

Industrial Development and Development Strategies; some review of past arguments

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“A country is said to have become industrialized when it has achieved a degree of industrial self-reliance; when its production and trade are able to satisfy the basic needs of its population; and when a significant portion of its economic and social structure has been transformed by industrial production with strong internal linkages”.

1. Industrial development vs industrial growth

Industrial development is an integral part of overall socio-economic development and is subservient to it. Indeed, development is successful only insofar as it serves the country's basic socio-economic objectives. Industrial growth, by contrast, is simply an increase in ,say, the number of plants or wage earners and is not an end in itself, nor is it necessarily a sign of successful industrialization. In economies where the modern sector is relatively isolated from the traditional sector, it is possible to achieve industrial growth without achieving development. In such cases, the trickle-down effects are negligible because of internal structural rigidities, or because decisions on finance, markets and technology are made elsewhere, or because the factor production endowments of developing countries are being applied, inappropriately. Industrial growth within such an economic enclave may even have an adverse effect on the traditional sector, or on

food production or the environment. Planners must therefore see to it that growth takes place hand-in-hand with development and that the industrial sector plays its proper role, which is to bring about and sustain a socio-economic transformation.

2. Goals of industrial development

The aim of industrial development is to raise peoples' standards of living by increasing the domestic production of consumer, intermediate and capital goods, thereby expanding the circle of incomes, markets, technology and environment. This calls first for an assessment of resources, potentials and constraints in order to formulate strategies and second for the drawing up of Industrial master plans to guide investment in productive facilities and support services, including training. If assessment is thorough and the plans carefully laid, then it should be possible, in time, to produce locally most of what is consumed locally. It should be possible, too, to improve the country's ability to import, so that what cannot be produced locally can be obtained, in equitable trade, from outside.

There is widespread agreement that industrial development is the only way of extricating developing countries from poverty and backwardness. This is because industry creates by far the best conditions for the efficient functioning of an economy, for maximizing national income and for speeding up economic growth through enhanced capacity for domestic savings. With the help of industrialization, which utilizes modern production techniques, the rest of an economy can be diversified. For example, the agricultural sector can be modernized if industry is able to supply agricultural and irrigation equipment, fertilizers and pesticides; and infrastructures can

be modernized and expanded if industry is able to supply transport and communication equipment and construction materials. Thus industrialization not only builds up the manufacturing sector of an economy, it also, by introducing industrial means of production into other sectors of the national economy, increases labor productivity in those sectors as well.

3. The role of industrial development planning in developing countries

The Principles of industrial development planning provide a basis for identifying and quantifying a country's development objectives. Drawing on these principles, planners can devise concrete ways of achieving the objectives and of mobilizing the country's resources. Industrial development planning is, in short, a means for bringing about industrial development. By taking into account a country's own human and natural resources as well as its access to external resources, industrial planners can work out an optimal rate of industrialization and can formulate the policy instruments and mechanisms that will achieve the desired socio-economic development.

Industrial development planning in developing countries must first and foremost expand the industrial sector, including agro-based industries.

This expansion should, in time, achieve a number of goals (see figure 1)

- (a) It should satisfy the basic needs of the population for manufactured goods, preferably through domestic production, but where this is not feasible, through equitable trade;
- (b) It should satisfy, to a large extent, the requirements of the country's industries for manufactured intermediates;
- (c) Where economically justifiable, it should produce equipment for replacement or for expansion of industrial production capacity.

Development planning cannot, however, serve the needs of development unless it at the same time manages to modernize and restructure the agricultural sector by supplying up-to-date agricultural and irrigation equipment, construction materials, fertilizers, pesticides etc. Plans must also be made to upgrade transport facilities and education as well as to modernize mining, which will in turn allow the rational exploitation of natural resources, especially minerals.

Despite the need to plan for other sectors, it is clear that industrial planning has priority, for a structural projection of industry makes it possible to analyze and verify all the other sectors of an economy. However, since the over-rapid and uncoordinated development of industry could hurt these other sectors, particularly the agricultural sector, planners must strike the correct balance between industry and agriculture. The latter's need for industrial inputs to trigger structural transformation should be matched with its potential to generate the investment surpluses needed for sustaining industrialization.

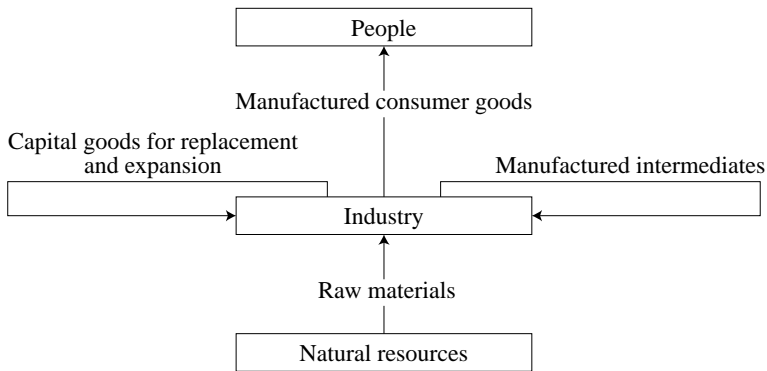


Figure1. Industrialization transforms a country's natural resources to meet the basic needs of people

When agriculture is restructured, the overall economy is benefited in many ways;

- (a) Higher agricultural productivity increases agricultural surpluses. These in turn raise the incomes, and hence the living standards of farmers, stimulating demand for manufactured consumer goods and eventually creating more jobs in industry. Food surpluses, as well as wool, cotton, timber, straw and bagasse, can be processed by the industrial sector, thus expanding output based on local raw materials and allowing for the export of processed agricultural products rather than commodities;
- (b) The introduction of new technology into the agricultural sector increases labor productivity, creating a surplus of labor in rural areas that can be absorbed to advantage by the expanding industrial sector. Industrial planners must work out a mechanism for the transfer of surplus rural labor to industry and must draw up a programme for the required education, training and upgrading of skills. It is worth mentioning here that the relationship between industry and agriculture

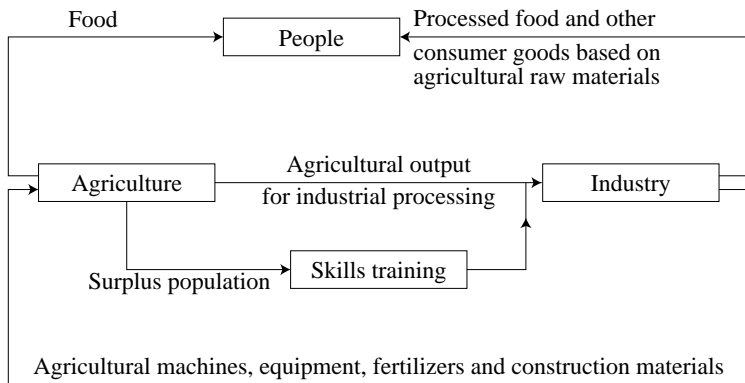


Figure 2. Industry and agriculture interact to satisfy the needs of the people.

constitutes the most critical area in industrial development planning.
(see figure 2)

The restructuring and modernization of other sectors of the economy, such as mining and services, also plays a key role in industrialization. The relationship between industry and mining can be very important. For some developing countries, particularly those that are rich in crude oil, copper, bauxite or other minerals, it is almost as important as the relationship between industry and agriculture.

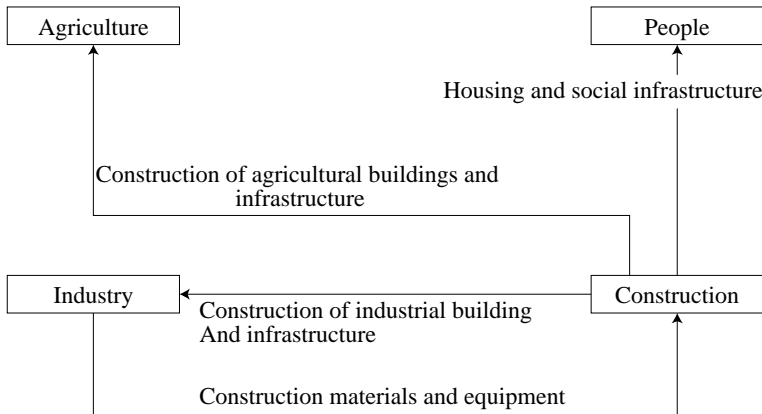


Figure 3. Pivotal role of construction in industrial development

Modernization of construction sector is crucial as well. Just as industry will need large-scale works, like factories and estates, warehouses, roads, railways, bridges, ports and housing, so also agriculture will need silos, dams and irrigation networks, communication networks and rural access roads. Since in most developing countries construction is still carried out in traditional ways, with very low performance and productivity, it is usually this activity that becomes the bottleneck in implementing industrial or

agricultural plans. Even so, construction accounts for a major share of capital formation in many developing countries, and the industrial sector must provide it with enough building materials and equipment to make it efficient. Industrial development planning must quantify the investment linkages between the two sectors and strike the necessary balance between industry and construction(see figure3)

Even more urgent is the housing situation in developing countries, where a high percentage of the urban population lives in unacceptable conditions that are deteriorating even further. This deterioration is due, on the one hand, to overall population growth, rural/urban migration and rising ratio of urban to total population and, on the other hand, to a shortage of construction materials. The amount and timing of investment in physical and social overheads, as well as the conditions under which financial viability can be assured, are basic issues to which industrial development planning must address itself.

4. Obstacles to development planning in developing countries

There is a growing recognition among developing countries that they cannot achieve economic independence, overcome their backwardness or realize a socio-economic transformation without the intervention of the State. This intervention is needed for many reasons;

- (a) Domestic capital formation is at a low level in most developing countries;
- (b) The private industrial sector is weak both in absolute terms and relative to the commercial sector and to real estate, which exert stronger attractions;
- (c) The economies of most developing countries are dualistic in nature;

- (d) Economic and financial resources are concentrated in the public sector because they come mainly from taxes levied on various activities, particularly foreign trade, or from the export of materials and other commodities. Therefore (and this is particularly true in the initial stages of industrialization) it is only the State that can mobilize the financial resources to develop social and physical infrastructures and carry out large industrial projects, where the pay-off periods are likely to be long and where much of capital may have to be in foreign currency;
- (e) The need for foreign capital means that the government must become involved in negotiating terms and conditions and in regulating the pattern and volume of the capital inflow.

Thus government is not merely an organizer of the development process, it is also a direct participant in it and shoulders major responsibility for planning and pursuing industrial activities. Notwithstanding this central role, experience in many developing countries shows that governments have not been able to impose their will on all of the economic agents. The gaps between a plan's expectations and its actual achievements show how complex a task it is to assess and forecast the behavior of internal and external factor and incorporate them into a plan..

The concentration of economic and financial resources within the public sector provides the governments of developing countries with means of promoting their industrialization processes, especially insofar as these resources enable them to invest in social and physical overheads. However, a number of obstacles, both internal and external, have kept industrialization from living up to expectations

the internal obstacles have to do mainly with government machinery - there may, for instance, be too little discipline among policy makers, the development planning approach may be inappropriate or the development planning may be ignoring the private sector. If development planning is to promote industrialization, there needs to be an appropriate climate the government administration. Policy-makers must be committed to the plan, and they must, if necessary, be willing to restructure the administrative system to create conditions favorable to the industrialization of both the public and private sectors..

Three types of external obstacles are encountered in industrial development planning in developing countries. The first is transnational corporations, which are firmly controlled by forces outside the country and usually pursue objectives that are at odds with those of the country. The second obstacle is adverse terms of trade and the relative price system implicit therein, which tend to push the economies of developing countries in directions that run counter to the national industrialization strategies. This obstacle call for offsetting policy measures that would promote the export of manufactured goods, while at the same time developing domestic productive capacity to meet domestic needs. It also suggests a need for greater cooperation among developing countries. The third obstacle is fluctuations in the world market. These fluctuations raise complex problems for planners, who must act to minimize their interference with plan implementation.

This is the array of problems being faced by developing countries as they attempt to industrialize. The problems are immense and constitute a serious constraint to industrialization. While industrialization cannot be

achieved spontaneously in a situation dominated by unrestricted market forces, it can be achieved, given the right socio-economic environment, by the application of scientific principles. It is these principles, as well as practical procedures for planning the industrialization process, that are the subject of these industrial development discussion.

II. Strategy options in industrial development planning

Industrial development strategies, which express long-range, qualitative goal and directions, constitute the overall framework within which industrialization must take place. If they are not clearly defined and explicitly stated, it will be difficult or impossible to formulate and implement the shorter range working plans. However, there is no single set of strategies applicable for all developing countries, primarily because their stages of development, per capita incomes, economic structures, populations and natural resources are so diverse. Each country will have to adopt its own strategy based on its priorities and will have to decide for itself what it can achieve both short-term and long-term. Strategy options will vary greatly, depending on the level of industrialization a country has already attained, its natural resources and factor inputs, and its potential for mobilizing external technological and financial resources to supplement its own efforts.

Generally speaking, developing countries can be placed in one of the following categories:

- (a) Countries that have sizable internal markets and that have already industrialized to some extent on the strength of those markets, of which Brazil, China and India are examples;
- (b) Countries that are, despite their limited internal markets, highly export-oriented in manufactured goods, of which Singapore, the Republic of Korea and Taiwan (province of China) are examples;

- (c) Countries that manufacture intermediate goods from their agricultural or mineral production, of which Ghana, Cote d'Ivoire and Paraguay are examples;
- (d) Least developed countries (LDCs), where main productive activity is agriculture.

Group(a) consists of countries that have already succeeded in replacing many imports and are now at the point where they are able to export manufactured goods and, at the same time, expand their import substitution programme by producing some capital goods. Group(b) consists of countries that although they never emphasized import substitution, have begun to export, mainly to the developed countries; they rely on their cheap labor and are very dependent on foreign sources for the inputs and equipment they need for their manufacturing activities. Group(c) comprises countries that have started up large-scale industrial production based on their natural resources but that have yet to diversify their industrial bases. Group(d) consists of countries with meager natural resources and lacking many of the entrepreneurial, technological and infrastructural prerequisites for industrialization.

The planners in each country must choose an appropriate set of strategies and must also readjust these strategies from one industrial plan to the next. In discussing the industrial strategies, some of the characteristics that make them suitable in difficult kinds of developing countries will be pointed out.

1. Basic industries strategy

To ensure sustained industrial growth in developing countries, basic

industries should be given priority because they give rise to backward and forward linkages in domestic production.

A basic industries strategy presupposes a highly integrated pattern of markets, raw materials and infrastructures. These requisites may already be in place, as they are in group(a) countries, or they may be created artificially be a group of countries acting on a regional basis or entering into a multinational co-operative arrangement. The strategy must identify the sub-sectors in which a country wishes to develop its own capacities, specify priorities and core projects and describe the skills and technologies that will be needed.

The basic industries strategy approach does not aim at complete self-sufficiency. It is not necessary, nor is it in most cases possible, to create overnight, an industrial base that would allow for completely self-reliant development. Instead, policy makers and planners choose this strategy because it will lead to the optimal utilization of national resources and the interlinked production of capital, intermediate and consumer goods. The plan must identify that share of demand which the country intends to meet through imports and that share which it intends to meet through domestic production. Self-reliant and self-sustaining growth requires built-in mechanisms that restructure the economy so as to increase industrial production capacity and strengthen intersectoral relations.

The strategic objectives to which the planner has to address himself include the following;

- (a) Total mastery of the technology of producer goods, such as machine tools and heavy power-generation equipment; of capital goods for

consumer and intermediate goods industries; and of common facilities, e.g. transport and utilities, equipment;

- (b) The development of a capital goods, perhaps in co-operation with other developing countries, to enhance the country's long-term development prospects, with a view to fostering specification, complementarity and trade;
- (c) The harnessing of the entire national industrial potential to supply agriculture with pesticides, fertilizers and heavy and light farm machinery at reasonable prices. Wherever possible, the heavy agricultural equipment should be designed expressly to function under local conditions. The construction and transport sectors must also be provided with the inputs and equipment they require;
- (d) The enhancement of the domestic capacity to provide the essentials of education, health and housing;
- (e) The export of consumer products with a high value-added content and of industrial intermediates and equipment to both developed and developing countries.

A planner must gauge the size of the market before setting up a basic industries strategy; indeed, size matters far more in the case of capital and intermediate goods industries than it does in the case of consumer goods and agro-based industries. The size constraint meant that developing countries with large populations and markets are more able to set up basic industries than developing countries with small populations and markets.

By investigating the following, planners in small developing countries can judge whether a particular basic industry is feasible. We may here define small developing countries as those with populations of up to one million and of low per capita income: and smallish as those with populations

between one and ten million, as well as those with populations of less than one million, but of relatively high per capita income.

- (a) The minimum economic size of production of the different basic industries and their component stages of production, given the country's particular circumstances. For example, small re-rolling mills for the main steel products have been found to be economically justifiable in many smaller developing countries;
- (b) The possibility of acquiring small, efficient units for basic industries (steel mills are an example), as well as the possibility of manufacturing products that require less capital-intensive methods and that can be made in smaller quantities. One example of the latter possibility is brick, tile and lime kilns, which are generally small, dispersed, low in capital cost, fueled by oil, wood, peat or coal, whichever is available and economical, and serve a relatively limited market radius. Other examples are light engineering workshops for rural areas and small mechanical engineering units to carry out metal-work repairs and to produce certain spares and simple products. For developing countries that are islands, marine repairs are of importance.
- (c) The possibilities for regional or sub-regional co-operation among developing countries, some of which do not have the resources to establish such industries on their own, and others of which do not have large enough markets. By pooling resources and establishing multinational industries that benefit from economies of scale, they would overcome these constraints on their industrial development and would achieve, collectively, self-reliance and self-sustained industrialization.

2. Strategy for choosing a technology

One of the crucial problems in planning industrialization is deciding on the appropriate technology. Here the planner must deal with a number of connected issues, such as the mobilization of resources, especially surplus labor; the priority to be assigned to different industries or sectors; their relative rates of growth during particular periods; and the choice between labor-intensive and capital-intensive types of production.

Labor-intensive vs. capital-intensive. Labor-intensive technology is characterized by a relatively low capital-labor ratio K/L , which means that it will offer more employment opportunities for a given amount of investment than will capital-intensive technology.

Labor-intensive technology is often favored because it immediately maximizes employment. Thus, for instance, instead of buying a small number of expensive mechanical looms, this strategy would consider it preferable, from the point of view of employing many people at an early stage, buy a large number of less expensive hand looms. This logic can be deceptive, however, for as we shall see later, output and employment can also grow on the basis of capital intensive technology. The appeal of labor-intensive enterprises such as handcraft and cottage industries lies mainly in the fact that they can satisfy part of the need for consumer goods on the basis of local raw materials and simple production tools are also made, by and large, by hand, locally.

Capital- intensive technology is characterized by highly productive, up-to-date machinery and equipment, and a relatively large capital outlay is needed to equip one workplace (high capital-labor ratio K/L); compared to labor-intensive technology, it is characterized by a high output-capital ratio Y/K and a high output-labor ratio Y/L . Modern technology always

achieves a higher output per machine, per worker and per unit time than traditional technology. When production technology is modernized, the volume of output does not vary in linear proportion to the cost of the machinery - it increases faster. For example while the materials and labor needed to produce a modern lathe do not differ greatly from those needed to produce an old-fashioned lathe, except for the electronic accessories, the output of the modern lathe, especially if it is semi-automated or fully automated, can be a hundred times greater.

Thus, a capital-intensive process always uses less labor, and often even less capital per unit of output, than a labor-intensive process. This means that it is possible to get more output with the same amount of investment, fewer production units and far fewer workers, and it explains why the capital-labor ratio tends to increase as a result of technological improvements, in accordance with the economic law of concentration of production and capital.

Labor-intensive technology is applicable mainly in consumer goods industries. Most basic industries require the use of machinery and equipment such as lathes, forging machines, furnaces and cranes. Iron, steel and petrochemicals cannot be produced by labor-intensive methods; mechanical engineering requires at least some mechanization to ensure minimum quality. Nevertheless, some commodities, for example, building materials such as bricks and lime, can still be made by labor-intensive methods.

The fact that labor-intensive technology is applied primarily to the consumer goods industries would seem to imply that such industries are preferable because they encourage consumption and inhibit investment. In

the long run, however, this slows the increase of output and hinders the establishment of the basic industries that are needed for self-reliant and self-sustaining growth. If, instead, basic industries are chosen, the supply of capital goods will grow faster, leading to a higher investment ratio, and the greater stock of physical capital can be used to put more people to work. Eventually, therefore, capital-intensive technology maximizes both output and employment.

For each developing country there is, in line with the country's economic indicators and its stage of development, an optimal set of technologies to produce appropriate array of products. These technologies will combine the country's resources – its labor force, its financial means, particularly, foreign exchange, and its natural resources – in the best possible way. In making this choice of technology, a planner must also take into account other factors, such as the size of the market, and he will want to consider introducing technological innovations that improve the efficiency of production with relatively small capital outlays.

The latter consideration, technological innovations, can be pivotal for agro-based industries. For example, the introduction of emerging knowledge in biotechnology and genetic engineering can sharply improve the productivity of labor and capital. It is very important from the point of view of dynamics that the new technology increase the productivity of labor and capital. Developing countries that want to expand employment should think carefully before they opt for labor-intensive technology. Any labor-intensive technology that does not generate surplus revenues cannot be recommended in the long run except, maybe, in the case of a particular region, since it is only from surplus revenues that new investments can

come; if there is no surplus, the economy will stagnate.

Issues influencing the choice of technology. The proportion of capital-intensive to labor-intensive capacities will vary, from country to country. In developing countries with very high per capita incomes, such as small OPEC countries, and where the national incomes far exceed the countries' current and future requirements, there is obviously no place for labor-intensive technology. However, in developing countries with very low per capita incomes, large surpluses of labor and well-established traditional sectors that make consumer goods, the planner might want to think along the following lines;

- (a) In the early stages of industrialization, capital-intensive technology should be introduced mainly in the basic and capital goods industries. Any surpluses in foreign exchange or financial assistance from abroad should be channeled to the sub-sectors that can expand the domestic stock of physical capital;;
- (b) The traditional sector, which is labor-intensive, can continue to play its time-honored role in the economy, but it should be made more efficient. Research institutions and information services at the national and regional levels would probably be a good way of encouraging research and development;
- (c) Consumer goods should insofar as possible be made by labor-intensive processes. Consumers should be persuaded to choose goods whose manufacture maximizes labor inputs. For example, instead of producing luxury consumer durables, such as automobiles, washing machines and fans and coolers, the assembly of which is less capital-intensive;
- (d) Some capital goods and intermediates can be made by less capital-

intensive processes. In rural areas and even in some urban areas, lime, bricks and wood should be used instead of cement, and clay roof tiles should be used instead of galvanized iron or synthetic materials;

- (e) Another way of encouraging labor-intensive technology would be to focus, as some newly industrialized economies(NIES) already do, on goods such as textiles and electronic equipment, whose competitiveness in world markets depends on high labor content.

For countries with surplus labor in industries where there is no choice but to use capital-intensive technology, particularly basic industries, it is important to mitigate the adverse effects of such technology by “stretching” it so it provides the employment required. There are, in fact, always ways in which labor can be efficiently substituted for capital, even with a capital-intensive technology, and the planner must encourage engineers and technicians to explore these possibilities. For example, early on in Japan’s industrialization, when wages were comparatively low, textile machinery was utilized to its utmost by running extra shifts. Certainly there were more frequent halts for repair, but since repair was itself a labor-intensive activity, the overall effect was a greater use of labor and more efficient use of all resources.

Thus, even where mechanization is necessary, double and triple shifts can greatly decrease the overall capital-intensive ratio. It should be pointed out, however, that stretching capital intensive technology requires a good maintenance and repair capability; otherwise, down-time costs will start to affect the benefits. Similar capital-stretching, labor-intensive techniques are being used in some South-East Asian countries for their textile, electronics and woodworking industries.

Considerable scope for maximizing the use of labor does in fact exist, if only the appropriate process or product mixes can be found, and it is the task of the planner to spread awareness among engineers and technicians to help them come up with ideas. Even where the main production processes are technically rigid, there are always periodical processes, such as materials handling and packaging, that can be carried on efficiently with labor-intensive methods, so that, overall, some of the production can probably still tolerate greater labor-capital substitution. There are also a number of assembly operations where more labor could be introduced if the work were parceled out on a sub-contracting or auxiliary basis, as proved feasible, for example, in the electronics industries of some labor-surplus countries.

Finally, the planner should bear in mind that there is an interrelationship between the production process and the product. As soon as an established process is modified, the product usually must be modified as well, making fine distinctions less critical and frequently lowering the general quality of the product. In this respect, the available potentials within a developing country should be considered. Some adaptations have been innovated in developing countries, and there are many cases of developing countries having altered machinery or processes brought from developed countries to suit their own local conditions.

Integration of technology planning and industrial development planning. Most developing countries, particularly the least-developed, lack experience in technology planning, which is a vital component of the overall industrial planning process. The introduction of such planning is complicated task calling for a number of organizational measures, some of which

are outlined below;

- (a) Integrating science and technology into the overall management and planning process necessitates the establishment of a central board for science and technology, to work with the central planning body. By harmonizing efforts, such a board would avert wasteful duplication in research and development. It would also encourage innovation in production methods and products;
- (b) Research and development centers should be established at the large industrial complexes, where they would serve to master, maintain, modify and, possibly, further develop or copy imported technology. These centers would also be charged with organizing the production of spare parts;
- (c) Most developing countries face a shortage of spare parts for their industries, a situation that reflects the lack of domestic capital goods industries and dependence on scattered foreign sources of supply. One solution to this problem is to centralize the supply of spare parts; other solutions include more standardization of spare parts, the production of spare parts locally or changes in the design of production equipment.

Technological plan should be worked out in advance of the production plan, because the latter depends on the choice of technology, including the type of product to be manufactured and the appropriate inputs. The technological plan must address itself to standardization and spare parts.

In countries with relatively diversified industrial raw materials, the plan must seek to gear output to these materials.

The planner should also explore, and then narrow down, the possibilities of acquiring and adapting industrial technology in joint efforts with other developing countries; these efforts could avert the increased dependence on external sources that often accompanies technological advances. Since developing countries share problems in information collection, forecasting, and technology assessment, selection and acquisition, as well as in the endogenous development and application of the new technologies, they should exchange experience in this field. Co-operation could even extend beyond this exchange of experience to the collective negotiation for and acquisition of technologies and the setting up of common production facilities, technological institutions and programmes. Equally important, developing countries may have to consider a collective strategy for their response to technological changes.

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