o	t_1	t_2	. . .	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}
- Public sector:										
o in local currency										
o in foreign currency										
- Private and traditional sectors:										
o in local currency										
o in foreign currency										

(i) Analysis of industrial production

The planned gross investment ratio decides the proportion of supply of consumer goods to capital goods in the country. This can be easily explained on the basis of equation (5.19) (see chapter V, page 168)

$$X = W + R + I + C + E - M \quad \ldots \quad (5.19) \text{ (repeated)}$$

If we assume that total exports equal total imports, then equation (5.19) can be rewritten as follows:

$$X = W + R + I + C \quad \ldots \quad (6.5)$$

If we further assume that the gross inventory remains constant, then equation (6.5) can be simplified as follows:

$$X = W + I + C \quad \ldots \quad (6.6)$$

Since ($N = X - W$), then:

$$N = I + C \quad \ldots \quad (6.7)$$

If we assume a closed economy situation, then the structure of the industry will take the following form:

(a) The output of consumer manufacturing industries will be equal to what is spent in the country on manufactured consumer goods and services.

(b) The output of capital goods industries will be equal to the gross investment (I) and intermediate goods industries which cover the total requirements of the economy (W).

However, due to the weakness of capital and intermediate industries prevailing in most developing countries, the structure of the economy is distorted. They depend by and large upon the developed countries for their means of production and intermediate goods requirements and in order to balance the imports on the later they have to export raw materials and agricultural products. This situation requires an overall analysis of the structure of the economy so as to provide for its restructuring.

It is important in the first place to reveal the weakness of the structure of the industrial sector by comparing the demand on production of key products with the sources of supply, as shown on Table (6.3) below:

Table 6.3

Analysis of the structure of industrial production

Industrial product	Demand	Local production	Local production-demand = (+ export) or (- imports)	(+ exports) or (- imports) x 100 demand

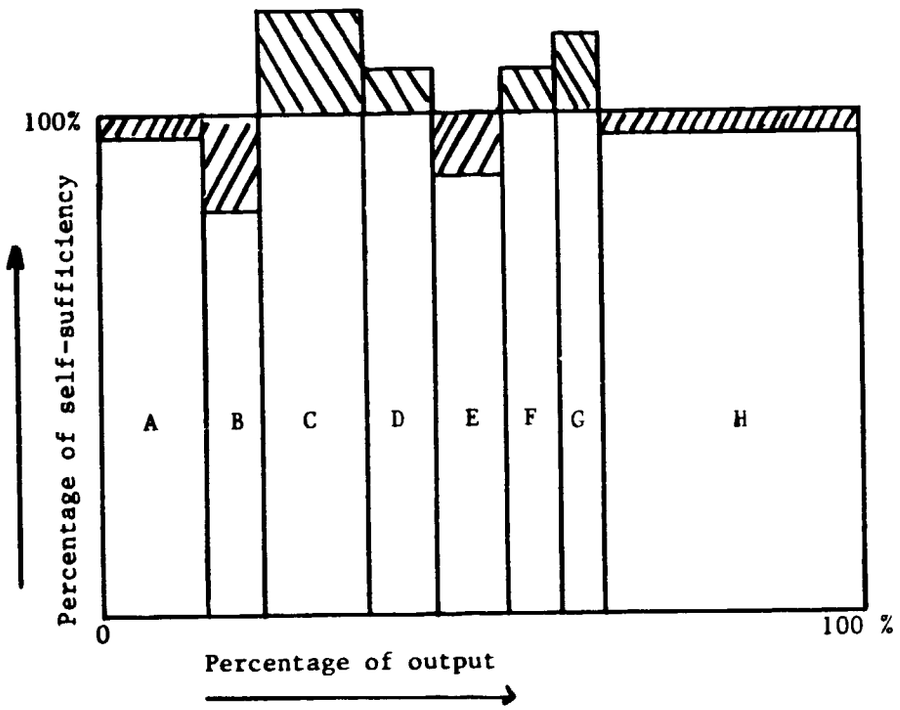
Moreover, it is also useful that the planner compare the differences in structure between his country and other developing countries and developed countries, especially those similar in size of population and natural endowments. In this respect, the planner can use the "skyline" charts 29/. We illustrate below two hypothetical skyline charts for a developed and a developing country (see figures 6.1 and 6.2). However, it should be pointed out here that this method of comparison has only relative meaning. For example, agricultural exports from a developing country does not mean that it enjoys food self-sufficiency. Another example would be the export of minerals due to general weakness of the manufacturing industries.

29/ Examples of actual skyline charts for different developed and developing countries have been given by W. Leontief in his Scientific American article, September 1963, pages 162 - 163.

Figure 6.1

Self-reliance and self-sufficiency chart

(a) Industrialized country



Net import

Actual Output

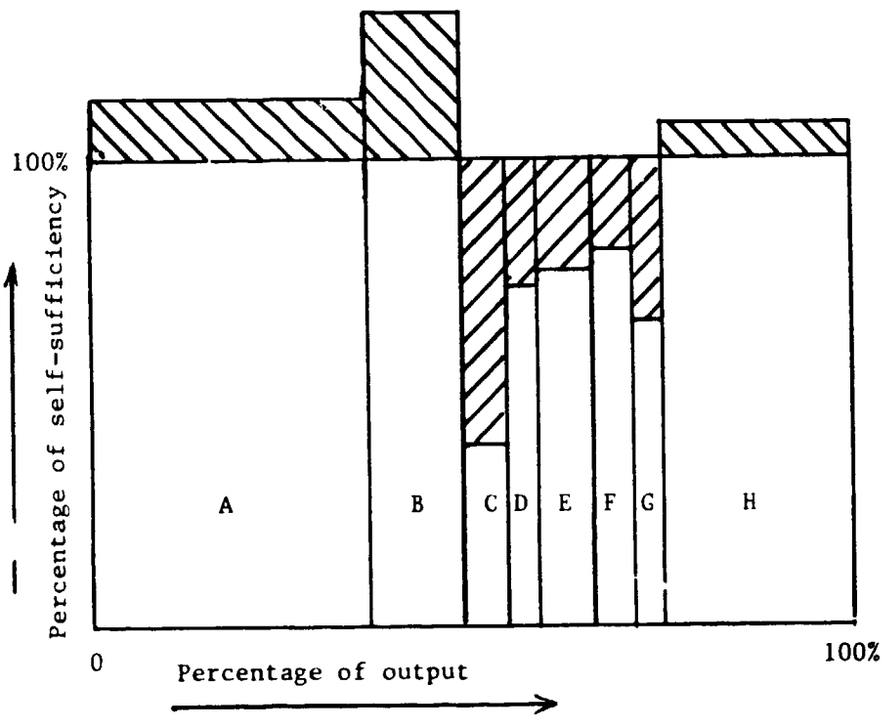
Net Export

A = Agriculture
B = Mining
C = Manufacturing (heavy durables)
D = Manufacturing (light durables)
E = Manufacturing (non-durables)
F = Construction
G = Finance
H = Services

Figure 6.2

Self-reliance and self-sufficiency chart

(b) Developing Country



Net import

Actual Output

Net Export

A = Agriculture
B = Mining
C = Manufacturing (heavy durables)
D = Manufacturing (light durables)
E = Manufacturing (non-durables)
F = Construction
G = Finance
H = Services

An input-output table (if it is available for successive years) is very useful in analysing the economy's initial state, particularly the structure of industry, for it can reveal the status of interlinkages among sub-sectors of the economy as well as its dependence upon foreign countries. Input-output tables for successive years show the development of the structure and permit evaluation of this development on the basis of the extent to which it moves from a position of relatively weak interdependence to strong interdependence. Thus, input-output provides a map for the industrialization process. Moreover, comparison of the structural relationship in a given developing country with that of other developing countries and developed countries on the basis of input-output tables is of particular significance for plan preparation, for it shows possibilities for increasing intermediate products.

In order to reveal the weakness of the industrial structure of a developing country it has proved useful that the planner triangulizes the disaggregated input-output table. A triangulized disaggregated table is one rearranged in such a way that the zero entries are concentrated within a single angle of the table. Table 6.4 is a hypothetical matrix of the economy of a developing country. The table in this way shows little or no particular pattern of either dependence or independence among sub-sectors. Triangulization of this table (see table 6.5) clearly reveals the weakness of the structure of the economy.

Table 6.4

	Production				Final Demand	Purpose of final demand		Sources of product (i)		Total availability of product (i)
	1	2	3	4		local cons.	export	imports	local prod.	
1	3	2	0	4	30	20	10	10	29	39
2	0	2	0	0	40	15	25	0	42	42
3	1	6	2	2	10	10	0	11	10	21
4	0	5	0	3	30	20	0	14	4	28

Table 6.5

	Production				Final Demand	Purpose of final demand		Sources of product (i)		Total availability of product (i)
	2	4	1	3		local cons.	export	imports	local prod.	
2	2	0	0	0	40	15	25	0	42	42
4	5	3	0	0	20	20	0	14	4	28
1	2	4	3	0	30	20	10	10	29	39
3	6	2	1	2	10	10	0	11	10	21

Table 6.5 reveals that the structural interdependence is rather weak. Other observations on the structure can also be made. For example, the sub-sector producing product (2) has highly backward linkages and its output goes almost entirely to final demand, particularly for exports. Whereas the sub-sector producing product (3) has no backward linkages but very strong forward linkages and half of its production goes to final demand; and half of product (3) is imported. Half of the products of sub-sector (1) are imported and half of them are exported. This can be a case for sectors with wide varieties of products; for example, export of certain surplus agricultural products and import of those other which are lacking.

In order to permit detailed analysis, the table should be disaggregated to reveal which products are exported and which are imported. But this could also be done on the basis of balances. Comparing the triangulized tables over time makes it possible to evaluate the dynamic changes of the structure. Of interest in this connexion is the evaluation of backward linkages development with the primary sector of the import-substituted and export-promoted industries. If, for example, the sector which comprises import-substitution industries does not develop backward linkages with the national economy, then these industries are of no importance for restructuring the national economy. Of similar interest is evaluation of the development of basic and intermediate industries and their interlinkages with the rest of the economy.

The supply of consumer goods, services and capital goods must maintain a definite proportion to each other as set by the gross investment ratio (I/N). If, for example, the gross investment ratio is 0.2, then the relative ratio of the net value of supply of the capital goods to that of the investment goods must be kept at 1 to 4. So long as the planned investment ratio does not change, the two must grow at the same rate. If, however, the gross investment ratio becomes bigger as income grows, then the supply of investment goods would become greater relative to that of consumer goods and services.

Analysis of the production of capital goods (means of production and intermediate goods)

Durable capital goods are required to maintain and expand the stock of capital in the economy. They usually take one of the following forms:

- buildings
- installations
- power machinery and power equipment
- installation for storing and transmitting
- machine tools and other technical equipment
- tools, devices and models
- lifting gears, conveyance
- vehicles for rail and road, ships and aircraft
- laboratory instruments, measuring instruments, testing apparatus and weighing machines
- factory and office apparatus and equipment

Some commodities can interchangeably be used in the form of durable capital goods and intermediate goods. For example, steel is an intermediate product if processed in the mechanical industries. If, however, steel is used in construction, then it is a capital good. The most precise way of analyzing the demand for capital and intermediate goods is, of course, through balances. In the initial stages of industrialization, developing countries must concentrate on balancing the key capital and intermediate products, such as cement, steel, oil products, sulphuric acid, fertilizers, tractors, lorries, agricultural pumps, etc.

As demonstrated in example (5.1) in Chapter V, balances should be introduced within a sub-sectoral plan. In the case of cement, for example, the balancing of cement should be part of the elaboration of the plan of the building and construction materials sub-sector. In elaborating such a plan, it is necessary to examine all possibilities of using alternative materials, for example, bricks, lime, tiles, etc., and the most practical design for different constructions, as well as the availability of raw materials.

Analysis of the production of consumer goods

Raising the standard of living through better satisfaction of the basic needs for consumer goods is one of the major tasks of national and industrial planning. Improving the satisfaction of basic needs in the long run, in line with the planned structure of the economy, must be decided in a draft national plan. It would be of great assistance to the sectoral planning activity if the national plan of a developing country were to include a section on raising the standard of living, which is the final task of the entire planning process.

Basic needs must be analyzed in packages. For example, in elaborating the basic need for food, the planner must seek the optimal combination of nutritional substances - proteins, fats and carbohydrates, including animal and vegetable protein and as necessary and sufficient quantity of mineral salts and natural vitamins. This package must correspond to the specific tastes, traditions and customs of the people in he country in question as well as to the availability of agricultural resources. For example, in island countries where fish is abundant, fish should play a more important role than in countries where cattle is abundant. Moreover, it is necessary that the value of total basic needs satisfied during one year is equal to the supply from both local and imported sources of manufactured and non-manufactured consumer goods and services .

It is advisable for the precise calculation of plan objectives that work on the draft of a national plan should begin with an analysis of the past levels of living standards of the population. Such analysis requires, of course, calculation of past per capita consumption for basic consumption needs, such as protein, calories, various processed and unprocessed food articles, textiles, footwear and other necessary consumer goods, including the

housing situation. It is useful to calculate these past per capita figures or norms in the form of time-series so as to assess the progress (or deterioration) in satisfaction of the basic needs of the population. Moreover, it is important that the planner disaggregate the consumption norms in accordance with different income groups of the population for both urban and rural populations, in order to reveal the urgent needs of the poorest part of the population (see table 6.6).

Table 6.6

Level of per capita consumption of basic consumer goods during the year (t) by different income groups

(a) Urban population

Per capita consumption / Product	Income groups							
	1	2	3	4				
Protein								
Calories								
Footware								
Textile								
.								
.								
.								

(b) Rural population

Per capita consumption / Product	Income groups						
	1	2	3	4			
Protein							
Calories							
Footware							
Textile							
.							
.							
.							

Comparison of these norms with those of other developing countries and developed countries is very useful in order to arrive at a better assessment of the required level of satisfaction (see table 6.7).

Table 6.7

(a) Rural population

Per capita consumption / Product	The country in question	Developing countries 1.2.3...	Developed countries 1.2.3...
Protein			
Calories			
Footware			
Textile			
.			
.			
.			

It is essential that the planner defines with the participation of public authorities and the different social groups, for each item of the basic needs package, a desired lavel of consumption which could be considered during the concerned period as an acceptable one and as a significant progress. Moreover, the planner should identify for the level of each item so calculated, the necessary operations and all the requirements to achieve these operations: investment, mastery of technologies, manpower, industrial infrastructures, necessary import, finance, etc.

For the preparation of the section in the draft national plan on raising the standards of living, the following indicators serve as guidelines which assist the planner in elaborating the basic needs. In the elaboration process of the sectoral plans, these indicators should, in as far as possible, be precisely calculated and homogenized on the basis of balances:

(a) General indicators of the well being of the population: the ratio of consumption in the national income; resources available for consumption; real per capita income - if possible, real per capita income for different strata of the population; indices for cost of living; the volume of the population's consumption of material goods and services.

(b) The population's consumption: per capita consumption of the main foodstuffs: grain and grain products, milk and dairy products, meat and meat products, fish and fish products, vegetable oil, sugar, potatoes and rational calorific value of about 3000 calories per person per day as an average. The per capita consumption/acquisition of the main non-foodstuffs: fabric, knitted goods, leather, footwear; the number of durable consumer goods, such as radios, bicycles, television sets, etc., per family (or 100 families).

(c) The provision of housing and municipal and domestic services: the average living space per person; the amount of housing construction in progress in rural and urban areas; the number of new housing units; the availability of the main municipal services; consumption of electricity, gas, water; the volume of work on domestic services rendered to the population.

(d) Transport: the volume of transportation services provided to the population.

(e) Education: the number of all primary, secondary and vocational schools of all types per 10,000 of the population; planned new additions in staff, students and schools.

(f) Health care: the number of hospital beds, doctors, etc., per 10,000 people.

(g) Culture: the number of libraries and clubs; the quantity of books, magazines, newspapers per capita, etc.

On the basis of these indicators, the industrial planner can calculate the balances of processed foods, textiles, leather and other light manufactured consumer goods, as well as other durable consumer goods, such as T.V. sets, bicycles and furniture.

The products of light industry and the food industry make up over 75 per cent of the total volume of consumer goods in most developing countries. One of the main suppliers of raw materials for these branches of industry is the agricultural sector, the processed products of which make up about 2/3 of the volume of consumer goods. Thus, the increased production of consumer goods and the successful development of agriculture and other raw material branches are organically correlated and must be harmonized in such a way that the requirements of the population for consumer goods are met.

In order to meet the planned demand in the long run for manufactured goods, the planner has to calculate the necessary intermediate and possibilities for their production as well as, eventually, the necessary complementary imports. A large part of these intermediates must be drawn from agriculture, which in turn must be modernized, expanded and intensified. The expansion and intensification of agriculture will require different industrial inputs, such as agricultural tools, machines, fertilizers, etc., which must be met from the industrial sector. In order to facilitate the drawing up of balances of those basic industries which are interlinked with agriculture, the planner usually needs norms to calculate the effects of investment in industry on other sectors. For example, what is the effect of one kilogram of fertilizers on agricultural output and the investment required in the industry for producing one kilogram of fertilizers?

Such norms enable the planner to calculate the investment necessary in different industries in order to calculate the investment necessary in different industries in order to increase agricultural output by one unit or one dollar. Finally, it should be pointed out that it is of paramount importance that the planner in a developing country first of all exhaust all possibilities for improvement of the standard of living with limited investment. For example, in a number of countries it would be possible that, during the initial periods of industrialization, the increase in the standard of living would be met through increasing productivity on the basis of introducting new organizational methods of production without large financial investments.

- Analysis of manpower for the industrial sector

The major objective of planning is directed at the population; a rise in their standard of living and the provision of productive jobs. Surplus population and unemployment and underemployment are the most intractable socio-economic problems faced in the great majority of developing countries. Due to the significance of these problems, the draft national plan in a developing country should include a section on manpower planning focussing, inter-alia on the following:

(a) Present socio-demographic indicators: The population size, including urban and rural; the social composition of the population (including unemployed and non-working women and the number of the employed in the economy).

(b) Long-term estimation of the size and structure of the population

(c) Estimation of the quantity of labour resources and skills, as well as their distribution among sectors of the economy and region of the country, for the medium-term plan.

The economic demand for skilled workers and experts could be determined from two balance calculations:

(a) The demand for skilled workers and sources for meeting this demand.

(b) The demand for engineers and experts with higher specialized education and sources for meeting this demand, such as universities and colleges.

In the industrial plan, the requirements for the labour force could be elaborated as follows:

(1) Estimation of the technical coefficients for the labour force at the sub-sectoral level (a_{oi}). This could be estimated from past experience on the basis of the following equation:

$$a_{oi} = \frac{X_{oi}}{X_i} \qquad \ldots\ldots \qquad (6.8)$$

Where:

a_{oi} is the labour time required per one dollar output of sub-sector (i)

X_{oi} is the total annual labour time required for producing the planner output of sub-sector (i), (X_i).

The application of formula (6.8) which is based on past experience, could result in some defficiencies when planning the labour force, for it does not reveal any disguised unemployment. Disguised unemployment must be eliminated in developing countries, otherwise the labourer will consume more than he produces, which would lead to stagnation of the economy. The coefficients (a_{oi}) must, therefore, be estimated accurately on the basis of an analysis of the productivity of labour in sub-sectors of the industry.

The total requirements of the industrial sector for labour force ($X_o^{ind.}$) could then be calculated on the basis of the following equation:

$$X_o^{ind} = \sum_{i=1}^{m} a_{oi} \cdot X_i / \text{average working hours in the year per person} \qquad \ldots \qquad (6.9)$$

It is of paramount importance that the industrial plan cover the requirements for the major groups of skills, e.g., turners, welders, carpenters, drivers, etc. This could be done on the basis of the following formula:

$$X_o^{ind(*)} = \sum_{i=1}^{m} a_{oi}^{*} \cdot X_i / \text{average working hours in the year per person} \quad \ldots \quad (6.10)$$

Where:

$X_o^{ind(*)}$ are the requirements of the industry for the group of skills (*) and (a_{oi}^{*}) is the time required for the skills (*) per one dollar output of sub-sector (i).

Planning of the labour force and skills should also be disaggregated by industrial sub-sectors, where account should be taken of the peculiarities of all branches of the sub-sector, as well as the specific requirements for labour in the public, private and traditional sectors.

A useful method for planning the labour force at the industrial sectoral and sub-sectoral levels is an estimation of the amount of manpower in management and administration on the basis of a regression analysis of the Cobb-Douglas function.

Planning the training of skills is extremely important. This includes upgrading the skills of the existing manpower and training of youths taking up a job. Such planning, to be meaningful, must be done on a regional basis, must take into consideration the common skills requirements of all sectors of the economy and must include on-the-job training, particularly at construction sites. Experience shows that the process of construction of industrial capacities, particularly large industrial complexes and infrastructural facilities could serve as a mass on-the-job training for the formation of skills.

In order to calculate the balance of labour for a given sub-sector, the following information on the planned output and employment coefficients is required (table 6.8):

Table 6.8

Item \ Branches of sub-sector (i)	Branches of the modern sector								Traditional Sector	Total labour time required for the whole sub-sector
	1		2							
	Priv	Publ	Publ	Priv						
Output of branch (i) in dollar										
Average labour time requirement per dollar of branch (i)										
Total amount of labour time required by each branch										

The planner can calculate the requirements for certain skills for the sub-sector in question in the same way.

Regional manpower balances assume importance because the overall manpower planning of the country as a whole may not necessarily reveal surplus population or a lack of different groups of skills in different regions of the country. Regional balances bring out the level and pattern of and demand for manpower from which the planner can then trace those regions which have a high surplus population or a scarcity of particular skills. These balances can sometimes be used as an instrument for analysing the appropriate movement of the population to economically more promising areas in accordance with the planned structure of the economy.

In the following, we introduce the regional manpower balance:

	Labour force as per 1.1 (t)
+	new admissions into economic activities, including youths taking up a job
+	graduates of universities, colleges and technical schools
–	departure by reason of death
–	retirements
+	employed people coming from other districts or region in order to work
–	employed people going to other districts of regions in order to work
=	Working people as per 31.12 (t + 1)

The labour force as per 1.1.(t) or any other year, for example, (t + 5) or (t + 10) could be calculated on the basis of labour technical norms for different sectors of the economy within the region. The following information will be required (table 6.9):

Table 6.9

Sector or sub-sector (i) / Item	Agriculture	Industry	Other sectors			Total time of working people in the region as per 1.1
	Different types of agriculture	Different industrial sub-sectors	-	-	-	
Output of the sector or sub-sector (i)						
Average time of labour requirement per dollar output of sector or sub-sector (i)						
Total time of labour requirement for each sector or sub-sector (i)						

Comparison of the estimated labour force with those people who are able to work in the year in question indicates the figure for unemployment (or possibly shortage) in the region:

Estimated labour force as per 1.1 (t) -
Estimated number of people who are able to work as per 1.1 (t) =
Estimated unemployment (or shortage of people) in the region as per 1.1 (t).

A shortage of surplus in qualifications and skills can also be revealed in the same way. It is advisable that developing countries strengthen their regional planning by creating specialized units for regional planning in the country, as shown in Chapter II. These units can cover different skills, as well as the distribution of natural resources in the form of minerals, water, soil, and agricultural resources among industries within the region. Regional planning is also extremely necessary for the location of new industrial projects and in order to avoid bottlenecks in supply. It can play a decisive role in avoiding pollution and other problems connected with industry, such as road congestion, bottlenecks in public transport, etc.

(viii) Planning the growth rate of the industrial sector

In quite general and quantitative terms, the growth rate of GDP originating in the industrial sector or that of the economy as a whole is determined mainly by the following factors: (a) the investment ratio; (b) the incremental capital-output ratio; and (c) changes in the output-capital ratio. The latter, in fact, causes the creation of economic growth with no investment. The first two factors decide the growth of the sector or of the economy due to new investment, while the third is the result of improvement in the utilization of the existing stock of capital.

Growth of the industrial net output

The growth rate of industrial sector in the planned year (t), due to new investment allocated to this sector $[r^{r}_{ind}(t)]$ could be expressed as follows:

$$r^{n}_{ind}(t) = \frac{\Delta Y^{n}_{ind}(t+1)}{Y_{ind}(t)} \qquad \ldots \qquad (6.11)$$

The additional output of the industry is a result of elaboration of the industrial plan at different levels of the hierarchy on the basis of iterative procedures. It should be pointed out, that only on the basis of the iterative procedures can we estimate the value of the incremental capital-output ratio. This is after deciding on the technology, the intermediates to be used, the design and types of output, etc. It should also be pointed out that the construction periods and possibilities of capacity utilization should be taken into account.

The capital-output ratio (K/Y) as indicated in Chapter III expresses simply the relation between the value of total stock of capital used (K) and the value of national income in the year (t). As a whole, it represents an aggregate of numerous different ratios for particular sub-sectors and one has always to remember that this aggregate ratio may be high or low according to which sub-sectors predominate in the industry or the country in question. Capital-output ratios may be affected by the intensity with which capital equipment is utilized. If some of it is standing idle or is only used

intermitently (in other words, if there is excess capacity), the ratio will tend to be on the high side. If, on the contrary, the equipment is used effectively, the ratio will tend to be low to a similar extent.

It is important that the planner should take into consideration the possibility of increasing income by improving the utilization of available capacities and raw materials so as to increase the level of output-capital ratio. This is usually achieved on the basis of improving the organization of production as has been shown in order to increase output with little or no investment.

The rate of growth of GDP originating in the industrial sector due to better utilization of existing capacities (r^e_{ind}) could be expressed as follows:

$$r^e_{ind} = \frac{\Delta Y^e_{ind}(t+1)}{Y_{ind}(t)} \qquad \ldots \qquad (6.12)$$

Where:

$\Delta Y^e_{ind}(t+1)$ is the increase in GDP orginating in the industrial sector in the year $(t+1)$ due to the improvement in utilization of existing capacities and materials.

The total rate of growth of industry (r_{ind}) is the sum of the rates of growth due to both new investment and improvement of capacity utilization.

$$r_{ind} = r^n_{ind} + r^e_{ind} \qquad \ldots \qquad (6.13)$$

The total rate of growth of gross value-added originating from industry and the industrial sector (i), as well as the private and traditional activities of the (i^{th}) sub-sector must be calculated. In this way the industrial plan can include growth rates of all sub-sectors of the industry according to the three sections of the plan, i.e., (a) the section covering the activities owned and possible to be completely controlled by the government; (b) the section covering the activities owned by the government but difficult to control: and (c) the section concerned with the private sector (see table 6.10).

The elaboration of sub-sectors of the industry, including the private, modern and traditional sectors, opens up wider possibilities for the planner for expanding the industrial sector within the resources available. Moreover, if the growth rates of all sectors are calculated in the same way, the planner can finally adjust the growth rate for the final version of the plan. This is the procedure which is referred to as "from bottom to top planning", and which is complementary to that "from top to bottom planning" which starts with the first draft of the national plan. On the same basis the planner can calculate the growth rate for medium- and long-term plans, although the growth rate for the long-term plan may not necessarily be based on detailed calculations in the way shown here.

Figure 6.3

Rate of growth of GDP originating from the industrial sector during medium-term plan

Sub-sector of the industry / Plan Section	1	2	3	4			n		average
Section (1) (activities owned and possible to be controlled by the government)	r_{11}	r_{21}	r_{31}	r_{41}	.	.	.	.	
Section (2) (activities owned by the government but difficult to control	r_{12}	r_{22}	r_{32}	r_{42}	.	.	.	.	
Section (3) (activities of the private sector)	r_{13}	r_{23}	r_{33}	r_{43}	.	.	.	.	

r_{ij} is the rate of growth of sub-sector (i) of section (j)
(j = 1,2,3)

2. Sub-sectoral planning

(i) Analysis of the sub-sector's initial state

The sub-sectoral plan, irrespective of scope and period, has to be drawn-up on a well-founded analysis of the sub-sector's initial state as well as a determination of its potential possibilities. The nature of such an informational stage, however, depends on the extent to which the data base covers the current activity of the sub-sector. In fact, if the planning process has already been established on a proper basis in the country, then the analysis of the initial state necessary for development of a new plan will depend mainly on the outcome of the preceding plan, although this in practice is not very easy because preparation of the new plan must start at least one or two years before the current plan is accomplished. Planners must, therefore, estimate plan implementation and the probable outcome of the current plan.

In countries in which the necessary information on the initial state of industry is not available, the planner must organize a sub-sectoral survey. In fact, such surveys or complementary surveys are necessary for all developing countries. Planning experience shows that most of these countries do not have sufficient information on industry's initial state. Even those countries with relatively long planning experience lack, in many instances the necessary information and analysis.

Studies of industry's current state and analysis of past developments facilitate identification of the major trends in industry's development, as well as the major bottlenecks and disproportions that impede industrialization. Moreover, analysis of the real initial conditions for industrial planning is not only necessary for the preparation of industrial plans but also for the elaboration and follow-up of industrial plan implementation.

The starting point for the information studies is evaluation of the existing industrial sub-sectoral capacities. The existing industrial sub-sectoral capacities could be described under four groups of indicators.

The first consists of the theoretical output capacities; the second, their rate of utilization; the third is their ownership; and the fourth is the possible output of the traditional sector (see table 6.10)

Table 6.10

Available industrial sub-sectoral capacities and their rate of utilization

Products of Group (i)	Public Sector		Private Sector		Possibility of traditional sector	Total available capacity	Average rate of utilization
	Capacity	Rate of utilization	Capacity	Rate of utilization			

Information on inputs of different manufacturing commodities and their sources reveal the patterns of consumption, the role of domestic industries in meeting demand and the extent to which the country is dependent upon foreign sources for meeting final demand. This analysis must also include the exports of local industries (see table 6.11)

Table 6.11

Sources of manufacturing goods

Products of Group (i)	Local production			Sources of manufacturing goods for domestic consumption		Exports
	Public	Private		Local	Imports	
		Industrial	Traditional			

An assessment of natural resources and intermediates required for the production of the sub-sector in question is necessary in order to decide upon the direction and the limits of expansion of the sub-sector's capacities. The natural resources (renewable and non-renewable) to be assessed, include minerals, agricultural and forest resources, water, land and biological resources of land and water such as biomass, livestock, fish and poultry. The forms of natural resources can be grouped as follows according to the nature of their functions in the development of the mining industries and agriculture: (a) energy resources; (b) timber and mineral raw material resources; (c) agro-biological resources.

For sub-sectors of light industry which depend by and large upon agriculture for their inputs, relevant agricultural surveys should be conducted so as to find out types, quality, quantities and location of natural resources and agricultural products, potentially available, being exploited currently, being used locally and being exported. These surveys should indicate the costs along with the degrees of exploitation and locations. Similar attention should be given to the forest and fishery resources, their maintenance and reproduction.

The surveys should indicate the yields for each crop and each region. In addition, the present consumption of inputs (fertilizers, pesticides, etc.) and the different levels of techniques utilized so as to permit analysis

concerning the improvement of productivity and restructuring the agricultural sector in accordance with the requirements of satisfaction of basic needs by the industrial sector. Moreover, these surveys should enable the identification of the potentialities of each region and the reasons of the discrepancies between realities and potentialities as well as the reasons for which certain techniques are more efficient.

In order to secure the agricultural inputs for industrial processing it is important that the planner analyse the system of prices (inputs and outputs), the factors explaining this system of price (for example, maintain a low level of urban wage, external competition, etc.) and their consequences on agricultural development.

(ii) Concentration of production

One of the advantages of sub-sectoral planning is that the planner can concentrate the production of a certain product or similar products in single producing units so as to benefit as much as possible from economies of scale as has been shown in Chapter III. In calculating the advantages of economies of scale, as a result of concentrating on the production of a certain product or similar products, the planner must take into account the losses connected with the increase of production capacities. For instance, in agro-industries we cannot concentrate all tomato processing in a single factory for the costs of wastes and transport from different agricultural areas to a centralized processing unit and from the processing unit back into the market will be very high.

The same does not, however, apply in the case of the iron and steel industry, where concentration of the production in one complex is justified unless the demand is so high that it exceeds the optimum production size of the iron and steel production unit. In this case a second site for production could be considered in accordance with the availability of raw materials, energy resources, market, etc. The planning of concentration or production on the sub-sectoral basis should also cover the private sector, where licenses for establishing production units should be issued in accordance with such analysis.

(iii) Specialization

Planning the sub-sectors of the industry which produce heterogeneous products, such as mechanical and electrical industries should be based on the reorganization and restructuring of the existing production capacities in harmony with the planned ones with the aim of increasing the level of concentration on the production of similar components within single producing units. For example, in the engineering industries it is typical that a large number of factories produce similar products, such as gear boxes, bolts, etc. While elaborating the sub-sectoral plan, the planner should consider the best ways and means to concentrate the production of certain components within certain producing units.

Example

Let us assume that in a certain country there exist three mechanical engineering factories (A, B, C) producing inter alia, three types of gears (1, 2, 3) with the following yearly output:

Table 6.12

Yearly output (in thousand units)	Factory	A	B	C	Total
	1	20	40	10	70
	2	20	10	100	130
	3	30	20	20	70

Let us assume that it is possible to reorganize the production of the components in a way presented in the following table so as to facilitate specialization in production.

Table 6.13

Yearly output (in thousand units)	Factory	A	B	C	Total
	1	-	70	-	70
	2	-	-	130	130
	3	70	-	-	70

In this way each factory can increase substantially the productivity of machines and labour by specializing in one product. Higher productivity of machines in these three factories means they can produce additional output without or with little investment. In addition with the increase of the size of batches of the same product, it would be possible to introduce economies in the production of intermediates.

Of great significance is the inclusion of the private sector in this process. In this connexion the licensing policy should be completely in line with the sub-sectoral plan. In the first place, the licensing policy should avoid all possible duplication of production. It is typical in a great number of developing countries to license a number of assembly factories for television sets, radios, automobiles, etc. In most cases, due to market constraints these factories do not have a chance to develop the production of components which are usually mass produced. Therefore, it might be deemed more economical for the country to concentrate investment (private and public or both) in a single car factory or television factory, for instance, so as to provide for the production of components. Moreover, the planner should explore the possibilities for creating core industries in relatively small market contexts as well. For example, in the mechanical engineering sub-sector, the creation of centralized foundry, forging factory and production of standardized parts, etc., can play an important role in industrialization. For this purpose the planner should collect and analyze the requisite information and data (see table 6.14).

Table 6.14

Information necessary on standardized products

Producing unit \ Product	1	2	3	...	m
1					
2					
3					
.					
.					
.					
n					
Total output					

(iv) Product mix

In planning the sub-sector the best possible combination of production should be carefully designed. For example, in planning the iron and steel industry we must decide on the stages of production and services necessary to be included in each production site so as to maximize the benefit from all by-products generated throught different processes within the site and to reduce transportation costs of intermediates from one site to another. Combination of production can also play an important role in chemical industries where the inputs and outputs of many chemical reactions are strongly interlinked. It may therefore be desirable to create complexes for different branches of chemical industries.

(v) Complementarity

In organizing co-operation, the sub-sectoral planner needs to carry out relevant surveys and collect information on the producing units of the sub-sectors so as to find out the possibilities of co-operation between small-scale and traditional industries and large-scale industries. The former

could be integrated within the latter by carrying out special operations or producing parts as sub-contractors. All components which require labour-intensive operations and assembly of segments could be carried out in small-scale and traditional industries in developing countries to productively participate in industrialization and in turn to widen reinvestment possibilities and expand employment opportunities. It should, however, be pointed out here that the co-operation of handicraft and small-scale industries with the large-scale industries require effort on the part of the government in order to train and form the necessary skills.

(vi) Integrated demand forecasting

In general, long-term forecasts constitute one of the major elements of elaborating studies for industrial sub-sectoral plans in order to determine the appropriate variant of development. Long-term forecasting usually covers planning periods of ten to fifteen years and is applied in the analysis of demand for the major groups of commodities, for example, steel, sulphuric acid and total production of processed food. It is also applied in the analysis of demand for labour force, strategic raw materials and energy, as well as in the estimation of resource depletion of non-renewable raw materials. Demand analysis for a number of materials should be made on an integrated basis. For example, demand for food, as has already been indicated, must be analysed on the basis of a whole group of food products to satisfy basic needs, as a demand for one single product can easily be upset in practice if demand shifts to other alternatives. Similarly integrated demand analysis must be drawn up for a number of products, such as construction materials and energy.

From the qualitative point of view, sub-sectoral planning requires sufficient information on the best economic way to satisfy the demand for different commodities. As an example, we will illustrate this problem on the basis of the construction and building materials industries. In this sub-sector the planner must try to identify the needs by type of construction. Moreover, in elaborating the sub-sectoral plan of construction and building materials, possibilities for expansion of the output of construction materials should be examined. Policies to encourage utilization of these materials should also be envisaged. For example, in areas where limestone is available, building designs which use limestone should be

encouraged; and where bamboo and wood are available, these should be used as much as possible in housing and other buildings. In areas where mines and mineral processing industries are operating, masonry mortars, flooring tiles and the like could possibly be produced on the basis of the usually abundant thrown-out quantities of the fine silicons and dolomitic wastes.

3. Preparation of new projects and their integration in the Industrial Plan

(i) Iterative procedures of industrial planning and the role of project preparation

As has been indicated in Chapter II, the preparation of comprehensive plans begins with the first draft national plan, which is sub-divided by economic sectors in accordance with their assigned role. The draft industrial plan should then be sub-divided in accordance with its sub-sectors. Further, the sub-sectoral planners elaborate these plans with the aim of facilitating the optimal utilization of available resources. This approach is referred to as "from top to bottom planning".

A proper elaboration of an industrial plan with the aim of rational utilization of available human, natural, material and financial resources should be based on the outcome of sub-sectoral analysis; for example, for engineering industries, chemicals, textiles, etc., sub-sectoral planning facilitates the co-ordination of available capacities within the sub-sector, as well as interlinkages with other industrial sub-sectors and other sectors of the economy. The benefits from sectoral planning can be immense, since such plans are elaborated within the real life of the industrial activity. Well prepared sub-sectoral plans therefore constitute one of the main contributions to the industrial plan.

After having analyzed the existing capacities of the sub-sector on the basis of the above-mentioned principles, the planner can proceed with the drawing up of balances for the key products of the sub-sector for annual-, medium- and long-term plans. The left side of the balance would of course,

be the most important part, i.e., domestic production, imports and inventory and stocks (see equation 5.1, page 140 and the example on cement, pages 214 - 148 in Chapter V). Domestic production represents the best possibilities of utilizing the existing capacities on the basis of reorganization of the production process and the new required capacities. The latter permits preliminary identification of the nature, size and scope of required new projects or expansion of the existing capacities. If the balances have been drawn up for the region, then we have the first indicators concerning the location of the new capacities.

In order to calculate the investment requirement for the industrial sector each sub-sectoral planning unit (or its substitute) must prepare tables of incremental capital-output ratios for all branches of the sub-sector. It is preferable to calculate these ratios for alternative technologies so as to facilitate a detailed analysis based on the choice of technology (see table 6.15).

Table 6.15

Incremental capital-output ratios for alternative technologies (j) in a definite sub-sector (j = I, II, III)	K_I	K_{II}	K_{III}
Envisaged additional production	ΔY_I	ΔY_{II}	ΔY_{III}
Investment requirements for additional output	$K_I \cdot \Delta Y_I$	$K_{II} \cdot \Delta Y_{II}$	$K_{III} \cdot \Delta Y_{III}$

It is also important to estimate the average incremental capital-output ratio for the traditional industries of the sub-sector. It is important that the planner clearly identifies activities which should be expanded within the public sector and those within the private sector in accordance with the shares established for them in the plan. This would enable the planner to tentatively estimate investment required for the establishment of new capacities from both public and private sectors.

TABLE 6.16

	Alternative technologies				
	I	II	III	...	m
Incremental capital-output ratios for alternative technologies	K_I	K_{II}	K_{III}	...	K_m
Envisaged additional production to be equipped with technology (j) (j = I, II, III, ..., m)	ΔY_I	ΔY_{II}	ΔY_{III}	...	ΔY_m
Investment required for additional production capacities	$K_I \cdot \Delta Y_I$	$K_{II} \cdot \Delta Y_{II}$	$K_{III} \cdot \Delta Y_{III}$	...	$K_m \cdot \Delta Y_m$

Investment requirement for additional output of sub-sector (i), (I_i^n), can be calculated as follows:

$$I_i^n = \sum_{j=1}^{m} k_j \cdot \Delta Y_{ij} \qquad \ldots \qquad (6.14)$$

Where:

K_j is the incremental capital-output ratio for the technological alternative j.

Y_{ij} is the planned additional output of sub-sector (i) which would be based on technology (j).

The investment requirement for additional output must be broken down in yearly requirement $[I_i^n.(t)]$. This calculation provides for the preliminary estimation of investment required from public and private savings (see table 6.18).

Table 6.17

Sub-sector	Public	Private			Total Sub-sector
		Modern	Traditional	Total Private	

If the estimated investment requirements for the public industrial sector exceed the estimated allocation for the industrial sector estimated in the draft national plan, then more licenses could be issued in the private sector if the latter has not exceeded the estimated private savings planned to be channelled into the industrial sector. If private and public sectors each exceed the planned savings, then the planner has to reduce the capital requirements by including more labour-intensive processes wherever possible if labour force and training facilities are available on the one hand, or by postponing projects that are less urgent on the other.

On the same basis the planner must calculate the requirements for labour force for the sub-sectoral plans after adjusting them to the capital available. This should preferably be carried out on a regional basis as has been shown above. If, in some regions, the demand for labour will exceed the available labour force while other regions still suffer from surplus population, then the planner should consider possibilities of shifting surplus population to more promising regions or shifting some capacities to the over-populated areas. Special emphasis should be given to the problems of education and training. Similar exercises should be done for the requirements of the planned industrial capacities for energy. In many cases the energy balance would show bottleneck in energy supply. This in turn requires considering the postponement of some energy-intensive projects and the priority of energy related projects, such as thermo- and hydroelectric stations, refineries, reinforcement of the electric network in the country, etc.

As a result of these iterative calculations the planner can arrive at a more or less balanced industrial plan. Such a plan could indicate what existing capacities should be better utilized and how, on the one hand, and what new capacities should be created with what technology, inputs, outputs and where, on the other. These new capacities must then be the departure point for project preparation. Project studies are of great significance for the provision of accurate and detailed costs so as to calculate foreign exchange and domestic financial requirements during the medium-term plan.

The elaboration of industrial sub-sectoral plans makes possible the examination of the wider potentials of the industrial sector on the basis of the available resources and the integration of new and existing industrial projects. The individual projects contained in the sub-sectoral plan should be technically feasible and economically justifiable. The preparation of technically and economically well conceived industrial projects constitutes "from bottom to top planning" which is complementary to that from "top to bottom planning". The preparation of industrial projects should be carried out systematically. In fact, just as industrial planning is a continuous process, preparation of industrial projects is also a continuous process.

The two processes are mutually reinforcing. Information generated by sub-sectoral analysis, such as the capacities to be added, the preferable technologies and sites are valuable inputs for project preparatory studies. On the other hand, data and information generated by project preparation, such as available technologies, alternative inputs, output, by-products, necessary skills and investment are, in turn, indispensable for sub-sectoral analysis.

In order to upgrade the capability of developing countries for preparing and implementing sound industrial projects, developing countries need to establish and strengthen consultancy engineering capacities to prepare for pre-feasibility and feasibility studies to ascertain the commercial profitability of investment proposals.

(ii) Financial evaluation of industrial projects [30/]

In general, the investment profitability analysis focuses mainly on determining the ratio between profit and capital. It is of extreme significance for defininig commercially sound projects. This is simply because no production capacity, whether it is owned by public or private sector can recapture the original investment outlay in the long rund if it cannot cover the cost of production and provide net positive commercial profit.

This financial evaluation of industrial projects assist in revealing investment opportunities. But it also provides for the formulation of appropriate measures and policies to be undertaken so as to ensure the repayments of production capacities which cannot establish themselves commercially under given market conditions.

30/ For more details see "Manual for the Preparation of Industrial Feasibility Studies". United Nations 1978.

Financial evaluation of industrial projects should be part of the project preparation and complementary to that of sub-sectoral planning. This analysis should be repeated in accordance with the requirement of iterative process on the basis of information received from the updated sub-sectoral plan. Of extreme significance is the use of commercial evaluation in selection of project alternatives to be considered within the sub-sectoral plan. In general, the following alternatives exist in the industrial planning practice:

(a) Different production processes to produce a definite final product by using different technologies or intermediates.
(b) Different scales of production.
(c) Different combination of output.
(d) Different location and sites.

The commercial evaluation of the project focus mainly on the discounting methods, which can be based either on Net Present Value, or the Internal Rate of Return.

(a) Net present value

The net present value (NPV) of a project is defined as the value obtained by discouting, separately for each year, the difference of all cash outflows and inflows occurring throughout the life of project at a fixed, predetermined interest rate. This difference is discuounted to the point at which the implementation of the project is supposed to start. The NPVs obtained for the years of the life of the project are added to obtain the project NPV.

The ratio of the NPV and the pressent value of the investment (PVI) required is called the net present value ratio (NPVR). NPVR can be greater, equal or smaller than zero. In the case of having one project a positive choice should only be made if the NPVR is greater than or equal to zero. In the case of alternative projects, the one with the highest NPVR should be chosen.

(b) The internal rate of return

The internal rate of return (IRR) is the discount rate at which the present value of cash flows is equal to the present value of cash flow. The procedure used to calculate the IRR is the same as the one used to calculate th enet present value. However, instead of discounting cash flow at predetermined cut-off rate, several discount rates may have to be tried until the rate is found at which NPV is zero. This rate is the IRR, and it represents the exact profitability of the project.

The commercial evaluation include simple methods which involve the pay-back period and the simple rate of return.

The pay-back period is defined as the period required to recapture the original investment outlay through the profits earned by the project. Profit is defined as net profit after tax, adding financial cost and depreciation.

The simple rate of return is defined as the ratio of the profit in a normal year of full production to the original investment outlay (fixed assets, pre-production capital expenditures and net working capital).

Finally, when dealing with an investment under conditions of uncertainty in the cases of inflation, changes in technology, false estimation of demand and length of the construction and running-in periods, the following factors should be examined:

a. sales revenues
b. capacity utilization
c. investment costs

Under uncertainty analysis these factors can be examined. Uncertainty analysis can be undertaken in the following three steps:

(a) Break-even analysis

Break-even analysis determines the break-even point, the point at which sales revenues equal production costs.

(b) Sensitivity analysis

With the help of sensitivity analysis it is possible to show how the profitability of a project alters with different values assigned to unit sales prices, unit costs and sales volume. This method is frequently used even if the simple and discounted evaluation methods do not show satisfactory profitability and an improvement is felt to be possible by chaning some of the variables.

(c) Probability analysis

Probability analysis is carried out in the context of project preparation with the objective of improving the accuracy of cost estimated and, in turn, of profitability forecasts.

(iii) National Economic Evaluation of the Industrial Projects 31/

The evaluation of commercial profitability has a serious limitation in the case of public projects for it does not reveal the contribution of industrial projects to the national economy.

For the purpose of evaluating the contribution of industrial projects to the national economy the method of social cost-benefit analysis was developed. This analysis is an approach which could use to maximize the benefits in the same way as private firms use commercial profitability analysis to select these projects which would maximize their earnings.

The manner in which projects are incorporated into industrial plans is a tactical one and is approached by means of social cost-benefit analysis. In developing countries, public investment plays a critical role and it is incumbent upon the planner to know which investment alternative to undertake and what technology to adopt. That is to say that considerable data would need to be compiled on existing and new projects to ensure consistency between

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31/ Interested reader in further reading this subject may refer to the UNIDO Guidelines of Project Evaluation. New York 1972.

the investment programme and the target rate of growth as laid down in the plan. This subsumes a capacity to translate project ideas into actual productive units at a satisfactory rate during the plan period. Feasibility studies consequently constitute a desirable and necessary condition for ensuring the consistency and feasibility of the proposed investment programme. A feasibility study carried out on the basis of market prices can state commercial profitability, but additional analysis would need to be carried out to establish whether the project under consideration stands to contribute to national economic objectives. The planner would need to investigate whether the proposed investment would yield optimum benefits to the economy. The method of accounting prices is one way by which costs and benefits of projects could be assessed on a comparable basis, that is to say, social cost-benefit analysis. Plans, on the other hand, which set out national objectives and strategies determine the parameters via which social cost-benefit analysis could be carried out. The method is, therefore, one which aims at relating plans to projects and projects to plans.

Governments in developing countries are constrained in using fiscal and monetary policies alone to influence the rate of economic growth. Efforts directed to project selection assume significant importance because the implementation of the right project could help contribute optimally to explicit national objectives and also because such efforts could assist in bridging the gap between planning at the macro level and project programming at the micro level.

The need of accounting prices arises out of the thesis that market prices in developing countries do not, because of structural rigidities, correctly reflect the current scarcity of goods or productivity of factors of production; or not take into account that these will change sharply as the result of development; or that the market may not reflect the social value of goods where these differ from the sum of individual private values. Accounting prices represent a set of equilibrium prices associated with an efficient allocation of scarce resources and maximum output. They can also be used to express social values when these are different from market values.

The problem with social cost-benefit analysis is that it is difficult to apply in practice mainly because of the uncertainties inherent in constructing shadow prices. For this reason the methodology cannot claim to be policy prescriptive, but it is, nonetheless, suggestive of policy in that it can indicate whether the economy of a given country would be going in the right direction as a result of implementation of a set of pre-defined projects. Moreover, because of its varied demands for information and for rigorous analyses, it breeds discipline and system in approaches to project development. This, no doubt, is a very good thing especially in view of the time and money that all too frequently are spent in developing countries on feasibility studies. Ideally, accounting prices could be determined using linear programming within the framework of a general equilibrium solution, which is, however, difficult to apply. Hence resort is made to partial solutions to construct the required parameters.

Example No. 6.1[31/]

The project: Fibreboard manufacture in Ruritania[32/]

This example is based on the approach of the UNIDO Guidelines for Project Evaluation. The intention here is to illustrate in a simplified way the computation involved in the social cost-benefit analysis.

Basic information on the project

Studies and surveys carried out in Ruritania in the year t_o led to the formulation of a project for the establishment of a fibreboard mill in a rural area of the country located some 200 kms from the capital city. The area can

31/ This example was developed on the basis of a paper prepared and presented by S. Hable-Selassie to the Symposium on the use of socio-economic investment criteria in project evaluation, Washington, D.C., 1973.

32/ Ruritania is a hypothetical country.

maintain an adequate supply of seven-year old softwood thinnings for operating a small- to medium-sized fibreboard mill. The potential mill sites are near the main railway line connecting the most important consumption centres. Abundant or adequate supply of labour, land, electricity and water for industrial use are available in the area.

The demand for fibreboard in Ruritania is not adequate to absorb the whole output of the proposed mill, which is 6,150 metric tons per year of fibreboards (hardboards as well as softboards). The increases in demand are, however, such that by the year t_5, the earliest that the mill could come into full production, the Kenyan market should be able to absorb the total output. The prefeasibility study had explored the commercial viability of the project on the basis of a two-shift a day and a three-shift a day output. On a three-shift a day basis, the mill will be working at 85<per<cent of its absolute capacity, i.e., at a rate of 5,260 metric tons per year. The commercial analysis has established the viability of the project at this level of output.

Break even point could be reached with an output of 2,820 metric tons, i.e., at 46 per cent of absolute capacity and the pay-back period is 3.3 years with the mill operating at 85 per cent of its capacity. The commercial study gives much data which could be used to test the sensitivity of the results of various shortfalls in output expectations, increases in costs or reduction in world prices, but the analysis here will be concerned at converting the commercial figures as given for an output level of 5,260 metric tons into social accounting values.

The methodological approach

Following the UNIDO Guidelines for Project Evaluation, the two principal objectives of investment in developing countries are aggregate consumption and redistribution of income. These objectives capture most of the other objectives explicitly or implicitly cited in development plans and strategies. For example, valuation of output and inputs using a shadow price of foreign exchange could serve attain the goal of improving the balance of trade through project selection. Similarly, using a shadow price of savings in evaluating the contributions of a project to the aggregate consumption

objective could take into account the effects of the projects on the savings rate. And the reduction of unemployment goal could be reflected in the income redistribution objective. The choice of objective settled, the evaluation of national economic profitability simply becomes an exercise in assessing consumer valuations of goods and services as reflected by their willingness to pay for them.

The direct benefits arising out of implementing the project are that, it saves foreign exchange since it replaces imports. One indirect benefit is the effect of consumption and investment in a situation where the savings rate is sub-optimal. An attempt has been made to calculate reinvestment benefits. These are calculated on the basis of the following formula:

$$RB = [S(p^k - 1)] \qquad \ldots\ldots \qquad (6.15)$$

Where: RB = reinvestment benefits
S = total savings from the project
p^k = social opportunity cost of capital

The costs to be attributed to the project are the resources used to put up the mill and operate it. A distinction will need to be made between domestic and external resources. A further distinction to be made is between skilled and unskilled labour with regard to domestic resources and between loan and equity with regard to external resources.

Since in this analysis we are not concerned with a ranking of projects but simply with establishing whether the project under consideration should or should not be included in the stock of projects subsequently to come under greater scrutiny by the Government's project evaluators, our calculation is limited to assessing the present value of the stream of net benefits of the project over its operating lifetime.

We, therefore, express the net aggregate consumption benefits over the lifetime of the project as follows:

$$NPV = \sum_{o}^{t} \frac{(B - C)}{(1 + 1)} t + \sum_{o}^{t} \frac{S(p^k - 1)}{(1 + 1)^t} \qquad \ldots\ldots \qquad (6.16)$$

Where, NPV = net present value
B = social benefit streams
C = social costs
t = operating life of the project
S = annual total savings generated by the project
i = social rate of discount
p^k = opportunity cost of capital

Accounting prices

Valuation of output

Fibreboard in Ruritania is mainly used in the construction industry and to a lesser extent in furniture making and packaging. The prefeasibility study stated that CIF prices increased appreciably in Ruritania between t_{-1} and t_o/t_1, although world production has continuously been expanding, on the one hand, and substitute materials are available, on the other. As a result of domestic production, consumers will have a command over a bundle of foreign exchange saved which they could spend in the consumption of other goods. We shall use CIF as the unit of account for valuing output since in this project it represents the amount of utility derived by consumers from the operation in the mill.

Valuation of direct material inputs

The main inputs are thinnings, sawmill waste and eucalyptus for which there are alternative uses in the project area especially for construction, firewood and other general purposes. We shall, therefore, assume market prices as reflecting their opportunity costs. The study states that the Ruritania Power Company could supply all the electricity required by the mill at the established tariff rate. There does not appear to be a subsidy element in electricity pricing nor a rationing in electricity supply. Market price will, therefore, be used for valuing electricity costs; similarly also for water and fuel. The latter is also a domestic input in that supply is obtained from the Ruritania Oil Refinery.

Shadow price of labour

The mill will have a small labour force. On a three-shift a day basis, it could employ a total of 106 persons, out of which 88 are unskilled or semi-skilled. The mill, which is to be located in a rural area, will withdraw labour from the agriculture sector. Because there is unemployment and underemployment in Ruritania, this withdrawal of labour will not lead to a reduction of output in agriculture. In other words, the marginal productivity of labour is zero, provided we ignore the disutility of work. It could, therefore, be argued that labour should be considered costless in evaluating the social costs of the project.

However, in an economy where the savings rate is not optimal, i.e., the social discount rate is lower than the rate of return on investment, then we should place an extra weight on a unit of investment compared to a unit of consumption. The project would generate additional employment which is likely to increase the total consumption of the community. Unless the increase in output exceeds the increase in consumption, labour is not costless. We follow Amartya<Sen in equating the unit cost of labour to the extra consumption generated by an extra unit of employment, extra consumption being expressed by:

$$x = W.c - d(1 - c') \quad \ldots\ldots \quad (6.17)$$

Where, W = industrial wage rate
c = propensity to consume of the worker
d = consumption per person when employed
c' = propensity to consume of worker's former hosts.

We assume that (c) and (c') approximate unity and therefore that x = W. In other words, market wages are taken to reflect the social cost of unskilled and semi-skilled labour. We do not propose to use an accounting rate for skilled labour either since we feel that in the Ruritania economy the wage rate reflects the equilibrium level of demand and supply in the skilled labour market.

Shadow price of savings

On the other hand, money in the hands of the Government commands greater weight in social cost-benefit analysis because of their higher propensity to save and invest. The shadow price of savings can be estimated according to a formula derived by Marglin:

$$p^k = \left[\frac{(1 - s)r}{i - sr}\right] \qquad \ldots\ldots \qquad (6.18)$$

Where, p^k = shadow price of savings

s = the proportion of income saved and reinvested

r = the social rate of return from investment; and

i = the social rate of discount

Partly to simplify the calculations in this exercise and partly because it would appear realistic to do so, we will calculate the shadow price of savings according to the following formula, i.e., $p^k = \frac{r}{i}$. This represents the value of the marginal unit of investment in terms of present aggregate consumption.

Shadow price of foreign exchange

Foreign exchange in Ruritania, as in other developing countries, is not freely available at the official exchange rate. It is subject to controls which seek to ration its use. Therefore, the marginal willingness to pay for foreign exchange exceeds its value at the official rate. The shadow price of foreign exchange is a means of measuring this excess. It is a key parameter in social cost-benefit analysis. However, the problem of determining it poses difficulties in practice. We need not go into these here; but for our present purpose we will use the UNIDO Guidelines formula to get a first approximation of the shadow price of foreign exchange:

$$U = r\left(1 + \frac{\text{tariff revenue}}{\text{import expenditure}}\right) \qquad \ldots\ldots \qquad (6.19)$$

Where,

r = official exchange rate.

Social rate of discount

We have already observed that the social rate of return in the private sector (r) exceeds the social rate of discount (i). This is a typical phenomenon in developing countries and poses a problem of choice of discount rate for discounting future benefit streams to the present. A lower social discount rate would mean the diversion of resources from profitable private sector investments to public sector investments. But there is need for adopting uniform treatment in both sectors, since typically governments in developing countries shoulder responsibilities in both sectors. In the case of the project under consideration, for example, the Government, through its financial institutions is expected to contribute 57 per cent of the equity capital.

We shall, therefore, use a social discount rate of the social time preference variety to derive present value. To determine the social rate of time preference, we will use Ragnar Frisch's formula:

$$s = \frac{D}{1-D} \qquad \ldots\ldots \quad (6.20)$$

Where, s = social time preference

D = 1 - (1 - B) [1 - y(-w)]

B = pure social time preference

y = growth rate of per capita income

w = elasticity of the marginal utility of income with respect to income.

Taking w = -2 following Frisch, B = .05, y = .02 yields a social time preference of 10 per cent which we shall use for discounting benefit streams.

Table 6.18 thus summarizes our calculations of parameters based on the assumptions and observations made hitherto:

Table 6.18

Value of parameters

Parameter	Value/converting factor
Output	0.81
Direct material inputs	1.0
Unskilled and semi-skilled labour	1.0
Skilled labour	1.0
Foreign exchange	1.28
Social return on investment (r)	20%
Social rate of discount (i)	10%
Shadow savings rate (p^k)	2.0

The result

Table 6.19 presents the resource flows over a period of 12 years based on the parameters established in Table 6.18 and corrected by the shadow price of foreign exchange. The total net benefits were discounted using a social discount rate of 10 per cent to derive the net present value. This equals R$ 5,887,834. Thus we obtain a positive result and therefore we can recommend the project for the inclusion in the stock of candidate projects.

Table 6.19

Resource Flows[1/] in R$

Years	1	2	3	4	5	6	7	8	9	10	11	12
Output			3,926,336	5,891,200	5,891,200	5,891,200	5,891,200	5,891,200	5,891,200	5,891,200	5,891,200	5,891,200
Costs												
Equipment and engineering												
(foreign exchange)		7,616,000										
Land	21,000											
Construction												
(foreign exchange)	776,600	302,720										
(domestic)	659,750	263,500										
Interest and contingencies,												
(foreign exchange)[2/]	283,264	687,424										
(domestic)	175,000	375,000										
Working capital	-	1,291,000										
Material inputs												
(foreign exchange)			1,123,584	1,568,592	1,568,592	1,568,592	1,568,592	1,568,592	1,568,592	1,568,592	1,568,592	1,568,592
(domestic)			431,713	997,463	997,463	997,463	997,463	997,463	997,463	997,463	997,463	997,463
Management and labour inputs												
(foreign exchange)			199,680	199,680	199,680	199,680	199,680	199,680	199,680	199,680	199,680	199,680
(domestic inputs)			271,690	323,800	323,800	323,800	323,800	323,800	323,800	323,800	323,800	323,800
Total Costs	1,915,714	10,535,644	2,026,667	3,089,535	3,089,535	3,089,535	3,089,535	3,089,535	3,089,535	3,089,535	3,089,535	3,089,535
Net direct benefits	-1,915,714	-10,535,644	1,899,669	2,801,665	2,891,665	2,801,665	2,801,665	2,801,665	2,801,665	2,801,665	2,801,665	2,801,665
Indirect benefits[3/]	-	-	200,836	487,318	487,318	487,318	487,318	487,318	487,318	487,318	487,318	487,318
Total net benefits	-1,915,714	-10,535,644	2,090,505	3,288,984	3,288,984	3,288,984	3,288,984	3,288,984	3,288,984	3,288,984	3,288,984	3,288,984
Discount factor	1.0	.9091	.8264	.7513	.6830	.6209	.5645	.5132	.4665	.4241	.3855	.3505
Net present value	-1,915,714	-9,577,954	1,727,593	2,471,014	2,246,376	2,042,130	1,856,631	1,687,907	1,534,311	1,394,858	1,267,903	1,152,788

Total net present value = 5,886,843

1/ All foreign exchange flows have been corrected by the shadow price of foreign exchange.

2/ Only the foreign exchange component of interest and insurance charges are included because domestic interest payment considered as transfers within the economy.

3/ This is calculated assuming S = 50% of commercial profits after tax and are reinvested. Hence RB = /_ S Profits (PK-1) _/

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