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FACTORS AFFECTING STEEL DEMAND AND ITS PRODUCT PATTERN IN DEVELOPING COUNTRIES 1/

by

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1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. The document is presented as submitted by the author, without re-editing.

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FACTORS AFFECTING STEEL DEMAND AND ITS PRODUCT PATTERN IN DEVELOPING COUNTRIES[1]

prepared by

The Secretariat of the United Nations
Economic Commission for Europe

SUMMARY

The paper is devoted to a discussion of some of the main factors influencing the demand for steel in the developing countries. Thus, the tariff structure of certain developing countries was examined and it was suggested that tariff barriers imposed to protect a local steel industry did not, on the whole, exert a retarding influence on the growth of steel consumption. Tariffs or other trade restrictions imposed in response to balance of payments difficulties were more likely to restrict the volume, though not always the pattern of consumption.

The main factors influencing the demand for steel in agriculture were seen to be the rate at which subsistence farming is transformed into farm production, and distribution channels to markets are organized. Steel is used mainly in farm buildings, food storage facilities, and, to a lesser extent, in the local manufacture of certain farm implements.

The demand for steel in construction in the developing countries depends on the competitiveness of steel vis-a-vis other building materials, and on the type

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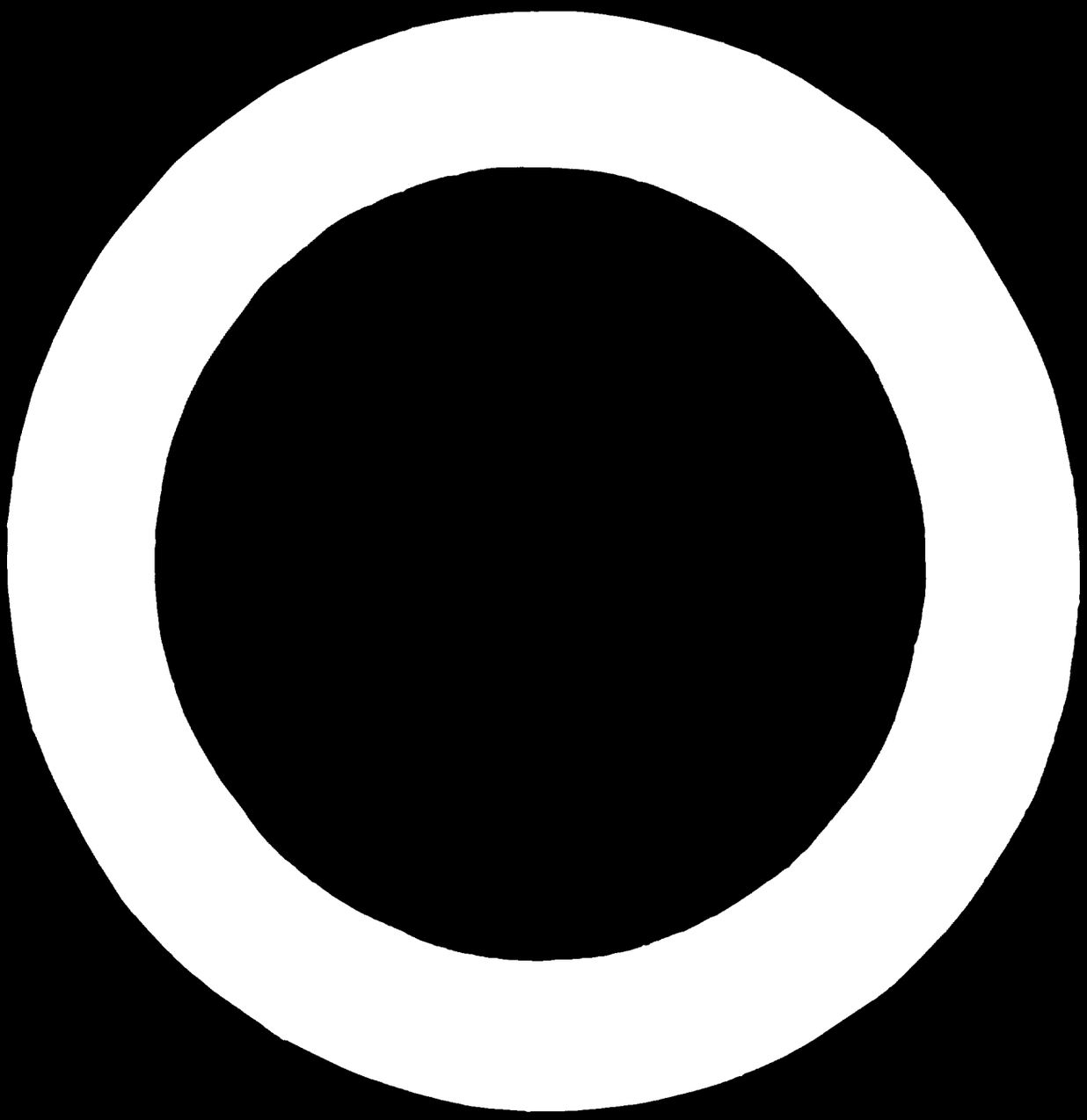
1/ The document is presented as submitted, without re-editing.



and amount of steel-using constructional activity carried out. It was shown that, while there are only a limited variety of structures which are major steel users, the numbers built in individual countries differ widely according to local circumstances, exogenous factors being more important than endogenous factors at early stages of growth.

On the uses of steel in railways, the relationship between economic development and the growth and density of the railway system was discussed. The uses of steel for railway track material and rolling stock were analyzed, and the factors influencing their demand outlined. It was suggested that owing to more efficient alternative methods of transport now available, the importance of the railways in development was declining although there would always be a place for them in every country where bulky goods had to be transported over long distances.

The oil industry was examined as a consumer of steel. The uses of steel in exploration and production, transportation and refining were discussed and their relative importance as factors influencing the demand for steel assessed. A look was also taken at the relationship between oil production and steel consumption.

The demand for steel in the mining and manufacturing industries of the developing countries was analyzed. The mining sectors of most developing countries were closely identifiable with the country's exports of raw materials, and it was shown how these varied over time and how the demand for steel in mining was also likely to vary in similar proportions. The product pattern of steel used in manufacturing industry was then identified and it was shown how, for various reasons, the rate of growth of the steel-using sectors of industry tended to increase faster than other sectors. The section concludes with a discussion of the relationship between imports of plant and machinery compared with domestically-produced equipment and it was pointed out that investment goods tended to be imported until quite late in a country's development, steel consumption at earlier stages being mainly confined to consumption goods, light tools and electrical machinery.

As a general conclusion, the study shows that at early stages of economic development the volume of steel consumption in one sector is determined quite independently of the consumption in another, and that the sector pattern of steel use is different in each country, depending on the specific type and speed of

development of one or the other sector. It was also difficult to find meaningful relationships between steel consumption (per capita or aggregate) and the rate of growth on the level of development for developing countries; consistent relationships of this type, as they have been proved for the industrial countries, begin only to appear at much more advanced stages of economic development. Until the manufacturing sector develops beyond a certain point, i.e. non-repetitive projects whose development depends on local, exogenous factors such as the pattern of raw material resources, the climate, location, political and social structure, etc. They may, of course, create in many cases new steel demand, not only through replacement demand, but also through the new industries which may grow around the initial projects.

Contents

Tables

A. TRENDS IN THE LEVEL OF STEEL CONSUMPTION IN DEVELOPING COUNTRIES

Following the practice adopted elsewhere, developing countries are defined as all of Latin America, Africa (excluding South Africa), the Far East (excluding China (mainland) and Japan) and the countries of the Middle East. An alternative procedure might have been to define the stage of development in relation to the degree of dependence on imports of steel. This, however, makes no allowance for differences between countries in the availability of steel making raw materials, and in undertaking long term comparisons this definition would lead to a diminishing sample of countries as more of them set up steel making plants. In 1938 there were only four steel producing countries in the developing world (Argentina, Brazil, Mexico, India) whereas by 1965 the number had increased to eighteen, but of these in 1965 only five produced more than 500,000 tons of crude steel. Table 1 shows the development of steel consumption in the developing countries over the last fifty years, in regional groupings. Steel production in developing countries was negligible before the Second World War, 2.8 million tons in 1950, 4.4 million tons in 1955, 9.3 million tons in 1960 and 17 million tons in 1964. Nevertheless, this represented no more than 3.8 per cent of world steel production in 1965.

The development of steel consumption

In 1965, little more than half of steel consumption in developing countries was met from indigenous resources. Table 1 shows the development of local steel production in developing countries in relation to their apparent consumption.

The Latin American region has proceeded further than the others in covering its steel requirements from home production, now relying for over two thirds of its need on indigenous sources. The Far Eastern region reached 58 per cent in 1965, averaging under two thirds for the last five years, with the African and Middle Eastern regions relying principally on imports. Both the Latin American and Far Eastern regions developed home steel production to the point to cover half their requirements in 1959 and have exceeded this ever since.

Production and consumption data by products have been analyzed for the whole of the Latin American region and for India to show the remarkable strides that have been made in these two areas in achieving reduced reliance on imported supplies over the last ten years. Production is related to apparent consumption, which excludes exports, in Table 2.

Table 3 gives data on the development of steel consumption in the developing countries over the last fifty years, in regional groupings. The table shows that apparent steel consumption (production + imports - exports, not adjusted for changes in stocks) in the developing world has risen 5.7 times over the last fifty years and over the last eight years it rose by 84 per cent. There are considerable differences in the trend between regions, in that consumption in the Far Eastern region rose to more than double since 1957, in Latin America by over 60 per cent, in the Middle East by 120 per cent and in Africa by only 52 per cent. These statistics should be related to population trends to be more significant and Table 4 sets out the development of apparent consumption per head (kg. per head).

While steel consumption per head rose by 36 per cent since 1957 for the developing world as a whole, for Africa it increased not at all, whereas for the Far Eastern region it almost doubled over the same period. The present per caput consumption in developing countries should be viewed in relation to the world average of nearly 300 kg., and while the developing world (as defined for the purposes of this study) accounts for 44 per cent of the world's population it was responsible for only 7 per cent of the world steel consumption in 1965. This proportion has risen very little since 1913 when it was 5.0 per cent, although steel production in developing countries has risen from nothing then to close on 17 million tons in 1965. Over the last ten years steel consumption per head has actually declined in more than a third of all developing countries.

The pattern of steel consumption

There is very little relationship between the pattern of steel consumption in countries with similar levels of total per capita steel consumption except in broad terms. Table 5 shows per capita steel consumption and the consumption pattern in 1962-1964 for a number of countries.

The table shows the most important products in almost all the countries listed to be heavy and light sections and sheets, which commonly account for 40 to 70 per cent of total steel consumption between them. No distinctive differences in the pattern of consumption emerge by comparing the high per capita consumption countries with the low; indeed, the relationship between the proportion of consumption held by the two product groups does not appear to reach a common level even among countries with similar per capita steel

consumption levels.

It is clear from the statistical evidence that the association which was shown to exist between levels of per capita steel consumption and the proportion of flat products in earlier studies prepared by the Secretariat, ceases to apply below a certain level of development. It is significant, however, that all developing countries had a flat product ratio of less than 25 per cent in 1955-1957. Also, the stage of development of the railway system is an important factor affecting the pattern of steel consumption in the developing countries. If railways are being built or extended, countries with a low per capita consumption tend to require a greater percentage of railway track material than do countries with higher consumption levels. In the four countries listed with the lowest per capita steel consumption the percentage of rolled steel used for railways averaged 9 per cent in 1962-1964, while in the eight highest consumption countries the percentage was only $2\frac{1}{2}$ per cent. The importance of tubes, pipes and fittings, and hence the relative proportions of other products, largely depends on whether or not the country is an oil producer, regardless of its overall per capita consumption. The average percentage contribution of tubes to consumption in Iran, Iraq and Venezuela was 16 per cent, for all other countries it was only just over 9 per cent.

This suggests that at low levels of development the distinctive features of each country seem to outweigh the similarities, at least as far as steel consumption is concerned. The volume of steel consumption in one sector of the economy is often determined quite independently of the consumption in another, and the sector pattern is quite different in each country. This is true, even if countries are grouped together according to their principal economic activity. The steel statistics for agricultural exporters, e.g. Thailand, Egypt, Brazil, Pakistan, Uruguay and Argentina, show no common features; neither do those for the exporters of mining products, e.g. Chile, Congo Republic and, to a lesser extent, the Philippines and Malaya. Even among the oil-producing countries, the pattern of steel consumption shows few similarities except in respect of steel tubing. However, the agricultural exporting countries as a group do tend to show features which are distinct from the mining and petroleum exporting countries. Per capita steel consumption in 1963, at 22 kgs. was appreciably lower than per capita consumption in the mining export economies (39 kgs.) and in the petroleum export countries (45 kgs.). On the

other hand, the product consumption pattern as between the agricultural and mining exporters was remarkably similar, with percentages taken by single products in no case showing differences of more than 5 percentage points between the country groups. The pattern of consumption in the petroleum producing countries was, by contrast, appreciably different, particularly in respect of their heavy consumption of tubes and heavy and light sections with lower shares for sheets.

The dissimilarities also predominate if one studies the pattern of consumption over time. Table 6 gives the per capita steel consumption in 1955 and the pattern of steel consumption in selected countries in 1955-1957. This table may be compared with Table 5 to give an impression of changing trends between 1955-1957 and 1962-1964.

Table 6 illustrates the dissimilarities in consumption pattern between countries in the same way as Table 5. Yet in broad outline the table also shows that there have been shifts of emphasis in the importance of product groups as compared with Table 5.

The importance of railway material was considerably greater in 1955-1957 (Table 6), indicating that the development of the railways, while a feature of the mid 1950's, is now no longer as important in most countries. This is particularly true of the Congo (Kinshasa), Pakistan, Thailand, Iran, Brazil, Mexico, Argentina and Chile, whose consumption of railway track material in 1955-1957 averaged 17 per cent of total steel consumption compared with $3\frac{1}{2}$ per cent in 1962-1964.

Sheets, on the other hand, are becoming more important and increased their share from 17 to 22 per cent of total consumption between 1955-1957 and 1962-1964. This undoubtedly results from industrial growth, especially the manufacture of consumer and electrical goods. Heavy and light sections remained the largest product group with an unchanged proportion of 33 per cent in the two periods.

An examination of the countries grouped according to type of economy shows that no radical change took place between 1955-1957 and 1962-1964 in the product and consumption pattern for each group. The agricultural export economies increased their capita steel consumption by only 4 kg. in the period, the only significant product change being an 8 per cent increase in sheet consumption at the expense of railway material and tinplate. The pattern in the mixed

agricultural and mining export economies was similar. In the mining export economies per capita consumption has remained constant although here, the switch from railway material to sheet was unusually large. Finally, in the petroleum producing countries, the importance of tubes has declined as the economy has developed and extended the uses of all other steels.

An examination was undertaken of the availability of local production, the product pattern of steel consumption in relation to the type of economy and the development of per capita steel consumption over time as factors determining the demand for steel in developing countries. This followed previous investigators, particularly an earlier Secretariat study(1), in the hope that the much improved national accounts statistics, which have become available since then, would permit some ranking of the determining factors by multi-variate analysis. In the first place the correlation for some fifty developing countries for which data were available was established between per capita steel consumption and gross domestic product per capita. This was done for 1953/55, 1958 and 1963 in order to establish whether either the economic development in the countries over that period, or the coming into being of more reliable statistics had reduced the wide scatter of observations, which ruled out the calculation of correlation coefficients for developing countries in the earlier study. No significant increase in this, the most marked correlation between steel consumption and economic indicators of development was found to occur over the ten year period.

The attempt was made to apply similar analysis to the data presented in "The Growth of World Industry"(2). Here again it was found that only a limited proportion of the variation of steel consumption in developing countries could be accounted for by variation in the level of industrial production (or its constituent elements), industrial employment, or proportion of value added in industrial activity. In displaying these relationships as scatter diagrams only a limited measure of clustering along regression lines occurred and extreme departing observations could invariably be readily accounted for by features specific to the countries concerned.

(1) Long-term Trends and Problems of the European Steel Industry, loc. cit.

(2) The Growth of World Industry, prepared by the Department of Economic and Social Affairs, United Nations, New York, 1967.

Limitations of the analytical approach

This general analysis of the statistics available has served to illustrate very broad historical trends, but in attempting to carry it to greater depth to throw light on the development of steel demand and consumption in developing countries severe obstacles were encountered.

There is an unfortunate paucity of comparable statistical material on which to base such a study. Statistics illustrating macro-economic aggregates are seldom available for more than a few of the developing countries; and for some countries they either do not exist at all, or have been collected on a different and noncomparable basis. Hence it is rarely possible to compile aggregate statistics for the developing countries as a whole, either in one period or over time in order to compare economic development with changes in steel consumption.

Even if it had proved possible to compile accurate macro-economic statistics, it is doubtful whether these would have been usable in more than a limited way to explain the direction of steel consumption in a particular country. In many countries with an incipient capital stock, even a small investment makes a noticeable difference to steel consumption, sometimes doubling it in one year. The only way to relate macro-economic variables with steel consumption to bring out meaningful relationships is therefore to take three to five-year averages so that the fluctuations from year to year may be discounted. On the other hand, by so doing one loses sight of the particular investments which caused steel consumption to grow.

Finally considerable difficulties arise in finding meaningful relationships between steel consumption whether per caput or aggregate, and the rate of growth or the level of development of the developing countries. Consistent relationships only begin to appear at much more advanced stages of economic development. The several countries normally classed as "developing" each portray such a diversity of economic experience that comparisons between them are of dubious value even where they are statistically possible. The same may be said for comparisons of two or more developing countries over time. Until the manufacturing sector develops beyond a certain point, i.e. when an indefinite number of identical steel-intensive articles begin to be produced, steel consumption is almost entirely directed towards non-repetitive or "once off" projects whose development depends on local, exogeneous factors such as the pattern of raw

material resources, the climate, location, political and social structure, etc. To compare experience in statistical terms in the several developing countries is in any case not particularly instructive; it "disembodies" the actual development taking place, and increases the danger that the real factors determining economic growth may be overlooked.

The remainder of this chapter is for this reason essentially descriptive rather than analytical and considers steel demand in terms of specific end-uses. In each section, the question "Which are the major factors influencing the demand for steel?" has been kept in the forefront, and an attempt has been made to answer it in terms of each major end use of steel on the basis of the experience available.

B. IMPORT RESTRICTIONS AND THEIR EFFECT ON STEEL CONSUMPTION IN DEVELOPING COUNTRIES

As has been shown in Section A of this chapter total consumption of steel in the developing countries does not, however, depend on demand alone. Many countries do not have their own steel industries and have to import their requirements. In these cases particularly balance of payments considerations and the tariff policies of the recipient countries must also be taken into account. Lack of availability of foreign exchange and consequent barriers to trade may also affect overall availability of steel even though demand may be high.

Import restrictions

Trade barriers exist for a number of reasons and in a variety of forms. Their main purposes are generally to protect the balance of payments or to protect a particular industry. They also exist to raise extra revenue; to maintain standards of quality; to channel trading through selected importers, etc. They may appear as a fixed or ad valorem tariff, global or selective quotas, import licences, exchange control permits, import taxes, prior deposit requirements, multiple exchange rates, etc.

a) Balance of payments considerations

A large number of developing countries suffer from balance of payments difficulties caused, for example, by rising imports of capital and consumer

goods, an inelastic market for their staple exports, and more often than not, internal financial instability. An indication of the external financial strength of a number of developing countries was given in a study prepared by the Secretariat[1] which showed the trend in import capacity derived from exports of goods and services, as follows:

Trend in import capacity

Annual rate of growth: 1953/1954 - 1959/1960

(percentages)

Taiwan	12.1	Nigeria	3.9
Malaysia	11.3	Chile	3.4
Ghana	9.7	Ceylon	2.6
Iran	9.4	Ecuador	2.6
Sudan	9.0	India	2.4
Venezuela	7.7	UAR - Egypt	1.6
Jamaica	7.4	Tunisia	0.3
Trinidad and Tobago	7.0	Philippines	0.2
Tanzania	6.6	Ethiopa	0.7
Morocco	6.3	Bolivia	1.2
		Kenya	1.9
		Pakistan	4.9

Source: World Economic Survey 1965, United Nations, New York.

A low rate of growth of import capacity is often associated with either an inadequate level of foreign exchange reserves or an excess of foreign indebtedness. Insofar as countries in this position include in their actions to strengthen their external position by import restrictions on iron and steel products, this may affect the volume of consumption of the steel using industries directly. The actions taken in 1966 by the seven countries at the bottom end of the above list to restrict iron and steel imports included the following:

(i) Egypt (UAR)

Purchases of iron and steel from abroad are made in accordance with allocations of currency by the Planning Committee. With the existing shortage of foreign currency it is impossible to point to any regular system covering such imports. Individual contracts are considered on their merits and foreign currency is allocated only if the contract, credit terms, etc., are approved. Tariffs are not

(1) World Economic Survey, 1965, United Nations, New York, 1966.

a major impediment to trade, duty rates ranging from 2 per cent for pig-iron, scrap and ferro-alloys, to 10 per cent for semi-finished steel and 20-30 per cent for the broad range of ordinary finished steels. However, to the customs duty has to be added a statistical duty of 10 per cent and a quay duty of 3 per cent.

(ii) Tunisia

All imports are subject to import licences. Applications for import licences must pass through the Central Bank to obtain authority for the transfer of currency. Bars and rods, angles, shapes and sections, and sheets and plates are subject to annual quota (3 million Dinars in 1965); the remaining imports under Chapter 73 of the Brussels Tariff Nomenclature being quota free. The size of the quota is decided between the "Groupement des Importateurs de Produits Sidérurgiques" and the "Sécrétariat d'Etat au Plan et à l'Economie Nationale" and is allocated among members of the "Groupement."

(iii) Philippines

Imports of iron and steel products are not subject to quotas or other non-tariff barriers to trade, the main obstacle being a comparatively high rate of customs duty on finished steels. Ferro-alloys, scrap and semi-finished steels are imported free of duties. Rates of duty on the main groups of finished steels are 60 per cent on bars and rods, 40 per cent on tinplate, 15 per cent on sheet, 25 per cent on angles, shapes and sections and 50 per cent on tubes.

(iv) Ethiopia

There are no import quotas in Ethiopia and no non-tariff barriers to trade of any consequence. It is necessary for importers to obtain an exchange control permit and to hold a general import licence, but these formalities are designed to control the activities of importers and the movement of currency, not to control the volume of imported steel. Customs duties are high for certain categories of finished steel; $48 per ton on sheets, $40 per ton for tubes and fittings. Other steel is charged a 10 per cent ad valorem duty. In addition to these duties, imported goods are liable to a Transaction Tax of

12 per cent ad valorem and a Municipality Tax of 1 per cent ad valorem on the customs assessed value.

(v) Bolivia

There are no import quotas of any kind in Bolivia on iron and steel products, nor is there any exchange control, import licence requirements, credit restrictions, etc. Duties range from 13 per cent to 15 per cent.

(vi) Kenya

There is a substantial import duty on certain iron and steel products and virtually none on others; there are no quotas or other non-tariff barriers to trade, although there is full exchange control which has now also been extended to the sterling area. High duty products include sheets (corrugated and galvanized): 30 per cent ad valorem; reinforcing rounds: 17½ per cent; and uncoated sheets: 15 per cent. In addition to normal import duties, "suspended Duties" may be imposed on certain products by the Minister for Finance if he is satisfied that it is in the public interest to do so.

(vii) Pakistan

There are substantial duties and taxes on most iron and steel products imported into Pakistan. Statutory duties range from up to 15 per cent on semi-finished steel and 17 per cent to 40 per cent on the major categories of finished steel. In addition, there was in 1966 also a 25 per cent defence surcharge and a 15 per cent sales tax to be taken into account. The recent cessation of United States aid and the conflict with India have complicated the regulations applicable to the import of iron and steel. In the Import Policy Statement for January to June 1966, steel has, in most cases, been placed on the Free List of imports subject to close Government control.

b) The protection of domestic steel industries

Without exception, all developing countries with domestic steel production facilities protect them from foreign competition. Very often, the protective measures apply solely to those iron and steel products manufactured locally while other products are admitted without difficulty. The main developing

countries with productive facilities include: Argentina, Brazil, Chile, China (Taiwan), Colombia, India, Republic of Korea, Mexico, Pakistan, Peru, Rhodesia and Venezuela. Experience in Argentina and India illustrate the way in which protective measures have been applied, and a brief description is given below.

Argentina

The Argentine iron and steel industry consists of two integrated iron and steel works, about ten smaller steelworks and around eighty rerolling companies. Until 1961, there was a large gap between domestic capacity available for finished steel production and that available for crude steel production. This necessitated considerable imports of semi-finished steels. With the subsequent establishment of the "Sociedad Mixta Siderurgica Argentina" (SOMISA) imports were greatly reduced and in 1963 totalled 289,000 tons as opposed to 1.94 million tons in 1961. To protect the new domestic industry, the Argentine Government announced on 19 October 1961 that import duties and special duties on billets and ingots would be increased from Pesos 13 to Pesos 30 per ton. These duties, on top of normal tariffs ranging from 40 to 220 per cent on nearly all steel products, the imposition of a six months prior deposit to the value of 50 per cent of the goods imported, an unstable rate of exchange, a statistical fee of 1½ per cent ad valorem, a sales tax of 10 per cent landed value, and a freight tax of 4 per cent of the freight charge, provide effective protection for the home industry. It has been stated that should these restrictions prove insufficient to protect the local industry, further measures will be introduced as necessary.

India

Six steelworks exist in India (1966) with a combined capacity of 7.5 million tons of crude steel. A rather severe control of imports was established in India to protect local industry, but it is also partly the result of the critical foreign exchange situation. A wide variety of protective measures are in force. Tariffs range from 40 per cent on semi-finished steels and most finished products to 60 per cent. Quotas are also in force for certain products, as well as an additional "regulative customs duty" of 10 per cent on all products. For products made in India, excise duties are payable over and above the taxes outlined above. These are fixed at a level which effectively excludes foreign steel and may be

altered without further legislation should this be required. The excise duties range from Rs.75.00 per metric ton on steel ingots, to between Rs.125 and Rs.375 on finished steel products.

The effect of trade barriers on steel consumption patterns

It is extremely difficult to assess the influence on the pattern of steel consumption of trade barriers such as those outlined above, as there is no way of separating the trade barrier effect from other factors. However, certain general observations may be made.

Protective measures to stimulate domestic industry should not, in theory, alter the consumption pattern if all that is involved is a change in supply source. In practice, however, consumption is affected in several ways. It is held back insofar as domestic steel in many developing countries is usually more expensive than imported steel, if this leads to substitution by other products or the abandonment or postponement of the steel using project. Consumption may also be retarded insofar as centralized import restrictions are normally based on broad groups of steel products, although local production may not cover every type of steel in the group, i.e. some products are liable to prohibitive import duties in the short run although they cannot be obtained locally. On the other hand, steel consumption of locally made products may be increased if the ready availability of supplies encourages the establishment of steel using industries. In Latin America, for example, consumption of finished steel in those countries having their own integrated steel industries increased by 143 per cent between 1952 and 1964, while consumption in other countries grew by only 78 per cent. It should, however, be borne in mind that steel production capacity would probably not have been set up in the absence of existing markets and/or growth prospects.

Protective measures imposed for reasons other than the benefit of local industry tend to distort consumption patterns in proportion to their efficacy, especially in countries where local production does not exist. In Nigeria, for example, a total ban on almost all imports was imposed in 1965 in an attempt to redress the considerable trade imbalance. Since iron and steel is not produced in Nigeria, except for small quantities of reinforcing rounds and light sections, this measure had far reaching effects on the whole economy and had to be modified within a few months. This was an extreme case, but as the examples of

barriers to trade quoted above showed, other countries having balance of payments difficulties face the same problems to a smaller degree. At the same time it should be added that steel is an essential material for industrial expansion and is usually one of the last items to become subject to import restrictions even when balance of payments considerations have forced a tightening up of imports as a whole. Where restrictive regulations do exist in force, their purpose is often rather to direct steel imports to high priority projects than to limit supplies altogether.

In developing countries not suffering from serious balance of payments difficulties there is seldom excessive protection against steel imports, especially if the country is a non-producer. Steel is often subject to "nominal" duties only, usually imposed for revenue raising purposes. Duties for semi-finished steels seldom exceed 10 per cent and for finished steels 20 per cent. There is no evidence that these duties seriously distort patterns of steel consumption in the class of developing countries referred to in this paragraph.

C. THE INFLUENCE OF THE TYPE OF ECONOMIC DEVELOPMENT ON THE LEVEL AND PATTERN OF STEEL CONSUMPTION IN DEVELOPING COUNTRIES

Steel used in agriculture in developing countries

The main factors determining the demand for steel in the agricultural sector of developing countries might be summarized as being:

(i) The rate at which subsistence farming is transformed into farm production for the market and agriculture is linked to the economy;

(ii) The speed and effectiveness of carrying out reforms of agricultural tenure systems to increase sizes of holding and cropping units and to provide cultivators with incentives to carry out improvements;

(iii) The dissemination of knowledge of improved practices of cropping, husbandry and management to permit intensification and greater productivity, which are a condition, as well as a result of farm mechanization.

Progress has been painfully slow under all three headings and although many development plans are being revised to provide a change of emphasis away from crash industrialisation programmes, spectacular advances in agricultural

production cannot be expected. In the economic history of industrial countries breakthroughs in farming techniques have always occurred in response to pressures from outside the agricultural sector, and the work of the plant breeder, the soil scientist, the agricultural engineer has always been slow in reaching the farm.

Partly for these reasons, relatively small amounts of steel have been used in the agricultural sector of the economies of developing countries, despite the fact that farming provides employment for an average of about 80 per cent of the population in many cases. Steel use in agriculture may be described under three headings: Farm Mechanization, Food Storage and Farm Buildings.

Farm Mechanization

Full scale farm mechanization is essentially a response to a specific development in fully industrialized economies and cannot be successfully transplanted in an unmodified form to economies at an earlier stage of development. In any event most of the implements and devices were designed for crops and conditions occurring in temperate climates and have only limited relevance to tropical agriculture, i.e. for most developing countries. The main uses of machinery in tropical crop production are in the preparation of land for planting and in the processing of some major crops. Other applications of mechanization are concerned with later stages of the cropping cycle, e.g. weed control, harvesting, mechanical handling and transport implements. Nearly all agricultural machinery is imported from North America and Europe and the proportion imported into developing countries is relatively modest:

Imports of tractors and agricultural machinery into developing countries 1963 (million US $)

	Imports			Exports		
	Tractors	Machinery	Total	Tractors	Machinery	Total
Central America	28.4	11.0	39.8		0.1	0.1
South America	23.8	12.3	36.2	0.9	0.4	1.3
Far East	34.6	7.8	42.8			0.1
Middle East	6.8	1.8	8.6			
Africa	20.6	21.7	42.6	0.2	0.5	0.8
	114.2	54.6	170.0	1.1	1.0	2.3

Source: Statistical Year Book 1963, United Nations, Food and Agriculture Organization, Rome, 1964.

Over two-thirds of the imports are tractors, not all of which are for agricultural purposes and the bulk of total imports (78 per cent) went to only seven countries (Mexico, Venezuela, Pakistan, Thailand, Ghana, Brazil and Colombia). Even allowing for the steel content of imports, therefore, it could hardly be maintained that farm mechanization is, so far at any rate, a major determinant of steel demand in developing countries nor is it likely to become one in the foreseeable future. The main obstacles to a more rapid spread of mechanical methods developed in industrialized farming areas are small average size of fields and holdings, lack of financial resources and lack of knowledge, both of operation and maintenance and the modifications needed under tropical conditions. Efforts are being made to tackle these obstacles but there is no prospect of a major breakthrough in the foreseeable future.

Food storage

Low cost storage buildings, both on and off the farm have a particularly vital role to fulfil in the agriculture of developing countries and steel used in their construction is a major item in steel consumption in the agricultural sector. Steel is used as reinforcements in concrete silos and buildings and structural sections in storage sheds for bagged grain, pulses, etc. In India, which is one of the few countries for which estimates for steel usage by end product are available, over one quarter of the estimated steel consumption in agriculture goes into storage buildings, almost entirely as structural sections and galvanized cladding and roofing sheets.

Farm Buildings

In developing countries the choice between steel and alternative materials for farm buildings will, in addition to price comparisons, be determined by the relative advantages of speed of erection, resistance to physical damage and corrosion and the availability of labour accustomed to handling metal components.

For the most part steel in farm buildings will, however, be used for reinforcement of concrete foundations, footings and beams either in the form of steel rods or galvanized wire mesh. In addition, some of the internal equipment of farm buildings may be made of steel. Steel's high strength to weight ratio makes it particularly suitable as a material for wide-span buildings, either as lattice beams, angle iron roof trusses or portal frames. Lattice beam construction was evolved for rapid industrial construction and involved the erection of

tubular or channel frames to take numerous kinds of cladding materials, e.g. corrugated asbestos cement sheeting, galvanized sheets, wood wool slabs, asbestos cement cavity decking, etc. Angle iron roof trusses are a popular form of cheap roof construction encountered in agricultural buildings. Portal steel frames exploit the advantage of steel of possessing plasticity as well as being elastic under load conditions.

Construction and steel in developing countries

The extent to which steel is used in construction (other than farm buildings) in the developing countries will be influenced by two considerations: first by the competitiveness of steel as a building material; and second, on the type and amount of steel-using constructional activity carried out in the developing countries. The products in greatest use include structural steels, reinforcing material (bars and wire rods) and galvanized sheet. Small quantities of other steel products may also be found among ancillary fittings in some constructional projects.

a) Structural steels

At early stages of a country's development, structural steel is not likely to be a competitive constructional material if other local substitute materials exist in good supply. Not only is this type of steel expensive to import (where local production facilities do not exist) but the lack of skilled labour able to fabricate and assemble complex steel structures, the existence - for most purposes - of adequate traditional building methods, the comparative simplicity of making cement (where limestone is available), the lower costs of building materials more labour-intensive than steel in countries where labour is plentiful and cheap, and in many cases the simple lack of awareness that steel has certain advantages over some other methods of construction - all these factors tend to minimize the use of structural steel as an exclusive substitute for other local materials.

The types of construction in which structural steel is usually found as a dominant material include installations such as bridges, single-storey shed-type buildings, industrial plant, multi-storey buildings, mass-produced structures and certain infrastructure projects such as dams, ports, locks, etc.

b) Reinforcing steels

Reinforcing steels, usually bars and rods but also pre-stressing wire and

wire mesh, will generally be required whenever concrete is used in significant quantities in nearly all types of building. Statistical information as to the quantities consumed for these reasons is unfortunately unavailable as steel destined for constructional purposes cannot be distinguished from its other end-uses. An indication of the demand for reinforcing steels may, however, be obtained from a study of cement consumption which has been rising rapidly (as has its local production) in developing countries; and this is undoubtedly associated with an equivalent rise in the consumption of reinforcing steels.

c) Galvanized sheets

This important class of constructional steel, mainly used for roofing. The growth of demand in the developing regions of the world is shown below.

Exports of galvanized sheets to developing countries
(in thousands of tons)

Countries of destination	1953	1958	1963	1965
Latin America	79.3	88.7	110.7	93.9
Africa (excluding South Africa)	76.4	133.6	135.7	126.6
Far East (excluding China (mainland) and Japan)	218.1	175.0	217.7	218.2
Middle East	19.0	39.3	45.7	65.7
Total developing countries	392.8	436.6	509.8	504.4

Source: Iron and Steel Board, London.

The figures illustrate the post-war growth of demand for galvanized sheet in the Middle East and Latin America, but suggests that demand has remained static in the Far East since 1953. As a proportion of total steel imports by the developing regions, galvanized sheet is relatively unimportant, accounting for only 4 per cent of imports in 1958 and 3 per cent in 1963.

The amounts of steel used in individual building projects vary from a few to many thousands of tons. However, quantities of between 500 and 2,000 tons are not uncommon for medium-sised projects, amounts of up to 12-15,000 tons for larger developments and amounts up to 100,000 tons for very large industrial plant.

These figures may be related to the figures on total apparent consumption of steel used in construction in the developing countries as a whole. Such a

comparison will necessarily be only approximate because, as was pointed out in an earlier study prepared by the Secretariat[1] the statistical coverage on the subject of steel usage in the construction industry is limited even in the industrialized countries. In the developing countries relevant statistics are virtually non-existent. Consequently, in order to measure the importance of steel in construction the apparent consumption figures for heavy and light sections (which includes reinforcing material) have been used. These figures represent orders of magnitude only, as sections and bars may be used for other purposes besides construction, notably for rolling stock and heavy engineering. Moreover, these "other purposes" vary in importance in different countries. The above mentioned study showed that the proportion of the total market for sections and bars held by the construction sector in selected European countries ranged from 12.8 per cent to 60.3 per cent, while the construction sector's share of total steel consumption ranged from 13.8 per cent to 29.2 per cent. In the developing countries, the importance of steel in construction is likely to be relatively greater in the absence of a large industrial sector and of a developed transport system, and the proportion of sections and bars used in construction may be as high as 80 or 90 per cent of total consumption in some cases.

Table 7 shows the three year average apparent consumption of sections and bars in selected developing countries in 1962, 1963 and 1964.

The table shows clearly that, apart from a few countries such as Argentina, Brazil, Chile, Mexico, Iran, Iraq, Lebanon and Hong Kong, the apparent consumption of bars and sections is so small as to be insufficient for investment in more than a few major projects per year. In the whole of Africa, for example, in 1964, enough structural steel was consumed for only 550 medium-sized projects using about 1,000 tons each. Similar conclusions derive from the figures for the Far and Middle East.

In countries where steel-intensive construction is confined to a few projects only, it is unlikely that the factors influencing the demand for one project will necessarily be related to the factors influencing the demand for another. The decisions to build a bridge, or a hotel, or a factory, will probably be made quite independently of one another, at least at early stages

(1) The Use of Steel in Construction, United Nations, New York, 1964, prepared by the Economic Commission for Europe (ST/ELE/STEEL/10).

of development. Similarly, the pattern of constructional activity found in one developing country is unlikely to match that found in another.

The need to build a bridge, for example, will be determined primarily by exogenous factors such as the geographical structure of the country and the physical and historical relationship between the various lines of communication; and second, by endogenous factors such as the growing inadequacies of the old methods of communication. Similarly the decision to build or extend a port requires first that the country has the necessary coastal facilities, and second that trade is growing beyond the capacity of existing installations.

Both exogenous and endogenous factors also operate in the decision to build single storey shed-type buildings. In agriculture the need for these buildings will mainly depend on the type of produce made in country and the size and distribution of cultivated land; and secondly, it will depend on the extent to which farming is growing, new crops are introduced, and more modern farming methods employed. In industry, exogenous factors determining the pattern of constructional development include the range of raw materials available; while the main endogenous factor is industrial growth itself.

The range and quantity of steel-intensive multi-storey buildings depends to a minor extent on geological and seismic considerations such as the strength of the supporting soil and substratum, and partly on economic factors such as the demand for hotels in tourist areas, and the size and complexity of the financial and commercial sectors of the monetized economy.

Finally, the factors influencing the demand for industrial plant, as for other types of industrial building, will depend on the pattern, speed and direction of industrial growth in each country. The form of industrial growth itself depends partly on local facilities and available raw materials, partly on the competence with which the national planners will be able to utilise these facilities. A discussion of the factors leading to industrial growth is, however, outside the scope of the present study.

The considerable variety of constructional activity as between one country and another at low levels of development is illustrated by the figures in Table 8 which shows the percentage of construotional investment by class of industry, the per capita level of Gross National Product (G.N.P.), and the size of the construction sector in relation to G.N.P.

The table shows that with few exceptions construction accounted for between 3 per cent and 7 per cent of the G.N.P. of each of the listed developing countries. Moreover, there appears to be a broad tendency for the proportion to increase slightly as per capita G.N.P. rises both with regard to a single country over time and comparing different countries with varying G.N.P. per capita. At the bottom of the scale, the 1963 proportion of construction in G.N.P. in Kenya and Uganda was 2 per cent; while at higher levels of per capita income it was 8 per cent in Puerto Rico; 6 per cent in Trinidad and Tobago; 5 per cent in Panama and 4 per cent in Argentina and Chile.

The classification of construction into the three categories - dwellings, non-residential building and "other" construction and works, shows that wide differences in the composition of constructional activity exist between the various developing countries. A regular pattern only begins to emerge once a relatively high level of development is reached, and even then it is by no means uniform throughout. Table 10 shows, for example, that in the Federation of Malaya, South Korea, Thailand, Kenya and the Sudan, about 15 per cent of constructional activity was devoted to dwellings in 1958 and 1963, while in Mauritius and the Philippines the proportion going to dwellings was about half. Conversely, the relative importance of "non-residential" and "other" construction and works differs widely also. In Venezuela in 1958, non-residential building took 65 per cent of constructional investment while "other" construction and works took 10 per cent. In Colombia, on the other hand, the proportion taken by "other" construction was 53 per cent.

The diversity and small scale of steel-intensive constructional activity in most developing countries and the distinction between the exogenous and endogenous factors influencing the demand for this activity leads one to an important general conclusion concerning the nature of demand for steel in construction. At early stages of growth, the exogenous factors tend to predominate and steel is used mainly for projects which are broadly related to the country's infrastructure needs and physical resources. The demand for steel in these projects will vary considerably from country to country according to specific requirements. Endogenous factors only increase in importance at later stages of development and are a function of the degree to which the economy becomes more integrated.

Railways and steel in developing countries

Railways and economic development

The building of railways has in some countries (e.g. the United States, Germany, Russia) been an important element in initiating rapid industrial development. Railway construction promotes economic growth in three distinct ways: (a) Through bringing about lower domestic transport costs commercial exchange is promoted and markets are being extended; (b) Railways to connect producing areas with world markets have in many cases been a necessary condition for the coming into being and development of export industries, which have in turn generated capital for further growth; and (c) In many countries the construction of railways has initiated the growth of heavy industries as the basis of an industrial economy, in the first place to supply the building needs and later for maintaining extensive rail networks. It is clear that the building of railways alone is not sufficient as the examples of India, China, 19th century Canada and Argentina will show, in all of which countries a great deal of railway construction took place without leading to any exceptional growth. The other institutional, social and political factors required for growth must also be present and the coming of the railways has often preceded this.

The choice between road and rail transport development

Many developing countries are faced with the choice between road and rail transport, both in the planning of individual projects for the exploitation of indigenous resources and in the provision of a general framework for fostering industrial growth. In many cases the only existing railways were originally built in order to serve export industries and may not be well adapted to the needs of a progressively diversifying economy. The problems arising are similar to those facing mature industrial economies where competing forms of transport have to be integrated to deal with the rising volume of traffic at the lowest real cost to the community. In the case of the developing countries the solution of the problem is both more straightforward and more complex. The traffic flows are fewer and easier to determine and it is easier to graft additional facilities onto an existing embryonic system than to adapt a network designed for an earlier age. On the other hand a number of additional restrictions arise, e.g. the desirability of providing maximum employment, the need for training an industrial labour force, the need to conserve scarce foreign exchange, etc.

Road transport often appears to hold out considerable advantages over railway development in less developed countries, mainly for two reasons: first the general lower traffic density over an extensive network, particularly in the smaller countries of Africa and Latin America, is usually handled more economically by buses and lorries. Second, railways are much more complex institutions to manage and control than road transport undertakings. Shortages of the required skilled managerial manpower, which may be urgently needed in other sectors, can lead to lower standards of service, which impose additional costs on nascent industries, e.g. slower deliveries leading to the need for carrying larger stocks and thus inflating capital requirements. This is borne out by the fact that in recent years most railway administrations have operated at a loss, in spite of fiscal concessions, subsidies and low charges on stocks of capital.

Nevertheless, in most cases where large volumes of bulky commodities (particularly minerals) have to be moved and where alternative water transport is not available railways will usually provide the most economical form of transport. If the country is short of foreign exchange and possesses coal and/or hydroelectric resources the advantage of rail over road is reinforced. Against this, however, has to be set the continuing import requirement for track maintenance and rolling stock, which is less likely to be displaced eventually by import substitution than road vehicles.

Railway network in developing countries

Accurate statistics to illustrate the historical development of the world railway network are surprisingly not readily available. The figures relating to the developing world have been estimated as follows:

	1850	1900	1930	1950	1955	1963
		(1,000 kilometres of lines)				
Africa (excl. S. Africa)	0.4	7.6	43.4	49.2	51.6	51.1
Latin America	1.2	60.2	133.2	144.8	146.3	143.9
Asia (excl. China (mainland) and Japan)	1.4	42.2	95.8	93.3	97.0	99.0
	3.0	110.0	272.4	287.3	294.9	294.0
Estimates World Total	41	757	1184	1200	1210	1210
Developing World %	7.3	14.6	23.0	24.0	24.4	24.4

Source: Railways and Steel, ECE, Geneva, 1957, and World Railways, London, 1964

Thus since the middle of the last century the railway systems of the developing world have grown, particularly during the first quarter of this century, until they now account for nearly a quarter of the world total. This growth, however, had substantially ceased before the last world war, and later extensions to the network in some countries are largely counterbalanced by closures elsewhere. The summarized figures conceal much variation and a good deal of railway construction has taken place over the last ten years, notable examples being Colombia and Brazil, India and Iran, East Africa and the Congo. These selected countries, which headed the railway construction programme of their respective regions, built some 9,400 kilometres of lines since 1955. This seemingly large figure should, however, be placed into perspective against the United States' rail construction programmes, for example, where during the railway boom of the 1870's over 60,000 kilometres were built and over 75,000 kilometres in the first ten years of this century. The total rail network of developing countries is still less than that of Europe and most of them are virtually without a railway system. The very marked concentration of existing rail facilities in a few developing countries is illustrated by the fact that the three largest Latin American and the India and Pakistan railway systems between them carry three quarters of the total passenger and freight traffic in the developing world.

Total length of railway lines is an imperfect measure of the extent of a railway system, because it does not allow for differences between the proportions of multiple track lines, siding, marshalling yards, etc. Data for these are available for most developing countries and they have been summarized to show that while length of lines has marginally declined between 1955 and 1963, length of railway track has increased by 3 per cent between these two years. The difference is particularly marked in the Far Eastern region where the total is heavily weighted by the Indian railway system which increased total track length by 8½ per cent, although length of lines increased only marginally.

Traffic density and replacement requirements

With a relatively stationary railway network the steel demand for permanent way material in developing countries is largely replacement demand. The rate at which existing tracks wear out and need to be replaced depends on many factors most of which cannot be quantified for lack of statistical data. Statistics of

aggregate passenger and freight traffic carried are collected on a reasonably comparable basis and when these are related to the total length of railway lines operated an approximate picture of traffic density emerges. The country data for developing countries have been summarized as a rough indication of relative passenger and freight traffic density and their trends between two recent years:

Passenger and freight density in developing countries

Region	Passenger kilometres (in thousands) per km of railway line			Net Ton-kilometres (in thousands) per km of railway line		
	1956	1963	%	1956	1963	%
Africa (excl. South Africa)	198	250	+ 26	444	507	+ 14
Middle East	33	43	+ 30	26	27	+ 4
Latin America	237	258	+ 9	275	311	+ 13
Far East (excl. China (mainland) and Japan)	970	1335	+ 38	697	1200	+ 72
	460	606	+ 32	440	630	+ 44

Source: United Nations, Statistical Yearbook 1964, New York, 1965.

It is evident that there is a wide range of variation in the traffic density between countries, which remains visible after averaging into broad regional groupings. The figures for the Far Eastern region, which shows the traffic density for the region to be double the average for all developing countries, are heavily weighted by the figures for India, which accounts for 70 per cent of the region's passenger traffic and 82 per cent of the freight traffic. Indian Railways are investing heavily to expand capacity and to replace locomotives, rolling stock and other equipment and facilities which are becoming obsolete. During 1966 the Indian railways are investing the equivalent of 690 million US$, of which 116 million US$ will be foreign exchange. Fully stretched railway systems like the Indian are, however, counterbalanced by others that have considerable spare capacity. This follows from the fact that although the developing countries have almsot a quarter of the total length of railway lines in existence in 1965, in 1963 they carried little more than 5 per cent of world freight traffic (measured in ton-kilometres). This proportion has remained virtually the same for the last fifteen years, although freight carried has doubled over that period.

An attempt has been made to establish correlations between published statistics of rail freight traffic and associated factors such as the movement of gross national product, gross domestic product, indices of industrial production, etc. It was hoped that a measurable degree of association might turn the forecasts of economic aggregates, which are undertaken in the majority of developing countries, into a tool for forecasting the demand for railway services. In view of the wide disparity in rail freight densities which has been shown to exist it is perhaps not surprising that the attempt failed. Nevertheless it may be of some interest to show the summarized movement by regions of the factors thought to be associated between 1953 and 1963 (confined to countries for which data were available).

	Rail freight traffic (million ton-kilometres)			Gross National Product	Index of Industrial Production
Region	1953	1963	%	%	%
Africa (excl. South Africa)	13 530	17 300	+ 28	+ 35	+ 24
Latin America	35 331	40 709	+ 15	+ 60	+ 80
Far East (excl. China (mainland) and Japan)	53 263	112 151	+110	+ 55	+335
Middle East	2 200	3 581	+ 62	+ 72	n.a.

Source: United Nations Statistical Yearbook 1964, New York, 1965.

Railway track and equipment

The manufacture of railway track and equipment calls for large expensive plant operating at a high level of capacity to produce at economic cost. It is to be expected, therefore, that the number of producers and producing countries should be small and that rails should form an important part of international trade in finished steel. Before the first World War rails represented well over a quarter of the total steel imports of developing countries but this proportion has steadily declined and rails now represent less than 5 per cent. The decline in this proportion is not so much due to an absolute decline in rail imports into the developing countries, which reached a peak during the post-war deferred maintenance and replacement period greatly exceeding previous peaks reached during railway booms prior to 1914, as to a much steeper increase in total finished steel imports into developing countries. These were at about 3½ million tons before 1914 and in 1939, and rose to an average of nearly 10 million tons for the period 1960-1965. The

proportion of rails in this trade has been consistently higher than the average share of rails in world steel trade.

Import statistics, however, present only a part of the picture of rail consumption in developing countries, since imports have been increasingly supplemented by home production. There are now five steel producing industries in Latin America able to produce rails (three of them only on a fairly small scale) and India has become virtually self-sufficient for rail requirements over the last ten years. Notably due to the rise of India as a major producer of rails since 1955 the dependence of the developing world on imports has steadily declined and of the average consumption of rails of over 1 million tons per annum well over half is now produced domestically. 1964 was the first year when home production of rails in developing countries exceeded imports. In 1955 the developing countries capable of producing rails met only 10.1 per cent of their requirements from home sources but by 1964 this proportion had grown to 72.0 per cent. Obviously it would be mistaken to assume that the availability of indigenous sources is a major factor in determining the demand for rails, particularly in ignorance of the price relativity of home produced and imported rails, but the associated savings in foreign exchange presumably raised the level of consumption beyond what it otherwise would have been (see also Table 9).

Railway rolling stock

The more intensive use of existing railway networks and changes in fuel economics and efficiencies for prime movers have led to a large investment in locomotives and rolling stock in developing countries. This has had a significant effect on the product pattern of steel demand. The gradual replacement, for example, of steam locomotives by diesel and electric engines had shifted demand from boiler plates, tubes and boiler mountings to rolled steel bars, thin flats, forgings and castings. The demand for sheet, castings, alloy steels for gears and crankshafts for diesel engines and electric motors increased, although the total steel requirements are less for a given number since electric and diesel locomotives are much lighter. Electric and diesel locomotives have a shorter life but the demand for steel is not likely to increase on that score. The gradual transition from steam to diesel and electric traction is illustrated by the following regional statistics of haulage units.

Railway hauling stock in developing countries

	Year	Steam	Electric	Diesel	Diesel/Electric	Total
Africa (excl. South Africa)	1955	3 499	95	809	-	4 403
	1964	2 943	126	987	313	4 369
Latin America	1955	11 381	463	1 055	-	12 899
	1964	8 807	498	1 789	1 619	12 713
Middle East	1955	548	-	55	-	603
	1964	531	-	29	260	820
Far East (excl. China (mainland) and Japan)	1955	13 019	85	480	-	13 584
	1964	13 927	241	568	673	15 399
All developing countries	1955	28 447	643	2 399	-	31 489
	1964	26 198	865	3 373	2 865	33 301
% of total	1955	90.4	2.0	7.6	-	100.0
	1964	78.7	2.6	10.1	8.6	100.0

Source: Railways and Steel, ECE Geneva, 1957; and "World Railways" London, 1964

The construction of carriages and wagons, which is now extensively undertaken in developing countries (twelve companies in India and four in Brazil are known to be exclusively concerned with the manufacture of rolling stock), has generally gone over to integral or tubular forms of construction. This dispenses with the use of heavy sections in the building of underframes. The use of high strength, corrosion resistant steel sheets for construction and fabrication by welding increase the pay load and proportionately reduce the weight. Details of the present rolling stock park of the railway system in the developing world are as follows:

	Passenger carriages		Freight wagons		Rail cars	
	1955	1964	1955	1964	1955	1964
Africa (excl. South Africa)	6 901	7 122	92 753	103 957	275	308
Latin America	20 725	13 693	227 791	241 516	452	1 687
Middle East	782	842	15 490	20 519	15	20
Far East (excl. China (mainland) and Japan)	35 172	38 075	344 978	448 483	491	669
	63 580	54 732	681 012	814 475	1 233	2 684

Source: Railways and Steel ECE Geneva 1957 and "World Railways" London, 1964.

The Indian railway system is by far the most extensive in the developing world and it operates nearly half the passenger carriages and nearly two-fifths of the freight wagons. Nevertheless 30 per cent of the planned steel

requirements of Indian Railways in 1965/66 is for the construction of new rolling stock.

Tyres, wheels and axles

Imports into developing countries of tyres, wheels and axles for railway rolling stock have been as follows:

	1913	1929	1938	1950	1955	1958	1959	1960	1961	1962	1963	1964
	1,000 tons											
Africa (excl. South Africa)	8.8	8.6	7.4	8.4	9.5	11.0	8.2	8.7	7.3	8.6	9.7	10.5
Latin America	50.4	36.1	28.0	35.2	36.5	32.7	18.7	19.2	20.5	20.1	17.1	16.1
Middle East	6.5	0.9	1.2	3.1	6.2	1.8	1.6	3.0	2.0	1.8	2.1	1.5
Far East	28.8	28.0	30.7	23.1	26.7	31.1	67.4	73.0	44.4	87.3	72.2	39.1
Total	94.5	73.6	67.3	69.8	78.9	76.6	95.9	103.9	74.2	117.8	101.1	67.2
% of total finished steel imports	2.6	1.4	1.9	1.2	0.9	0.7	1.0	1.0	1.7	1.3	1.1	0.7

Source: Statistics of World Trade in Steel, ECE, Geneva.

Imports have thus remained stable over a long period but apparent consumption has risen substantially, the difference being supplied by local production. Over the last five years the proportion of tyres, wheels and axles consumed in developing countries met by imports has declined from 80 to 60 per cent, in so far as it is possible to estimate it from incomplete statistics. Such data as are available suggest that tyres, wheels and axles account for a major part, probably exceeding one quarter, of railway steel requirements in the developing countries.

In summary, it can be said that in the past, the building of a railway system has been an important factor in promoting economic development. During the building phase, railway material has usually been imported on a large scale and often accounted for a sizeable proportion of total steel imports to the developing countries. More recently, some countries have begun to produce their own railway material. In general in developing countries railway construction was originally undertaken to serve specific export industries, was largely financed by foreign investors and was not always well adapted to

serve the needs of the economy as a whole. More recently, the development of road and air transport facilities has altered the pattern of the most economic integrated transport system. Competition with other forms of transport has shown that railways have technical and economic advantages only in carrying bulky goods over long distances. Railways will certainly continue to be built and operated but they are unlikely to play as significant a part in the industrialisation of developing countries as they have done in the past.

Steel in the oil industry of developing countries

The oil producing industry is a large consumer of steel, mainly of tubes and fittings and, to a lesser extent, of plate and sections. Many of the oil producing countries are developing economies and apparent consumption of tubes and fittings makes up a sizeable proportion of these countries' total steel requirements.

The main uses of steel tubing in the oil industry can be described under three headings; exploration and production; transportation; and refining. The importance of each category of use varies between one country and another according to local circumstances and the stage to which the produce is processed before being exported.

Exploration and production

The two major uses of tubes at the exploration and production stage are for drilling and casing new wells. A 'drilling string' at a modern well can be up to 20,000 ft. deep and consists mainly of successive sections of drill pipe, each usually about 30 ft. long. At a depth of 5,000 ft., the entire drilling string may weigh 50 tons or more. When drilling is successfully completed, the drilling string is removed and casing inserted. This, like the drill pipe, is also often in 30 ft. lengths, and becomes progressively narrower as the well deepens. A typical casing programme of a 15,000 ft. well might be: 18.5/8th inch diameter casing to about 500 ft., 13.3/8th inch casing to 4,000 ft., 9.5/8th inch casing to 7,000 ft. and a 7 inch casing to completion. Both drill pipe and the casing are invariably made of seamless tubing.

The amount of tubing used for exploration and production purposes clearly varies between one country and another according to the intensity of exploration, the density of the oilfields and the depth at which the oil is found. More new tubing will usually be used in unexploited areas than in well surveyed oilfields

nearing exhaustion.

Transportation

The principal methods used for the transportation of oil from the oilfields to the refinery or marine terminal for shipment overseas is by pipeline. By 1962, there were 240,000 miles of oil carrying pipeline in existence in countries outside Eastern Europe, the USSR and China (mainland). The carriage of refined products by trunk pipeline has also steadily increased over the last twenty five years.

Modern pipelines are usually constructed of steel pipes each 30-40 ft. long, varying in diameter from about 6 inches to over 30 inches. The smaller pipelines i.e. those under about 20 inches diameter are usually made of seamless tubing, but the larger trunk pipelines are often constructed of welded pipes. For protection, pipelines are usually coated with bitumen or coal tar and one or more wrappings of bitumenized felt or glass fibre. Under normal conditions the life of a pipeline may be twenty five years or more.

The distribution and number of pipelines among the oil producing countries depends on a number of factors, notably the distance from the oilfield to the refinery or marine terminal, the number of output of the oilfields and the type of terrain to be crossed.

Refining

The developing countries (as defined for the purposes of this study) produce just under one half of the world's crude oil supplies. Of the total a little over half comes from the Middle East, rather more than a third from Latin America, under 10 per cent from Africa and under 5 per cent from the Far East. World oil refining capacity is mainly located in the industrialized countries. At the end of 1964, only 22.1 per cent of total capacity was situated in the oil producing developing countries. This proportion has diminished and continued to do so as the development of larger tankers has reduced unit transport costs for crude oil and as the spread of crude and product pipelines has altered the respective locational weights of raw materials and final product markets in the economics of refinery location. A large quantity of tubes and fittings are used in the construction of a refinery and so make up an important part of the demand for tubes in the oil producing areas.

Petroleum refining is a process of considerable and growing complexity. Refineries, and especially cracking plants require a large quantity of mild steel and alloy tubes, some of which must be capable of withstanding very high pressures and temperatures. In all, it has been estimated that about 5-6000 tons of seamless tubes are needed in the construction of a small modern refinery, of which some 5-6000 tons would be made of alloy steels.

Consumption of other steel products by the oil industry

The oil industry consumes considerable quantities of other steel products apart from tubing, notably plates and sections. Plates are used, inter alia, in the construction of "fractioning towers," and more especially, in the building of "tank farms" where the crude or refined oil is stored before refining of shipment. For example, a modern tank farm built recently on Kharg Island in the Persian Gulf, consisted of eleven tanks with a capacity of half a million barrels each and was constructed from 16,000 tons of 8 ft. x 30 ft. plate varying in thickness from 3/8th inches to 1.5/8th inches. In connexion with the same project a ten berth jetty was also constructed in the form of welded steel box frames supported on steel piles.

Steel consumption and oil production

It is obvious that the demand in different countries will vary considerably according to local circumstances, and that there is not likely to be a close relationship between the volume of oil production and steel consumption, except in the general sense that in the course of the development of an oilfield the demand for drilling and casing tubing will precede the demand for pipeline and tubing used for refineries. The relationship between oil production and steel consumption in the oil industry is further weakened by the fact that once these large scale investments have taken place and existing resources are in full production, steel usage will drop sharply (to a level required by maintenance) although oil production may continue at a high, or even rising level.

The following statistics illustrate these relationships. Table 10 gives apparent consumption of tubes and fittings in the main oil producing of the developing countries in selected years between 1913 and 1964. Although tubes are, of course, used for many other purposes the figures are probably fairly representative of general trends in the oil industry.

Table 10 shows that apparent consumption of tubes and fittings in the oil

producing developing countries, which produce about half the present world output of crude oil, almost doubled over the last ten years. Steel demand for oil exploration, producing and refining is clearly one of the major factors determining world steel trade trends and tubes and fittings have accounted for about one seventh of the total over the last ten years fairly consistently. There is, however, a good deal of variation between regions. In Africa, for example, the proportion of tubes to total steel imports has risen from under 10 per cent before the war to nearly a quarter in 1964, whereas in the Middle East the proportion has declined from nearly a third in 1950 to under 15 per cent in 1964. For Latin America the ratio has declined somewhat, mainly due to substitution of imports by domestic production. Mexico, the largest tube consumer in Latin America, has now displaced virtually all imports.

The table shows also that in several countries, such as Mexico, Argentina, Kuwait, Iraq, Saudi Arabia, Algeria and Indonesia, apparent consumption of tubes and fittings reached a peak in 1959-1961, in some cases dropping to almost half that level by 1964. On the other hand, in Venezuela, one of the longest established oil producers, apparent consumption reached a peak in 1958. In the remaining countries (Brazil, Iran, Libya and Nigeria), apparent consumption is still rising. Also illustrated by the figures is the considerable "lumpiness" of tube consumption comparing one year with another. This, again, is a reflection of the investment pattern peculiar to the oil industry. To take an example: in Algeria (including the Sahara), there were under thirty producing oil wells in 1955, no major pipelines and no refineries. Apparent tube consumption was only 13.3 thousand tons in that year. In 1959, 1960 and 1961, three major pipelines were built, extending in aggregate for almost 1200 miles. Apparent tube consumption rose steeply to total 190.2 thousand tons, 158.6 thousand tons and 121.2 thousand tons in each respective year. No major pipelines were built between 1961 and 1964 and tube consumption fell again to 58.0 thousand tons in 1962. However, two refineries were then built and there was a rapid expansion of drilling. In 1964, there were 587 producing wells and tube consumption was again running at a level of almost 100,000 tons.

These developments are not reflected, even with approximate time lags, in actual oil production figures, which in all the oil producing areas have risen fairly steadily over the last decade. Table 11 gives crude oil production figures in selected years between 1950 and 1964 for the main oil producing

countries in the developing areas.

A comparison of Tables 10 and 11 shows that in recent years the Latin American countries have produced rather less oil in relation to their tube consumption than have the Middle Eastern countries. In 1960-1962, for example, the Latin American countries produced 39.3 per cent of the world's oil although apparent consumption of tubes was 55.8 per cent of the total. In the Middle East, the respective percentages were reversed at 52.6 per cent and 19.7 per cent.

The divergencies are partly explained by the fact that the Latin American countries use a great number of tubes for other purposes such as irrigation and industry; but they are also partly explained by the fact that there are over fifteen times as many oil wells in Latin America than in the Middle East and over twice as many refineries, although oil production is smaller.

In summarizing it appears that tube consumption in the oil industry bears little relation to oil production either in any one year or in terms of growth over time. The volume of tube consumption by the oil industry depends primarily on physical factors such as the area, depth and capacity of the oil fields and their distance from the refinery or marine terminal; and, to a lesser extent, on commercial factors such as the relative advantages of locating the refinery in the oil producing country itself as against exporting the crude oil. The same considerations apply broadly to consumption of other steels by the oil industry.

Steel demand of the mining and manufacturing industries in developing countries

The demand for steel in the mining and manufacturing sectors of a developing economy depends on a number of factors, notably the range of steel-intensive products made, the size of the steel-using sectors, and the extent to which steel-intensive investment and consumption goods are imported or made locally.

These factors are closely bound up with the problem of growth itself, a full discussion of which is beyond the scope of this study. However, one might briefly mention some of the more important considerations insofar as they throw light upon the pattern of steel using activity and its evolution in the developing countries.

The structure of the developing economy

Observation shows that almost all developing economies have developed a "dual" structure in which the modern, industrialized sector, usually based on one or two towns, is distinctly separated from the rest of the economy without there being any real integration or cohesion between them. One reason for this state of affairs is that historically, development has often been initially stimulated by external factors, i.e. demand from industrialized countries for the foodstuffs and raw materials which the developing countries can supply. Thus manufacturing activity in these countries tends to centre round a few highly organized mining or processing industries, for example rubber and tin in Malaya, meat processing in Argentina, oil in Iran and Saudi Arabia, etc., phosphates in Morocco, copper in Chile and Zambia, etc. The rate of investment in these industries depends mainly on the profits of the exporting companies which in turn will mainly depend on the state of demand in industrialized countries. Similarly, the type of the investment is largely determined by the level of technology in the industrialized consuming countries rather than by the level of skills and technical know-how already present in the emerging country. Likewise, by a process of simulation and thanks to modern methods of communications, a highly modernized technology tends to spread to other industries having no relation to the export trade.

There thus exists a discontinuity between a modern, manufacturing sector, which is basically capital-intensive, and the remainder of the economy, in which manufacturing is mainly based on primitive, traditional methods. This is especially true as regards steel-intensive industrial production which usually only occurs on a significant scale in the modern sector of the economy. As this sector is typically modern, the steel intensiveness of the investment and consumption goods made tends to be similar to that in industrialized countries.

The steel products made

a) Export-oriented industries

The precise product pattern of steel output in each country will vary according to circumstances. In fact, observation shows that experience differs widely between countries, and this is particularly true if one considers the predominant export activity in each country. In the following table, the activities are listed which between them account for the large majority of

exports from the developing countries.

Country	Principal exports
Afghanistan	Fruit and nuts, fur, skins
Argentina	Meat, wheat and maize, textile fibres, sugar
Bolivia	Tin
Brazil	Coffee
Burma	Rice
Chile	Copper, iron ore, saltpetre
China (Taiwan)	Sugar, textiles, miscellaneous manufactures
Colombia	Coffee, petroleum
Congo (Kinshasa)	Copper, diamonds, tin, rubber, coffee, wood manganese
Egypt (UAR)	Cotton
Ghana	Coffee, wood, manganese
Hong Kong	Manufactured goods (textiles and clothing)
India	Textiles, tea
Indonesia	Rubber, petroleum
Iran	Petroleum
Iraq	Petroleum
Ivory Coast	Coffee, cocoa, wood
Jamaica	Sugar, bauxite, alumina
Kenya	Coffee, vegetable fibres
South Korea	Wide range
Liberia	Iron ore, rubber
Madagascar	Coffee, spices, sugar, rice sisal
Malaya	Rubber, tin
Mexico	Wide range of food and raw materials: few raw material based manufactures
Morocco	Phosphates, fruit and vegetables
Mozambique	Cotton, sugar, cashew nuts
Nigeria	Oil seeds, cocoa, petroleum, tin
Peru	Wool, cotton, guano, copper, iron ore
Philippines	Sugar, copper, wood
Rhodesia and Malawi	Copper, tobacco
Sierra Leone	Diamonds
Tanzania	Sisal, cotton

Country	Principal exports
Thailand	Rice, rubber, maize, tin
Trinidad and Tobago	Petroleum
Tunisia	Phosphates, wine, fruit and vegetables, oils
Uganda	Coffee, cotton
Venezuela	Petroleum
South Viet Nam	Rubber, rice

It can be seen that in nearly all countries the export structure is based on a small number of products with few countries having the same combination. Only in China (Taiwan), South Korea, Hong Kong and Mexico is there a wide diversity of exports - and in all cases except Hong Kong this is probably due to their close geographical or political proximity to the United States market. The exports of most other countries are either agriculturally based, or based on mined raw materials, a distinction which greatly affects the quantity and type of steel intensive investment in the export sector of the economy. A mining economy requires more steel per unit of capacity than an agricultural economy per unit of investment. For example, in Rhodesia in 1961, 1.3 tons of steel per thousand pounds of capital formation was used in agriculture compared with 3.1 tons in mining. In a mining economy, the products which will be used in the largest quantities include support arches and other heavy rolled products; while in an agriculturally based export economy, the main requirements will be for galvanized sheet and bars and light sections to provide food storage facilities and farm buildings.

The demand for steel in the export sector of these economies depends also on the demand for the exported product and on the developing countries' ability to supply it. This can vary considerably over time for a single country. For example, production of tin in the Congo (Kinshasa) declined by nearly 50 per cent between 1955 and 1963, while in Thailand it increased by about 40 per cent. Steel consumption showed a similar movement in the two countries. In general, mining production in Brazil, Chile, India, Jamaica, Liberia, Mexico, Peru, Sierra Leone, Thailand, Venezuela and Zambia increased substantially between 1955 and 1963; production in British Guiana, Burma, Ghana, Federation of Malaya, Nigeria, Philippines, Surinam and Tunisia remained fairly stable; and production in Algeria, the Congo (Kinshasa) and Indonesia declined. Insofar as steel-intensive investment in mining is related to production, this gave an

impression of the changing demand for steel in this sector.

b) Home market oriented industries

In addition to its uses in the export industries, steel is used in varying quantities in industries based on domestic demand. The factors influencing the demand for steel-intensive goods are largely the same as those influencing the demand for industrial - and especially investment - goods generally; i.e. the size of the market, the capital available for investment, comparative costs vis-à-vis imports, the presence of the necessary skills and entrepreneurial spirit, political security, etc. Unfortunately little information exists as to the structure of industry in the various developing countries, the quantity and type of investment in each and the relationship between this investment and the level of development. A census of industrial activity has been made in several countries in connexion with their development plans, but they are frequently out of date and in many cases only one census has ever been carried out in a particular country. What little information there is shows that the main outlets for steel at early stages of a country's development include steel for:

a) The manufacture of steel-intensive goods on a mass production basis where the market is sufficiently large. In early stages of development, the demand is mainly for consumer goods such as hollow ware, bicycles and building components, (e.g. window and door frames), roofing materials, baling hoops for textile, agricultural and jute industries, agricultural implements and accessories, and bolts, nails, valves and springs. In later stages of growth, demand for mechanical engineering industries making basic investment machinery such as frames, looms, oording and winding machinery for textile, etc. begins to grow in importance.

b) Jobbing work, i.e. the production on an individual basis of special machines and appliances, including machine tools.

c) The manufacture of electrical goods, if the market is a large enough, i.e. where hydroelectric development has occurred in the developing country. Products might include cables, switchgear, transformers and electrical motors.

d) Repair or maintenance work on imported vehicles and machines.

The steel products mainly used in these industries include wire rods and some light sections and bars, strip, light plate, cold reduced sheet and

tinplate as can be seen from Table 12. The table has been compiled on the assumption that due to the "dual" technological structure of the developing economies, the steel-intensiveness of manufactured products will be roughly the same as in the industrialized countries. A tractor manufactured in Burma, for example, will require the same steel content as a tractor built in the United Kingdom. The pattern of steel consumption in each of the industries listed above is set out in the table which is based on experience in the United Kingdom in 1964. It is shown, for example, how light rolled sections and hot rolled bars are the most important steel products used for tools and implements, bolts, nuts, screws and metal windows and door-frames. Tinplate is the major product consumed by the food, drink and tobacco industries and by the cans and metal boxes industry.

An example of the similarity of produce breakdown between the industries of the industrialized countries and those in developing economies is brought out by comparing Table 12 with the figures in Table 13, which lists the various steels and their proportionate uses in Indian industry as forecast in 1963 for 1965-1966.

In motor vehicles, for example, the similarities are striking: 46 per cent of sheet and 14 per cent bars and rods were used in the United Kingdom, as compared with 52 per cent and 17 per cent in India. Again, in electrical engineering, the proportions shown for the United Kingdom were 44 per cent for sheet and 26 per cent for plates, compared with 39 per cent and 18 per cent in India. The differences are not so much due to differences in technical requirements of like products, but rather to differences in production within the broad industrial classifications available.

The size of the steel-using manufacturing sector

If one factor influencing the demand for steel in the developing countries' manufacturing industry is the product pattern, another is the size of the sector making these products. Unfortunately, the statistical information necessary to analyse the relationship between industrial growth and the size of the steel-using manufacturing sector exists for few of the developing countries. In this section only a broad indication of the size and rate of growth of the manufacturing sectors as a whole can be given.

Most developing economies explicitly formulate their economic aims in a

national plan. Industrial growth is necessarily a central issue, although its function and scope differs from country to country. Countries also differ in the way actual experience has measured up to the targets laid down in their plans. Table 14 lists a number of developing countries and gives (a) the size of the manufacturing sector as a percentage of gross national product in 1963, (b) the past growth rate of gross national product, (c) the 'planned' rate of growth in manufacturing industry in the years covered by the plan, and, (d) the actual rate of growth in manufacturing industry during the plan so far.

The table amply illustrates the variety of experience which is to be found in the developing countries; with 'planned' growth rates in manufacturing ranging from 6½ per cent to 21 per cent and real growth of gross national produce from -0.4 per cent to 6.7 per cent. The size of the manufacturing sector also varied between 5 per cent and 22 per cent of gross national product in 1963. Nor was any meaningful relation to be found by comparing the rate of growth of manufacturing with the size of the sector. At the levels of development attained by these countries, the individual factor endowments, including the availability of raw materials, proximity to industrialized markets, and political and social structure, make for differences that cannot be explained in terms of indigenous economic forces alone.

However, within the manufacturing sector as a whole, there are certain features which do seem to be fairly common experience among the developing countries. Two points may be made which are relevant to the growth of steel consumption. First, in very early stages of development manufacturing growth tends to centre around light consumer industries which are not large steel consumers. This is often followed by the establishment of certain producer goods industries, such as cement and fertilizers. After this it is common for the developing countries to gear their growth plans towards the establishment of heavy industry, sometimes including a steelworks, for the manufacture of investment goods and also to speed up the process of import substitution. The second point is that the expansion of metal and metal products manufacture in the heavy industries sector may proceed at rates considerably faster than the growth of other parts of the industrial sector. This is shown in Table 15. The table shows the actual growth rates of various sectors compared with metals, for principal regions between 1958 and 1962.

The table shows that for the less industrialized countries as a whole,

the basic metals and metal products industries showed the highest rates of growth of all industrial sectors. The predominance of the growth of metal goods was most marked in Asia. One reason for this is the emphasis countries place on metal goods in their development plans. In Venezuela for example, the currently planned annual rate of growth of manufacturing industry is 13½ per cent per annum. Basic metals, on the other hand, are expected to rise by 55 per cent, and metal products by 26 per cent. Similar figures for China (Taiwan) are 12½ per cent, 20 per cent and 41 per cent; for South Korea 11½ per cent, 18 per cent and 20 per cent; for Colombia 5½ per cent, 14 per cent and 14 per cent and for Chile 6½ per cent, 8 per cent and 9 per cent.

Another reason for the emphasis on expansion of metal production is the need, common to almost all the developing countries, to substitute home production for this important category of imports in order to alleviate the foreign exchange burden.

Finally, there is no doubt that strategic and sometimes prestige considerations play a role in countries' decisions to set up certain heavy industries. Steelworks themselves are a good example. These are large consumers of steel, and their establishment plays an important part in consumption patterns in the period during which they are erected.

It can therefore be said that the rate of growth of the metal sector is one of the most important factors stimulating the demand for steel. Not only is an expanding engineering and light investment industry indispensable to the growth of the industrial sector as a whole, and hence is emphasized in nearly all development planning, but experience has shown that in the past it is these sectors which have, in fact, shown the fastest rates of growth.

Import substitution of steel-intensive goods

The third major factor influencing the demand for steel in the manufacturing industries of the developing countries is the extent of import substitution of steel-intensive goods. Here, one must distinguish between investment and consumption goods.

a) Investment goods

At early stages of development virtually all heavy investment goods are imported as complete units. Not only does the know-how and finance often not

exist to enable these goods to be made locally, but more important, there is seldom sufficient effective demand in the country to make the establishment of a manufacturing plant worthwhile. There are several reasons for this, one of which concerns the relationship between the level of technology inherent in modern producing investment goods, the consequent high level of output which must be obtained from machines to produce a satisfactory rate of return, and the inability to stimulate sufficient demand to absorb this high output at low levels of economic development. Until the size of the effective market reaches a point at which a domestic investment goods industry has sufficient outlets to be viable the developing countries will continue to import their requirements. Alternatively, it might be possible to design investment machinery with a lower total output potential but with the same or lower unit costs. This might be an effective way of bringing forward the "take-off" point at which a developing country could establish its own heavy investment industry on a large scale, and hence substantially increase the demand for steel. Such technology does not, however, exist to any significant extent at present. Without it, and given the "dual" nature of the economy to which reference was made earlier, there are real problems in effecting a rational policy of import substitution, and when it is attempted countries frequently have to resort to protective tariff or other barriers to trade to insulate their newly developed industries from external competition.

It is difficult to generalize about the point in a country's economic growth when import substitution becomes economic, or when it actually occurs. A country with a strong export surplus and a healthy balance of payments will probably be less concerned with the need to curb imports than a country in acute balance of payments difficulties. The state of a country's balance of payments situation depends primarily on the composition of its exports, the demand for and the terms of trade of its exports, its population growth, the ability of its government to adjust its import requirements to the resources available, etc.

A country's decision to set up an industry to produce import substitutes will depend on the size of the effective market, which is determined by a variety of factors, e.g. the income and property distribution in the country, net domestic savings, the size of the consuming population in the monetized sector, and especially the size of the export sector. For example, in cotton exporting countries such as China (Taiwan) or Hong Kong, manufacturers of cotton

dyeing, spinning and weaving machinery tend to spring up comparatively early in the development of the investment industry. Similar considerations apply in some of the mining economies, although where the mine is owned by an overseas company, imported machinery is often used up to a relatively late stage in the country's development unless the government intervenes against this possibility.

The little statistical evidence which exists shows that in spite of wide discrepancies between countries, there is a general tendency for the value of imported plant and machinery to decrease as a proportion of investment in plant and machinery as the country develops. In East, Central and West Africa, for example, the proportion of locally manufactured machinery and transport equipment is about 10 per cent of the total, the remainder being imported. In Rhodesia, on the other hand, the engineering industries have developed to the extent that about 25 per cent of these requirements are manufactured locally and a further substantial proportion assembled.

b) Consumption goods

Local production of these goods begins far earlier in development than in the case of investment goods, for several reasons. First, in many cases the product has always been made, but of another material. The switch to steel manufacture is therefore much less abrupt than would be the introduction of modern investment machinery for which there are no precedents. Second, the expansion of locally made consumption goods is easier in that the less the unit cost of the final product in relation to income levels and the prices of goods being replaced the larger the market, and the easier it is to keep output at levels which bring in an adequate return. Third, the expansion of steel-intensive consumption goods often occurs incidentally to the expansion of another complementary good for which demand already exists; for example, tinplate with foodstuffs, wire with rubber tyres, strip for baling, etc. Finally, at low stages of development there exists a wide demand for a range of goods - such as hand tools - which fall between the normal definitions of an investment or a consumption good, but which are steel-intensive. The development of these manufactures invariably precedes the development of investment goods industries proper.

D. CONCLUSIONS

All theoretical approaches to development policy accept that the association between economic structure and stages of growth is the result of interaction. It is generally held that levels of income affect the growth of industrial sectors, which in turn influence income levels. From this it follows that there should be an observable pattern common to countries at different stages of development and that all countries follow more or less the same path. As far as steel consumption is concerned there is, however, little evidence that this pattern approach yields a serviceable account of the growth behaviour of countries over time.

In the countries at early stages of economic growth, exogenous factors predominate and the biggest steel users are often either expatriate export-orientated industries, or government agencies concerned with major infrastructure projects. The quantities of steel used in industry and agriculture are insignificant at early stages of development and demand in these sectors is limited by the minimum range of projects necessary to sustain the societies economic life. Hence, apart from demand for general purpose bars, rods and sheet, constructional steels, oil tubing, or railway material usually form the greater part of the demand, and until industrial growth begins, per capita steel consumption tends to remain low.

The next phase in many countries is characterized by the growth of light, mostly consumer orientated industries, often situated in one or two confined areas, such as the capital city and other larger towns. These industries tend to be either ancillary to the export orientated industries mentioned above, (oil products, in the Middle East, rubber goods in Malaya, etc.), or they arise out of hitherto hand operated crafts (textiles in India and Hong Kong, etc.), or they replace traditional methods of satisfying basic consumer wants (meat processing, cement making, etc.). Direct steel consumption in these industries is usually small; most steel used being incorporated in imported investment goods. A limited amount of constructional steel is used in the plant buildings of these industries. The demand for steel in one sector of the economy still

tends to remain unaffected by events in other sectors. (1) It is only at much higher growth levels that the events in one sector gradually begin to make themselves felt on another, until in the developed countries, which are more homogeneous in economic terms, an increase in demand in one sector has immediate repercussions on the rest of the economy. This is also true for steel demand, which then tends to fluctuate in similar directions and in direct relation to economic growth in general.

Therefore, until that stage is reached, opportunities of increasing steel consumption vary with the type of economy being developed, i.e. with the different degrees of steel intensity obtaining in different sectors or steel using industries. It is clear that potential steel demand in developing countries is enormous (a rise in consumption of only 10 kg per capita among the rural population of the developing countries would necessitate an increased world steel output of no less than some 12 million tons), but that its realization will depend on the progress of development in general.

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(1) This independence of steel demand in each sector of the developing economies explains why there are so few meaningful statistical relationships between steel consumption per capita (or in total) and the various macro-economic variables available for the developing countries. For example, an increase in gross fixed capital formation may or may not be accompanied by an increase in steel consumption, depending on whether the investment was steel-intensive (e.g. a railway) or not (e.g. a road).

Table 1

Development of steel production in developing countries as a proportion of apparent consumption by regions, 1913 to 1965

(percentages)

Region	1913	1929	1938	1950	1960	1965
Latin America	-	5.6	11.5	34.8	56.5	67.6
Africa (excl. South Africa)	-	-	-	2.9	4.7	4.8
Far East (excl. China (mainland) and Japan)	-	19.6	22.1	41.6	51.7	58.7
Middle East	-	-	-	-	9.6	16.4
Developing world	-	9.8	15.9	29.2	44.7	53.5

Source: Calculated from Long-term Trends and Problems of the European Steel Industry, loc. cit.; and the European Steel Market, ECE, Geneva, several issues.

Table 2

Home Production as percentages of Apparent Consumption[(a)] in India and Latin America, 1955 to 1964

INDIA	1955	1958	1959	1960	1961	1962	1963	1964
Railway track material	53.5	11.2	72.1	45.0	50.0	69.2	75.3	100.0
Heavy and light sections	75.0	71.7	80.0	88.0	93.0	94.0	94.0	94.3
Wire Rods			90.0	84.5	95.0	91.0	89.1	83.1
Strip	16.6	33.5	35.6	30.6	64.2	53.0	60.0	78.3
Plates	67.9	70.0	58.3	71.3	70.6	84.0	76.6	69.3
Sheets			72.5	47.0	50.9	67.0	71.1	67.2
Tubes and fittings	-	-	74.9	56.2	79.0	-	-	-
Wire	40.9	50.1	47.0	26.3	37.5	39.5	47.5	75.5
Tinplate	56.9	57.1	48.9	47.0	67.0	68.8	67.9	62.5
Wheels, tyres and axles	86.0	54.0	72.0	72.0	40.0	31.5	52.0	68.0
LATIN AMERICA								
Ingots and semis	4.2	6.4	6.5	19.2	13.2	53.3	62.5	10.9
Railway track material	8.3	7.6	8.6	14.9	30.0	27.8	22.7	21.5
Heavy and light sections	52.1	63.2	63.5	78.5	61.0	83.8	84.0	85.0
Wire rods	96.0	91.0	92.0	97.7	95.9	95.0	95.0	93.3
Strip	70.1	74.0	79.1	72.5	73.0	79.0	80.0	80.0
Plates	32.8	52.8	64.7	37.8	56.3	55.0	71.0	87.0
Sheets	26.3	10.4	12.0	72.1	65.9	74.0	73.1	71.0
Tubes and fittings	6.1	32.7	33.6	43.5	50.0	46.5	39.0	52.7
Tinplate	5.8	26.9	37.5	33.2	47.6	50.0	30.3	29.1

Source: The European Steel Market, ECE, Geneva, various issues; and Iron and Steel Annual Statistics 1965, London 1966.

(a) In finished steel weight.

Table 3

Development of Apparent Steel Consumption in Developing Countries by Regions, 1913 to 1965

(1,000 tons crude-steel equivalent)

Region	1913	1929	1938	1950	1957	1960	1965
Latin America	2,260	2,694	2,006	3,781	8,051	8,414	12,144
Africa (excl. South Africa)	425	504	459	1,171	1,648	2,135	2,512
Far East (excl. China (Mainland) and Japan)	2,643	3,280	4,110	3,541	6,026	8,187	13,852
Middle East	270	373	409	1,222	1,459	2,034	3,200
Developing World	5,598	6,851	6,984	9,715	17,184	20,770	31,708
Indices:							
1913=100	100	122	125	174	307	371	566
1957=100	33	40	41	57	100	121	185

Source: Long-term trends and Problems of the European Steel Industry, ECE, Geneva, 1959; and The European Steel Market, various issues, ECE, Geneva.

Table 4

Development of per capita apparent steel consumption in developing countries by regions, 1913 to 1965

(kg. per head)

Region	1913	1929	1938	1950	1958	1960	1965
Latin America	25.0	23.9	13.2	23.3	41.0	39.0	50.0
Africa (excl. South Africa)	3.1	6.0	3.8	6.2	9.6	10.0	9.6
Far East (excl. China (mainland) and Japan)	3.2	4.5	2.9	3.1	7.1	9.1	13.0
Middle East	6.3	12.7	9.7	19.3	20.3	25.5	36.0
Developing world	7.2	8.9	5.6	8.5	14.0	15.2	19.0
Indices:							
1913=100	100	124	78	118	195	211	264
1957=100	51	64	40	61	100	109	136

Source: Cf. table 3

Table 5

Pattern of Rolled Steel Consumption and Per Capita Consumption in Developing Countries 1962-1964

Type of economy	Country	Per Capita Consumption of steel in 1963 (kg)	Proportion of products in total (percentages)						
			Railway Material	Heavy and light sections	Plates	Sheets	Tubes and fittings	Tinplate	Wire rods
A	Indonesia	3 (a) (b)	10	31	7	18	11	2	3
M	Congo (Kinshasa)	3	7	30	8	32	13	2	-
A	Pakistan	8 (a)	7	13	5	30	8	7	2
A	Egypt	10	12	40	3	9	18	7	-
A	Thailand	11	-	29	5	37	11	4	-
AM	Philippines	20 (a)	-	15 (c)	8	33	6	12	5
A	India	14	10	38	14	19	n.a.	4	-
P	Iran	20	-	46	3	17	26	2	-
AM	Malaya	26	3	34	12	23	12	7	1
A	Uruguay	26	-	46	5	20	5	10	5
P	Colombia	30	2	28	4	16	7	6	7
A	Brazil	43	3	30	8	31	3	1	9
P	Iraq	39	3	69	3	9	10	3	-
AM	Mexico	57	4	22	5	27	13	4	7
A	Argentina	63	1	33	12	16	11	5	13
M	Chile	74	6	30	3	28	4	5	7
P	Venezuela	91	-	29	3	10	21	11	5
A	= Agricultural Economy	22	5.5	32.5	7.5	25	9.5	5	4
AM	= Mixed Agriculture and Mining	31	2	24	8	28	10	8	4
M	= Mining	39	6.5	30	5.5	30	8.5	3.5	3.5
P	= Petroleum	45	1	43	3	13	16	5.5	3

Source: The European Steel Market, ECE, Geneva, various years and Statistics of World Trade in Steel, various years. (a) - 1962; (b) - 1961; (c) - Includes wire rods.

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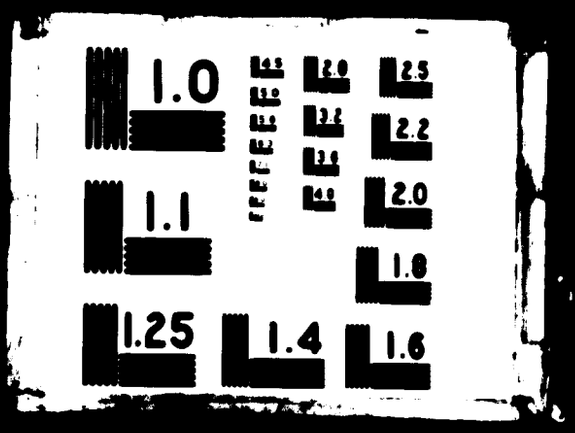

Table 6

Pattern of Rolled Steel Consumption and Per Capita Consumption of Steel in Developing Countries
1955-1957

Type of Economy	Country	Per capita consumption of steel in 1955 (kg)	Proportion of products in total consumption (percentages)						
			Railway Material	Heavy and light sections	Plates	Sheets	Tubes and Fittings	Tinplate	Wire rods
A	Indonesia	3	3	29	5	27	17	10	1
M	Congo	13	15	38	7	26	10	-	-
A	Pakistan	4	22	12	6	14	20	6	-
A	Egypt	14	9	51	7	8	13	4	-
A	Thailand	9	18	31	4	28	6	9	-
AM	Philippines	13	1	15	5	37	8	21	-
A	India	8	11	46	6	21	4	5	1
P	Iran	15	30	30	5	11	19	3	2
AM	Malaya	36	4	35	10	21	12	11	-
A	Uruguay	36	-	30	5	19	2	18	3
P	Colombia	27	1	33	8	24	20	7	-
A	Brazil	25	11	30	10	7	9	13	1
P	Iraq	33	6	67	2	7	14	3	-
AM	Mexico	31	15	27	11	11	21	9	-
A	Argentina	108	10	33	11	12	5	11	1
M	Chile	54	13	26	10	11	6	7	6
P	Venezuela	109	5	34	3	2	50	2	-
A	Agricultural Economy	26	10.5	33	7	17	9.5	9.5	1
AM	Mixed and Agricultural Mining	27	7	26	9	23	14	14	-
M	Mining	38.5	14	32	8.5	18.5	8	3.5	3
P	Petroleum	46	10.5	41	4.5	11	28	4	0.5

Source: Long-term trends and problems of the European steel industry, ECE, Geneva, 1959; United Nations, Statistical Yearbook 1956, New York, 1957.

Table 7

Apparent Consumption of Sections and Bars in Developing Countries
(1962-1964 averages)

AFRICA	Thousands of tons
Algeria	30.9
Angola	12.4
British East Africa	26.5
Central African Customs Union	13.1
Congo (Leopoldville)	16.7
Ethiopa	6.8
Federation of Nigeria	45.0
Federation of Rhodesia and Nyasaland	76.1
Ghana	25.8
Guinea	2.6
Liberia	22.5
Libya	23.3
Morocco	62.1
Mozambique	11.5
Rwanda - Burundi	1.1
Sudan	35.8
Togo	9.3
Tunisia	31.6
'Other' Africa	92.2
MIDDLE EAST	
Bahrain	6.1
Iran	164.2
Iraq	113.5
Israel	58.3
Kuwait	65.9
Lebanon	98.8
Saudi Arabia	32.8
Syria	64.3
Egypt	63.9
'Other' Middle East	69.0

LATIN AMERICA	Thousands of tons
Argentina	455.1
Bolivia	6.3
Brazil	846.2
British West Indies	33.8
Chile	230.9
Cuba	27.9
Dominican Republic	15.8
Ecuador	18.7
Haiti	4.2
Guatemala	17.8
Honduras	4.9
Mexico	517.6
Panama	3.6
Paraguay	0.8
'Other' Latin American	70.5
FAR EAST	
Afghanistan	2.1
Burma	8.3
Ceylon	25.1
Federation of Malaya	62.7
Hong Kong	188.6
Indonesia	53.9
Laos	0.8
Pakistan	59.2
Philippines	53.1
Republic of Vietnam	13.1
Thailand	76.2
'Other' Far East	74.8

Source: National production Statistics: Statistics on World Trade in Steel, ECE, Geneva, several years.

Table 8

The Pattern of Constructional Avtivity in Developing Countries

Country	Year	Gross National Product (GNP) per capita (in US$)	Construction as percentage of GNP	Share of investment in construction (percentages)		
				Dwellings	Non-resid. buildings	Other constr. and works
China (Taiwan)	1958	92	4	21	42	37
	1963	121	4	25	35	38
Fed.Malaya	1958	186	-	23	22	55
	1963	222	5	15	22	63
Philippines	1958	113	3	54	46	
	1963	127	4			
Rep.Korea	1958	110	4	19	37	44
	1963	124	4	16	32	52
Thailand	1958	84	5	26	74	
	1963	112	5	16	84	
Honduras	1958	177	5	42	19	39
	1963	193	4	39	35	26
Puerto Rica	1958	550	7	39	61	
	1963	886	8	42	58	
Trinidad and Tobago	1958	486	4	28		72
	1963	581	6	29		71
Chile	1958	398	3	61		39
	1963	457	4	55		45
Colombia	1958	248	4	47		53
	1963	298	5	36	11	53
Ecuador	1958	165	3	33	20	47
	1963	189	4	36	25	39
Venezuela	1958	650	7	25	65	10
	1963	716	4			
Jordan	1958	162	5	35	13	52
	1965	204	4	36	13	51
Kenya	1958	83	4	29	29	42
	1963	88	2	16	21	63
Mauritius	1958	197	5	45	22	33
	1963	270	5	48	3	39
Morocco	1958	142	4	47		53
	1963	144	4	40		60
Nigeria	1958	91	2	48		52
	1963	102	3	48		52
Rhodesia and Nyasaland	1958	152	9	93		7
	1963	175	5	89		11
Sudan	1958	69	7	19	41	40
	1963	80	7	16	38	46
Tanganyika	1958	57	6	50	28	22
	1963	79	3	18	38	46
Uganda	1958	65	3	68		32
	1963	75	2	21	33	46

Source: National Accounts Statistics 1964, United Nations, New York, 1965.

Table 9

Imports of Rails and Fittings into Developing Countries, 1913 to 1964
(thousands of tons)

Region	1913	1929	1938	1950	1955	1958	1959	1960	1961	1962	1963	1964
Latin America	498.9	370.1	97.2	108.2	277.3	276.3	324.1	303.2	117.0	155.9	243.6	292.3
Middle East	29.5	50.9	33.6	113.4	163.2	43.9	43.8	67.8	47.9	32.9	43.5	22.3
Far East (excluding China (mainland) and Japan)	278.2	253.9	209.2	191.8	375.7	688.6	175.9	357.2	369.5	331.7	197.2	50.6
Africa (excluding South Africa)	124.7	149.1	78.2	158.2	202.1	235.6	135.3	135.3	259.1	261.1	127.3	121.3
Developing World	931.3	824.0	418.2	571.6	1018.3	1244.4	679.1	863.5	733.5	780.1	611.6	486.5

Source: Statistics of World Trade in Steel, ECE, Geneva, issues for several years.

Table 10

Apparent Consumption of Steel Tubes and Fittings in the Principal Oil-Producing Developing Countries

(Thousands of tons)

Country	1913	1929	1938	1950	1955	1958	1959	1960	1961	1962	1963	1964
Algeria	2.0	5.3	5.0	10.8	13.3	100.0	190.2	158.6	121.2	58.0	65.0	99.7
Libya								47.2	69.0	63.7	115.3	141.9
Nigeria								16.4	14.4	24.7	37.7	86.1
Egypt	8.9	13.5	7.2	14.5	40.6	18.9	15.4	49.2	22.1	29.2	25.5	35.4
Africa	10.9	18.8	12.2	25.3	53.9	118.9	205.6	271.4	226.7	175.6	243.5	363.1
Iran		19.9	54.7	43.5	25.0	99.7	49.9	74.6	56.8	71.9	81.4	123.1
Iraq		1.7	3.7	38.7	20.4	81.2	103.3	57.8	32.9	28.6	9.0	11.6
Kuwait				0.5	6.2	68.1	17.8	22.6	74.4	37.3	25.7	28.9
Bahrain				1.8	5.8	5.1	5.2	3.3	6.2	6.1	4.9	2.6
Saudi Arabia			0.8	62.4	8.9	28.6	0.5	14.7	51.6	35.6	33.8	44.2
Middle East		21.6	59.2	146.9	66.3	282.7	276.7	173.0	221.9	179.5	154.8	210.4
Argentina	27.8	79.8	45.2	84.7	59.4	166.9	256.0	163.2	133.0	172.1	210.8	144.4
Brazil	25.2	28.6	14.9	34.9	27.8	17.1	26.0	76.9	83.0	90.3	112.8	84.2
Colombia	2.9	10.5	25.6	18.2	41.7	30.8	13.9	23.5	25.6	31.1	52.0	31.7
Mexico	40.0	29.2	11.1	100.2	140.1	253.8	211.1	277.7	254.1	225.6	288.8	292.7
Venezuela	0.7	83.9	55.9	69.9	245.2	302.3	195.3	103.8	67.8	79.8	89.5	55.4
Latin America	96.6	232.0	152.7	307.9	514.2	770.9	702.3	645.1	563.5	598.9	753.9	608.4
Indonesia	3.0	10.8	-	12.5	26.1	27.3	30.1	39.5	17.7	24.7	18.5	16.7
TOTAL	110.5	283.2	224.1	492.6	660.5	1199.8	1214.7	1129.0	1029.8	978.7	1170.7	1198.6
of which produced domestically (1000 tons)	-	-	-	14.1	125.5	294.5	259.5	397.5	393.8	371.5	410.9	434.5
Percentage of apparent consumption	-	-	-	2.9	19.0	24.5	22.0	35.1	38.3	38.0	35.0	38.9

Source: National production statistics and "Statistics of World Trade in Steel," ECE, Geneva several issues.

Table 11

Oil Production: Main Producers in Developing Areas
(millions of long tons)

Region and country	1950	1955	1959	1960	1961	1962	1963	1964
Western Hemisphere								
Mexico	10.0	12.5	13.5	14.7	16.2	17.2	18.0	18.3
Venezuela	78.0	112.6	145.1	148.6	152.2	167.5	169.6	177.6
Colombia	-	6.3	7.4	7.7	7.4	7.2	8.4	8.7
Argentina	-	4.3	6.3	9.0	11.9	13.8	13.8	14.1
Brazil	-	0.3	3.2	4.0	4.5	4.3	4.8	4.5
Middle East								
Iran	32.0	16.1	45.7	51.8	58.5	65.0	72.6	83.5
Iraq	7.0	32.8	41.1	46.7	48.2	48.4	55.8	60.6
Kuwait	17.0	53.9	68.4	80.6	81.4	90.7	95.7	105.0
Saudi Arabia	27.0	46.8	53.3	61.1	68.1	74.6	79.8	85.0
Africa								
Algeria	-	0.1	1.2	8.5	15.5	20.4	23.5	26.1
Libya	-	-	-	-	0.9	8.6	21.9	40.9
Nigeria	-	-	0.5	0.9	2.2	3.3	3.7	5.8
Far East								
Indonesia	-	12.1	18.8	20.4	21.1	22.7	22.5	23.7
TOTAL	171.0	297.8	404.5	454.0	488.1	543.7	590.1	653.8

Source: British Petroleum, Statistical Reviews of the World Oil Industry, 1960, 1964, London.

Table 12

Use of Steel Products by Industry
(percentages)

Product	Food drink tobacco	"Light" machinery	Miscellaneous non-electrical engineering	Tools and implements	Electrical machinery	Domestic electric appliances	Other electrical goods
Plates 3/8" and over	-	15	8	-	19	-	-
Plates under 3/8"	-	8	5	-	9	-	-
Other heavy rolled products	-	9	7	-	-	-	-
Wire rods and other bars in coil	-	-	-	5	-	-	-
Other light sections and hot-rolled bars	-	7	8	31	-	-	3
Bright steel bars	-	10	13	8	4	3	10
Hot-rolled strip	-	-	4	8	-	-	19
Cold rolled strip	-	6	20	18	7	16	34
Hot rolled sheet	-	-	-	3	9	-	-
Cold rolled sheet	-	16	4	4	35	75	29
Tinplate	93	-	-	-	-	-	-
Tubes and pipes	-	13	15	-	-	-	-
Castings and forgings	-	9	17	-	-	-	-
Total products	100	100	100	100	100	100	100

Table 12 (Continued)

Product	Motor vehicles manufacture	Motor cycles and bicycles	Bolts nuts screws	Wire	Cans and boxes	Hollowware	Other metal industries
Plates 3/8" and over	4	-	-	-	-	-	-
Plates under 3/8"	9	-	-	-	-	5	7
Other heavy rolled products	-	-	-	-	-	-	-
Wire rods and other bars in coil	-	-	15	98	-	-	-
Other light sections and hot-rolled bars	6	14	51	-	-	-	19
Bright steel bars	6	11	25	-	-	-	-
Hot rolled strip	12	10	-	-	-	-	12
Cold rolled strip	5	25	5	-	-	5	16
Hot rolled sheet	4	-	-	-	-	4	7
Cold rolled sheet	46	9	-	-	5	76	28
Tinplate	-	-	-	-	95	5	-
Tubes and pipes	4	19	-	-	-	-	-
Castings and forgings	-	-	-	-	-	-	-
Total products	100	100	100	100	100	100	100

Source: Iron and Steel Board, 1964 Annual Statistics, London, 1965.

Table 13

Use of Principal Steel Products by Industry in India: 1965/1966

Product	Group I Mechanical Engineering	Group II Mechanical Engineering	Industrial machinery	Machinery and small tools	Internal combustion engines and similar engines	Electrical engineering	Instruments	Other manufacturing	Small units engaged in assembly work	Small scale servicing
Structurals	15	2	19	-	8	10	8	5	2	-
Plates	30	-	47	-	21	18	28	-	4	-
Sheets	6	38	11	3	52	39	51	19	73	16
Bar and rods	38	13	12	94	17	17	11	-	14	70
Wire	9	20	-	-	-	13	-	13	7	14
Strip	-	23	-	-	-	2	-	7	-	-
Tinplate	-	6	-	-	-	-	-	52	-	-
Rails	-	-	-	-	-	-	-	-	-	-
All products	100	100	100	100	100	100	100	100	100	100

Source: Reappraisal of Steel Demand, National Council of Applied Economic Research, New Delhi, 1963.

Table 14

Planned Size and Growth of Manufacturing Industries

Country	1963 manufacturing as % of GNP	Past growth of GNP(a)	"Planned" growth of manufacturing	"Actual" growth of manufacturing	Years covered by plan
		annual rate of increase (%)			
Sudan	5(b)	3.2	21	9.3	1961/2-1970
Egypt (UAR)	14	5.0	13.5	15.3	1960/1-1964/5
China (Taiwan)	22	6.7	12.5	12.5	1960 -1964
South Korea	10	4.9	11.5	15.0	1962 -1966
India	n.a.	3.6	11	7.2	1961/2-1965/6
Colombia	17	4.2	8.5	6.3	1961 -1970
Pakistan	10	2.5	8.5	9.0	1960/1-1964/5
Morocco	14	-0.4	9	4.7	1960 -1964
Malaysia	8	3.5	7.5	11.1	1961 -1965
Chile	17	2.5	6.5	3.6	1961 -1970

Sources: World Economic Survey 1965, United Nations, New York.
Yearbook of National Accounts Statistics 1964, United Nations, New York.
(a) 1953/1954-1959/1960.
(b) 1958.

Table 15

Percentage Growth of Industrial Productions: Selected Industries (1958-1962) (percentages)

Region	Light manufacturing	Heavy manufacturing	Paper and paper products	Chemicals	Non metallic minerals	Basic metals	Metal products	Mining, manufacturing electricity gas
Less industrialized countries	22	41	42	41	27	44	44	38
Africa[a] (excl. South Africa)	-	13	24	23	7	38	5	-
Latin America	16	31	27	38	24	24	31	23
Asia: east and south-east (excl. Japan)	30	59	58	41	45	102	167	41

Source: Growth of World Industry 1938-61, United Nations, New York.

(a) Growth during 1958-1961.

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