INDUSTRIAL DEVELOPMENT IN ASIA AND THE FAR EAST

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INDUSTRIAL DEVELOPMENT IN ASIA AND THE FAR EAST

- A DECADE OF INDUSTRIALIZATION
- ENGINEERING INDUSTRIES IN THE ECAFE REGION
- SMALL-SCALE INTEGRATED ALKALI PLANTS

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FOREWORD

The Commission at its nineteenth session emphasized the fact that information regarding industrial development in countries of the region was of great interest to other countries and could help to pave the way for joint-venture projects. It therefore suggested that the secretariat might compile and publish at regular intervals an *Industrial Development News*. As a first step in implementing that directive of the Commission, it is felt that the countries of the region should be presented with a review of industrial development in the region over the past decade which will serve as a background for further reading on current development in the fields of industry and natural resources. As 1965 is the mid-point of the United Nations Development Decade, it is also opportune to have a review of industrial development in the ECAFE region over a long period to facilitate assessment of past achievements and to indicate development trends and whether the pace of industrial development needs to be accelerated. This will, in turn, make it possible to lay down guidelines for action needed to accelerate industrialization. This review therefore covers industrialization in Asia and the Far East during the period 1953—1963. The engineering industry in ECAFE countries has been dealt with at length. As the basic chemical industries play an important role in industrial development in the developing countries of the region, information on the production of caustic soda and allied products is included in this issue.

This review is based on published material and information supplied by governments in the region. As the national data and statistics available were incomplete in many cases and totally inadequate in some, this review should be considered only as a first attempt at a study of the characteristics of industries and trends in their development in some of the countries in the region.

CONTENTS

A DECADE OF INDUSTRIALIZATION IN ASIA AND THE FAR EAST[1]

I. INTRODUCTION

The secretariat has submitted for each annual session of the Committee a current review of developments in natural resources and industry in the ECAFE region to focus attention on the progress made, difficulties encountered and the experience gained in the industrial programmes of countries.

In certain respects, this review differs from the annual reviews submitted at past sessions of the Committee. The fact that a Regional Symposium on Industrialization is to take place later in the year (1965) makes it desirable for the examination of the rates of growth and pattern of industrial development to cover a longer period than usual; hence an attempt is made to present the picture for the preceding decade rather than for just the preceding year.

Secondly, in the light of the emphasis given by the United Nations Conference on Trade and Development to the development of manufacturing and the need for expansion of trade in manufactures, an attempt has been made to analyse trends and patterns not only on the basis of the region as a whole and the individual countries (to the extent that statistics permit) but also for certain important industrial sectors.

Thirdly, at the mid-point of the Development Decade, an examination covering a longer period and in greater depth than usual will be particularly appropriate, as it may help the Committee to suggest measures for ensuring that the objectives of the Decade are attained.

Apart from the introduction and conclusions, the review consists of three main sections. Section II attempts to provide an overall picture of current developments, with a brief review of long-term rates of industrial growth both in the region and in individual countries, as well as analyses of the relative importance of the region in the industrialized world, the relationship of industrial growth to economic growth and the accumulated capacity for further growth.

Section III discusses development trends and problems in four major industrial sectors: chemicals, base metals, engineering, textiles and pulp and paper (both consumer and producer goods industries).

Section IV outlines relationships between the various processes and products both within and among the industries and notes the need for advance planning and regional co-operation.

II. TRENDS IN INDUSTRIAL AND ECONOMIC GROWTH

(A) Region's rates and pattern of industrial development

During 1953—1963, a decade roughly coinciding with planned efforts at industrial development in the ECAFE region, the region's industrial output, expanded significantly. Though statistics relating to this are not complete, the following will serve as a broad indication of the rising trend. As can be seen from table 1, the output of mining, power and manufacturing industries in the ECAFE region (excluding mainland China, Australia, Mongolia, New Zealand and Western Samoa) in 1963 was about 3.4 times its 1953 level. During this period Latin America, which comprises several industrializing countries, increased its industrial output by only 80 per cent, while the highly industrialized North America (United States and Canada) by only 36 per cent. If the world as a whole (excluding Albania, mainland China, Mongolia, North Korea and North Viet-Nam) is considered, it can be seen that industrial output in 1963 was only 1.8 times the 1953 level.

The region's industrial growth during the period under consideration was uninterrupted, though rates varied from year to year. Before 1958, which is generally considered a year of recession, industrial output had expanded at a rate of 10 per cent in 1954, 12.3 per cent in 1955, 13 per cent in 1956 and 14 per cent in 1957; the rate for 1958 was 3.2 per cent. After 1958, the industrial growth rate was 18 per cent in 1959, 20.5 per cent in 1960, 16.3 per cent in 1961, 7.8 per cent in 1962 and 10 per cent in 1963. The fact that the annual rates of growth have slackened since 1960 has caused some anxiety over the prospects of attaining the industrial growth needed to help raise national incomes in the region during the Development Decade. In this connexion, however, a few points should be noted. First, the year 1960 gained a particular advantage over the following years owing to the rapid recovery from the low level of output of the recession.

[1] Based on paper E/CN.11/I&NR/L.50, prepared by the ECAFE secretariat for seventeenth session of the Committee on Industry and Natural Resources.

Table 1

ECAFE REGION: INDICES OF INDUSTRIAL PRODUCTION BY INDUSTRIES AND COUNTRIES, 1953 TO 1963

Country or area and item	Index number (1958 = 100)									
	1953	1954	1955	1956	1957	1959	1960	1961	1962	1963
Industries[a]										
Electricity and gas	62	67	73	83	93	115	133	154	166	185
Mining	66	66	76	88	100	107	119	127	136	141
Coal	89	83	83	91	101	100	110	117	122	125
Metals	99	102	106	113	116	104	123	130	134	133
Crude petroleum and natural gas	31	35	57	74	91	113	123	133	147	156
Manufacturing	57	64	71	85	97					
Food, beverages and tobacco	74	74	85	91	95	105	112	121	126	132
Textiles	68	77	86	97	104	112	124	131	139	148
Paper and paper products	58	68	77	89	100	124	145	169	177	196
Chemicals, petroleum and coal products	51	58	69	83	96	114	133	150	169	197
Non-metallic mineral products	60	69	72	85	100	114	139	156	173	178
Basic metals	67	73	79	93	103	131	169	202	208	234
Metal products	39	46	49	71	94	138	193	245	276	300
Countries										
China (Taiwan)	65	70	78	82	93	113	129	144	163	179
India	72	78	86	94	97	108	120	129	138	152
Japan	60	65	69	86	99	124	156	186	201	222
Korea, South	...	54	64	79	91	115	125	132	154	175
Pakistan	48	62	78	89	94	112	119	126	150	171
Philippines[b]	59	66	74	86	93	108	112	119	126	134
New Zealand[b,c]	75	83	88	88	95	104	113	119	125	...
ECAFE region[a]										
Ibid., excluding Japan	59	66	78	89	96	109	122	131	141	155
World[d]	78	80	89	94	99	110	119	126	136	144

Source: *United Nations Monthly Bulletin of Statistics* and national publications,

[a] Excluding mainland China, Australia, Mongolia, New Zealand and Western Samoa.

[b] Manufacturing only.

[c] Fiscal year beginning July of the year stated, base July 1958 — June 1959 = 100.

[d] Excluding Albania, China (mainland), Mongolia, North Korea and North Viet-Nam.

Secondly, there appears to have been some deceleration of industrial growth since 1960 chiefly because of short-term difficulties confronting countries in the region in their efforts to industrialize. For instance, such shortages of transport, power and raw materials as have occurred can be overcome in time partly through adjustments of planned targets in the light of circumstances. Thirdly, as the emphasis in the region gradually shifts from light to heavy industry, a long "gestation" period is inevitably involved in the massive investment required by the latter type of industry. If and when the stage of self-sustained industrial growth is attained, there is no reason why a relatively high rate of expansion should not be maintained from year to year. Thus, much caution should be exercised in interpreting the apparent deceleration of industrial growth in the region since 1960.

Underlying the rates of growth of total industrial output are, of course, the trends in component industries. In fact, industries in the region have evolved according to a discernible pattern which may be said to consist partly of the four following types of industry:

(1) One group of industries has widely been developed in the region chiefly with a view to achieving self-sufficiency in the supply of their essential products. Such industries have frequently been developed on the strength of the availability of raw materials in the countries concerned. They are chiefly industries producing such essential consumer goods as cotton textiles, leather products, vegetable oil and pharmaceutical goods. Once the goal of self-sufficiency has been attained, considerable foreign exchange can be saved and spent on indispensable imports for which no local substitutes are available.

(2) A group of industries mostly connected with direct investments of foreign capital are engaged in processing imported raw materials or assembling imported components. Development of this type of industry has frequently been induced by high import duties on finished goods. Examples are petroleum refining in China (Taiwan), India and Japan, assembly of motor cars in India, Japan and the Philippines and manufacture of electrical appliances in the Philippines. Not only is there a sizable saving of scarce foreign exchange but the balance of payments position is also reinforced by the capital inflow where there is direct foreign participation in the running of the industries.

(3) There is a third group of industries designed to meet the basic needs of economic development; an

example is the cement industry, which has been extensively developed in countries of the region. Despite this, however, the progressively rising demand cannot be met out of domestic output alone, and most of these countries continue to import a substantial proportion of their requirements. Other examples are iron and steel, engineering and basic chemical industries, though here the objective is not only to satisfy the more basic needs of economic development but also to provide a strong industrial base for future development. Here again considerable saving of scarce foreign exchange can be achieved provided that the import requirements of the industries do not cancel out the initial advantage.

(4) There are also industries producing mostly for export, especially in Japan and Hong Kong, where the proportion of manufactured exports is relatively high. Other countries frequently develop industries processing formerly exported raw materials for export in finished form. Considerable foreign exchange can be earned as several countries attempt to diversify their export products, which previously consisted only of raw materials and foodstuffs.

The above four categories are not mutually exclusive. For instance, an industry may fall into both the first and fourth categories at the same time, since, beyond the point of self-sufficiency, industries of the first category will have an exportable surplus and be classified under the fourth category. Similar considerations apply to the relationship which may exist between the second and fourth categories on the one hand and the third and fourth categories on the other.

Out of such a pattern of development have emerged several industries whose rates of growth between 1953 and 1963 differed widely. *Manufacturing* as a whole had the highest rate of increase, its 1963 level of output being about 3.6 times that of 1953, while *mining* was the lagging sector, its level of output in 1963 being only about 2.1 times that of 1953. *Electricity and gas* production about doubled and closely followed manufacturing. The expansion of industrial output in the region can accordingly be seen to follow the rates of growth of manufacturing and electricity and gas more closely than that of mining.

Table 2

PAST TRENDS IN THE GROWTH OF ELECTRICITY GENERATION IN THE ECAFE REGION

Country	Energy generation (in million kWh)				
	1951	1956	1960	1961	1962
Afghanistan	24.3	35.6	118.0	123.0	160.5
Australia	10,420.0	16,055.0	22,221.0	23,955.0	25,453.0
Brunei	0.47	3.4	9.1	10.3	11.1
Burma	40.9	112.2	254.2	287.3	322.3
Cambodia	18.9[a]	34.4	61.3	74.2	82.3
Ceylon	96.2	193.1	288.8	311.1	350.7
China (Taiwan)	1,285.1	2,249.8	3,628.0	4,087.7	4,692.7
Hong Kong	415.2	710.0	1,301.5	1,542.4	1,786.9
India	5,858.0	9,663.7	17,078.7	20,036.9	22,833.8
Indonesia	614.0	1,480.0	1,050.0	1,220.0	1,242.1
Iran	...	268.3[b]	860.0	940.0	1,000.0
Japan	41,434.0	62,500.0	101,700.0	116,809.0	124,019.9
Korea, South	314.0	1,119.0	1,699.4	1,772.0	1,978.5
Laos	0.88[c]	2.7	6.9	8.0	9.4
Malaysia:					
Former Federation of Malaya	618.0	902.1	1,134.3	1,293.7	1,425.5
North Borneo (Sabah)	...	4.3	15.0	18.7	22.9
Sarawak	3.5	9.9	18.9	23.6	27.2
Singapore	208.6	417.0	610.4	664.4	716.9
Nepal	6.2	10.3	11.3	10.9	12.6
New Zealand	3,462.0	4,967.0	6,835.0	7,899.0	7,951.0
Pakistan	299.3	838.2	1,449.9	1,818.9	2,307.5
Philippines	594.0	1,279.9	2,259.5	2,555.3	3,010.1
Thailand	104.8	328.1	515.7	611.9	709.2
Viet-Nam, South	216.0	212.5	304.7	328.6	374.9
Western Samoa	...	...	4.4	4.9	5.7
Total for ECAFE region	66,034.4	103,396.5	163,435.3	185,903.7	200,505.8

Note: ... indicates data not available.

[a] Estimated. [b] For 1957. [c] For 1952.

The output of *electricity and gas* expanded at high annual rates of between 8 and almost 14 per cent before 1958, when its rate of growth was 7.5 per cent. After 1958, rates of growth of between about 8 and almost 16 per cent were consistently maintained. Such remarkable expansion reflects the high priority given by ECAFE countries to the development of power as part of the basic economic facilities. During the period 1951-1962, gross electricity generation in the region (excluding mainland China and Mongolia) increased from about 66 billion kWh to about 200 billion kWh, representing more than a threefold expansion. During the same period, consumption of electrical energy in the world as a whole increased about 2.5 times, in the Soviet Union 3.6 times, in Europe 2.3 times and in the United States 2.2 times. It can thus be seen that the ECAFE region has maintained a high rate of growth of electricity production, exceeded only by the Soviet Union. Japan has played a dominant role in this production, its share being about 63 per cent in 1963. The two other major producers have been Australia and India, whose shares were 12.7 per cent and 11.4 per cent respectively. In other words, over 86 per cent of all electric power generated in the region is contributed by the three major producers. Of these, India has had the highest rate of expansion since 1961, the level of output in 1962 being 3.9 times that of 1951. The corresponding figures for Japan and Australia are 3 and 2.4 respectively.

An analysis of the installed generating capacity according to type of prime mover reveals that there has been an increasing trend in the region towards the installation of thermal power plants, particularly in Japan and China (Taiwan), though known resources for hydro-electric power have been neither fully developed nor exhausted. There are at least four reasons for such a trend towards thermal power plants in the region. First, they require shorter periods for construction and commissioning. Secondly, the initial capital outlay per kW of thermal plant capacity is less than that for a hydro-electric plant. Thirdly, with recent technological developments in the field of thermal power, thermal plants—especially those with reasonably large capacities —can be operated at high thermal efficiencies and in many cases it is possible for them to be economically competitive with hydro-electric power stations. Finally, in view of the seasonal variations in the output of hydro-electric stations, thermal power plants have to be built and operated under an integrated programme.

The most common experience of the countries of the region in regard to their electric power development programmes is that the demand for power has always been ahead of the available generating capacity. Despite what the countries feel to be very liberal allocations of resources for their electric power development, the supply capacity has almost invariably fallen behind the requirements. In the search for sources of power to meet an ever-increasing demand, several countries of the region are showing a keen interest in the possibility of using nuclear resources for power generation. Though nuclear power has been established as a technically feasible proposition, it has not yet been possible to make it competitive with conventional power.

The greater part of the demand for power has come from industrial undertakings, though domestic consumers have also played their role. In the utilization of electricity, an analysis shows that industrial consumers account for about 70 per cent or more of the offtake, particularly in China (Taiwan), the former Federation of Malaya, India, Japan and Pakistan. This does not necessarily mean that the countries concerned have reached a high degree of industrialization, though it indicates the importance attached to the use of electricity for directly productive purposes as against its use for providing amenities and comforts.

The growth of *mining*, the lagging branch of industrial activity in the region, has sometimes been interrupted. In 1954 and 1958 output stood still, though in other years before 1958 there were substantial annual rates of increase of between about 14 per cent and 16 per cent. After 1958, with the exception of 1960 when the rate of growth was over 11 per cent, growth appears to have slackened, the rate for 1963 being only about 3.7 per cent. Within the mining group, *crude petroleum and natural gas* have been most dynamic, their combined output in 1963 being about 5 times the 1953 level, while *coal* and *metals* in 1963 increased to about 1.4 and 1.3 times the 1953 level respectively.

In general, mining in the region depends to a great extent on exports and, unfortunately, export demand for primary products, with the exception of petroleum, has been lagging behind industrial production. At the same time, domestic demand for the products of mining, though stimulated by national efforts to process them at home, has not risen fast enough. Moreover, despite efforts by several countries of the region to encourage mining through such measures as proper legislation and rationalization programme, mining has, in some countries, been faced with near-exhaustion of known reserves, unsuccessful prospecting for new ones, obsolescence of equipment, lack of equipment and spare parts, labour shortage and unrest, lack of transport facilities and trained manpower and uncertainty as to market prices. Finally, mining involves the highest risks among the industries, and, in general, risk or venture capital is scarce in the region. Although the possibility of foreign investment exists, capital from outside the region will not be attracted to mining in sufficient quantities in the absence of proper guarantees and incentives.

The output of *coal* in the region has shown uneven expansion. It actually fell in 1954 and 1958 and stood still in 1955 and 1959. The highest annual rate of growth, about 11 per cent, was achieved in 1957 and not attained again. In fact, market deceleration in the growth of output has taken place since 1960, and the rate of growth for 1963 was only 2.5 per cent.

Table 3

ECAFE COUNTRIES: MINERAL FUEL PRODUCTION, 1959 TO FIRST HALF OF 1964

(coal and crude petroleum in thousand tons and natural gas in million cubic metres)

Country or area	Coal						Crude petroleum						Natural gas					
	1959	1960	1961	1962	1963	1st half 1964	1959	1960	1961	1962	1963	1st half 1964	1959	1960	1961	1962	1963	1st half 1964
Afghanistan	41	48	66	67	...	...	—	—	—	—	—	—	—	—	—	...	...	...
Australia	20,624	22,930	24,391	24,874	25,176	13,332	—	—	—	—	...	...	—	—	—	—	...	...
Brunei	—	—	—	—	—	—	5,390	4,583	4,124	3,824	3,500[a]	...	1,778	1,620	1,380	1,272	1,129	...
Burma	1	—	2	3	...	...	529	545	565	584	612	—	5	12	9	...	...	...
China: mainland[b]	347,800	420,000	378,600	...	...	...	3,700	5,500	5,500[a]	5,800[a]	7,000[a]	...	...	...	...	...	...	...
Taiwan	3,563	3,962	4,239	4,554	4,812	...	2	2	2	2	2	...	26	25	37	38	51	...
India	47,800	52,593	56,065	61,370	66,912	...	413	451	512	1,025	1,649	...	—	—	—	—	...	...
Indonesia	638	658	549	472	...	18,218	20,596	21,284	21,284	22,784	21,120	11,354	2,230	2,431	2,561	2,706	2,706	...
Iran[c]	239	230	198	158	...	...	46,194	52,392	58,959	65,320	71,628	39,980	...	7,000	8,414	9,178	...	...
Japan	47,258	51,067	54,484	54,399	52,056	2,544	45	527	656	761	792	...	507	731	951	1,210	1,692	...
Korea, South	4,136	5,350	5,884	7,444	8,858	489	—	—	—	—	—	—	—	—	—	—	—	—
New Zealand	852	812	765	711	720	323	1	1	1	1	1	1	...	...	...	...	...	...
Malaysia[d]	77	7	—	—	—	—	56	60	60	59	52	—	—	—	—	—	—	—
Pakistan	734	831	921	990	1,242	...	312	353	378	446	469	...	633	845	982	1,192	1,404	...
Philippines	140	168	152	163	169	...	—	—	—	—	—	—	—	—	—	—	—	—
Thailand[e]	109	108	109	135	137	62	...	...	...	...	...	...	—	—	—	—	—	—
Viet-Nam, South	20	27	57	71	104	39	—	—	—	—	—	—	—	—	—	—	—	—
ECAFE total	474,030	558,791	526,480	155,411[f]	160,778[f]	...	58,830	85,010	92,041	100,606	106,825	...	...	...	...	...	...	...

Source: United Nations, *Statistical Yearbook and Monthly Bulletin of Statistics* and ECAFE secretariat paper on development of the petrochemical industry in the ECAFE region (I&NR/90).

[a] Petroleum Press Service, Vol. XXXI No. January 1964.

[b] United States Geological Survey.

[c] United Nations, *Statistical Yearbook*, 1963 and *Monthly Bulletin of Statistics*, July 1964.

[d] Sarawak only.

[e] Lignite.

[f] Excluding China (mainland).

By far the largest producer of *coal* in the region is mainland China, whose output[2] in 1961 was larger than that of all other countries in the region put together and accounted for about 71.6 per cent of the region's output. If mainland China is excluded, the region's coal output in 1963 was about 161 million metric tons to which India, Japan and Australia, the three major producers, contributed 41.3 per cent, 32.6 per cent and 15.6 per cent respectively. In other words, if mainland China is excluded, India, Japan and Australia accounted for almost 90 per cent of the region's output of coal. In these countries coal is faced with the competition from petroleum, and more efficient production is required to enable it to meet that competition. Thus, rationalization and consolidation of small mines has begun in India, Japan and South Korea, and, on the whole, fruitful results have been obtained. Similarly, with government assistance in the form of improved facilities for loading and transport, coal mining cost has been reduced in Australia and India. All the same, competition from cheap fuel oil and the increased cost of coal mining reduced the output of Japanese mines slightly in 1963.

The region's output of *metals* has, like that of coal, had unsteady growth. It actually fell in 1958 and 1963, while rates of increase for other years were moderate, the only exception being about 18 per cent for 1960. As in the case of coal, growth has definitely slackened since 1960.

If mainland China is included, the region's output of *tin-in-concentrate* in 1963 was about 119,500 tons, to which Malaysia, mainland China, Thailand and Indonesia contributed 50.8 per cent, 20.2 per cent, 13.2 per cent and 11.1 per cent respectively. In other words, the four main producers of the region accounted for as much as 95.3 per cent of total output. In recent years, output in all countries has shown an upward trend with the exception of Indonesia, where it has been steadily declining. Since the Thai output surpassed that of Indonesia in 1963, Thailand has moved up from fourth to third place in the region's production of tin-in-concentrate. Though this metal has been through some difficult times since the end of the Korean War boom, owing to the existence of a strong world demand the situation has now been reversed.

Without mainland China, the region's output of *iron ore* in 1963 amounted to about 32 million tons, to which India, Malaysia, Australia, Japan and the Philippines contributed 45.2 per cent, 23 per cent, 17.7 per cent, 7.6 per cent and 3.9 per cent respectively. In fact, these five major producers accounted for 97.4 per cent of the region's total output. In all of these countries, production in recent years has been expanding to meet either domestic or export demand, the exceptions being Japan where output has been declining and the Philippines where there have been ups and downs.

The region's output of *manganese ore* in 1963 amounted to about 2.5 million tons, to which India, the largest producer in the region, contributed 42 per cent, the rest being accounted for by mainland China, Japan and Australia. Over the past decade production of all these major producers has expanded, with the exception of India where it appears to have followed a declining trend.

[2] Based on the official statistics published by the Government.

Table 4

ECAFE COUNTRIES: IRON ORE AND TIN CONCENTRATE PRODUCTION 1959—FIRST HALF OF 1964

	Iron ore (1,000 tons)						Tin concentrate (ton)					
	1959	1960	1961	1962	1963	1st half 1964	1959	1960	1961	1962	1963	1st half 1964
Australia	4,219	4,397	5,374	4,921	5,690	...	2,389	2,237	2,789	2,760	3,132	...
Burma	4	16	—	14	4	...	813	965	965	1,220	1,032	516
China[a] (mainland)	(45,000)	(55,000)	(45,000)	(35,000)	...	...	(21,337)	(243,385)	(24,385)	(24,385)	(24,000)	...
Hong Kong	122	116	119	113	114	607	—	—	—	—	—	—
India	7,980	10,680	12,132	13,188	14,784	...	—	—	—	—	—	—
Indonesia	—	—	—	—	—	—	21,960	22,959	18,872	17,868	13,352	...
Iran	58	58	58	40	...	...	—	—	—	—	—	—
Japan	5,840	4,240	2,832	2,421	2,460	...	1,005	872	868	866	866	...
Korea, South	282	392	500	471	500	...	—	—	—	—	—	—
Laos	—	—	—	—	—	—	299	389	337	372	360	...
Malaysia	3,821	5,736	6,844	6,609	7,380	...	38,127	52,813	56,927	59,544	60,912	...
Pakistan	2	6	4	...	...	...	—	—	—	—	—	—
Philippines	1,236	1,140	1,176	1,387	1,272	...	—	—	—	—	—	—
Thailand	6	11	56	45	16	...	9,839	12,273	13,482	14,915	15,840	...
ECAFE total	66,570	81,792	74,095	64,209	32,220[c]	...	95,769	116,893	118,625	121,930	119,494[b]	...
World total							143,100	162,800	163,700	168,900	167,256	...

Source: [a] United States Bureau of mines.

[b] Statistical Bulletin of the International Tin Council, excluding USSR and Eastern Europe.

[c] Excluding mainland China.

Table 5

ECAFE COUNTRIES: PRODUCTION OF NON-FERROUS METALLIC ORES (OTHER THAN TIN), 1958 TO 1963

(thousand metric tons)

	Australia	Burma	China (mainland)	China (Taiwan)	Federation of Malaya	Hong Kong	India	Indonesia	Iran[a]	Japan	Korea, South	New Zealand	Pakistan	Philippines	Sarawak	Thailand
Manganese ore (Mn content)																
1958	27.8	0.5	*255*	—	—	—	555.0	23.3	0.2	108.1	—	0.1	—	8.9	—	1.0
1959	43.2	0.2	*300*	—	—	—	503.0	22.5	0.7	123.7	0.2	—	—	13.9	—	0.4
1960	30.1	0.1	*375*	—	—	—	501.0	5.7	2.3	120.3	0.6	0.1	—	7.0	—	0.5
1961	42.4	0.1	*300*	—	—	—	506.0	7.0	0.6	106.3	0.6	—	—	7.8	—	0.5
1962	35.0	0.1	*300*	—	—	—	491.0	5.8	0.6	108.0	0.4	—	—	4.8	—	2.9
1963	...	...	...	—	—	—	*428.0*	...	...	96.8	1.7	..	—	*1.0*	—	3.4
Copper (Cu content)																
1958	76.9[c]	0.1[b]	*30*	1.5	—	—	8.9	—	—	81.5[c]	0.5	—	—	47.0[c]	—	—
1959	96.5	0.2	*50*	1.6	—	—	8.7	—	—	85.2	0.3	—	—	49.5	—	—
1960	111.2	0.2	*70*	2.1	—	—	9.4	—	—	89.2	0.4	—	—	44.0	—	—
1961	97.2	0.1	*100*	2.2	—	—	9.3	—	—	96.4	0.4	—	—	51.9	—	—
1962	112.5	0.2	*100*	2.1	—	—	10.5	—	—	103.6	0.8	—	—	54.7	—	—
1963	...	...	...	...	—	—	*10.1*	—	--	107.2	0.9	—	—	64.0	—	—
Lead (Pb content)																
1958	333.6[c]	19.9[c]	*50*	—	—	0.1	4.1[c]	—	17.0	36.7[c]	1.2	—	—	1.3[c]	—	1.0[c]
1959	321.4	19.6	*70*	—	—	—	4.9	—	15.0	36.1	0.2	—	—	0.4	—	1.4
1960	313.1	18.0	*80*	—	—	—	4.6	—	15.0	39.5	0.9	—	—	0.1	—	2.0
1961	274.0	16.2	*90*	—	—	—	4.2	—	15.0	46.3	0.9	—	—	0.1	—	2.2
1962	376.1	20.4	*90*	—	—	—	4.7	—	10.0	53.5	1.4	—	—	0.1	—	2.4
1963	...	...	...	—	—	—	...	—	...	*58.6*	1.9	—	—	0.1	—	*2.1*
Zinc (Zn content)																
1958	298.4[c]	11.2[c]	*45*	—	—	—	4.3[c]	—	9.0	143.0[c]	0.3[c]	—	—	—[c]	—	—
1959	279.8	11.0	*65*	—	—	—	5.8	—	6.8	142.3	0.7	—	—	—	—	—
1960	322.6	10.3	*80*	—	—	—	5.7	—	8.5	156.7	—	—	—	5.0	—	—
1961	316.2	7.3	*100*	—	—	—	5.4	—	13.5	168.3	0.4	—	—	3.3	—	—
1962	342.9	8.2	*100*	—	—	—	5.9	—	7.5	192.4	0.4	—	—	4.5	—	—
1963	...	...	...	—	—	—	*6.3*	—	...	198.1	1.1	—	—	4.3	—	—
Tungsten ore (WO_3 content (tons))																
1958	864.0	815	*9,000*	—	31	25	—	—	—	480	1,958	2	—	—	—	391
1959	663.0	676	*10,800*	—	15	26	1	—	—	650	1,901	6	—	—	—	283
1960	1,129.0	569	*12,000*	—	27	21	2	—	—	589	3,195	6	—	—	—	265
1961	1,561.0	610	*12,000*	—	22	11	6	—	—	562	4,097	4	—	—	—	309
1962	1,059.0	523	*12,000*	—	6	10	7	—	—	631	4,154	6	—	—	—	256
1963	...	...	...	—	...	7	...	—	—	...	3,394	...	—	—	—	123
Chrome ore (Cr_2O_3 content)																
1958	0.4	—	...	—	—	—	30.1	—	20.8	14.7	—	—	11.8	147.0	—	—
1959	0.1	—	...	—	—	—	45.1	—	28.3	20.1	—	—	8.0	241.0	—	—
1960	0.3	—	...	—	—	—	50.2	—	29.0	23.8	—	—	9.0	270.0	—	—
1961	—	—	...	—	—	—	22.9	—	31.7	24.8	—	—	12.5	241.0	—	—
1962	0.2	—	...	—	—	—	31.4	—	34.9	20.6	—	—	10.5	196.0	—	—
1963	...	—	...	—	—	—	...	—	...	...	—	—	7.2	*190.0*	—	—
Bauxite																
1958	7.0	—	*150.0*	—	266.5	—	168.9	343.9	—	—	—	—	2.0	—	138.5	—
1959	15.0	—	*300.0*	—	287.8	—	218.0	387.2	—	—	—	—	2.2	—	210.0	—
1960	71.0	—	*350.0*	—	459.2	—	387.4	395.7	—	—	—	—	0.6	—	289.4	—
1961	16.0	—	*400.0*	—	416.5	—	475.9	419.9	—	—	—	—	0.4	—	257.5	—
1962	30.0	—	*400.0*	—	355.0	—	**573.0**	**461.0**	—	—	—	—	—	—	229.4	—
1963	...	—	...	—	451.2	—	555.9	...	—	—	—	—	—	—	...	—

Sources: United Nations *Statistical Yearbook and Monthly Bulletin of Statistics;* Central Statistical and Economic Department, Burma, *Selected Monthly Indicators;* Ministry of Economic Affairs and the Central Bank of China, Taiwan, *Taiwan Production Statistics Monthly;* Commerce and Industry Department, Hong Kong, *Hong Kong Government Gazette;* Central Statistical Organization, India, *Monthly Abstract of Statistics;* Biro Pusat Statistik, Indonesia, *Statistik Kenjunktur,* Bureau of Statistics; Office of the Prime Minister, Japan, *Monthly Statistics of Japan;* The Korean Reconstruction Bank, *Monthly Economic Review;* Central Statistical Office, Pakistan, *Statistical Bulletin;* Central Bank of Philippines, *Statistical Bulletin; Sarawak Annual Report;* Bank of Thailand, *Monthly Report.*

[a] Twelve months beginning 21 March of the year stated. [b] Content of Matte. [c] Content of concentrates.

Note: Figures in italics are estimates.

The major producers of *bauxite* in the region are India, Indonesia and Malaysia. Between 1955 and 1960, the former Federation of Malaya's output doubled, though there has since been some decline. Since the formation of Malaysia, output in the former Federation and in Sarawak put together has made it the largest producer of bauxite in the region. Up to 1960 Indonesia was a bigger producer than India, but the higher rate of growth of output in India has enabled that country to move up to and retain second place in the region since 1961.

The principal producer of *chrome ore* in the region is the Philippines, which accounted for 63 per cent of the region's total output in 1963, while India, Iran, Japan, Pakistan and North Viet-Nam are smaller producers.

The region's main producers of *copper ore* are Australia, Japan, mainland China and the Philippines, which altogether accounted for about 95 per cent of the region's total output of 397,000 tons in 1963.

Crude petroleum and natural gas, which have been the most dynamic in the mining group, have been able to maintain annual rates of growth of no less than 8 per cent since 1953. Indeed, before 1958, output expanded at tremendous annual rates, that for 1955 being as high as 63 per cent. After 1958, the highest rate achieved was about 13 per cent in 1959, and growth appears to have slackened since 1959.

The region's production of crude *petroleum* amounted to about 106 million tons in 1963. Of this total Iran accounted for 67 per cent and Indonesia for 19.9 per cent, while the much smaller producers, namely mainland China and Brunei, were responsible for 6.6 per cent and 3.3 per cent respectively. Iran has tremendously expanded its output in the past decade, the level of production in 1963 being about 24 times that of 1954. It is true, of course, that output in 1954 was at a very low level. Expansion of output has also been very rapid in mainland China, though its significance as one of the region's producers is relatively small. Indonesia's output has increased steadily, while that of Brunei has declined since 1956.

The largest producer of *natural gas* in the region is Iran. Other producers of more or less equal size are Indonesia, Japan, Pakistan and Brunei. Japan and Pakistan have shown remarkable rates of growth of output of natural gas, and the level of Japanese output in 1963 was about 12 times that of 1954. On the other hand, output in Brunei has actually declined in recent years. On the whole, the share of natural gas in the region's consumption of energy is still slight, though it has risen from less than 1 per cent in 1951 to over 2 per cent in 1961.

As has been pointed out, *manufacturing* was the most dynamic branch of industrial activity during the period under consideration. Within manufacturing itself, the sector which has shown the highest rate of growth is *metal products*, while that which has shown the smallest rate of growth is *food, beverages and tobacco*.

Food, beverages and tobacco have a weight of 16.3 per cent in the region's index of manufacturing production. Output in this sector has been stagnant, its level in 1963 being about 1.8 times that of 1953. Rates of growth over the years have been moderate and ranged between 4 per cent and 8 per cent, the only exception being 1955 when output grew at a rate of 15 per cent. In 1954 there was actually no increase in output. The industries processing food, beverages and tobacco are naturally closely bound to farming production so the general stagnation in the region's agricultural production is reflected in the index for this group of industries.

Sugar may be said to exemplify the products of this sector. In this connexion, it can be seen that the Philippines, a major producer in the region, increased its output by only about 34 per cent between 1954 and 1962 despite the recent impetus given by favourable prospects in the United States market. Similarly, during the same period, Australia increased its output by 40 per cent. On the other hand, India has become the largest producer of sugar owing to the high rate of expansion in the period, its level of output in 1963 being about 2.5 times that of 1954.

The three most important producers of food, beverages and tobacco in the region are Japan, India and Australia which accounted for 33.8 per cent, 22.9 per cent and 13.5 per cent respectively of the region's output in 1962. In other words, the three largest producers were the source of over 70 per cent of the region's food products, beverages and tobacco.

Textiles, which have a weight of 11.1 per cent in the region's manufacturing index, show a slightly better record than food, beverages and tobacco, the level of textile output in 1963 being about 2.2 times that of 1953. In fact, growth of the region's output of textiles was interrupted in 1958, when production fell by almost 4 per cent. In other years, rates of growth ranged from about 5 per cent to about 13 per cent, and, since 1960, growth rates have tended towards the lower limit. Textiles have suffered partly because of the narrowing of markets both within and outside the region. Within the region, expansion of new textile industries in smaller countries bent on greater self-sufficiency in this respect has adversely affected traditional exporters. Outside the region, the International Cotton Agreement of July 1961, which came into force on 1 October 1961, and subsequent restrictions on exports of textiles from the region's major producers to the United Kingdom and the United States have severely curtailed their export potential. At the same time, there have been problems of obsolete equipment, high cost of production and excess capacity. Faced with all these problems, the bigger producers have exerted continuous efforts to reduce cost, raise quality and improve marketing. They have also

Table 6

ECAFE COUNTRIES: PRODUCTION OF SUGAR, 1954-1963

(thousand metric tons)

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Australia	1,283	1,156	1,194	1,295	1,378	1,290	1,367	1,371	1,831	...
Burma	24	20	19	22	44	43	45	46	50	...
Ceylon	—	—	—	—	—	—	3	4	10	...
China: mainland	693	717	807	864	900	1,260	1,260	1,200	1,300	...
Taiwan	658	828	803	949	899	914	869	885	704	738
India	1,208	1,785	2,161	2,286	2,166	2,303	2,814	3,095	4,046	2,314
Indonesia	718	852	786	828	769	856	675	627	592	631
Iran	84	83	83	81	111	110	89	95	134	...
Japan	44	44	65	77	119	145	149	200	284	385
Pakistan	84	96	114	118	172	187	157	121	209	...
Philippines	1,329	1,281	1,198	1,060	1,242	1,514	1,398	1,530	1,511	...
Thailand	43	37	39	50	73	120	140	150	151	...
Viet-Nam, South	—	1	2	1	5	9	12	18	20	61

Source: United Nations, *Statistical Yearbook and Economic Bulletin for Asia and the Far East.*

intensified their efforts to develop production of synthetic fabrics, which have so far had more favourable market conditions than cotton, jute or woollen fabrics.

The major producers of textiles in the region are India, Pakistan, Japan and Australia. In 1962 the shares of Japan, India, Pakistan and Australia in total output of the region were 51 per cent, 23.5 per cent, 8.4 per cent and 7.5 per cent respectively, thus making the combined contribution of these major producers over 90 per cent.

Cotton yarn output in various countries may be taken to illustrate the situation of non-synthetic textiles, though it may not be representative in the strict sense of the term. Output of the two largest producers increased very little during the period between 1954 and 1963, the increases in India and Japan being 25 per cent and 3 per cent respectively. Indeed, after it reached its high point in 1957, it has steadily declined in both countries. The smaller producers do, however, show a remarkable record of progress: the rates of increase in the period under consideration being 50 per cent, 104 per cent, 182 per cent, 200 per cent and 145 per cent for Australia, China (Taiwan), Hong Kong, the Republic of Korea and Pakistan respectively.

In a similar manner, the output of *rayon and acetate continuous filaments* may be taken to exemplify the situation with regard to synthetic textiles, which appear to have brighter prospects than other textiles. The two major producers of these filaments are Japan and India. During the period 1954–1963 their output in Japan rose by 59 per cent, and in India by as much as 565 per cent.

Paper and paper products constitute one of the most dynamic sectors of manufacturing in the region: output in 1963 was about 3.4 times that of 1953. High annual rates of growth have consistently been maintained and have ranged between 5 and 24 per cent, the exception being 1958 when output remained unchanged. Like other sectors under consideration, paper and paper products have shown some deceleration in their growth since 1960, the rate in 1963 being only 11 per cent.

Despite its remarkable rate of growth during the period under consideration, the relative importance of paper and paper products in total industrial production of the region is small, since it is assigned a weight of only 2.9 per cent, compared with 16.3 per cent for food, beverages and tobacco and 11.1 per cent for textiles. The rapid rate of growth for paper and paper products reflects an increasing demand for them as urbanization proceeds, educational facilities spread and plentiful supplies of raw materials in the region become available.

The major producers of paper and paper products in the region are Japan, Australia and India, whose shares in the region's output in 1962 were 68 per cent, 14.2 per cent and 4.5 per cent respectively, their combined share being 86.7 per cent.

Chemicals, petroleum and coal products, which have a weight of 11.1 per cent in the region's manufacturing index—equal to that of textiles—have shown more rapid growth than paper and paper products, their level of output in 1963 being 3.9 times that of 1953. High annual rates of growth have consistently been maintained and have ranged between 12 and 20 per cent, the exception being 1958 when it was only 4 per cent. Unlike most other sectors of industrial activity under consideration, chemicals, petroleum and coal products have shown little sign of deceleration in their growth since 1960, the rate for 1963 being as high as 16.5 per cent.

The chemical industries of the region have been characterized by a recent shift in emphasis. While such consumer goods as matches, paints and medicines still play their role, increasing attention has turned to fertilizers and industrial materials.

The region's major producers of chemicals are Japan, Australia and India, whose shares in the region's total output were 16.6 per cent, 10.7 per cent and 8 per cent respectively in 1962.

The trend of *sulphuric acid* output may be examined to give an indication of the development of chemical industries in the region. The major producers of sulphuric acid are, in order of importance, Japan, Australia and India. During the period 1954—1963 Japan and Australia showed moderate rates of growth of 66 per cent and 70 per cent respectively, while the growth in India was as high as 280 per cent. The trend in India is suggestive of rates of growth achieved by smaller producers of chemical products in the region.

It is difficult to know how much weight to assign to *non-metallic mineral products*. When all the six other major sectors of manufacturing production are put together, they make up a total weight of 81.3 per cent, leaving 18.7 per cent to sectors which, with the exception of non-metallic mineral products, are not specified. During the period under consideration non-metallic mineral products did better than food products and textiles and almost as well as paper and chemicals, their level of output in 1963 being about 3 times that of 1953. Annual rates of growth over the whole period have remained fairly high and have varied between 3 per cent and about 22 per cent, with the exception of 1958 when output remained constant. Again, the trend since 1960 points in the direction of deceleration of growth, the rate of expansion for 1963 being about 3 per cent, compared with about 22 per cent for 1960. On the whole, output of non-metallic mineral products has been stimulated by the high priority given in almost all countries of the region to the development of basic economic facilities and by the increasing demand from the construction sector.

The most important non-metallic mineral product is *cement*, which is being produced by a number of countries in the region, principally Japan, mainland China, India and Australia, in that order of importance. Among these producers, Japan increased its output by 170 per cent between 1954 and 1962, and mainland China, India and Australia by 95 per cent, 93 per cent and 70 per cent respectively. While in the three other major producers output has been increasing, in mainland China it has declined since 1960.

Basic metals, which have a weight of 7.4 per cent in the region's manufacturing index, have had a rate of expansion close behind that of chemicals during the period under consideration, their output in 1963 being about 3.5 times the 1953 level. On the whole, annual rates of growth have been high and have varied from 3 per cent to about 31 per cent, the only exception being 1958, when output fell by 3 per cent. Owing to the high rate of growth achieved in 1959 (31 per cent), the slackening of growth since then does not appear serious, the rate for 1963 being 12.5 per cent.

The major producers of basic metals in the region are Japan, Australia and India, whose shares of the region's output in 1962 were 67 per cent, 15.2 per cent and 14.8 per cent respectively, their combined share being 97 per cent.

Table 7

ECAFE COUNTRIES: PRODUCTION OF CEMENT, 1954-1963
(thousand metric tons)

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Afghanistan	...	...	...	...	21	34	37	41	70	...
Australia	1,727	1,991	2,135	2,322	4,456	2,616	2,799	2,856	2,935	3,120
Burma	59	60	39	37	36	36	45	40	53	124
Ceylon	84	86	85	49	80	95	85	82	85	78
China: mainland	4,600	4,503	6,393	6,860	9,300	12,270	13,500	10,000	9,000	...
Taiwan	536	590	591	604	1,015	1,067	1,183	1,505	1,841	2,240
Federation of Malaya	86	109	104	114	110	193	286	331	326	361
Hong Kong	100	116	121	104	152	142	150	184	212	216
India	4,468	4,559	5,008	5,691	6,186	6,936	7,845	8,246	8,587	9,350
Indonesia	147	149	145	267	299	413	387	445	511	...
Iran*	65	132	224	313	410	579	782	652	745	...
Japan	10,675	10,563	13,024	15,176	14,985	17,270	22,537	24,632	28,787	30,000
Korea, North	231	360	597	895	1,244	1,926	2,285	2,250	2,376	...
Korea, South	62	56	46	92	296	358	431	523	790	778
New Zealand	323	409	451	540	561	562	617	651	631	722
Pakistan	682	692	785	1,095	1,089	1,002	1,138	1,243	1,395	1,500
Philippines	270	409	446	511	643	727	785	1,019	961	951
Thailand	383	386	398	402	456	510	526	810	965	995
Viet-Nam, North	254	300	197	165	302	380	406	453	470	...

Source: United Nations, *Statistical Yearbook and Monthly Bulletin of Statistics.*

* Excluding natural cement.

The production of *crude steel* in the major producing countries can throw some light on the trend in the basic metal industries as a whole. These countries are, in order of importance, Japan, mainland China, India and Australia. Of these, mainland China has shown the highest rate of expansion, output in 1962 being 5.3 times that of 1954. Japan has had the next highest rate of growth, output in 1963 being 3.6 times that of 1954. India almost trebled and Australia almost doubled output during the same period. Because of a higher rate of growth, India, which used to be a smaller producer than Australia, has moved up to third place in the region.

Metal products, with a weight of 26.8 per cent in the region's manufacturing index, constitute the largest single sector in manufacturing. The sector has also been one with the highest rate of expansion, output in 1963 being 7.7 times that of 1953. The annual growth rate varied from year to year between 12.5 and 45 per cent, the exceptions being 1955, 1958 and 1963, when it was 6.6 per cent, 6.3 per cent and 8.7 per cent respectively. Again, it appears that growth in this sector has slackened since 1960.

The region's major producers of metal products are, in order of importance, Japan, Australia and India, which in 1962 contributed 63.5 per cent, 11.8 per cent and 5.8 per cent respectively to the region's output, their share being over 80 per cent; by 1961 Japan had increased its output of metal products to 6.7 times its 1953 level, while the corresponding figure for India, namely 3.8, was much lower.

Because of their heterogeneous character, a representative metal product is difficult to find. For a broad indication of the trend in the sector, however, production of *passenger cars* in the region may be taken as an example. Japan is the biggest producer of passenger cars, followed by Australia and India, though up to 1959 output in Japan was smaller than in Australia. Between 1954 and 1963 output of passenger cars in Japan increased 28-fold, but in Australia and India only 3.3-fold and 4.3-fold respectively.

This survey of industrial activity in the past decade has shown that, in the region as a whole, producer goods industries have tended to grow much faster than consumer goods industries. The contrast between the expansion of, say, food products and that of metal products brings out this point very clearly. Despite the faster increase in the output of producer goods, their share in total industrial production is believed to be small in all countries of the region except Japan, mainland China, Australia and India. Most smaller countries of the region have largely restricted their industrialization efforts to consumer goods industries, whose attractions are obvious. They have ready foreign and domestic markets and require relatively low capital investment, relatively high labour input and simple technology, all of which render them suitable for local conditions. Nevertheless, such highly capital-intensive producer goods industries as power, cement, fertilizer and steel have been considered essential to development even by the smaller countries of the region, and active steps have been taken to develop them.

(B) Individual countries' rates of industrial growth

A survey of industrial activity in the region in the past decade would not be complete if attention were concentrated entirely on regional rates of growth of industrial activity as a whole and of its various sectors. For a more complete and accurate picture of industrial growth in the region in the past decade it is necessary to ascertain how industrial activity in the region is distributed among the various countries and whether those countries have achieved the same rate of industrial growth in the past decade.

Industrial activity in the region is concentrated in a few countries only. In 1958, the developing countries of the region accounted for only 22.8 per cent of total manufacturing output. Of this, India, which contributed 15.3 per cent to the region's total, alone produced more than two-thirds. The three major developed countries of the region, Japan, Australia and New Zealand, contributed 48 per cent, 18.4 per cent and 4.6 per cent respectively to the region's total, their combined share being 71 per cent.[3]

Recent developments appear to have intensified the concentration of industrial activity in the few particularly developed countries of the region. By 1961, the share of developing countries in the region's total manufacturing output had been reduced from 22.8 per cent in 1958 to 18.5 per cent. India's share in total output had also declined from 15.3 per cent in 1958 to 12.6 per cent in 1961, though that country still contributed just over two-thirds of the developing countries' share. On the other hand, the combined share of Japan, Australia and New Zealand had increased from 71 per cent in 1958 to 76 per cent in 1961, though it was only Japan which had improved its relative position. The shares of Japan, Australia and New Zealand in 1961 became 60 per cent, 12.4 per cent and 3.6 per cent respectively.

Japan's position is thus dominant both among all countries of the region and among its developed countries. Therefore, Japan's inclusion in the region's index of industrial production makes a considerable difference. When it is included, industrial output in the region between 1953 and 1963 can be seen to have risen by 240 per cent; when it is excluded, that figure is only 160 per cent. Japan has thus played a predominant

[3] The distinction between developing and developed countries adopted in this paper is admittedly an over-simplification. Certain countries having highly developed agriculture though relatively less developed industrial activity, are found to be in intermediate stages of development.

role in expanding the region's industrial output. The same is true, though to a lesser extent, of Australia, India and New Zealand.

Not only has there been uneven distribution of industrial activity in the region, but some countries have also shown more rapid rates of industrial growth than others. Of the countries for which indices of industrial production are available, Japan has shown the highest rate of growth during the period under consideration.

Between 1953 and 1963 industrial output in *Japan* increased by 270 per cent. High annual rates of increase ranging between 8 per cent and 26 per cent have been maintained, though in 1955 and 1958 output increased by only 6 per cent and 1 per cent respectively. Since 1960, when the rate of growth was about 26 per cent, there has been some slackening of the pace, the rate for 1963 being about 10 per cent. Japan being by far the biggest industrial producer of the region, deceleration in industrial growth in the region as a whole since 1960 has resulted chiefly from the Japanese trend.

Under the impetus of a series of development plans, from the six-year plan adopted in 1956 to the latest ten-year long-range plan (1961/62-1970-71), Japan, the only Asian country with a well-developed industrial base before the Second World War, has continued to forge ahead in various fields of industrial activity. Manufacturing has developed at a tremendous rate; output more than quadrupled during the period 1953-1963. The sectors of manufacturing which have shown more rapid expansion have been such producer goods industries as machinery, ferrous metals and chemicals, while consumer goods industries have lagged behind. Indeed, Japan has successfully transformed its economy from one based on light industry to one based on heavy industry and has switched from the export of light industrial products to the export of chemicals, machinery, transport equipment and ships. Expansion in the output of electricity and gas has been less rapid than in manufacturing as a whole, while mining has lagged behind.

Pakistan has shown a rate of output growth close behind that of Japan, its industrial output in 1963 being 3.5 times that of 1953. High annual rates of growth ranging between 5 per cent and 29 per cent have been continuously maintained. Before the recession of 1958, the years 1954 and 1955 showed tremendous growth rates of 29 per cent and 26 per cent respectively. After 1958 the year with the highest rate of growth was 1962 with 19 per cent. There has been no clear sign of deceleration, though output in 1963 grew at a rate of only 14 per cent. During the period under consideration, Pakistan successfully completed its first plan and was in the process of implementing its second five year plan (1960-65). Manufacturing output more than trebled, while mining lagged behind.

Next to Pakistan, the *Republic of Korea* has had the highest rate of industrial growth, its output in 1963 being 3.2 times the 1954 level. The country has benefited tremendously from industrial rehabilitation, made possible by extensive foreign aid, and from the five-year plan (1962-1966) launched at a time of great economic difficulty. High annual rates of growth have been maintained and have varied from about 10 to almost 24 per cent. Instead of slackening, growth since 1960 appears to have accelerated, its rate for 1960 being about 10 per cent and that for 1963 about 13.6 per cent. Unlike other countries in the region for which indices of industrial production are available, mining in the Republic of Korea has shown greater expansion than other branches of industrial activity, mining output in 1963 being 6.4 times as high as in 1954. This reflects successful rationalization and development of the mines. Manufacturing grew less than mining, while electricity lagged behind.

China (Taiwan) had a rate of industrial growth slightly below that of the Republic of Korea, output in 1963 being about 2.8 times as high as in 1953. Before 1958, annual rates of growth in China (Taiwan) ranged between 5 per cent and 13 per cent, while after 1958 they varied between 7 per cent and 14 per cent. On the whole, industrial growth since 1958 appears to have accelerated, though the rate of growth for 1963 was about 10 per cent. During the period under review, China (Taiwan) successfully completed its two four-year development plans and began to implement a third (1961-1964). Electricity and gas had the highest rate of expansion, followed by manufacturing, while mining and particularly construction lagged behind. In manufacturing, chemicals have shown rapid expansion in recent years, textiles moderate growth, while food appears to have stagnated.

In the *Philippines* manufacturing output between 1953 and 1963 rose by 130 per cent. Annual rates of growth of from 4 per cent to 16 per cent have been maintained. In 1960, output grew only at a rate of 3.7 per cent; but since that year, growth appears to have accelerated, the rate of growth in 1963 being 6.4 per cent. Industrial activity in the Philippines has been stimulated by rough guidelines and later by the five-year integrated socio-economic development programme (1963-1967). It appears that producer goods industries have shown rates of growth close behind those of such light consumer goods as food products and textiles.

Between 1953 and 1963, *India* increased its industrial output by 110 per cent. On the whole, annual rates of growth have been moderate varying between 3 per cent and 11 per cent. The year 1960 showed the highest rate of growth during the period; in view of this, the growth rate of 10.5 per cent for 1963 reflects favourably on progress since 1960. With two more or less successful five-year plans behind it, India has been implementing its third five-year plan (1961-1966). Though difficulties due to bottlenecks in transport and power have confronted the country, these are gradually being overcome. The slow growth rate as a whole

reflects, in a sense, the gradual transition of the industrial base of the country from light to heavy industry and the long 'gestation' period it necessarily entails. Output of electricity, which almost quadrupled during the period under consideration, showed greater growth than that of manufacturing and mining. In fact, manufacturing output doubled during the period, while mining output almost doubled. In manufacturing, the greatest rate of growth, particularly in recent years, has been recorded in such heavy industries as basic metals and chemicals reflecting the shift from light to heavy industries. Among the light industries, such sectors as food products have had a better record than textiles, which have become stagnant.

Between 1953 and 1962 *New Zealand* increased its manufacturing output by 70 per cent. In 1956, however, growth was interrupted and there was no change in output. In the remaining years, rates of growth have been moderate, ranging between 5 per cent and 11 per cent. It also appears, as in the case of Japan and some other countries, that slackening of growth has taken place since 1960, the rate of growth for 1960 being about 9 per cent and for 1962 about 5 per cent. In New Zealand in recent years, the section of manufacturing which has shown the highest growth rate is paper and paper products, while wood and cork products have lagged behind.

The index of industrial production for *Australia* is by no means complete, and is discussed here simply to give a broad indication of the trend in recent years. Manufacturing output in Australia between 1959 and 1962 rose by 8 per cent, as against 66 per cent for Japan. On the other hand, the output of fuel and power increased at the faster rate of 29 per cent, as against 45 per cent for electricity and gas in Japan. In manufacturing, the heavy industries appear to have fared better than light industries. Thus, the highest rate of growth has been achieved in metals, machinery and apparatus, while textiles have lagged behind.

It is not possible to give exact rates of growth for other countries, since indices of industrial production are not available. It can, however, be said of them that the decade has been one of steady industrial progress based on planning; for all countries of the region with the minor exception of Hong Kong have formulated plans for economic and industrial growth.

It is thus clear that while industrial growth has taken place in countries of the region, substantial rates of growth have occurred in some countries only, particularly Japan where the greater part of manufacturing activity in the region is concentrated.

(C) Nature and significance of rates of industrial growth in the region

National indices of industrial production, in terms of which growth in relative terms has been discussed, are not strictly comparable, as the classification, weightage and statistical coverage of industrial production vary from country to country. Owing to the criteria adopted for industrial statistics, much of the expansion of cottage and small-scale industries may not have been taken into account. In fact, the distinction between such concepts as "factory industry", "modern industry" or "organized industry" on the one hand, and "cottage industry", "small-scale industry" or "the unorganized industrial sector" on the other, is by no means wholly clear and varies from country to country. In an attempt to standardize terminology, the ECAFE Working Party on Cottage and Small-Scale Industries which met at Bangkok in November 1955 suggested that a cottage industry should be defined as "one which is carried on wholly or partly with the help of the members of the family, either as a whole or part-time occupation" and a small-scale industry as "one which is operated mainly with hired labour usually not exceeding 50 workers in any establishment or unit not using any motive power in any operation, or 20 workers in an establishment or unit using such power". Because of the important part played by these industries, an examination of indices of industrial production based on strict criteria of inclusion may not reveal the whole industrial picture of the region.

It is not difficult to see why several countries of the region have had a preference for small-scale and cottage industries. First, investment in cottage and small-scale enterprises has been regarded as possessing the advantage of yielding a relatively high value of current output and a high level of employment at comparatively low capital cost. Secondly, it is recognized that small enterprises help to spread industry throughout rural areas, which saves the cost associated with urbanization and contributes to a more equal distribution of income as between villages and towns. Finally, the foreign exchange component of investment in cottage and small-scale enterprises is usually small.

Quite apart from government policy, there are cases in which small-scale operations are more advantageous than large-scale ones and where small-scale establishments can survive economically side by side with the latter. Handicraft industries whose products have a high artistic value and require individual care and attention in their manufacture must necessarily be run on a small scale. In some ECAFE countries, these industries have become fairly important foreign exchange earners. Small-scale operations have also been found efficient in some simple processing industries such as those subsidiary to agriculture or complementary to large-scale manufacture. Indeed, new fields for small-scale industries may be opened up with the further exploration of technological possibilities.

Though small-scale and cottage industries are expected to play an increasingly important role in the industrial development of countries in the region, it is unfortunate that there are several factors which have

tended to retard their development. First, in a small-scale industrial establishment, the worker's income is low when compared to that of his counterpart in a larger establishment. This reflects the lower productivity attained in an average small-scale unit. Secondly, because of his lack of proper skill a worker in a small-scale industrial unit works longer hours than a worker in a large-scale unit. While this again may be due to low labour productivity in small-scale operations, it may also be caused by a lack of efficient managerial skill, proper equipment and finance and, where trade unions exist, by their organizational weakness in the small-scale industries sector. Thirdly, in most small establishments, the proprietor usually undertakes the job of management and may have had little or no formal training for the varied and difficult work involved. This, as has been pointed out, partly contributes to low productivity in small-scale industrial establishments. Fourthly, small-scale industries are often faced with a persistent lack of funds for the purchase of equipment and plant facilities and for marketing and day-to-day operations. This is partly because credit institutions are usually reluctant to assist small-scale establishments for lack of adequate security. When loans are secured, they are on relatively expensive terms. This chronic shortage of funds also contributes to low productivity and has an adverse effect on the management's attitude towards improvement. Finally, while large-scale establishments have easy access to a vast amount of information in many fields of technology and business management, it is difficult to make such information available in the small-scale industries sector. Managers of small establishments are often unaware of the need for information, and even those who do realize its importance often do not know where it can be obtained. Hence, on the whole, smaller establishments are slow in catching up with technological developments.

In an effort to develop cottage and small-scale industries and to put them on a sound footing, several countries of the region have taken measures to overcome the difficulties involved. Problems of low wages and long working hours have partly been solved by legislation requiring payment of minimum wages and the application of labour laws, where they exist, to factories which had hitherto evaded registration under factory acts. To combat the problem of lack of skill at all levels, training facilities have been provided by various governments in the hope that the trainees will be better able to employ modern methods of production and thus achieve higher productivity. To obtain more adequate access to capital and credit facilities, many institutional devices have been attempted, some with considerable success. These include a system of special financing institutions for small industries which is found, for instance, in Japan perhaps in its most comprehensive form. Finally, the industrial estate has been useful not only as a means of providing financing services, training programmes and other common facilities, but also as a centre of advisory and information services.

The indices of industrial production, besides failing to take into account the expansion of cottage and small-scale industries in the region during the past decade, are not intended to show the relative position of industrial activity in the region vis-à-vis the world as a whole. In fact, the contribution of the region to world output of industrial products has remained small, as can be seen from the following table giving the region's percentage of the world index of industrial production in 1958 and 1963:—

	1958(%)	*1963(%)*
Mining, Manufacturing Electricity and Gas . .	4.3	5.9
Food, beverages and tobacco	4.9	5.2
Textiles, clothing and leather products . . .	5.7	6.9
Wood products and furniture	4.6	...
Paper and paper products	4.0	5.8
Coal and crude petroleum, chemical, coal, petroleum and rubber products	4.7	5.5
Non-metallic minerals and products	3.7	4.7
Metal mining and basic metals	3.7	5.5
Metal products	3.1	5.7
Electricity and Gas	4.8	5.8

Source: United Nations, *Monthly Bulletin of Statistics.*

It can be seen from the figures that, in 1958 (the base year for the index), the region's industrial output only contributed 4.3 per cent of the world total, as against 35.8 per cent and 26.5 per cent contributed by Northern America (United States and Canada) and Europe respectively. Of all the sectors, textiles, clothing and leather products contributed the largest share, though 5.7 per cent is small when compared to 26.9 per cent and 28.1 per cent from Northern America and Europe respectively. Again, despite the gradual shift of emphasis in several countries of the region from light to heavy industry, the region's share in the world's output of heavy industry was relatively small, for instance, metal products, of which the region's contribution was only 3.1 per cent and those of Northern America and Europe 28.7 per cent each.

Industrial development since 1958 has fortunately improved the relative world position of the region in all sectors of industry for which data are available, as can be seen from the figures for 1963, when the region's contribution of industrial output to the world total was 5.9 per cent, and those of Northern America and Europe declined from 35.8 per cent and 26.5 per cent to 32.8 per cent and 24.5 per cent respectively. In 1963 the largest contribution of the region still came from its improved share of textiles, clothing and leather products; while, in Northern America and Europe, output of these products declined from 26.9 per cent and 28.1 per cent of the world total to 26.7 per cent and 26.8 per cent respectively. Again, as the region's share of metal products increased, those of Northern America and Europe fell from 38.7 per cent and 28.7 per cent to 34.6 per cent and 24.4 per cent respectively. It can thus be seen that, though the relative position of the region improved and those of the more industrialized

Table 8

ECAFE REGION: GROWTH OF *per capita* PRODUCTION OF MAJOR INDUSTRIAL PRODUCTS 1952-1962

(in kilogrammes unless otherwise stated)

	ECAFE developing countries		*ECAFE developed countries*		*World average*	
	1952	*1962*	*1952*	*1962*	*1952*	*1962*
Producer goods:						
Coal	86.2	316.0	665.2	739.8	585.4	630.8
Crude petroleum . . .	12.8	63.4	3.1	7.0	243.6	385.7
Iron ore	3.1	8.3	27.5	48.1	54.7	75.0
Pig iron and ferro-alloys	3.0	15.3	53.7	202.8	59.6	84.8
Crude steel	2.4	11.1	89.9	293.9	82.6	114.5
Cement	6.7	16.3	89.8	299.2	62.5	113.6
Ammonium sulphate	0.03[a]	0.6[a]	20.1	24.2	...	...
Consumer goods:						
Cigarettes (pcs.) . . .	42[a]	178[a]	933	1,576	561[a]	800[a]
Paper (other than newsprint)	0.2[a]	0.8[a]	8.7	55.1	10.0[a]	15.1[a]
Cotton Fabrics	0.9	1.2	2.5	3.8	1.9	1.9
Sugar	3.5	5.0	10.8	20.7	14.2	16.4
Vegetable oils	1.1[a]	1.3[a]	0.8	2.6	...	...

Source: United Nations, *Statistical Yearbook*; International Cotton Advisory Committee; *Cotton-World Statistics* and national sources:

[a] Excluding China (mainland).

Northern America and Europe declined between 1958 and 1963, the region's relative world position in industrial production was still very small in the latter year.

The region being very much more heavily populated than other regions of the world, the fact that it contributes a relatively small share to world output of industrial products can be brought out much more clearly by an examination of the *per capita* production of major industrial products.

It can be seen from table 8 that among the producer goods there are some encouraging trends. As far as *coal* is concerned, *per capita* production in developed ECAFE countries exceeded world averages by 14 per cent in 1952 and by 17 per cent in 1962. In fact, *per capita* coal production in developed ECAFE countries has grown faster than in the outside world, though it will be recalled that mining in the region has been one of the least dynamic sectors of industrial production. The rate of increase in *per capita* coal production in developing countries of the region has been even higher than in its developed countries, with the result that, though *per capita* production in developing ECAFE countries has been far below world averages, the difference of over 85 per cent in 1952 was reduced to one of 50 per cent by 1962.

The picture as regards *crude petroleum* is, however, not too bright, though it is steadily improving. Here the developed countries of the region are handicapped vis-à-vis the developing countries, *per capita* production of the former being far below that of the latter. In 1962, the figure for developed countries was 1.2 per cent of the world average; but this percentage improved to 1.9 in 1962, thereby reflecting a faster rate of growth than that of the world as a whole. The increase in *per capita* production of petroleum was even higher in developing countries of the region, where it rose from 5.3 per cent of the world average in 1952 to 16.9 per cent of the world average in 1962. This is not surprising in view of the remarkable rates of expansion of output achieved by major producers of the region which happen to be classified with the developing countries.

The developed countries of the region still produced less *iron ore per capita* than the world as a whole, though the discrepancy between their production figure and the world average was reduced from 49.8 per cent in 1952 to 35.9 per cent in 1962. On the other hand, the rise in the *per capita* output in developing countries of the region is more marked, though the output has remained very small being 5.7 per cent of the world average in 1952 and 11.1 per cent in 1962.

Pig iron and ferro-alloys have perhaps made the most remarkable progress among the producer goods. In 1952, *per capita* production in developed countries of the region was 10 per cent under the world average; but, in 1962, it exceeded the world average by almost 150 per cent. This partly reflects the dynamic nature of the iron and steel industry in developed countries of the region. On the other hand, *per capita* output in developing countries of the region has been below the world average, though the quantities increased from 5 per cent of the world average in 1952 to about 18 per cent in 1962. All the same, in percentage terms, the increase in the latter group of countries has been greater than in the former groups.

Less remarkable progress has been made in the developed countries of the region in the *per capita* production of *crude steel* it exceeded the world average the by 8.6 per cent in 1952 and 109 per cent in 1962. *Per capita* output of crude steel rose at a higher rate in the developing countries of the region, though it was still far below the world average, the difference being 97.1 per cent in 1952 and 90.3 per cent in 1962.

The record in the *cement* industry has been even more impressive than in iron and steel. Developed countries in the region have produced more cement *per capita* than the world as a whole. In time the excess both in absolute and relative terms, became greater. In relative terms, it was 43 per cent above the world average in 1952 and as much as 164 per cent above the world average in 1962. Even the less-developed countries of the region, which started production from a small base, were not able to achieve a comparable rate of increase. In the latter group of countries, an increase was achieved in *per capita* output from 10.7 per cent of the world average to 14.4 per cent in 1962.

Though world averages for *per capita* production of *ammonium sulphate* are not available, its *per capita* output increased both in the developed and the developing countries of the region between 1952 and 1962. The rate of increase was greater in the case of the latter group of countries; but their *per capita* output was relatively insignificant.

Encouraging trends similar to those in producer goods can be found in the *per capita* production of consumer goods in the region. *Per capita* output of *cigarettes* in developed countries of the region was above the world average both in 1952 and in 1963, as a result of a higher rate of growth than in the world as a whole, exceeding it by 66.3 per cent in 1952 and 97 per cent in 1962. Though *per capita* output of cigarettes in developing countries increased faster than in the advanced countries of the region, it was still at a low level, the difference from the world average being 92.5 per cent and 77.5 per cent for 1952 and 1962 respectively.

The *per capita* output of *paper* (other than newsprint in developed countries grew at an even higher rate than that for cement. In 1952, it was only 87 per cent of the world average, but as much as 365 per cent by 1962. The rate of growth in the developing countries of the region was smaller, and *per capita* output there amounted to only 2 per cent and 5.8 per cent of the world average for 1952 and 1962. It will be recalled that paper and paper products formed one of the most dynamic sectors of manufacturing during the period in question.

The *per capita* output of *cotton fabrics* in developing countries of the region compared more favourably with the world average than the other industrial products under consideration, the level in 1952 and 1962 being 47.2 per cent and 63.2 per cent of the world figure respectively. A higher rate of growth was achieved in the developed countries, where *per capita* output exceeded the world average by 32 per cent and 100 per cent in 1952 and 1963 respectively. It is to be noted that *per capita* output of cotton fabrics in the world as a whole remained unchanged between 1952 and 1962.

The *per capita* output of *sugar* in developed countries of the region grew at a more rapid rate than in the world as a whole, being 77.1 per cent and 126 per cent of the world average in 1952 and 1962 respectively. Growth in developing countries of the region was less rapid than in developed countries, though it was still faster than the world average, *per capita* output in developing countries being 24.6 and 30.5 per cent of the world average in 1952 and 1962 respectively.

The world average is not available for comparison in the case of *vegetable oils*, but it can be seen that *per capita* production increased in both the developed and developing countries, though the rate of growth in developed countries was greater.

This examination of the *per capita* production of selected producer and consumer goods reveals that, in the developing countries of the region, the figures for all the items are still far below the world average, though for such products as cotton fabrics, sugar and cigarettes, comparison with the world average does not reflect too unfavourably on these countries. On the other hand, *per capita* production of almost all the items in developed countries of the region is greater than the world average, except for iron ore and particularly crude petroleum, the excess over the world average being marked in the case of such items as paper, cement and pig iron. Of course, if no distinction is made between the developed and the developing countries of the region, *per capita* production in the region as a whole will compare less favourably with the world average than if the developed countries are taken by themselves. Another point has also become clear from the foregoing examination of *per capita* production in the region. Given the rates of population growth in the ECAFE region as well as in the world at large, the rapid expansion of industrial activity in the region caused *per capita* output of all the items under consideration to rise at a higher rate than in the world as a whole between 1952 and 1962. Of course, one contributing factor may well be that output in developing countries started in most cases from a small base. Nevertheless, *per capita* production in developed countries of the region being in most cases above the world average, the small size of output cannot validly be cited to explain the remarkable rates of growth in the case of such items as sugar, cotton fabrics, paper and particularly cement.

(D) Region's capacity for sustained industrial growth

The conclusion to be drawn from the examination in the previous section is that, though the remarkable rate of industrial expansion in the region is a source of some gratification, it has been due partly to the very low base from which most countries of the region started their industrial development. The comparative ease of expansion from a small base is obvious; the slower rate of industrial expansion in the world as a whole in the past decade may simply have been due to the natural difficulty of expanding production from a substantial base. The examination of absolute figures has thus served as a healthy supplement to that of rates of growth. Moreover, in the long run, preoccupation with past rates of growth as such may not be very helpful; for the future, the progress of industrialization in the region cannot be judged simply by the percentage increase of the yearly industrial output in the past. What is crucial here is rather the ability of the countries to sustain a rapid rate of industrial growth, if this can somehow be gauged or measured. In this section an attempt will be made to assess the region's capacity for sustained industrial growth through a study of such capital formation as has taken place.

For future growth to be possible it is clear that accumulation of productive capital from current output is essential. It is probable that a fairly high annual rate of capital formation has been achieved and sustained in several countries of the region in the past decade. While capital formation permits the expansion of industrial output to take place, the relationship is indeterminate and there is no theoretical justification for expecting a very close correlation. In most countries of the region, the growth of industrial output may not correspond exactly to the expansion in total capital formation, because a high proportion of development expenditure has to be devoted to infrastructure. Moreover, as a result of technological progress, new capital investments are more productive than old ones, and the yield varies from country to country according to the degree of technical advance and the time-lag in the application of the latest techniques.

Table 9

ECAFE COUNTRIES: GROSS FIXED CAPITAL FORMATION[a] AS A PERCENTAGE OF GROSS DOMESTIC PRODUCT, AND *per capita* GROSS FIXED CAPITAL FORMATION, 1953—1963

Country	*Percentage ratio of gross fixed capital formation to gross domestic product*	*Per capita gross fixed capital formation (US dollars)*[b]
Australia (1953-1962) . . .	24.8	347.9
Burma	17.1	9.5
Ceylon (1953-1962) . . .	12.2	15.9
China (Taiwan) (1953-1962) . . .	14.6	21.2
Fed. of Malaya (1955-1961) . . .	11.5	31.0
India (1953-1960) . . .	14.5	10.0
Japan	26.8	106.2
Korea, South	12.0	13.9
New Zealand (1953-1963) . . .	22.2	310.2
Philippines	9.3	16.8
Thailand (1953-1962) . . .	15.8	14.0
Viet-Nam, South (1960-1962) . . .	8.3	8.4

Source: Compiled by the ECAFE secretariat from *United Nations Yearbook of National Accounts Statistics.*

[a] Excluding changes in stocks.

[b] Generally, national currencies are converted into US dollars at the official rates of exchange.

As far as gross fixed capital formation is concerned, countries in the region appear to fall into three groups. First, there are countries whose rate of gross fixed capital formation is below 10 per cent. This group comprises the Philippines and the Republic of Viet-Nam. The second group of countries, whose rate of capital formation is between 10 per cent and 20 per cent, consists of Burma, Ceylon, China (Taiwan), the former Federation of Malaya, India, the Republic of Korea and Thailand. China (Taiwan) and the Republic of Korea have profited substantially from their recent programmes of reconstruction in which foreign aid played a vital role. The high rate in the case of Burma has been due largely to the rapid expansion of construction activity. It may also be noted that countries falling in the first two groups are developing countries of the region whose share in the total output of industrial products is small. On the other hand, countries falling in the third group, namely, Australia, Japan and New Zealand, are developed countries whose total share in the industrial output of the region is predominant. In these countries, the rate of capital formation was higher than 20 per cent, Japan having the highest rate of all.

Though Japan has the highest rate of capital formation in the region, the *per capita* amount is much smaller than in Australia and New Zealand. In fact, Australia has the highest capital formation *per capita* in the region, followed by New Zealand, Japan's figure being only 30.6 per cent of that for Australia. *Per capita* capital formation in other countries is comparatively small, the highest among them being the former Federation of Malaya with a figure of US$31, or about 1 per cent of Australia's. Despite these low *per capita* amounts, it is expected that efforts to achieve the higher rates of capital formation proposed in the various national development plans will increase them in the future.

Industrial capital formation may be measured by studying the trends in consumption of the two main raw materials for the production of capital goods, namely, steel and cement. It is true that steel and cement are used for residential construction as well as for industrial purposes, but lack of data makes it impossible to deduct the residential use from the total to get the industrial use alone.

From table 10, it is clear that *per capita* consumption of steel and cement shows wide differences between countries in varying stages of development. Countries which show the highest *per capita* consumption of *steel* are in the developed part of the region. Australia being the biggest *per capita* consumer with 334 kg in 1962. *Per capita* consumption of steel in New Zealand used to be much higher than in Japan, which, as a result of a tremendous rate of growth between 1953 and 1962, has moved up to second place. In the developing parts of the region, *per capita* consumption of steel is still small, with the exception of Hong Kong. However, considerable amounts of steel consumed in Hong Kong went into house building and infrastructure to meet the requirements of a rapidly-growing population. It may also be noted that *per capita* consumption of steel increased in almost all countries of the region between 1953 and 1962, the sole exception being Indonesia, where it appears to have declined. It is true, of course, that in several countries, notably the developed ones, *per capita* consumption of steel declined between 1961 and 1962.

A similar pattern can be detected in the *per capita* consumption of *cement* in the region, where the biggest *per capita* consumers of cement are the three developed countries. *Per capita* consumption in Japan increased

Table 10

ECAFE COUNTRIES: *Per capita* CONSUMPTION OF CEMENT AND STEEL, 1953-1962

	Cement (Kg)			Steel (Kg)		
	1955	1961	1962	1953-55	1961	1962
Afghanistan	—	—	—	—	—	—
Australia	227.8	273.1	275.8	291.0	380.0	334.0
Brunei	—	9.2	—	—	—	—
Burma	6.8	6.2	7.8	—	—	—
Cambodia	—	—	29.6	—	—	—
Ceylon	22.9	29.5	28.6	5.6	8.8	19.0
China: mainland	7.6	20.3	...	4.7[a]	21.0[a]	20.0[a]
Taiwan	75.4	112.0	119.0	14.0	26.0	29.0
Hong Kong	95.6	171.2	221.1	47.0	96.0	130.0
India	11.6	18.8	19.0	6.0	12.0	14.0
Indonesia	6.0	8.2	6.5	3.2	4.6	2.5
Iran	10.8	33.7	36.3	8.1	17.0	17.0
Japan	105.1	242.6	284.0	77.0	274.0	242.0
Korea, South	6.4	23.2	36.6	...	...	...
Laos	3.9	6.5	18.6	...	...	...
Malaysia:	—	—	—	—	—	—
Federation of Malaya	62.0[b]	69.1[b]	85.8[b]	36.0[b]	28.0	37.0
Sabah	37.4	42.2	48.1	...	...	...
Sarawak	22.2	32.8	32.2	...	...	...
Singapore	[b]	[b]	[b]	[b]	...	...
New Zealand	191.3	270.7	255.1	168.0	222.0	192.0
Pakistan	9.2	15.4	14.8	3.0	7.9	6.6
Philippines	17.4	36.2	33.1	11.3	18.0	13.0
Thailand	21.8	24.2	29.3	8.5	9.5	11.0
Viet-Nam, South	12.2	25.4	26.9	...	9.2	6.0

Source: United Natons, *Statistical Yearbook, Yearbook of International Trade Statistics;* and national publications.

[a] Including Manchuria.

[b] Including Federation of Malaya and Singapore.

so fast between 1955 and 1962 that it now replaces Australia as the region's biggest *per capita* consumer. Developing countries of the region compare better with developed ones in their *per capita* consumption of cement. For example, the figures for Hong Kong and China (Taiwan) in 1962 are not too far below that for New Zealand. Both Hong Kong and China (Taiwan) are significant *per capita* consumers of cement, large quantities in Hong Kong again being used for house-building and infrastructure. The rest of the developing countries consume much less cement *per capita*. In all the countries under consideration, *per capita* consumption of cement increased between 1953 and 1962.

Further information on the extent of, and trends in, industrial capital formation can be obtained by examining the proportion of imports of capital goods in the total. Figures in table 11 cover only developing countries of the region, the developed countries which are substantial exporters of capital goods are left out.[4] Since most developing countries of the region still have to rely on imports for their capital goods requirements, the size of their industrial efforts is closely related to the value and proportionate importance of their capital goods imports. It is true, of course, that industrial capital formation includes not only the capital goods but also the materials and labour used in the installation of capital equipment and the construction of buildings.

It can be seen that, between 1951 and 1962, the value of consumption goods imports in the developing countries of the region fell, though that of imported materials chiefly used for consumption goods actually rose. On the other hand, both the value of capital goods imports and that of imported materials chiefly used for capital goods increased. In relative terms, the percentage of imports of consumption goods and materials chiefly for consumption goods fell from 75.4 in 1951 to 57.9 in 1962. At the same time, the proportion of imports of capital goods and materials chiefly used for capital goods increased from 24.6 per cent in 1951 to 42.1 per cent in 1962. It is significant that almost half the imports of the developing countries in the region consisted of goods required for domestic capital formation.

[4] Yet Australia is not a substantial exporter of capital goods but a large importer.

Table 11

COMPOSITION OF IMPORTS IN DEVELOPING ECAFE COUNTRIES[a] 1951—1962

Year	Value (in million US dollars)				Percentage distribution			
	Consumption goods	Materials chiefly for consumption goods	Materials chiefly for capital goods	Capital goods	Consumption goods	Materials chiefly for consumption goods	Materials chiefly for capital goods	Capital goods
1951	3,533	2,086	525	1,312	47.4	28.0	7.0	17.6
1952	3,658	1,458	617	1,476	50.0	20.5	8.7	20.8
1953	2,951	1,311	537	1,259	48.7	21.6	8.9	20.8
1954	2,714	1,444	585	1,312	44.8	23.8	9.7	21.7
1955	2,613	1,687	681	1,622	39.6	25.5	10.3	24.6
1956	3,005	1,801	804	2,060	39.2	23.5	10.5	26.8
1957	3,438	1,935	1,003	2,483	38.9	21.8	11.3	28.0
1958	3,019	1,612	838	2,025	40.3	21.5	11.2	27.0
1959	2,728	1,817	854	2,106	36.3	24.2	11.4	28.1
1960	3,113	2,125	891	2,756	35.0	23.9	10.1	31.0
1961	3,076	2,186	854	2,827	34.4	24.4	9.6	31.6
1962[b]	3,015	2,408	840	3,092	32.2	25.7	9.0	33.1

Source: Prepared by the ECAFE secretariat, based on national customs returns.

[a] Covering Burma, Cambodia, Ceylon, China (Taiwan), Federation of Malaya and Singapore, Hong Kong, India, Indonesia, Republic of Korea, Laos, North Borneo, Pakistan, Philippines, Sarawak, Thailand and Republic of Viet Nam.

[b] Preliminary.

Indeed, there is evidence to suggest that, as industrial activity in the region is expanded, not only will the proportion of capital goods in total imports increase, but the import content of capital formation may also increase at the same time. Table 12 shows the import content of gross domestic fixed capital formation in 1960-61 as compared with 1953-1954. It should be realized that the import content of gross domestic fixed capital formation depends not only on the domestic production of capital goods but also on the type of capital formation which is taking place. For instance, the construction of indigenous types of buildings, village feeder roads, irrigation canals and earth dykes requires little or no import component. On the other hand, reinforced concrete roads and buildings have a larger import content in most of the countries, where steel and sometimes even cement has to be imported. Again, industrial machinery is not produced in most countries and has to be imported. Thus, both the magnitude and the change of the import content of capital formation are the combined results of the form of capital formation and the domestic availability of various types of equipment and material.

Figures in table 12 show that, with the exception of Ceylon and Thailand, all developing countries in the region for which data are available reveal a marked increase in the import content of fixed domestic capital formation between 1953-1954 and 1960-1961. This is primarily the result of a change in the form of capital formation caused by the emphasis laid on industrial development requiring imported equipment. The reduction in the import content in the case of Thailand resulted from an increase in construction work for which the domestic supply of cement has greatly expanded. Figures in (B) are greater than in (A) because the former include materials to be processed locally.

Table 12

IMPORT CONTENT OF GROSS DOMESTIC FIXED CAPITAL FORMATION

Country	(A) Ratio import of capital goods to gross domestic fixed capital formation			(B) Ratio import of capital goods and material chiefly for capital goods to gross domestic fixed capital formation		
	1953-1954 (1)	1960-1961 (2)	(2)-(1) (3)	1953-1954 (4)	1960-1961 (5)	(5)-(4) (6)
Burma	30.0	31.9	+ 1.9	38.4	41.8	+ 3.4
Ceylon	46.6	40.0	— 6.6	79.3	57.4	—21.9
China (Taiwan)	28.4	37.8	+ 9.4	35.4	45.6	+10.2
India	13.3	17.3[a]	+ 4.0	17.6	22.3[a]	+ 4.7
Korea, South	7.3	16.5	+ 9.2	11.7	26.7	+15.0
Philippines	37.9	51.7	+13.8	57.0	59.2	+ 2.2
Thailand	42.7	35.9[a]	— 6.8	53.2	26.1[a]	— 7.1
Average of seven developing ECAFE countries	18.7	22.5	+ 3.8	25.5	28.7	+ 3.2
Japan	4.5	4.0	— 0.5	13.1	14.3	+ 1.2

[a] 1959-1960.

Table 13

ECAFE REGION: GROWTH OF TRANSPORT CAPACITY 1952—1962

Transport	Percentage share of region in the world total						Percentage increase of transport and its utilization in ECAFE region in 1952-1962		
	1952			1962					
	Developing ECAFE	Developed ECAFE	Total ECAFE	Developing ECAFE	Developed ECAFE	Total ECAFE	Developing ECAFE	Developed ECAFE	Total ECAFE
Railway length	...	...	...	...	...	...	5.4	-2.7	1.9
Railway freight	2.8	2.4	5.2	3.0	2.2	5.2	71.5	43.3	58.5
Merchant shipping fleet	1.8[a]	4.0	5.8	2.7[a]	6.9	9.6	125.8	170.7	156.5
International sea-borne shipping:									
loaded	6.3	1.8	8.1	8.1	3.3	11.3	138.9	236.7	160.7
unloaded	6.1	6.3	12.4	6.1	12.0	18.2	87.1	254.2	172.0
Commercial Vehicles in use	2.2	5.3	7.5	3.1	10.6	13.7	120.3	210.9	184.7

Sources: 1. National sources; 2. United Nations, *Statistical Yearbook*; 3. United Nations, *Economic Survey of Asia and the Far East.*

[a] Including mainland China.

No less importance has been attached to infrastructure as part of capital formation than to industrial capital formation in countries of the region. Table 13 shows the growth of transport capacity in the region between 1952 and 1962, since it is generally recognized that adequate transport as part of the infrastructure is essential to industrial growth. Railway length in the region as a whole increased, though that in the developed countries fell. The percentage share of the region's railway freight in the world's total is still small and remained constant between 1952 and 1962. However, railway freight increased during the period. Similar trends of increase can be seen in the case of merchant shipping, international sea-borne shipping and commercial vehicles in use; the rates of increase here are more substantial than in the case of railways. The greatest rate of increase is that of commercial vehicles in use. On the whole, the relative world position of the region is still a minor one though it has improved in all cases except for railway freight. Its largest share in the world total 18.2 per cent in 1962, was due to unloaded international sea-borne shipping. Theoretically, the capacity used for carrying passengers as opposed to goods and raw materials should not be counted as capital formation, though it is difficult to know how much of the expanded capacity in transport has been used for consumption purposes.

(E) Industrial expansion and economic growth

While in the past decade rapid industrial growth has taken place and countries of the region have built up their capacity to generate further industrial growth, it must be recognized that high growth rates and accumulated capacity for industrial growth as such are not ends in themselves but means to an end, which is economic growth. The success of industrial development in the region should therefore be judged not so much by growth of industrial output or expansion of capacity for such growth, but by the ability of industrial activity to foster growth of employment, productivity and national product, which is a declared objective of planned development in countries of the region.

To what extent industrial development can stimulate employment, productivity and national product depends partly on the relative importance of industrial activity compared with other fields of economic activity in national economies. Owing to lack of data, it is not possible to deal with all branches of industrial activity as one single sector of the economy. Table 15 therefore gives the contribution of manufacturing, the most dynamic branch of industry, to the national product of countries in the region.

The available data for some countries of the region show that the role of manufacturing in the economy was still in most cases insignificant even as late as 1960-1962 and that it had grown very little from 1950-1952, when most of the countries first embarked on their programmes of industrialization. In 1960-1962, the proportion of manufacturing in the economies of Cambodia, Indonesia, the former Federation of Malaya and Ceylon was still under 10 per cent, the initial position in 1950-52 being slightly lower except in the case of Indonesia, which was slightly higher. Manufacturing in most other developing countries of the region had a share of between 11 and 18 per cent in 1960-1962; they include the Philippines, India, Burma, Pakistan, the Republic of Korea, Thailand and the Republic of Viet-Nam. In the case of the Philippines, Burma, Pakistan and the Republic of Korea, the initial proportion in 1950-1952 had ranged between 7 per cent and 11 per cent, and thus the position in 1960-1962 represented much improvement. In other cases, little change had taken place from the initial situation. The countries which had the largest share of manufacturing in the national product were Japan, Australia, and mainland China, whose proportions in 1960-1962 were 30 per cent, 28 per cent and 22 per cent respectively. The initial proportions for Japan, Australia and mainland

China in 1950-1952 were 24 per cent, 25 per cent and 15 per cent respectively. Thus, it is only in the developed countries of the region and in mainland China that the share of manufacturing in national product compared favourably with the situation in advanced countries outside the region.

It is clear from the data that, despite high rates of industrial growth during the past decade, manufacturing in recent years has still had a relatively low weight in the national product and cannot be expected to contribute much to economic development goals of most countries of the region for some time to come. Of course, manufacturing is only a part of total industrial activity, and mining, construction and power need to be added to it to obtain the total industrial weight in the national product. In the absence of data, industrial activity other than manufacturing can only be found in "other sectors", whose share in all the countries is more substantial than that of manufacturing. Be that as it may, the addition of mining, construction and power to manufacturing to obtain a total weight for industry, if feasible, will probably change things very little, manufacturing being the most important branch of industrial activity in these countries. Reasons for this stagnation in the proportionate growth of manufacturing and industrial activity are to be found in the position of agriculture and "other sectors".

Except in the Republic of Viet-Nam and Indonesia, the share of agriculture in the national product declined between 1950-1952 and 1960-1962, the fall being more marked in Japan, Australia, mainland China, the Philippines and Cambodia. In all the developing countries of the region for which data are available, the share of agriculture in the national product in 1960-1962 was still substantial despite the decline, ranging between 34 per cent and 61 per cent and exceeding the share of manufacturing by at least a half, except in the case of China (Taiwan) where this margin was slightly less than half. It was only in the developed countries of the region that the share of agriculture in 1960-1962 was smaller than that of manufacturing. The situation in the developing countries of the region is understandable in view of the fact that their economies depend heavily on the export of agricultural products.[5]

"Other sectors", including services as well as mining, construction and power industries, appear to have had greater relative importance in the developed than in the developing countries of the region. Their share in 1960-1962 in Japan and Australia was not surpassed by that of any of the developing countries and had increased substantially since 1950-1952, the shift having been at the expense of agriculture. In fact, even at the more advanced stage of industrialization which Australia and Japan are attempting to reach, an increasing proportion of national resources will have to be devoted to the service or tertiary sector. In most developing countries of the region, the share of "other sectors" in 1960-1962 was greater than that of agriculture, with the exception of Indonesia, Pakistan, India and mainland China, where it was less, and Cambodia, where it was equal to the share of agriculture. In all developing countries of the region "other sectors" gained at the expense of agriculture,[6] with the exception of Thailand where the share of "other sectors" remained constant and the Republic of Korea, the Republic of Viet-Nam and Indonesia, where the share of "other sectors" fell, to the advantage of agriculture in the Republic of Viet-Nam and Indonesia and to the advantage of manufacturing in the Republic of Korea (and partly in the Republic of Viet-Nam).

The ability of industrial activity to generate growth of employment, productivity and national product depends not only on the relative weight of industry in total economic activity but also on other factors, one of which is the proportion of economically active population engaged in industrial activity. As the shares of agriculture and the service sectors in most developing economies are substantial, it can be expected that a major part of their labour force will be engaged in them rather than in industry. Another important factor is the type of industry being developed. Some types of industrial activity may stimulate more growth of employment than others. In fact, if growth of employment is the only goal desired, small-scale industries or cottage industries may be more successful than organized industries in stimulating it. On the other hand, if growth of productivity and output is desired, organized industries with a high degree of mechanization will help the country to achieve the objective better, though further employment opportunities provided by such industries per unit of capital cost may be smaller.

Table 14 gives indices of industrial production, employment, productivity and national product between 1951 and 1963. As far as growth of industrial output is concerned, the picture here is slightly different from that given in table 1, which is for a slightly shorter period. Complete output figures are available up to 1962 for six countries among which comparisons can be made. Between 1951 and 1962, industrial output quintupled in Pakistan and almost did so in Japan; it almost quadrupled in China (Taiwan), more than doubled in the Philippines (manufacturing output only) and almost doubled in the case of New Zealand and India.

In all cases where data are available, it can be seen that growth of industrial employment lagged behind growth of industrial output between 1951 and 1962. This can well be expected for, while there are theoretically no physical limits to growth of output, employment

[5] Despite its advanced economy, Australia also depends heavily on exports of primary products.

[6] This suggests a close interrelationship between the industrial and agricultural sectors of an economy and that relative stagnation in the agricultural sector has impeded industrial development in the region.

Table 14

ECAFE COUNTRIES: INDICES OF INDUSTRIAL PRODUCTION EMPLOYMENT, PRODUCTIVITY AND NATIONAL PRODUCT

(1958=100)

Country	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Production													
Australia	...	...	...	...	...	...	...	...	...	...	...	...	...
Ceylon	...	...	...	...	...	...	95	100	110	118	124	133	139
China (Taiwan)	42	53	65	70	78	82	93	100	113	129	144	163	179
India	72	74	76	81	85	92	96	100	108	120	129	138	152
Japan	46	49	60	64	69	86	99	100	124	156	186	201	222
Korea, South	...	...	...	54	64	79	91	100	115	125	132	154	175
New Zealand[a,b]	71	71	75	83	88	88	95	100	103	114	119	125	...
Pakistan	30	37	48	62	78	88	93	100	112	119	126	150	171
Philippines[a]	49	52	59	66	74	86	93	100	108	112	119	126	134
Employment													
Australia	91	87	88	93	97	98	99	100	102	107	103	106	...
China (Taiwan)[c]	64	79	88	93	93	97	100	100	101	103	126	126	...
India	85	89	87	89	91	100	102	100	106	110	115	120	...
Japan	70	71	71	76	77	86	95	100	102	110	118	126	*129*
New Zealand[a]	85	86	87	91	94	94	96	100	102	106	110	113	...
Philippines[a]	80	80	88	94	94	94	100	100	105	108	110	112	114
Productivity													
Australia	...	...	...	...	...	...	...	...	...	...	...	...	...
China (Taiwan)	66	67	74	75	84	85	93	100	112	125	114	129	...
India	85	83	87	91	93	92	94	100	102	109	112	115	...
Japan	66	69	85	84	90	100	104	100	122	142	158	160	*172*
New Zealand	84	83	86	88	94	94	95	100	101	108	108	111	...
Philippines	61	65	67	70	79	91	93	100	103	104	108	113	118
GNP at Constant Prices													
Australia	77	76	81	86	90	92	93	100	104	109	108	...	...
Burma	72	76	82	85	90	93	103	100	109	117	116	116	...
Cambodia	75	80	81	91	80	89	101	100	103	...	...	...	...
Ceylon	82	88	87	90	96	90	96	100	106	112	115	118	...
China (Taiwan)	58	65	72	78	84	88	94	100	107	116	125	133	142
Fed. of Malaya	...	...	...	...	93	96	99	100	104	113	119	...	...
India	78	81	86	88	90	94	93	100	102	109	112	115	...
Indonesia	76	79	84	90	93	96	103	100	101	102	...	...	...
Japan	63	70	74	77	85	91	100	100	118	134	156	167	180
Korea, South	...	...	78	82	86	86	93	100	105	107	111	114	120
Pakistan	85	87	92	93	92	98	98	100	104	108	114	117	...
Philippines	66	71	77	81	87	92	96	100	106	109	115	120	126
Thailand	72	77	85	85	93	96	96	100	111	126	131	137	148

Sources: United Nations, *Yearbook of National Accounts Statistics; Statistical Yearbook* and *Monthly Bulletin of Statistics;* Government of the Republic of China, Ministry of Economic Affairs and Bank of Taiwan, *Taiwan Production Statistical Monthly* and *Industry of Free China;* Government of India, Central Statistical Organization, *Monthly Statistics of the Production of Selected Industries of India* and *Monthly Abstract of Statistics;* Government of Japan, Ministerial Secretariat of Labour Ministry, *Monthly Labour Statistics and Research Bulletin;* The Bank of Korea, *Monthly Statistical Review;* Government of Pakistan, Central Statistical Office, *Statistical Bulletin;* and Central Bank of the Philippines, *Statistical Bulletin.*

[a] Manufacturing only. [b] Twelve months beginning 1 April of year stated. [c] Mining and Manufacturing.

cannot expand much at or near the level of full employment. China (Taiwan) and Japan with very high growth rates of industrial output also achieved very high growth rates for employment. Other countries with relatively low output growth rates also had low growth rates for employment. The relationship is, however, by no means hard and fast. For instance Japan, which had a higher growth rate for output than China (Taiwan), failed to achieve the same employment growth rate as China (Taiwan). Similarly the Philippines, which achieved a greater expansion of output than India, appears to have failed to catch up with India in its expansion of industrial employment. On the whole, then, the relationship between output and employment in a particular country depends on the pattern of industrial development it has taken, since industries of various types differ in their ability to generate growth in employment.

Between 1951 and 1962 employment rose at a faster rate than productivity in China (Taiwan) (97 per cent as against 95 per cent), India (41 per cent as against 35 per cent) and New Zealand (33 per cent as against 31 per cent). On the other hand, employment rose less rapidly than productivity in the Philippines (40 per cent as against 85 per cent) and Japan (80 per cent as against 142 per cent). Though data are too scanty for any broad conclusion to be drawn as regards the relationship between employment and productivity, these figures suggest that in China (Taiwan) and Japan industrial development has taken place in such a way that high rates of growth both of employment and of productivity can be combined, though the emphasis in Japan is on growth of productivity. On the other hand, in India and New Zealand, given the pattern of industrial development, only low rates of growth of employment and productivity can be achieved. Finally, the Philippines appears to have developed in such a way that a high rate of growth of productivity can be attained only at the expense of growth of employment. In China (Taiwan) and Japan, the growth rates of both productivity and employment are high.

Table 15

ECAFE COUNTRIES: SECTORAL CONTRIBUTION TO NATIONAL PRODUCT IN 1960-1962 AND CHANGE FROM 1950-1952

(per cent of aggregate product at constant prices)[a]

Country[b]	Agriculture		Manufacturing[c]		Others sectors	
	Share[d]	Change[e]	Share[d]	Change[e]	Share[d]	Change[e]
Japan	15	-11	30	6	55	5
Australia	13	-10	28	3	59	7
China: mainland	40	-10	22	7	38	3
Taiwan	32	- 3	18	2	50	1
Philippines	32	-10	16	7	52	3
India	45	- 4	16	0	39	4
Burma	40	- 6	15	4	45	2
Pakistan	52	- 8	14	6	34	2
Korea, South	40	- 5	13	6	47	-1
Thailand	37	- 1	11	1	52	0
Viet-Nam, South	34	5	11	1	55	-6
Cambodia	46	-10	8	2	46	8
Indonesia	61	5	8	-1	31	-4
Federation of Malaya	44	- 2	6	1	50	1
Ceylon	47	- 6	5	1	48	5

Sources: Compiled by the ECAFE secretariat from United Nations *Yearbooks of National Accounts Statistics*, State Statistical Bureau, *Ten Great Years* for mainland China, and other national official sources.

[a] Per cent of gross domestic product at market prices for Burma and Thailand and factor cost for Australia, Cambodia, Ceylon, Federation of Malaya, and Republic of Korea; of net domestic product at factor cost for China (Taiwan), Japan and Republic of Viet-Nam; of net national product at factor cost for India, Indonesia, Pakistan and the Philippines; and of upward adjusted (to take into account excluded services) net material product at market prices for mainland China.

[b] Ranked in descending order of the percentage share of manufacturing sector in the total product in 1960-1962.

[c] Including mining and electricity in mainland China, electricity and construction in India, and all utilities in Indonesia and Pakistan.

[d] 1956 only for mainland China, 1957-1959 for Cambodia, 1958-1960 for Indonesia, 1960-1961 for Australia and Federation of Malaya.

[e] From 1951-1952 for Burma, Cambodia, China (Taiwan), Indonesia and Thailand from 1952 for mainland China, for 1953-1954 for Republic of Korea, and from 1955-1956 for Federation of Malaya.

Between 1951 and 1962, real national product more than doubled in Japan and China (Taiwan), almost doubled in Thailand and the Philippines, and rose moderately in Burma, Ceylon, India and Pakistan. Japan had the highest rate of growth of real national product, and countries with high rates of growth of industrial output generally had high rates of growth of real national product as well. This is true of China (Taiwan) and the Philippines. The only exception was Pakistan, whose fivefold increase in industrial output did not generate more than a moderate growth in real national product (38 per cent). On the other hand, countries with low rates of industrial expansion generally had low rates of growth of real national product. This applies to Ceylon and India. Thus, growth of real national product appears to have depended on the rate of industrial expansion, the extent of dependence being determined by the relative share of industrial output in total national product.

The situation in Japan and Pakistan, where manufacturing output in 1960-1962 had weights of 30 per cent and 14 per cent respectively in national product, may be considered by way of illustration. A high rate of industrial expansion enabled Japan to increase its real national product substantially, since the contribution of industry to national product was appreciable. Except in 1958, when it remained unchanged, real national product in Japan grew at high annual rates. Before 1958, annual rates of growth of national product ranged between 4 per cent and 11 per cent, whereas after 1958 they varied between 7 per cent and 31 per cent. Indeed, growth of real national product appears to have accelerated after 1958, though annual rates of growth in 1962 and 1963 remained at 7 per cent and 11 per cent respectively. However, the case of Japan, the most industrialized country of the region, is exceptional. Pakistan, which achieved an even higher rate of industrial expansion than Japan between 1951 and 1962, was able to raise its real national product only moderately, since its industrial development had been started on a small base. In fact, growth of national product in Pakistan was sometimes interrupted; in 1955, national product there fell by 1 per cent and in 1957 it stood still. In other years real national product in Pakistan grew at a rate of 3 or 4 per cent, the only exceptions being 1953, 1956, 1958 and 1961 when rates of growth ranged between 6 per cent and 9 per cent.

These considerations help to put into proper perspective the task before most countries of the region during the Development Decade of raising national income at an annual rate of 5 per cent. It is obvious that this will entail greater efforts directed at industrial development and at expanding the capacity for industrial growth. For it is only when industrial activity constitutes a significant proportion of the national product that a high rate of industrial growth can raise real national product appreciably.

III. DEVELOPMENT OF SELECTED INDUSTRIES

(A) Chemical industries

Though the proportion of output of chemicals in total manufacturing output in the region declined from 11.1 per cent in 1958 to 10.2 per cent in 1962, chemicals in the region have in recent years changed from being consumer goods to producer goods serving the needs of agriculture and industry. In one direction more emphasis has been laid on the production of fertilizers to increase the output of food and industrial crops for domestic requirements as well as for export purposes. In another direction, the production of industrial chemicals has been developed to serve the needs of such modern industries as synthetic textiles. Developments in both these directions are surveyed below.

1. Fertilizers

Consumption trends and patterns

The region's consumption of nitrogenous(N) and phosphatic fertilizers(P_2O_5) almost doubled, while that of potassic fertilizer (K_2O) almost quadrupled between 1951/52 and 1961/62. The region consumes more nitrogenous than phosphatic or potassic fertilizers. Thus, out of a total consumption of about 3.3 million metric tons in 1961/62 N accounted for about 41 per cent while P_2O_5 and K_2O accounted for about 38 per cent and 21 per cent respectively. Of total consumption in 1961/62, the developed countries of the region accounted for about 68 per cent and the developing countries for the remaining 32 per cent.

There have been interesting trends in the consumption of the three types of fertilizers, of which the major consumers are China (Taiwan), India and the Republic of Korea among the developing countries and Australia, Japan and New Zealand, the developed countries. The percentage consumption of N by developed countries fell from 63 to 46.8 between 1951/52 and 1961/62, while during the same period developing countries increased their proportion from 37 per cent to 53.2 per cent. During this period, Japan's share fell from 59.7 per cent to 44 per cent, while India increased its share from 7.8 per cent to 19.7 per cent and the Republic of Korea from 7.5 per cent to 13.6 per cent. Indeed, it was because India and the Republic of Korea substantially increased their consumption in absolute and relative terms that the share of the developing countries in the region's consumption of N increased significantly. Developed countries accounted for 90.5 per cent of the total P_2O_5 consumption in 1951/52, though their share fell to 84.5 per cent in 1961/62 to the advantage of developing countries. Australia was by far the biggest consumer of of P_2O_5, although its share fell from 43.4 per cent in 1951/52 to 39.4 per cent in 1961/62. During the same period Japan increased its share slightly from 30.2 per cent to 30.8 per cent. The share of the developed countries of the region in the consumption

Table 16

FERTILIZER CONSUMPTION AND PRODUCTION, 1951/52 AND 1961/62

Country	Consumption in 1,000 metric tons						Percentage domestically produced					
	N		P_2O_5		K_2O		N		P_2O_5		K_2O	
	1951/52	1961/62	1951/52	1961/62	1951/52	1961/62	1951/52	1961/62	1951/52	1961/62	1951/52	1961/62
Burma	0.27	3.81[a]	0.13	0.80[a]	0.03	—	—	—	—	—	—	—
Cambodia	0.02	0.14	—	0.77	0.01	0.03	—	—	—	—	—	—
Ceylon	15.80	34.70	0.19	1.60	12.50	30.30	—	—	—	—	—	—
China (Taiwan)	76.20	*121.80*	*18.20*	*26.10*	*16.00*	*33.40*	18.1	53.4	67.6	92.3	—	—
India	50.90	*310.00*	*10.40*	*70.80*	*7.20*	*37.00*	45.4	48.8	87.5	98.2	6.1	—
Indonesia	10.80	21.10[a]	8.30	9.90[a]	0.38	10.40[a]	—	—	—	—	—	—
Iran	...	7.61[a]	...	4.32[a]	...	1.50[a]	—	—	—	—	—	—
Korea, South	49.30	214.00	*19.50*	*82.10*	—	17.10	—	15.9	—	—	—	—
Malaysia	8.60	*25.50*	0.45	*6.00*	2.40	*10.20*	—	—	—	—	—	—
Pakistan	3.10	62.10	0.02	10.60	...	6.04	—	39.0	—	13.2	—	—
Philippines	24.10	54.70	11.60	26.20	4.60	31.10	—	13.5	—	22.9	—	—
Thailand	3.10	11.10[a]	0.84	4.70[a]	0.31	2.10[a]	—	—	—	—	—	—
Viet-Nam, South	1.80	15.50	1.40	3.20	1.30	4.80	—	—	—	—	—	—
Total ECAFE developing countries	242.99	*838.44*	*71.03*	*227.37*	44.73	*169.97*	*15.2*	*33.6*	*30.4*	*44.4*	1.0	—
Australia	16.90	*35.30*	*341.30*	*577.50*	*9.60*	*47.40*	79.9	69.1	104.6	99.4	—	—
Japan	392.00[b]	*695.20*	*240.00*[b]	*452.50*	*140.00*[b]	*492.80*	116.3	156.6	111.7	109.1	—	—
New Zealand	3.70	*8.40*	*132.70*	*210.30*	*12.20*	*74.00*	62.1	44.0	92.0	96.9	—	—
Total ECAFE developed countries	412.60	738.90	714.00	1,240.30	161.80	614.20	114.3	151.1	104.6	102.5	—	—

Source: United Nations Food and Agriculture Organization, *Fertilizers, An Annual Review of World Production, Consumption and Trade* (1953 and 1962), and FAO paper "Anticipated Requirements of Chemical Fertilizers in the Region up to 1957".

[a] 1960/61. [b] Including Ryukyus.

of K_2O remained almost unchanged at just over 78 per cent during the period. Japan, the biggest consumer, reduced its share from 67.9 per cent to 62.7 per cent. Thus the pattern of fertilizer consumption shows wide disparity within the region.

Available figures suggest that average consumption per 1,000 hectares of arable land also varied from country to country in the region in 1960/61. Major consumers of fertilizers in the region, namely China (Taiwan), Japan, the Republic of Korea and New Zealand, also showed very high average consumption per 1,000 hectares of arable land, whereas Australia and India had relatively low figures. Ceylon showed figures above world averages except in its consumption of P_2O_5, but Indonesia and the Philippines consumed less than the world average in relation to arable land area.

Fertilizer requirements of countries of the region for which data are available are likely to go up to 5.2 million metric tons of nutrients by 1966/67, nitrogen constituting one half, phosphatic nutrient 30 per cent and potassic nutrient 20 per cent of the total. Seven countries—China (Taiwan), India, Indonesia, Japan, the Republic of Korea, Pakistan and the Philippines—are likely to account for the lion's share of these expected requirements.

Production trends and patterns

Only five countries in the region are major producers of fertilizers, which consist almost entirely of nitrogenous and phosphatic nutrients. Japan alone accounts for about 84 per cent of the output of nitrogenous fertilizers, while the combined share of Australia and Japan in the region's output of phosphatic fertilizers amounts to 77 per cent.

Table 17

ECAFE COUNTRIES: FERTILIZER CONSUMPTION IN RELATION TO ARABLE LAND, 1960/61

(metric tons)

Country	Average consumption per 100 hectares of arable land		
	N	P_2O_5	K_2O
Australia	0.83	19.23	1.12
Ceylon[a]	19.45	1.67	18.04
China (Taiwan)	120.00	42.06	41.68
India	1.76	0.36	0.18
Indonesia[a]	1.19	0.56	0.59
Japan	124.03	80.88	98.77
Korea, South	104.69	26.45	3.38
New Zealand	12.79	349.19	98.88
Philippines	6.30	3.33	2.85
World excluding mainland China and North Korea	7.80	7.48	6.47

Source: FAO: *Fertilizers, An Annual Review of World Production, Consumption and Trade, 1962.*

[a] Average consumption per 100 hectares of agriculture land, which includes meadow and pasture as well as arable land.

Ammonium sulphate is the most important of the various kinds of nitrogenous fertilizer produced in Japan, and there are several reasons why Japan has made great efforts to develop its production. Demand for the product, which is widely used in paddy fields, has been strong in both domestic and foreign markets during the post-war period. The raw materials needed for its manufacture are locally available, and its production provides a good starting point for other branches of the chemical industry, as production can easily be diversified and overall costs reduced.

The smaller production of phosphatic fertilizers in Japan was developed much earlier than the nitrogenous fertilizer industry and may be said to be the oldest chemical fertilizer industry in the region. However, unlike its nitrogenous fertilizer production which is based on domestic raw materials, Japan's production of calcium superphosphate has had to depend entirely on imports of phosphate rock. Balance of payments difficulties have sometimes made it necessary to curtail imports of this rock, and also superphosphate production has to compete with other industries for supplies of sulphuric acid.

In India, ammonium sulphate was produced as a by-product before the war, but not much progress was made until the war stopped imports. Production of superphosphate, on the other hand, started only during the war, and it has had to depend on the supply of imported rock phosphate and sulphur. The small quantity of potash produced in the region also comes from India as a by-product of the salt industry.

Import requirements

As production of fertilizers in almost all the countries of the region has remained far below the level of consumption, the region is dependent on outside supplies. The trend has, fortunately, been in the direction of reducing this dependence on outside sources. In the developing countries of the region, import requirements for N and P_2O_5 decreased from 84.8 per cent and 69.6 per cent to 66.4 per cent and 55.6 per cent respectively between 1951/52 and 1961/62, though dependence on outside supplies of K_2O has always been practically 100 per cent. In this group, it can be seen that production of P_2O_5 in China (Taiwan) and India increased so substantially that by 1961/62 they were almost self-sufficient in it. The developed countries of the region as a whole have produced in excess of their domestic requirements, the surplus being as much as a half in 1961/62 in the case of N, though here again dependence on outside supplies of K_2O has been 100 per cent. Japan has been the only developed country with a constant surplus for exports, especially of nitrogenous fertilizers.

Table 18

ESTIMATED NEED AND ANTICIPATED SUPPLY OF CHEMICAL FERTILIZERS IN COUNTRIES OF ASIA AND THE FAR EAST BY 1966/67[a]

Country	Nitrogenous fertilizers				Phosphate fertilizers			Potash fertilizers		
	Period	Estimated need	Anticipated domestic production	Anticipated imports	Estimated need	Anticipated domestic production	Anticipated imports	Estimated need	Anticipated domestic production	Anticipated imports
		Metric tons N			Metric tons P_2O_5			Metric tons K_2O		
Afghanistan . .	1967	16,830	8,250	8,580	8,800	—	8,800	—	—	—
Brunei	1966/67	500	—	500	300	—	300	400	—	400
Burma	1966/67	12,000	—	12,000	15,000	—	15,000	4,000	—	4,000
Ceylon	1966/67	40,000	67,500[b]	-27,000[c]	22,000	—	22,000	20,000	—	20,000
China (Taiwan)	1966/67	125,000	155,000	-29,800[d]	32,300	32,300	—	42,800	—	42,800
Hong Kong . .	1966/67	2,640	—	640	2,340	—	2,340	1,440	—	1,440
India	1966/67	900,000	675,000	225,000	420,000	290,000	130,000	150,000	9,000	141,000
Indonesia . . .	1966/67	300,000	—	300,000	150,000	—	150,000	15,000	—	15,000
Japan	1966/67	760,000	1,240,000	480,000[d]	540,000	585,000	-45,000[d]	620,000	—	620,000
Korea, South . .	1966	208,573	176,090	32,483	142,455	36,800	105,655	67,276	—	67,276
Pakistan	1966/67	145,000	145,000	—	100,000	15,000	85,000	20,000	9,000	11,000
Philippines . . .	1966/67	90,000	20,000	70,000	60,000	10,000	50,000	60,000	—	60,000
Thailand	1966	28,355	—	28,355	5,811	—	5,811	5,022	—	5,022
Viet-Nam, South	1966/67	31,500	7,400	24,100	49,200	23,200	26,000	19,400	—	19,400
TOTAL		2,660,598	2,494,240	166,358	1,548,206	992,300	555,906	1,025,338	18,000	1,007,338

Source: Report of the Conference on Development of the Fertilizer Industry in Asia and the Far East to ECAFE's Committee on Industry and Natural Resources, sixteenth session (E/CN.11/I&NR/51) (Data in the table are as reported by Governments concerned except in the case of Burma, Ceylon and Indonesia, for which FAO tentative estimates are used).

[a] Refers to July-June year unless otherwise stated.

[b] Calendar year, hence Ceylon's export figure strictly speaking not deducible.

[c] Export surplus of nitrogenous fertilizers shown for Ceylon is a tentative figure.

[d] Surplus available for export indicated with (-).

Output of plant nutrients in the region is expected to be 3.5 million metric tons by 1966/67 with China (Taiwan), India, Japan, the Republic of Korea, Pakistan and the Philippines accounting for a very large share of the region's total production. Since the requirements as has been pointed out, are expected to be 5.2 million metric tons, the region's net import of fertilizer nutrients will be about 1.7 tons by 1966/67. Japan will export significant quantities of nitrogenous and phosphatic fertilizers, while China (Taiwan) and Pakistan are expected to export more nitrogenous fertilizers by 1966/67. Since the production of potash fertilizers in the region is negligible, their imports will be as high as 58 per cent of the total, those of phosphatic fertilizers about 32 per cent and those of nitrogenous fertilizers about 10 per cent.

Economics of fertilizer production

The development of fertilizer production depends upon a number of factors. Availability of raw materials, production facilities such as capital, technical know-how, trained personnel, power, market potential and crop responses to the application of fertilizers due to soil and climatic conditions are some of the important ones.

The production cost of fertilizer depends chiefly on the prices of raw material and energy, the initial capital investment and the process used. The availability of adequate power at low cost is of crucial importance for nitrogenous fertilizer, whose manufacture consumes a good deal of electric power. Raw material cost has also been a major item in the production of fertilizers in the region. In 1957 it was as much as 65 per cent of total production cost in Japan and 76 per cent in China (Taiwan) (superphosphate in the latter). The depreciation charge on capital invested in a fertilizer plant is also usually high, since technological advances rapidly make it obsolescent.

Total production cost per unit depends, of course, on the scale of operation and the size of plant. Most of the nitrogenous plants constructed in the region in the post-war period have been large ones requiring a heavy capital outlay. Generally, the larger the plant, the lower the capital investment per unit of output and the lower the unit cost of production. In developed countries, an ammonia plant with an annual capacity of about 110,000 is considered economical. In countries of the region, however, additional capital outlay is involved, since, in view of the shortage of power, a new power house usually has to be built for every new plant. The use of natural gas instead of coal has fortunately reduced investment cost. For instance, it has been estimated that a new plant using natural gas costs between $750,000 and $1,500,000 less than a plant using coke.

Partly as a result of differences in production cost in the region, prices (net of subsidies) paid by farmers per kilogramme of ammonium sulphate vary from country to country. Figures available for 1961/62 indicate relatively high prices in China (Taiwan), Iran and India and relatively low prices in Pakistan and Thailand, while those in countries such as Australia and New Zealand were somewhere between the two extremes.

Table 19

ECAFE COUNTRIES: PRICE[a] PAID BY FARMERS PER 100 KG OF NITROGENOUS FERTILIZERS (AMMONIUM SULPHATE) 1961/62

(US dollars)

Country	*Price*
Australia	33.5
Burma	28.6
Ceylon	33.0
China (Taiwan)	44.0
India	38.2
Iran	41.9
Japan	27.8
Korea, South	31.4
New Zealand	33.9
North Borneo	29.4
Pakistan	14.0
Philippines	32.0
Thailand	24.0

Source: See table 17.

[a] Net of subsidies.

Apart from the scale of plant and cost, availability of resources is likely to determine the future development of fertilizer production in the region. In the field of nitrogenous fertilizers, the raw materials required for the manufacture of ammonia are solid feedstocks such as lignite, coal and coke; liquid feedstocks such as crude petroleum, naphtha and fuel oil; and gaseous feedstocks such as refinery off-gas, natural gas and coke-oven gas. Petroleum and petroleum products and natural gas available in the region offer good resource potential, whereas sulphur, essential to the production of ammonium sulphate, is not available in adequate quantity, though the use of substitutes such as gypsum can be further developed. For phosphate fertilizer, the essential raw material is rock phosphate, which is deficient in the region. Similarly, the region appears to be acutely deficient in natural potash resources.

Problems and their solutions

Development of the fertilizer industry has been impeded by a number of problems. First, the domestic market is small, for, with the exception of Japan, India, China (Taiwan), the Republic of Korea and Australia, most countries of the region still have too low a consumption to support plants of economic size. The farmers do not, in most cases, possess adequate experience in the use of fertilizers and there are also uncertainties about profits from higher yields owing to the low level and instability of primary commodity prices. Secondly, as the industry needs heavy capital outlay

with a high foreign exchange content, most countries of the region find that they have neither sufficient capital nor foreign exchange for the purpose. Thirdly, the industry involves complex techniques and a specialized knowledge of the equipment and processes, which are lacking in most countries of the region. Fourthly, as has been pointed out, the countries of the region lack some of the resources required for the development of the industry. Lastly, transport facilities are required to move large quantities of fertilizers from the factories to the consuming areas, and a large supply of power is needed for fertilizer production; hence, as the infrastructure of most countries of the region is inadequate, development of the fertilizer industry has been impeded.

While domestic efforts can largely solve the problems of low consumption and underdeveloped infrastructure, regional efforts are required to solve some of the more formidable problems. Regional geological surveys and exploration of potential raw material sources can help to remedy the current lack of resources. Similarly, some schemes for regional or sub-regional co-operation in production may assist greatly in remedying the smallness of domestic markets, and the lack of know-how and capital.

2. Basic chemicals

As a result of inter-industry relationships, the development of many industries, such as textiles, pulp and paper, glass and metals and metal products, cannot proceed without a firm supply of basic chemicals. All these industries consume substantial amounts of such basic chemicals as caustic soda, soda ash and sulphuric acid, production of which has been developed in countries of the region. The three basic chemicals are considered below.

Caustic soda

Production trends and pattern

The major producers of caustic soda in the region are Japan, mainland China, India, Australia and China (Taiwan). Japan's role is dominant, its share in the region's total output in 1962 being 86 per cent.

Growth of output between 1954 and 1963 for all countries for which data are available was particularly rapid. Between 1956 and 1963, output in the Republic of Korea grew more than twenty fold, largely because of the very low initial base of operation. Between 1954 and 1963, output increased more than five fold in India, trebled in China (Taiwan) and more than doubled in Australia, the Philippines and Japan. The high rate of growth in mainland China is suggested by the fact that between 1954 and 1958 output there more than doubled.

Japan and mainland China are the only two major producers which have surplus for export. China (Taiwan) has attained self-sufficiency except for rayon-grade caustic soda, which has to be imported. Despite the tremendous increase in production in India, which has made that country the region's second largest producer (mainland China excepted), India is still the largest importer in the region.

Economics of caustic soda production

The electrolysis of brine is a simpler process than the manufacture of soda ash. and can also be economical on a small scale. For instance, plants with a capacity of as little as 5 tons per day operate in several parts of the world. This is particularly true of plants located in centres of consumption, for considerable saving can be made in the transport and distribution costs of caustic soda and chlorine, classified as "hazardous" goods by carriers, rail, sea and road alike. Location near the consumers also saves the cost of fusion and packing, which amounts to about $20 per ton of fused caustic soda, for it can then be sold in the liquid state as 50 per cent NaOH. For this reason several paper mills all over the world have their own electrolytic caustic soda units which also yield chlorine. In cases where the cost of electricity is high. however. meeting the requirement from imports may be found cheaper.

There are two problems of particular importance in connexion with the production of caustic soda: that of satisfactory disposal of chlorine. which when wet is

Table 20

ECAFE countries: Production of caustic soda, 1954-1963

(thousand metric tons)

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Australia[a]	20.2	26.9	32.6	34.6	40.1	42.4	47.0	48.5	48.3	57.2
China: mainland	115	137	156	198	270	...	...	...	...	...
Taiwan	14.4	15.7	19.6	25.4	25.7	29.2	32.8	36.5	37.9	45.4
India	29.8	34.8	40.0	43.3	58.1	69.9	98.3	119.8	126.4	153.2
Japan	445	502	626	677	592	720	843	922	974	1,114
Korea, South	...	...	0.2	0.3	0.2	0.2	0.3	0.8	1.4	4.1
Philippines	1.2	2.0	2.3	3.2	3.4	3.3	4.4	3.2	..	...

Source: United Nations, *Statistical Yearbook and Monthly Bulletin of Statistics.*

[a] Twelve months ending 30 June of year stated.

very corrosive to all metals, and that of unnecessary waste. In the electrolysis of brine, chlorine and hydrogen are simultaneously produced. By planning utilization of the other two products, the cost of manufacturing caustic soda can be reduced and better returns obtained. The ideal arrangement would be to develop an integrated industry to utilize all the products of electrolysis, and it would be unwise to build electrolytic plants without a ready market for caustic soda, chlorine and hydrogen. Indeed, the lack of a ready market for all these products in developing countries of the region may become one of the main obstacles to rational development of the caustic soda industry.

Soda ash

Production trends and pattern

The major producers of soda ash in the region are Japan and India, whose shares in its output of that commodity in 1963 were 67.7 per cent and 27.7 per cent respectively, their combined share being above 95 per cent. Mainland China has also been a considerable producer, but no figures are available beyond 1958. Other producers of soda ash in the region are Pakistan and China (Taiwan), the latter being the smallest of the group.

Japan's output more than doubled between 1954 and 1963, while India's increased five fold and China (Taiwan)'s more than ten fold. Up to 1958, the output in mainland China doubled, thereby suggesting greater expansion by 1963.

Only Japan and mainland China produce enough soda ash for their requirements and still have a surplus for export. On the other hand, despite tremendous expansion in output during the last decade, India still cannot produce enough for its requirements and is the region's largest importer. Output in Pakistan has not changed much, while China (Taiwan) began production only in 1952.

Consumption pattern

Soda ash has a number of end uses, and available figures show the proportions used in Japan and India, the two major consuming countries, in 1961. In Japan about 76.6 per cent is used in the production of caustic soda, glass and chemicals; some is used in the production of seasoning and soap. India had a slightly different pattern of consumption. Almost 60 per cent of total consumption went into caustic soda, glass and chemicals. One major use in India not discernible in Japan's pattern was laundry, which took up as much as 28.5 per cent of the total.

There has been one recent development adversely affecting the demand for soda ash. The demand for chlorine has been rapidly expanding and, as this can be produced along with caustic soda through electrolysis, electrolytic caustic soda is gaining ground over chemical caustic soda, and the consumption of soda ash for the manufacture of caustic soda has been reduced.

Economics of soda ash production

There are five processes in vogue in various parts of the world for the manufacture of soda ash: the natural soda process; the ammonia soda process, the dual process for co-production of soda ash and ammonium chloride, carbonation of electrolytic caustic soda and complex processing of nepheline, an orthosilicate of potassium, sodium and aluminium.

Table 21

ECAFE COUNTRIES: PRODUCTION OF SODA ASH, 1954-1963

(thousand metric tons)

Country		1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
China: mainland		309.0	405.0	476.0	506.0	640.0	...	...	...	...	...
Taiwan		1.2	1.7	2.5	3.1	3.1	4.7	11.3	13.3	12.2	12.2
India		49.1	78.5	85.6	93.4	90.9	95.3	145.3	176.6	222.7	264.0
Japan[a]	A	601.7	645.2	755.0	769.9	665.9	144.3	795.8	...	...	...
	B	306.4	327.9	376.5	361.9	383.3	449.0	515.6	583.0	594.0	645.0

Source: United Nations, *Statistical Yearbook*.

[a] A: Finished soda ash made for sale plus crude soda ash consumed by producers in the manufacture of caustic soda.

B: Finished soda ash.

Table 22

ESTIMATED PATTERN OF CONSUMPTION OF SODA ASH IN JAPAN AND INDIA, 1961

End-use	Japan (% of total)	India (% of total)
Caustic soda	27.7	11.0
Glass	28.9	28.8
Chemicals	20.0	20.1
Others	23.4	40.1
TOTAL	100.0	100.0

Source: ECAFE document, "The Soda Ash Industry in Asia and the Far East Region" (E/CN.11/I&NR/CHI/L.6).

Of these, the processing of natural soda is both simple and cheap, since it requires in most cases only calcination and, in the rest, a preliminary washing and cleaning process. In either case, the processing costs for natural soda are far lower than for any of the remaining four. But this process can be used only when deposits of natural soda are available in quantities sufficient to justify exploitation.

The most widely used is the ammonia soda process, by which over 90 per cent of the world's soda ash is produced. In the past decade or so this process has been modified, particularly in Japan, so that ammonium chloride may also be obtained with soda ash.

The first essential requirement for starting manufacture of soda ash is the existence of a sufficiently large market, since considerable economies of scale are then attainable. Low-cost manufacture can be achieved by operating large-capacity plants continuously around the clock with automatic control of the process. Capital costs and labour costs per unit of output are thereby kept low. The extent of achievable economies of scale will be apparent when it is realized that the United States, which manufactures nearly 5.5 million tons per annum or a third of the world's production, has only five manufacturers. The bulk of the world's output is contributed by plants with a capacity exceeding 1,000 tons per day.

There is no doubt that, in countries of the region, plants with a capacity of 1,000 tons per day or over, favourably situated, can produce soda ash at costs comparable to those achieved in the industrially advanced countries, but unless there is sufficient demand, production cannot be carried on economically. Of course, market demand may increase in time. India, for instance, has developed soda ash manufacture with the help of tariff protection and, once the soda ash industry has been established, demand is stimulated by the establishment of consuming industries. However, before domestic demand can be sufficiently stimulated, regional co-operation in the immediate or near future seems to offer one solution to the problem of small domestic markets in most countries of the region.

Sulphuric acid

Production trends and pattern

The region's major producers of sulphuric acid are Japan, Australia and India, whose shares in its total output in 1963 were 71 per cent, 18.1 per cent and 8.3 per cent respectively, their combined share being 97.4 per cent.

Between 1954 and 1963, output almost quadrupled in India and almost doubled in Japan and Australia. There was thus a big expansion of output in the region in the past decade.

Table 23

ECAFE COUNTRIES: PRODUCTION OF SULPHURIC ACID,[a] 1954-1963

(thousand metric tons)

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Australia[b]	744	849	911	893	1,008	1,002	1,088	1,140	1,154	1,272
China: mainland	344	375	517	632	740	1,100	...	...	...	...
Taiwan	32	31	41	45	35	53	52	62	73	101
India	153	169	168	199	230	297	354	422	458	508
Japan	3,044	3,290	3,695	3,932	3,802	4,195	4,452	4,684	4,910	4,992
Korea, South	4	3	4	—	1	3	5	9	8	11
Pakistan	...	...	...	1	2	2	3	5	5	13
Philippines	27	24	22	2	2	1	...	...	...	...

Source: United Nations, *Monthly Bulletin of Statistics and Statistical Yearbook.*

[a] In terms of 100% H_2SO_4.

[b] Twelve months ending 30 June of year stated.

Table 24

ECAFE COUNTRIES: ESTIMATED PATTERN OF CONSUMPTION OF SULPHURIC ACID, 1960

(percentage of total consumption)

End-use	India[a]	Japan	China (Taiwan)
Fertilizer	58	62	85
Textiles	17	12	3
Metallurgy	7	4	—
Inorganic chemicals	7	—	—
Petroleum refining	2	1	2
Miscellaneous	9	12	10
TOTAL	100	100	100

Source: ECAFE document, "Development of the Sulphuric Acid Industry in Asia and the Far East" (E/CN.11/I&NR/CHI/L.9).

[a] 1960/61.

Consumption pattern

Table 24 gives the proportion of end-uses to which sulphuric acid was put in India, Japan and China (Taiwan) in 1960. As much as 62 per cent of the sulphuric acid consumed in Japan was for the production of fertilizers. The textile industry was also a substantial consumer, the proportion consumed being 12 per cent. However, the growth of demand from both these sources is likely to slacken, since chemical fibre production in Japan apepars to have passed the stage of fast growth, and the fertilizer industry has tended to change from ammonium sulphate to urea. Other consuming industries in Japan were the refineries and the petro-chemical industries, whose demand for sulphuric acid is likely to increase further.

In India, the proportion of sulphuric acid used in the production of fertilizer was 58 per cent, and demand from this source is likely to increase further owing to the planned increase in fertilizer production. The textile industry, with its share of 17 per cent, was also a substantial consumer.

China (Taiwan) had the highest percentage of sulphuric acid devoted to the production of fertilizers and demand from this source is likely to increase from the 1960 proportion of 85 per cent in view of the planned expansion of fertilizer output. Other uses were relatively small.

In general, by far the greatest consumer of sulphuric acid is the fertilizer industry, particularly its ammonium sulphate and superphosphate sections. This is generally true of developing countries of the region. Thus, the development of the sulphuric acid industry in the region will depend in the first place on the development of fertilizer production.

Economics of sulphuric acid production

In view of the increasing demand for sulphuric acid in the region, the question of the best suited raw material is of decisive importance, especially as viable deposits of sulphur, one of the main raw materials, have not been found in countries of the region. Those countries have generally to choose between imported sulphur and locally produced pyrite and conditions vary from country to country.

Sulphuric acid produced in Japan is exclusively derived from extensive local deposits of pyrite. In fact, Japan is one of the world's greatest producers of sulphuric acid from this source. Apart from pyrite, the country also has gypsum and anhydrite in various places; but, as pyrite is the main and a sufficient source for the production of sulphuric acid, it has not been found necessary to depend on them for this purpose. Though gypsum and pyrite are found in India, the supply of raw material for sulphuric acid poses an important technical and economic problem. Gypsum deposits are found to be too distant from the centre of consumption and the cost of transport accordingly high. Thus, the entire production of sulphuric acid is based on imported sulphur. The Philippines is in a situation similar to Japan's, for pyrite is found as a by-product in the flotation of copper concentrates and, since it is available in abundance, no attempt has been made to use the local deposits of sulphur and gypsum. Though China (Taiwan) produces some sulphur, imported sulphur has been found cheaper. However, local production of pyrite has been increasing and it is expected to be used as a raw material in the production of sulphuric acid as well.

Future development of the sulphuric industry in the region is likely to be determined not only by availability of raw materials, but also by the cost of production. The question of scale, which affects costs, is also linked with the kind of material used. For small-scale units to be run economically, the raw material used must be sulphur, as other raw materials are economical only for larger units.

Problems involved in basic chemical industry and their solution

As most modern chemical industries are capital-intensive, it is not easy to obtain sufficient foreign exchange for the purchase of both capital equipment and a considerable proportion of the raw materials and intermediate chemicals required to maintain production during the early years of operation. Technical know-how is also inadequate and will continue to be so until a sufficient number of personnel have gained experience and local research facilities have been established. Another difficulty is the small size of local markets in comparison to the minimum scale of economic production of various chemicals. Even if the minimum level is reached by local demand, the cost of production will often be high compared with that of larger scale production, which permits savings in expenditure on equipment, labour and fuel per unit of output. Finally, there are problems concerning infrastructure. The shortage and high cost of electric power are obstacles

to the development of several basic chemical industries which consume substantial amounts of it; lack of transport facilities has hampered the smooth flow of raw materials and chemicals.

Domestic measures to solve such problems include the development of power projects in close co-ordination with chemical industries to bring down the total investment as well as the operating costs. But more important are arrangements on a regional basis. These may take the form of financial and technical co-operation or a market-sharing arrangement to increase the size of the potential market. The case for regional co-operation is strong where investment cost exceeds the financial capacity of a country. Again, regional exchanges of technical know-how and information will be most useful.

(B) Base metals industries

The share of the output of base metals in the region's manufacturing production declined from 7.4 per cent in 1958 to 5.6 per cent in 1962. Development of production of these metals is timely, as the heavy industries and particularly the engineering industries, to which the region has turned increasing attention, have to be based on them. Indeed, economic development is normally accompanied by an increase in the consumption of these metals. Non-ferrous metals and iron and steel are here discussed in turn.

1. Aluminium and other non-ferrous metals

Consumption and production of aluminium

Demand for aluminium has come from various sources, since it can be put to many uses, including conductors for the electrical industry, transport equipment and consumer durables, apart from its more traditional use in construction. The figures available show that recent consumption of aluminium in the region has been of the order of 360,000 tons a year, of which Japan had the largest share followed by India and Australia. The world total has been about 3.7 million tons a year, of which consumption in the region has been about one-tenth. *Per capita* consumption has also been low in the region, the highest figure from Japan being about 5 lb, as against 24 lb in the United States.

Production of aluminium in the region amounted to 229,000 tons in 1962, or about 5.8 per cent of the world total. Growth of production between 1954 and 1963 was rapid in all the major producing countries. It rose more than fifteen fold in Australia (1954-1962), more than tenfold in India, quadrupled in Japan and almost doubled in China (Taiwan).

Structure of the aluminium industry

The region's aluminium production is concentrated in Australia, China (Taiwan), India and Japan. Though Japan accounted for 74.5 per cent of the total output, it does not produce bauxite and depends on imports. As seen in table 5, Indonesia, India and Malaysia are the region's main bauxite producing countries and have considerable ore reserves; indeed the region as a whole is rich in crude bauxite reserves. India is the only country in the region with a relatively well-developed fully-integrated aluminium industry. Elsewhere in the region, the aluminium industry exhibits a complementary production pattern involving interdependence of various stages of aluminium production located in different countries. Japan occupies a very important position in this pattern. It obtains its bauxite resources from Indonesia, Malaysia, Australia and India, but more than compensates for its lack of bauxite resources by the abundance of low-cost hydro-electric power, which greatly facilitates the establishment and development of the aluminium industry. Moreover, suitable location of alumina plants near the sea and of smelting plants near hydro-electric resources greatly assists the Japanese industry to achieve large economies.

Economics of aluminium production

The location of an alumina plant, for the conversion of bauxite, is determined by the heavy investment required for efficient operation and by access to the market. A plant of economic size, 200,000 to 250,000 tons per annum, requires an investment of from $40 million to $50 million. However, as the cost of bauxite amounts to about 20 or 30 per cent of the total cost of production per ton of calcined alumina (at an annual capacity of between 60,000 and 330,000), proximity to the beauxite ore resources is a significant factor. A fairly large plant is required, since economies of scale can be considerable. For instance, on account of the importance of capital and labour cost and general overhead expenses, per ton cost of production in the United States is estimated to fall from $82.30 at an annual capacity of 60.000 tons to $59.00 at an annual capacity of 330,000 tons, or by about 28 per cent.

Aluminium is obtained by reducing alumina. Production cost here is affected largely by capital investment and the cost of power. Capital investment ranges between about $550 and $1.200 per annual ton of aluminium (as against $160 to $230 in the case of alumina). Significant economies of scale also exist: in the United States, the capital investment per ton falls from $900-1.200 to $550-750 as the plant capacity expands from 20.000 to 220.000 tons per annum.

Production and consumption of other non-ferrous metals

Much impetus has been given to the production of *copper* in the region by its expanding electrical industries, but aluminium has become a serious chief competitor since, in its pure or alloyed form, it can replace copper for such electrical items as conductors and associated metal components.

In the region copper is produced by Japan, Australia, mainland China and India. the share of Japan in total output in 1962 being about 57 per cent. Output

increased tremendously in all the producing countries except India between 1949-54 and 1962. It rose almost seventeenfold in mainland China, more than quadrupled in Japan, more than trebled in Australia, but rose moderately in India during the period.

The main producers of copper ore are (table 25) Australia, Japan, mainland China and the Philippines. The latter produces no copper metal and therefore exports its entire output of ore. Most countries of the region are deficient in copper ore resources.

Table 25

PRODUCTION OF COPPER

(thousand tons)

Country	*Average 1949-54*	*1955*	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*
Australia	22.1	37.4	49.0	50.4	64.6	68.5	71.0	62.5	67.2
China (mainland)	6.0	10.0	12.0	15.0	30.0	50.0	70.0	100.0	101.4
India	6.4	7.3	7.6	7.8	7.8	7.6	8.8	8.6	9.6
Japan	48.8	79.8	91.0	107.2	101.8	152.4	184.4	199.3	212.0
World total	2,580	3,020	3,355	3,400	3,310	3,510	4,140	4,630	4,820

Source: Commonwealth Economic Committee on Non-Ferrous Metals, 1963, London.
Mineral Industry Survey, U.S. Department of the Interior Bureau of Mines.
World Mineral Production in 1962, Washington, October 1963.

Table 26

PRODUCTION OF LEAD

(thousand tons)

Country	*Average 1949-54*	*1955*	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*
ECAFE countries:									
Australia	203.2	224.5	236.2	239.1	248.6	236.1	242.5	210.4	248.0
Burma	3.7	19.1	19.5	19.5	17.1	19.4	17.4	15.5	16.9
China (mainland)	6.7	21.0	25.0	28.0	36.0	58.0	71.0	85.0	85.0
India	1.1	2.2	2.6	3.2	3.3	3.9	3.7	3.6	4.4
Japan	14.4	28.5	36.7	44.8	37.9	60.0	68.3	79.0	89.5
World total	1,720	2,010	2,140	2,250	2,230	2,155	2,285	2,410	2,420

Source: Commonwealth Economic Committee on Non-Ferrous Metals, 1963, London.
Mineral Industry Survey, U.S. Department of the Interior Bureau of Mines.
World Mineral Production in 1962, Washington, October 1963.

Table 27

PRODUCTION OF TIN

(thousand tons)

Country	*Average 1949-54*	*1955*	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*
Australia	1.8	2.0	1.9	1.8	2.1	2.2	2.3	2.5	2.7
China (mainland)	5.4	12.0	14.0	16.0	18.0	21.0	24.0	24.0	30.5
Malaysia	65.6	70.6	73.3	71.3	45.3	45.7	76.1	79.1	83.3
Indonesia	0.6	2.0	2.0	0.3	1.6	2.0	2.0	2.0	2.0
Japan	0.6	0.9	1.1	1.3	1.3	1.3	1.3	1.6	2.0
World total	176.0	184.0	187.0	188.0	158.0	155.0	189.0	192.1	199.5

Source: Commonwealth Economic Committee on Non-Ferrous Metals, 1963, London.
Mineral Industry Survey, U.S. Department of the Interior Bureau of Mines.
World Mineral Production in 1962, Washington, October 1963.

Table 28

PRODUCTION OF ZINC

(thousand tons)

Country	Average 1949-54	1955	1956	1957	1958	1959	1960	1961	1962
Australia	87.3	101.1	105.0	110.3	114.8	116.5	120.2	138.7	171.2
China: (mainland)	5.0	26.0	34.0	37.0	40.0	60.0	70.2	90.0	89.5
Japan	63.8	110.8	134.1	135.8	138.8	156.8	177.6	209.1	245.0
World total	2,150	2,650	2,790	2,885	2,775	2,870	3,030	3,230	3,315

Source: Commonwealth Economic Committee on Non-Ferrous Metals, 1963, London.
Mineral Industry Survey, U.S. Department of the Interior Bureau of Mines.
World Mineral Production in 1962, Washington, October 1963.

Table 29

ECAFE COUNTRIES: INDUSTRIAL CONSUMPTION OF TIN

(metric tons)

Country	1954	1961	1962
Australia	2,580	3,376	4,554
Ceylon	35	15	15
China (mainland)	2,400	7,300	7,300
India	4,100	4,570	4,570
Indonesia	330	500	1,352
Japan	6,096	14,549	14,040
New Zealand	400	305	360
Thailand	180	200	200
World total	131,000	175,000	175,000

Source: United Nations, *Statistical Yearbook*.

Demand for *lead* has come mostly from the motor and building industries. Its production in the region is carried on chiefly by Australia, but mainland China and Japan are also major producers. Between 1949-54 and 1962, output rose more than sixfold in Japan but rose very little in Australia and mainland China.

The region is highly deficient in lead ore; its producers are, in order of importance, Australia, mainland China, Japan, Burma and India (table 5).

Demand for *zinc* depends primarily on the construction and vehicle industries, which have expanded a great deal during the past decade. The major producers of zinc metal are Japan, Australia and mainland China. Between 1949-54 and 1962, output rose almost eighteenfold in mainland China, and by 90 per cent in Australia and 60 per cent in Japan.

Deposits of zinc ores are sparse in the region, the output coming mostly from Australia and Japan.

Demand for *tin* is chiefly influenced by the expansion of the canning industry; the introduction of new lines of canned food products brought about by rising living standards in developing countries of the region is likely to stimulate this demand in the future. The region's biggest industrial consumer of tin is Japan, whose consumption of about 14,000 tons in 1962 constituted about 8 per cent of total world consumption. Other major consumers in the region are mainland China, India and Australia. Between 1954 and 1962, industrial consumption of tin more than trebled in mainland China, more than doubled in Japan, almost doubled in Australia and rose only moderately in India.

Among countries of the region, only Malaysia, mainland China, Australia, Japan and Indonesia have facilities for tin smelting. Malaysia's output, however, constituted about 42 per cent of the world total in 1962. In that year, the five producers of the region altogether contributed 120,500 tons or about 60 per cent of the world output of tin.

Between 1949-54 and 1962, output in Malaysia rose by only 27 per cent. In Australia, it increased by 50 per cent, while in mainland China it rose more than five fold.

Tin smelting has to be based on tin concentrate, of which the major producing countries of the region are Malaysia, mainland China, Indonesia and Thailand (table 5). In contrast to its copper, lead and zinc resources, the region is believed to have the largest tin reserves in the world. The richest tin belt of the world lies in South-east Asia, extending from south-west mainland China through Burma, Laos, Thailand and Malaysia to Indonesia.

Problems of the non-ferrous metal industries and their solution

The non-ferrous metal industries of the region are faced with a number of problems. First, there is an insufficient local market for the products, partly owing to the low pace of development of the engineering industries. Secondly, transport and other infrastructural

Table 30

STEEL CONSUMPTION IN 1957 AND ESTIMATED TREND VALUE FOR 1972-1975 IN THE ECAFE REGION (THE FAR EAST AND OCEANIA)

(thousand metric tons of crude steel equivalent and kg per capita)

Country	1957		1972-1975 Trend value		Percentage increase	
	1,000 tons	Kg per capita	1,000 tons	Kg per capita	Absolute	Per capita
India	3,619	9	28,000	60	674	567
Indonesia	317	4	800	8	152	100
Japan	12,627	139	35,000	324	177	133
Former Fed. of Malaya and Singapore	278	44	700	88	152	100
Pakistan	307	4	2,000	22	551	450
Philippines	396	17	1,200	44	303	159
Thailand	154	7	600	22	290	214
Others	2,348	18	5,000	27	113	50
Total Far East[a]	20,046	25	73,300	73	266	192
Australia	3,125	324	7,000	560	124	73
New Zealand	366	164	760	291	108	77
Total Oceania[b]	3,511	235	7,800	409	122	179

Source: United Nations, Long-Term Trends and Problems of the European Steel Industry, Geneva 1959.

[a] Excluding mainland China and North Korea.

[b] Including the Pacific islands.

facilities are often insufficient; these industries depend to a considerable extent on the availability of an adequate and cheap supply of electric power, but this is still not available generally in the region. Thirdly, there is a lack of technical and managerial personnel for manning industries requiring specialized know-how and administrative organization. Finally, the industries require heavy capital investment and the foreign exchange component of this is also substantial, neither of which most countries of the region can easily afford.

Both domestic and regional steps could be taken to solve all these problems. In view of the small size of their domestic markets, countries of the region will have to foster the development of engineering industries so that the demand for non-ferrous metals will be adequate to permit their economic production. At the regional level joint industries might be promoted in order to profit from considerable economies of scale. Regional co-operation could also take the form of specialization in the various stages of production, especially in the case of aluminium, or it may simply be technical.

2. IRON AND STEEL

Consumption trends and pattern

The major consumers of steel in the region are Japan, Australia, mainland China and India. Between 1953-55 and 1962, apparent consumption of steel increased more than five fold in mainland China, more than trebled in Japan, more than doubled in India, but rose only moderately in Australia.

Table 31

PIG-IRON AND FERRO-ALLOYS[a] PRODUCTION IN ECAFE COUNTRIES[b]

(thousand metric tons)

Country	1953-55 Average	1956-58 Average	1963
Australia	1,861.3	2,222.6	3,684.0
China (Taiwan)	13.6	18.3	54.0
India	1,907.3	2,022.0	6,725.0
Japan	4,913.3	7,029.6	20,434.0
Korea, South		8.0[c]	2.0

Source: United Nations, *Statistical Yearbook* and *Monthly Bulletin of Statistics.*

[a] The proportion of ferro-alloys is believed to be very small.

[b] Unless otherwise stated, the figures relate to the total production of pig-iron and ferro-alloys; direct castings are also included.

[c] Refers to 1958.

Table 32

CRUDE STEEL PRODUCTION[a] IN SELECTED ECAFE COUNTRIES

(thousand metric tons)

Country	1953-55 Average	1956-58 Average	1963
Australia	2,186.0	2,942.0	4,356.0
China (Taiwan)	28.3	91.6	215.0
India	1,658.3	1,783.3	5,976.0
Japan	8,273.3	11,931.3	31,501.0
Korea, South	4.3	16.3	160.0
Pakistan	10.6	11.0	12.0

Source: United Nations, *Statistical Yearbook.*

[a] Covers, as far as possible, the total production of crude steel, both ingots and steel for castings, whether obtained from pig iron or scrap. Unless otherwise stated, wrought (puddled) iron is excluded.

[b] Ingots only.

On a *per capita* basis only Australia, Japan, New Zealand and Hong Kong were major consumers of steel in 1962. However, even the highest figure of 334 kilogrammes *per capita* does not compare favourably with that of 438 kilogrammes *per capita* in the case of the United States and the Federal Republic of Germany.

The demand for steel in the region is expected to increase considerably as development proceeds. The estimate for 1972-1975 is 81 million tons compared with 23.5 million tons in 1957, the base year for the projection. Though the main consumers will still be Japan, India and Australia, the expected growth of consumption in India of almost 700 per cent will make that country a very substantial consumer. Almost as high a rate of growth is expected in Pakistan (551 per cent), while demand from other countries is likely to grow less rapidly. The remarkably low rates of growth for Australia and New Zealand should be noted.

Production trends and pattern

The major producers of pig-iron and ferro-alloys in the region are Japan, India and Australia, contributing 66 per cent, 21.8 per cent and 11.9 per cent respectively; their output of these products amounted to 99.7 per cent of the region's total in 1963. World output of pig-iron and ferro-alloys in 1963 amounted to 263 million tons, to which the region contributed about 11.5 per cent.

Between 1953-1955 and 1963, growth of production was rapid in all the major producing countries except Australia. During that period, output of pig-iron and ferro-alloys more than quadrupled in Japan, more than trebled in India and almost doubled in Australia.

Progress has also been rapid in the production of crude steel in the region, which contributed 11.3 per cent to the world total of 374 million tons in 1963, although that share was small when compared with those of the United States (about 25 per cent) and the Soviet Union (about 21 per cent). Of the region's total in 1963, Japan contributed 75 per cent, India 14.1 per cent and Australia 10.3 per cent, their combined share being 99.4 per cent. Rates of growth in these major producing countries exceeded those for pig-iron and ferro-alloys except in Japan, where output of crude steel rose less rapidly. Thus, between 1953-1955 and 1963, output of crude steel almost quadrupled in Japan and India and almost doubled in Australia. Of course, the relatively high rates of growth were made possible by a lower base of operation than those of such large producers as the United States and the Soviet Union.

Even with the rapid rate of increase in steel output in the region, producing countries have had to meet steel deficits by imports from outside the region. The only exception has been Japan. In other countries, demand has grown faster than supply.

Economics of steel production

The raw materials for steel making are iron ore and metallurgical coke. Japan, India and Australia are the region's leading producers of metallurgical coke, Japan alone contributing 52 per cent in 1962. Some basis for the production of coke does exist in the region, as coal of a suitable quality is available (See table 3 for coal output). Iron ore (table 4) is also available in the region, Malaysia, Australia, Japan and the Philippines being the main producers. Japan, the most important producer of iron and steel in the region, still has to import iron ore from such countries as Malaysia, India and the Philippines and iron and steel scrap from India, Hong Kong and Australia.

Steel production is capable of considerable economies of scale. As the size of plant increases, unit cost falls mainly because labour productivity increases and investment cost per unit of output decreases as more is produced. The saving in labour cost with large-scale output may be considerable, since the proportion of wages and salaries in value added by the steel industry in major producing countries of the region can be of the order of 30 to 40 per cent (1955). Investment cost apart, the cost of raw materials and fuel constitutes a substantial part of the gross value of steel and can amount to as much as 74 per cent (Japan 1955). According to one estimate based on experience in the United States (table 34), the cost of pig-iron per ton

Table 33

METALLURGICAL COKE PRODUCTION IN THE ECAFE REGION

(thousand metric tons)

Country	1948	1956-58 (Annual average)	1959-61 (Annual average)	1962[a]
Australia	1,406	2,231	2,481	2,766
China (Taiwan)	75	149	185	112
India	1,670	2,741	5,101	7,049
Iran	...	9	21	20
Japan	1,941	5,627	8,428	10,934
New Zealand	5	6	6	6
TOTAL	5,097	10,763	16,222	20,887

Source: United Nations, *Statistical Yearbook*.

[a] Provisional.

Table 34

PRODUCTION COSTS OF PIG-IRON, STEEL INGOTS AND FINISHED STEEL IN PLANTS OF DIFFERENT SIZES LOCATED AT SPARROWS POINT

(1948: dollars per ton)

Country	Annual production capacity			
	50,000	250,000	500,000	1,000,000
Pig-iron	53.32	36.49	33.65	27.63
Steel ingots	76.99	53.25	47.42	40.02
Finished steel products	155.66	100.93	83.79	71.92

Source: United Nations, *A Study of the Iron and Steel Industry of Latin America*, New York, 1954.

in a plant with an annual capacity of 1 million tons is 50 per cent lower than that of a plant producing 50,000 tons per annum. Similarly, the cost per ton of steel ingots produced in a plant with an annual capacity of 1 million tons is 48 per cent lower than that of a plant with a production capacity of 50,000 tons a year. The extent of the economies of scale is even greater in the case of finished steel products, of which the production cost per ton in a plant with an annual capacity of 1 million tons is 54 per cent lower than in a plant with a capacity of 50,000 tons. This is due to the greater degree of mechanization made possible by the higher output and the better quality of larger-scale equipment.

The results obtained from another estimate of the cost per ton of finished steel (table 35) are also revealing. In a plant with an annual capacity of 1 million tons that cost is about 40 per cent lower than in a plant with an annual capacity of 50,000 tons. The economies achieved with higher productivity of labour are considerable, the difference in labour cost per unit between the larger and the smaller plants being 79 per cent. On the other hand, a comparison of the capital cost and raw material cost per ton in the two plants shows a difference of 30 per cent and 24 per cent respectively. Hence, labour cost in the bigger plant constitutes only 5.2 per cent of total cost, as against 15.3 per cent in the smaller plant. Capital cost is by far the biggest item, the proportions in the bigger plant being 67 per cent as against 58.7 per cent in the smaller plant.

The iron and steel industry is thus another industry which requires a larger market for economical operation.

Problems and their solution

The development of the iron and steel industry in the region involves problems similar to those confronting other industries requiring specialized techniques and knowledge, heavy capital investment and raw materials not locally available in adequate quantities. Lack of reserves of raw materials, especially coking coal, lack of capital, limited transport facilities, lack of trained manpower and the small size of the market are some of the more important problems.

Table 35

ECONOMIES OF SCALE IN STEEL PRODUCTION: COST PER TON IN 1948 US DOLLARS

	Annual capacity of plant in 1,000 tons of finished steel			
	50	*250*	*500*	*1,000*
Raw materials	33.84	31.26	31.26	25.68
Maintenance and Miscellaneous . . .	20.59	11.11	10.57	9.63
Capital charges . . .	122.93	101.20	87.10	85.05
Labour cost	32.00	15.20	8.57	6.60
Total cost	209.36	108.77	137.50	127.16

Source: United Nations, *Formulating Industrial Development Programmes with Special Reference to Asia and the Far East*, Report of the Second Group of Experts on Programming Techniques.

The lack of capital in the face of heavy investment is gradually being overcome by judicious application of modern techniques and the continuing progress in research, so that smaller-scale units are now feasible and economic. Recent technical developments have also opened up a number of important possibilities for developing iron and steel production in countries lacking high-grade coal through the use of inferior coking coals, non-coking coals and natural gas. The size of the market in most countries being small, some pattern of regional specialization may also be feasible and desirable. At a higher level, possibilities of joint production among contiguous countries with complementary resource endowments may also assist greatly in achieving the benefit of large-scale production and solving the problem of small domestic markets. To cope with the lack of trained manpower, training programmes could be worked out within the countries or training facilities in more advanced countries utilized.

(C) Textile industries

The textile industries, particularly cotton, have expanded greatly in the region since the Second World War. Japan and India have become the world's largest exporters of cotton textiles, and China (mainland and Taiwan), Pakistan and Hong Kong have entered the international market. Almost all countries of the region are developing the industry as the spearhead of a programme of industrialization and perhaps a means of export diversification. However, textile output has expanded less rapidly than other sectors of manufacturing taken together, and its share of total manufacturing output in the region declined from 11.1 per cent in 1958 to 8.7 per cent in 1962.

Structure of the industry

Available figures on the average size of establishments engaged in textile production, value added and number of employees reveal some differences among countries of the region. The average size of establishment is large in India, with about 1,500 employees. At the other extreme, the former Federation of Malaya and Thailand appear to be operating establishments of very small size. In other countries, the average number employed varies from 266 in the case of Pakistan to 31 in the Republic of Korea. The contribution of value added by the textile industry to the whole manufacturing industry is in most countries small. Pakistan, India and, to a lesser extent, the Republic of Korea being the exceptions with proportions of 47.7 per cent, 38.7 per cent and 27.4 per cent respectively. The textile industry accounts for a fairly large proportion of the total manufacturing labour force in Pakistan, India and the Republic of Korea; 59.8 per cent, 54.0 per cent and 33.2 per cent respectively. In other countries, this proportion ranges from 0.9 in the former Federation of Malaya to 16.9 per cent in Japan.

Table 36

ECAFE COUNTRIES: STRUCTURE OF TEXTILE INDUSTRY, 1958-1959

Country	A	B	C
Australia	48	5.5	6.4
Burma	50	5.5	14.7
Ceylon[a]	54	13.8	14.4
China (Taiwan)[b]	135	12.7	23.5
Fed. of Malaya[b]	10	0.4	0.9
India[c]	1,500	38.7	54.0
Indonesia[c]	89	6.9	16.3
Japan[c]	29	10.2	16.9
Korea[c], South	21	27.4	33.2
Pakistan[c]	266	47.7	59.8
Philippines[c]	168	5.8	7.5
New Zealand	52	4.8	5.7
Thailand[d]	5	...	3.8

A Average number of employees per establishment.

B Value added as percentage of total value added by manufacturing.

C Persons employed as percentage of total manufacturing employment.

Source: United Nations, *Growth of World Industry*, 1938-1961, New York, 1963.

[a] 1951. [b] 1959. [c] 1958. [d] 1954.

Table 37

ECAFE COUNTRIES: NUMBER OF COTTON SPINNING SPINDLES INSTALLED, 31 DECEMBER 1950—1962

(thousands)

Country	1950[a]	1960	1961	1962
Australia	223	237	216	260
China: mainland	5,046	9,600	9,600	10,000
Taiwan	—	400	4,500	464
Hong Kong	82	490	618	632
India	10,220	13,714	13,863	14,028
Indonesia	...	127	208	250
Iran[b]	160	561	646	666
Japan	3,739	13,218	13,319	13,332
Korea, South	305	475	479	544
Pakistan	164	1,941	1,998	2,145
Philippines	...	410	540	598
Thailand	18	60	90	101

Source: United Nations, *Statistical Yearbook*.

[a] On 31 January. [b] On 31 March.

Table 38

ECAFE COUNTRIES: NUMBER OF COTTON POWER LOOMS INSTALLED, 1952-1962

Country	1952 (on 31 July)		(1962 on 31 December)	
	Ordinary	Automatic	Ordinary	Automatic
Australia[a]	1,017	2,283	767	4,417
China: mainland	56,000	8,000	200,000	100,000
Taiwan	...	...	8,097	7,132
Hong Kong	440	10,060	4,000	15,619
India	189,160	9,313	187,725	18,761
Indonesia	...	...	1,380	2,000
Iran	2,060	640	3,632	10,468
Japan	238,350	51,843	326,493	50,710
Korea, South	2,379	1,234	11,759	3,594
Pakistan	8,249	1,335	12,500	19,500
Philippines	...	...	282	13,924
Thailand	672	—	5,000	2,589

Source: United Nations, *Statistical Yearbook*.

[a] 30 June.

Capacity and production trends of the cotton textile industry

The spinning capacity of the cotton textile industry expanded considerably between 1950 and 1962. Most of this capacity is mainland China, India, Japan and Pakistan. During the period under consideration, cotton spinning capacity increased thirteenfold in Pakistan, more than trebled in Japan, almost doubled in mainland China but rose only moderately in India.

Ordinary (non-automatic) power looms for cotton textiles are concentrated in Japan and, to a lesser extent, India, and mainland China. Between 1952 and 1962, cotton weaving capacity with ordinary power looms more than trebled in mainland China, rose slightly in Japan but actually declined by 1 per cent in India.

Automatic cotton power looms in the region are concentrated in Hong Kong and Pakistan, as well as in the three countries where the greater number of ordinary cotton power looms are installed. In half of the countries for which data on the cotton power looms are available, the ordinary type has been more important, Japan, India, and mainland China being the outstanding examples. In the other half of the countries listed, the automatic type has predominated, notable examples being Pakistan, Hong Kong and Iran. The rate of growth in the number of automatic cotton power looms has indeed been much greater than that of the ordinary type. Between 1952 and 1962 the number of the automatic type installed increased seventeenfold in Iran, fourteenfold in Pakistan, twelvefold in mainland China, almost doubled in India, increased moderately in Hong Kong, but declined slightly in Japan.

The increase in the weaving capacity already discussed does not, of course, take into account hand-loom weaving, which is very common in the region. Even if the data on the number of hand-looms installed were available, the size of this industry could be gauged easily, since utilization of capacity and volume of output vary according to the availability of yarn, the efficiency of the hand-loom, the price of mill-woven cloth and (as it is often only a part-time employment for agricultural workers) the time of the year. It is not difficult to understand why several countries of the region, notably India, have tried to encourage the cotton hand-loom industry. Several advantages present themselves. The overhead expenditure is negligible; transport costs are low, the market being largely local; skill is easily acquired and leisure time, especially in slack farming seasons, can be utilized; and it gives creative scope to the weavers and makes possible a wide variety of new designs.

The trends and pattern of cotton textile manufacture in general can be inferred from the figures for industrial consumption of cotton. Since the data cover not only the consumption of cotton in spinning mills and other factories but also non-commercial or household consumption, a fair amount of the raw material consumed by

Table 39

ECAFE COUNTRIES: INDUSTRIAL CONSUMPTION OF COTTON, 1955-1963

(thousand metric tons)

Country	*1955/56*	*1956/57*	*1957/58*	*1958/59*	*1959/60*	*1960/61*	*1961/62*	*1962/63*
China: mainland	1,294.2	1,344.3	1,474.3	1,843.0	1,886.3	1,517.7	1,170.8	1,192.5
Taiwan	27.1	28.2	28.3	31.4	40.1	45.5	45.2	54.2
Hong Kong	48.4	50.3	58.5	69.4	88.9	104.1	110.6	112.7
India	928.0	928.2	945.3	957.3	964.8	1,001.7	1,071.1	1,066.8
Iran	16.9	19.5	21.7	29.3	36.9	43.4	54.2	49.9
Japan	503.5	617.1	531.9	518.3	637.2	746.1	712.5	653.5
Korea, South	47.7	56.4	52.0	57.5	65.0	58.5	54.2	69.4
Pakistan	177.8	186.5	200.6	271.2	238.5	243.9	245.0	249.3
Philippines	2.2	6.3	9.8	16.3	29.3	29.3	32.5	34.7
Thailand	8.7	8.7	10.8	10.8	11.9	15.2	17.3	19.5
Australia	18.9	19.9	19.7	19.5	20.8	18.6	20.4	20.4

Source: United Nations, *Statistical Yearbook*.

the hand-loom industry is covered as well. The major consumers of cotton in the region are mainland China, India, Japan and Pakistan. The fact that the cotton textile industry in the major producing countries of the region has been relatively stagnant is clear from the slow rate of increase of cotton consumption in all the major producers, the highest rate being that of Pakistan, where cotton consumption rose between 1955/1956 and 1962/63 by only 40 per cent. One reason why the major producers and exporters of cotton textiles in the region have faced difficulties in recent years is also clear from the figures. Industrial consumption in small producers such as Thailand more than doubled during the period, reflecting increasing self-sufficiency in cotton textiles and reduced import requirements.

Production of specific types of cotton goods may also indicate trends in the cotton textile industry. By far the biggest producer of cotton yarn in the region is mainland China, whose production figures are available up to 1960 only. Other major though lesser producers are India, Japan, Pakistan, Hong Kong, China (Taiwan) and the Republic of Korea. Output in the more substantial producing countries increased very little between 1954 and 1963, the rate of increase of pure and mixed yarn in India and Japan being 25 per cent and 3 per cent respectively; 1957 appears to have been the peak year for cotton yarn output in India and Japan. Mainland China was the only exception among the more substantial producers, its output of pure cotton yarn having increased by almost 100 per cent by 1960.

Table 40

ECAFE COUNTRIES: PRODUCTION OF COTTON YARN, 1954-1963

A. Pure B. Mixed

(thousand metric tons)

Country		*1954*	*1955*	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*	*1963*
Afghanistan	A	0.1	0.2	0.5	0.6	0.3	0.1	0.1	0.5	...	...
Australia	A+B	14.1	15.7	16.9	18.1	19.8	18.9	20.9	19.4	19.7[a]	21.2
Burma	A	1.7	1.4	1.5	1.7	2.4	3.6	3.8	3.8	4.8	4.8
Ceylon	A	0.6	0.8	0.7	0.9	0.8	0.8	1.0	1.1	1.4	...
China: mainland	A	834.1	719.8	951.6	844.8	1,106.5	1,496.5	1,632.6	...	...	...
Taiwan	A	23.6	25.1	24.4	17.9	27.5	30.7	40.4	48.8	52.4	48.0
Hong Kong	A	39.4	37.4	43.2	48.9	57.9	63.6	78.5	97.1	106.8	111.1
India	A+B	708.1	739.5	758.0	807.4	764.5	781.5	787.9	862.3	859.6	892.8
Indonesia	A+B	4.9	5.4	6.0	7.3	7.8	6.0	8.0	...	...	...
Japan	A	422.7	375.1	468.6	507.8	418.6	458.6	536.2	545.1	449.7	48.0
	B	41.8	43.4	24.5	9.3	20.4	17.6	15.2	13.5	11.7	
Korea, Republic of	A	20.8	26.6	30.7	41.4	43.7	48.5	49.2	44.2	52.5	62.4
Pakistan	A	87.1	124.5	136.3	143.8	156.6	177.8	185.4	187.2	196.1	213.6
Philippines[b]	A	1.2	0.8	1.8	3.6	8.9	5.2	15.1	12.7	13.2	8.9
Thailand[c]	A	0.2	0.3	0.1	0.3	0.5	0.6	0.6	...	...	...
Viet-Nam, Republic of	A	...	...	...	...	...	0.3	1.3	4.4	4.7	...

Source: United Nations, *Statistical Yearbook and Monthly Bulletin of Statistics*.

[a] Including tyre cord yarn.

[b] Excluding yarn made from waste.

[c] Government production only.

Table 41

ECAFE COUNTRIES: PRODUCTION OF WOVEN COTTON FABRICS, 1954-1963

A. Pure B. Mixed

Country		1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
						(million metres)					
Afghanistan[a]	A	14	17	15	20	22	16	24	27	...	...
China: mainland	A	5,230	4,361	5,803	5,050	5,100	7,500	7,600	...	...	...
Taiwan	A	167	167	142	165	147	156	176	187	200	221
India[b]	A+B	4,570	4,658	4,852	4,862	4,505	4,504	4,616	4,701	4,560	4,428
Pakistan[b,c]	A	316	414	458	482	527	566	575	639	663	668
Philippines[d]	A+B	17	11	25	47	130	99	148	128	140	125
Thailand	A	...	...	11	10	13	19	21	22	21	...
Viet-Nam, South	A	...	...	...	...	...	...	3	16	21	41
						(million square metres)					
Australia[a]	A	28	29	34	40	38	37	38	43	46	47
Ceylon	A	5	5	7	5	6	7	11	...	...	...
Hong Kong	A	...	...	151	212	228	301	386	404	...	...
Japan	A	2,550	2,351	2,761	3,100	2,542	2,656	3,118	3,282	3,015	2,980
	B	112	173	148	112	104	101	104	101	69	
Korea, South	A	96	101	123	165	177	194	188	168	193	246

Source: United Nations, *Statistical Yearbook and Monthly Bulletin of Statistics.*

[a] Twelve months beginning March of year stated.

[b] Mill production only.

[c] Including finished fabrics.

[d] Incomplete coverage.

[e] Twelve months ending 30 June of year stated.

Table 42

ECAFE COUNTRIES: NUMBER OF WOOL SPINNING SPINDLES AND LOOMS, 1948-62

Country	Spindle (thousands)		Mechanical looms (units)	
	1948	1962	1948	1962
Australia[a]	446	422	5,217	4,691
India	117[a,b]	207[c]	2,301[a,b]	2,000[c]
Japan	547	1,774	14,007	34,863
New Zealand[d]	69	84	654	731

Source: United Nations, *Statistical Yearbook.*

[a] End of June.

[b] 1950.

[c] 1961.

[d] End of March.

Expansion in the less substantial producing countries generally took place at higher rates between 1954 and 1963. Thus output of pure yarn trebled in the Republic of Korea, more than doubled in Hong Kong, Pakistan and China (Taiwan), though in Australia the output of pure and mixed yarn rose by only 50 per cent. The production trends in more substantial countries and particularly in India and Japan are indicative of the stagnation of demand faced by the cotton textile industry in the region, since the combined share of India and Japan alone in the region's total (excluding mainland China) in 1962 was about 75 per cent.

Mainland China is by far the biggest producer of cotton fabrics in the region, but production data are available only up to 1960. The other two major producers are India and Japan, which together contributed 78 per cent to the region's total (in terms of length) in 1962. During the period 1954—1963 India had a better performance in cotton yarn than cotton fabrics, for its output of pure and mixed cotton fabrics actually declined by 3 per cent. On the other hand, Japan did better in cotton fabrics than in cotton yarn, its output of pure and mixed fabrics increasing by 11 per cent. As in the case of yarn, 1957 appears to have been the peak year for the output of pure and mixed fabrics both in India and Japan. Mainland China, however, showed a higher growth trend, its output increasing by 45 per cent up to 1960. In the lesser producing countries, rates of growth were generally higher. Thus output of pure fabrics more than doubled in the Republic of Korea and Pakistan, though it rose moderately in China (Taiwan) and Australia.

A very interesting fact that emerges from an examination of the available data is that, like India but unlike Japan, production of cotton yarn in the less substantial producing countries with the exception of Australia grew faster than that of cotton fabrics. On the other hand, it may have been noticed that in all the major producing countries except Japan, cotton weaving capacity has grown faster than spinning capacity. This suggests under-utilization of cotton textile weaving capacity in several of the major producing countries. Indeed, under-utilization of capacity has been

one of the chronic problems facing the cotton textile industry in the region in recent years.

Capacity and production trends of the woollen textile industry

The greater part of the wool spinning spindles in the region are installed in Japan and Australia. Between 1948 and 1962, their number more than trebled in Japan, almost doubled in India, rose slightly in New Zealand but fell by 5 per cent in Australia.

Wool weaving capacity is concentrated in Japan and India. Between 1948 and 1962, the number of wool mechanical looms more than doubled in Japan, rose slightly in New Zealand, but actually fell in Australia and India by 12 per cent and 3 per cent respectively. In Japan and New Zealand, it seems clear that spinning capacity has risen faster than weaving capacity, though the looms installed later may be more productive than those previously installed. This reservation about technological improvement should be borne in mind in any attempt to interpret the fall in the case of Australia and India. In fact, if a constant degree of utilization of capacity can be assumed, production figures may give a better indication of actual capacity.

To obtain a general trend of woollen goods production in the countries of the region, data on industrial consumption of wool will be found useful, although in the case of India consumption by cottage industry is not covered by available data. Japan and Australia are the region's major consumers of wool. Between 1948 and 1962, industrial consumption of wool more than trebled in Japan, rose slightly in India and New Zealand, but fell by 1 per cent in Australia. The stagnation of the woollen textile industry in Australia thus seems to be confirmed. The higher growth rate of wool consumption than of cotton consumption in Japan and India suggests a diversion of resources from cotton to woollen textile production.

By far the largest producer of wool yarn in the region is Japan, while Australia and India are much smaller producers. Japan has achieved a tremendous rate of growth for wool yarn in the past decade. Between 1948 and 1963, output of pure and mixed wool yarn increased more than thirteenfold in Japan, while in Australia it remained practically unchanged. In India, the output of pure and mixed wool yarn more than doubled between 1955 and 1963.

Table 43

ECAFE COUNTRIES: INDUSTRIAL CONSUMPTION OF WOOL, 1948-1962

(thousand metric tons)

Country	*1948*	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*
Australia	33.3[a]	29.5	31.3	28.6	33.1	33.6	29.5	33.1
India[b]	3.0	4.2	4.9	4.4	4.8	5.4	4.8	4.9
Japan	3.7	77.5	85.4	73.2	108.4	127.6	147.5	134.9
New Zealand[c]	4.4	3.6	3.5	3.5	4.5	4.9	5.1	6.1

Source: United Nations, *Statistical Yearbook*.

[a] Twelve months ending June of year stated.

[b] Excludes consumption in cottage industry.

[c] Twelve months beginning of 1 April of year stated.

Table 44

ECAFE COUNTRIES: PRODUCTION OF WOOL YARN, 1948-1962

A = Pure B = Mixed

(thousand metric tons)

Country		*1948*	*1955*	*1956*	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*	*1963*
Australia[a]	A	23.1	17.4	17.2	19.0	17.9	15.3	19.0	17.9	17.1	23.5
	B		1.9	2.4	2.7	2.7	3.0	4.0	4.3	4.1	
China (Taiwan) . . .	A	—	0.9	0.9	0.6	0.6	0.8	1.0	1.7	2.1	2.6
Hong Kong	A	...	1.0	1.2	0.7	0.6	1.2	1.7	1.9	3.6	...
India	A+B	...	9.4	11.6	12.6	13.2	13.4	12.7	14.8	18.0	22.6
Japan	A	2.1	57.9	80.8	93.3	74.3	92.8	110.3	120.4	118.5	152.4
	B	8.9	25.9	24.6	22.7	18.5	23.1	23.4	23.4	29.3	
Korea, South	A	...	0.1	0.7	2.2	2.0	2.4	2.4	2.9	3.6	3.6
New Zealand[b]	A+B	0.6	3.1	2.8	3.2	4.2	4.8	5.3	5.7	—	...
Pakistan	A	...	...	...	2.7	3.1	2.4	2.9	2.3	—	...

Source: United Nations, *Statistical Yearbook* and *Monthly Bulletin of statistics*.

[a] Twelve months ending June of year stated.

[b] Twelve months beginning 1 April of year stated.

Table 45

ECAFE COUNTRIES: PRODUCTION OF WOVEN WOOLLEN FABRICS, 1948-1962

A = Pure B = Mixed

Country		1948	1955	1956	1957	1958	1959	1960	1961	1962	1963
					(million metres)						
China (Taiwan)	A	—	1	1	1	2	2	2	3	3	
India	A+B	18	13	15	15	15	18	14	13	18	20
Korea, South	A+B	—	4	4	4	4	4	4	4	5	6
New Zealand[a]	A	3	2	2	2	3	3	3	3	...	...
					(million square metres)						
Australia[b]	A	34	21	21	21	20	17	19	16	15	23
	B		3	2	6	7	5	6	6	6	
Japan	A+B	21	155	184	206	224	271	322	340	343	360

Source: United Nations, *Statistical Yearbook* and *Monthly Bulletin of Statistics.*

[a] Twelve months beginning 1 April of year stated. [b] Twelve months beginning 30 June of year stated.

Japan is also the region's largest producer of woollen fabrics. Between 1948 and 1963 output of pure and mixed woollen fabrics almost doubled in Japan, rose slightly in India but fell in Australia by about 33 per cent. The slower rate of growth of woollen fabrics than of wool yarn has thus been in line with the slower rate of growth of wool-weaving capacity than of spinning capacity. The clear fall in the output of woollen fabrics in Australia also explains the marked decline in wool-weaving capacity noted earlier.

Production trends of jute textiles

Jute textiles, including yarn, cordage and cloth, are produced chiefly in India and Pakistan. Between 1951/52-1955/56 and 1962/63, output in India rose only slightly, while in Pakistan, with a smaller base, it rose more than fivefold. In fact, Pakistan's competition in export markets in recent years has increasingly made itself felt, particularly in sacking. Jute textile production has thus provided an outlet for the resources diverted from the stagnant cotton textile industry.

Production trends in the synthetic textile industry

The production of rayon and acetate continuous filaments in the region is chiefly centred in Japan and India. Between 1954 and 1963, output of this synthetic yarn increased more than sixfold in India but rose only slightly in Japan. The slower rate of growth in Japan was due chiefly to limitation of output imposed by a joint government-industry committee in 1957, though this was lifted early in 1963. Nevertheless, the industry in Japan has voluntarily agreed to restrict output.

As with rayon and acetate continuous filaments, the production of rayon and acetate discontinuous filaments is carried on chiefly in Japan and India, though the rate of growth in India has again been much higher than in Japan. Thus, between 1954 and 1963, output increased almost eightfold in India and rose only slightly in Japan, though the much smaller base in India should be noted.

Table 46

ECAFE COUNTRIES: PRODUCTION OF JUTE MANUFACTURES, 1951-1963

(thousand tons)

Country	Average 1951/52 1955/56	1958/59	1959/60	1960/61	1961/62	1962/63
India	997	1,083	1,113	1,048	1,093	1,246
Pakistan	54	203	256	249	273	298

Source: Commonwealth Economic Committee: Industrial Fibres, 1964.

Table 47

ECAFE COUNTRIES: PRODUCTION OF RAYON AND ACETATE FILAMENTS, 1954-1963

(thousand metric tons)

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
				A. Continuous						
Australia	1.3	4.5	5.1	6.1	7.1	7.5	7.4	5.0	6.6	—
China: mainland	—	—	—	—	0.2	0.7	3.2	5.0	9.1	—
Taiwan	—	—	—	0.8	1.5	1.7	1.8	1.9	1.9	1.8
India	5.0	6.9	8.8	11.2	15.0	16.4	20.7	23.5	27.6	33.2
Japan	83.8	88.6	103.1	121.6	84.3	116.1	142.8	141.2	136.8	133.2
				B. Discontinuous						
China: mainland[a]	—	—	—	0.2	2.4	5.4	5.4	6.8	11.3	—
Taiwan[a]	—	—	—	—	0.6	1.2	1.8	2.1	2.4	2.7
India	4.2	5.7	7.9	8.0	14.0	20.4	21.8	26.1	32.3	32.3
Japan	203.2	243.5	312.9	317.0	241.7	268.7	290.7	304.2	291.6	328.8

Source: United Nations, *Statistical Yearbook* and *Monthly Bulletin of Statistics.*

[a] Production of acetate is nil or negligible.

Table 48

ECAFE COUNTRIES: PRODUCTION OF WOVEN RAYON AND ACETATE FABRICS, 1954-1963

A Pure B Mixed

Country		1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
						(million metres)					
China (Taiwan)[a]	A+B	...	...	...	0.4	2.7	5.4	6.2	11.1	16.6	18.1
India[a]	A+B	171	227	277	259	305	369	378	422	384	...
Philippines[b]	A	...	...	...	2.2	...	10.0	9.1	...	11.5	...
						(million square metres)					
Australia[c]	A	16.9	12.6	13.1	19.0	17.7	13.8	13.8	16.4	15.3	19.9
	B	3.4	2.7	3.3	1.3	1.6	1.0	1.1	1.0	1.3	
Japan	A+B	1,096	1,396	1,700	1,909	1,612	1,673	1,828	1,775	1,641	1,632
Korea, South	A+B	44	67	69	68	71	62	62	58	64	49
Pakistan[d]	A	13.1	8.9[e]	13.3	11.7	7.5	16.2	21.8	18.3	20.9	17.2

Source: United Nations, *Statistical Yearbook* and *Monthly Bulletin of Statistics*.

[a] Including fabrics of non-cellulosic fibres.

[b] Production of large establishment only.

[c] Twelve months ending 30 June of year stated.

[d] Figures for 1954-1956 are in million metres.

[e] Production of less than 12 months.

Table 49

ECAFE COUNTRIES: PRODUCTION OF NON-CELLULOSIC FIBRES, 1954-1963

A Continuous filaments B Discontinuous filaments

(thousand metric tons)

Country		1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Australia	A	...	...	...	...	0.91	1.81	2.31	2.31	2.81	...
China: mainland	A	...	...	...	...	...	0.09	0.36	0.45	0.45	...
Taiwan	A	...	...	...	...	...	...	0.05	0.14	0.18	...
Japan	A	4.11	7.72	12.86	20.62	23.42	34.50	46.68	62.88	77.74	108.6
	B	5.57	8.54	15.92	21.76	22.95	46.26	71.60	90.24	105.00	130.6
Korea, South	B	...	...	...	...	...	0.09	0.09	0.23	0.32	...

Source: United Nations, *Statistical Yearbook* and *Monthly Bulletin of Statistics*.

Japan and India are also the region's major producers of woven rayon and acetate fabrics, but the rate of growth in India has been much smaller than in Japan. Thus, between 1954 and 1962, the output of pure and mixed woven rayon and acetate fabrics more than doubled in India but rose by only 50 per cent in Japan. In fact, Japan's output declined from the peak level of 1957. It may be noted that both in India and Japan, output of fabrics has risen more slowly than that of filaments.

Japan may, in fact, be said to have passed the stage of fast growth in the production of rayon and acetate products. For instance, the growth of output of woven rayon and acetate fabrics between 1954 and 1957 was greater than between 1954 and 1963. Nevertheless, Japan has turned to a new line of synthetic fibres—non-cellulosic ones—of which she is by far the largest producer in the region; they include nylon, acrylic and polyester fibres. Growth of output of these synthetic textiles has been tremendous. Thus, between 1954 and 1963, output of continuous and discontinuous non-cellulosic filaments in Japan grew more than 24-fold. As a result of such fast growth, it is now second only to the United States in the production of nylon. More recently, growth of output of polyester fibre in Japan has also been rapid. In fact, though its production of polyester fibre in commercial quantities only started in 1958, its output has gone further ahead than acrylic and has almost caught up with that of nylon. The Japanese textile industry has shown striking resilience in turning away from traditional products for which demand has been stagnant to promising new fields.

Economics of textile production

Unlike producer goods industries, the textile industries primarily serve the ultimate consumers. Textile production requirements are also less exacting than those of producer goods industries. Relatively simple technology and low capital intensity combined with large domestic markets make textile production very suitable for countries embarking on industrial development.

Raw material, fuel and power are usually the major components of the cost of production of textiles. For instance, raw material cost in Japan (1955) constituted about 77 per cent of the total cost of cotton textiles, another 7 per cent being accounted for by wages and salaries. In India, on the other hand, raw material cost (1955) constituted only 55 per cent of the total, while labour cost amounted to as much as 23 per cent. In Japan, spinning is mainly confined to the finer counts of yarn from long-staple cotton, which has to be imported almost wholly from abroad. As a result, the raw material cost is higher than in other countries where lower counts are spun from home-grown cotton of a coarser variety. Though Japanese cotton textile manufacturers spend more on raw material, they save a good deal of money by spending less on labour as a result of large-scale mechanization.

Cost structure in the cotton textile industry may be said to exemplify the situation in the textile industry in general. In particular, it should be noted that, while the industry does not require large-scale investments, mechanization can produce much better results. The adoption of automatic looms, as the experience of Japan has shown, not only increases labour productivity but also improves the quality of output and reduces the cost of production. As mentioned before, in several countries of the region automatic looms are more numerous than ordinary ones. This is particularly true of Australia, Hong Kong, Iran and Pakistan. For instance, 62 per cent of the looms in use in Pakistan in 1962 were automatic, while the proportion of automatic looms in Australia was as high as 87 per cent. On the other hand, only 9 per cent of the cotton looms in India were automatic. Even in Japan, which has undertaken much rationalization of the industry, the percentage was just 15 per cent.

Development measures

Problems faced by the textile industries of the region stem from both the demand and supply sides, which are inter-related. On the one hand, export demand has been generally stagnant, as more and more countries are aiming at self-sufficiency in textiles. This has adversely affected cotton textiles and, to a certain extent, woollen textiles, with the result that there has been, in several cases, excess capacity in the cotton textile industry and, in some cases, a decline in the capacity of the woollen textile industry. On the other hand, textile production has suffered from inefficiency and high costs because much of it has not benefited from modern techniques of production and organization.

Table 50

ECAFE COUNTRIES: STRUCTURE OF THE PAPER AND PAPER PRODUCT INDUSTRY, 1958-1959

Country	A	B	C
Australia	61	3.0	2.1
India[a]	660	3.5	2.0
Japan[a]	32	3.9	3.5
Korea[a], South	19	1.9	2.0
New Zealand	52	6.4	3.1
Pakistan[a]	319	2.4	1.7

Source: United Nations, *The Growth of World Industry, 1938, 1961*, New York, 1963.

[a] 1958.

A = Average number of persons employed per establishment.

B = Value added as percentage of total value added by manufacturing.

C = Number employed as percentage of total employment.

It is unlikely that demand for textile products will pick up, since it seems to have low income elasticity. Hence diversion of resources from traditional products to new lines indicated by research appears to be imperative to avoid waste resulting from excess capacity. Synthetic textiles offer promise, at any rate for the moment, as the experience of India and Japan has shown, but the industry needs rationalization and reorganization to bring it up to modern standards of efficient production. Increased mechanization in several countries of the region would not only raise labour productivity but also improve the quality of textile products and reduce their production costs.

(D) Pulp and paper industry

Paper and paper products constitute the smallest sector of manufacturing in the region. In 1958, the sector contributed only 2.9 per cent to the region's total manufacturing output and in 1962 the proportion declined to 2.5 per cent. However, in view of the educational and cultural advance made in the wake of economic development in the region, the paper industry is likely to increase its importance in the future.

Structure of the paper and paper product industry

The average size of establishment in India and Pakistan appears to be large, the average number employed per establishment in India being as high as 660. In other countries, the establishments are small. In all cases, the proportion contributed by the industry to total value added by manufacturing was small, the highest being 6.4 per cent in New Zealand. The number of people employed in the industry compared with total manufacturing employment was also slight in all cases, the highest proportion being 3.1 per cent also in New Zealand. This confirms the impression given by the small weight of the industry in the region's index of manufacturing production.

Consumption and production trends

Available data show that, between 1948/49 and 1957/58, the consumption of paper and paper board in the region increased from almost 1.5 million tons to about 4.7 million tons, or by 220 per cent. Consumption in the Far East,[7] the lion's share of the region's total, rose much faster than in Australia and New Zealand, the rate in the Far East being 292 per cent as against 61 per cent in Australia and New Zealand during the period. However, as increased consumption in Australia and New Zealand was matched by their increased production, the volume of imports was kept constant at 276,000 tons. On the other hand, the rise in total requirements in the Far East exceeded the rise in production during the period, and imports increased from 306,000 tons to 422,000 tons. Production in the region as a whole rose at a higher rate than consumption, that is, by 345 per cent, though the volume of imports of the region slightly increased during the period.

[7] ECAFE region excluding Iran and Afghanistan, but including mainland China.

Pulp consumption in the region between 1948/49 and 1957/58 rose by 276 per cent, much more than that of paper and paperboard, though the region's production of pulp rose less than that of paper and paperboard, that is, by 301 per cent. In the Far East, pulp consumption rose slightly less than pulp production (305 per cent as against 315 per cent) and imports increased from 56,000 tons to 189,000 tons. In Australia and New Zealand, consumption and production of pulp rose at a slower rate, that is, by 184 per cent and 272 per cent respectively, the much higher rate of production than consumption resulting in a fall in imports from 58,000 tons to 35,000 tons.

The major consumers of paper and paperboard in the region are Japan, India, Australia and New Zealand. In 1958, of the region's total consumption of paper and paperboard, Japan accounted for about 60 per cent, India about 9 per cent and Australia and New Zealand taken together about 18 per cent, their combined share being 87 per cent. Against a consumption of 4.8 million tons in 1958, production stood at 4 million tons in 1957/58. To this total Japan contributed 3 million tons or 75 per cent.

Table 51

ACTUAL AND ESTIMATED DEMAND FOR PAPER AND PAPERBOARD IN ASIA AND THE FAR EAST

(thousand tons)

	Newsprint		*Printing and writing*		*Other*		*Paperboard*		*Total*	
	1956/58	*1975*	*1956/58*	*1975*	*1956/58*	*1975*	*1956/58*	*1975*	*1956/58*	*1975*
Continental South-east Asia[a]	44	161	39	137	25	93	29	119	137	510
Insular South-east Asia[b]	49	170	48	160	76	245	13	56	185	630
South Asia[c]	90	400	185	715	73	310	99	460	445	1,890
Of which: India	73	320	150	575	61	260	86	390	370	1,550
Others	17	80	35	140	12	50	13	70	75	340
East Asia[d]	570	2,210	690	2,340	760	2,540	900	4,070	2,920	11,160
Of which: Japan	530	2,030	630	2,100	720	2,380	860	3,900	2,740	10,410
Others	40	180	60	240	40	160	40	170	180	750
West Asia[e]	4	17	5	19	5.5	20	3.5	15	18	71
Oceania[f]	325	590	115	255	170	365	200	530	810	1,740
TOTAL	1,082	3,551	1,082	3,627	1,110	3,575	1,245	5,200	4,515	16,000

Source: United Nations/FAO, *Pulp and Paper Prospects in Asia and the Far East* (Bangkok, 1 October 1962).

[a] Burma, Cambodia, Federation of Malaya, Laos, Singapore, Thailand and South Viet-Nam.

[b] Brunei, Indonesia, Philippines and Sarawak.

[c] Ceylon, India and Pakistan.

[d] China (Taiwan), Hong Kong, Japan and South Korea.

[e] Iran.

[f] Australia and New Zealand.

Table 52

ECAFE COUNTRIES: PRODUCTION OF PAPER AND PAPER PRODUCTS, 1958-1963

(thousand tons)

Country	1958	1959	1960	1961	1962	1963
China: mainland	1,630	2,130	...	...	...	...
Taiwan	84	106	121	124	138	138
India	257	259	345	364	388	463
Korea, South	28	40	55	67	82	97
Pakistan	32	37	64	76	77	73
Thailand	3	3	3	4	6	9
Viet-Nam, South	—	—	—	1	6	12
Total ECAFE Developing Countries (Excluding mainland China)	404	445	588	636	697	792
Australia[a]	82	84	90	89	91	92
Japan	2,990	3,827	4,512	5,394	5,671	6,380
New Zealand[a,b]	76	77	91	93	116	168
Total ECAFE Developed countries	3,148	3,988	4,693	5,576	5,878	6,640

Source: *United Nations Statistical Yearbook* and national publications.

[a] Registered mills only.

[b] Twelve months beginning 1 April of year stated.

Table 53

POST-WAR PAPER AND PULP DEVELOPMENT IN ASIA AND THE FAR EAST[a]

(thousand tons)

	Paper and board		Pulp (exl. dissolving)	
	1948/49	1957/58	1948/49	1957/59
Far East[a]				
Production	681	3,475	573	2,373
Net import	306	422	56	180
Consumption	987	3,897	629	2,553
Oceania				
Production	216	541	143	538
Net import	276	276	58	35
Consumption	492	817	201	573
Total ECAFE region				
Production	897	4,016	716	2,911
Net import	582	698	114	215
Consumption	1,479	4,714	830	3,120

Source: Approaches to Regional Harmonization of National Development Plans in Asia and the Far East (E/CN.11/CAEP.2/L.5).

[a] In this table the Far East excludes mainland China.

In 1958, the output of paper and paper products in the region amounted to 3.5 million tons and by 1963 it had increased to 7.4 million tons, that is at a rate of about 110 per cent. Japan, which contributed 85 per cent to total output in 1963, had a slightly lower rate of growth than New Zealand (114 per cent as against 121 per cent). India almost doubled its output, while there was a small increase in Australian production during the period.

It has been estimated that the total demand for paper and paperboard in the region (excluding mainland China) will increase from 4.5 million tons in 1956-58 to about 8 million tons by 1965, 11.6 million tons by 1970 and 16 million tons by 1975. It has also been estimated that by 1975 four countries—Japan, India, Australia and New Zealand—will account for nearly 86 per cent of the region's total demand for paper and paperboard, with about two-thirds of the total demand in Japan alone.

On the basis of the estimated consumption levels for paper and paperboard, total pulp requirements, including long- and short-fibred chemical pulps, semi-chemical and groundwood type pulps and waste paper, are expected to increase from about 4.2 million tons in 1957/58 to 17.0 million tons by 1975. Moreover, by 1975 the region will require about 35 million cubic metres of wood (both coniferous and broadleaved species), 1.8 million tons each of bamboo and bagasse and over a million tons of straw and grasses.

Economics of paper production

Paper is produced from wood, bamboo, bagasse, straw, grasses and other fibrous materials. In countries of the region, the outlook for supplies of these raw materials is good. The prospects of wood supplies for short-fibred pulp are far better than for the long-fibred pulps for conifer, though pulpwood from existing mixed tropical forests would in several cases be more expensive per ton of pulp than such alternative fibrous materials as bagasse or rice straw. As resources of conifers in many parts of the region are limited or non-existent, bamboo pulp will continue to be, or will become, the

chief substitute for coniferous chemical pulp. Generally, in countries where both bamboo and conifers are available bamboo will be found considerably cheaper than pines from natural stands. In all sub-regions of the Far East except continental South-east Asia, bagasse is likely to be the cheapest short-fibred raw material available in large quantities for pulp and paper manufacture. On the other hand, rice straw is unlikely to become an important raw material in the overall supply of virgin fibres to the pulp and paper industry in Asia and the Far East. In South Asia in particular, rice straw will not prove economically attractive as a raw material for paper. Finally, grasses and other fibres are not expected to contribute much to the supply of raw materials to the pulp and paper industry.

Because of modern technology, a pulp and paper plant is relatively capital-intensive and enjoys considerable economies of scale. Investment and capital charges, which constitute a large proportion of the total cost, are found to decline rapidly per unit of output with the increase in the size of plant, especially within the lower capacity range. Thus, the increases in the scale of operation tends to reduce investment charges and capital costs throughout the capacity range of 25-200 tons per day, but particularly within the lower range of 25-100 tons per day. Large-scale production and the possibility of process automation in the relatively large units are likely to reduce not only capital costs but also labour inputs per ton and to give better uniformity and quality.

Despite the considerable economies of scale that can be realized in pulp and paper production, small mills dominate the production of paper and paperboard in Asian countries with the exception of Japan, India and Pakistan. The general trend in the industrialized countries is towards larger paper mills. On the other hand, some of the developing countries of the region have recently displayed a keen interest in small-scale pulp and paper manufacture. The only way to make production costs in small-scale mills comparable with those of a larger unit is by reducing the capital charge per ton of product. This may be done in two ways: simplification of design and equipment and reliance on outside sources for the supply of power, water, chemicals, repair, transport and other facilities.

Development measures

In view of the uneven distribution of resources for pulp and paper production in the region, some measure of regional or sub-regional co-operation would be helpful. For instance, *continental South-east Asia* and *insular South-east Asia* are likely to attain surpluses in industrial wood, but *South Asia, East Asia and Oceania*[a] will have deficits. Yet it is in the three latter sub-regions that the prospects of development of the pulp and paper industry are bright in view of the existence of an already well-developed paper industry. Co-operation could, for example, take the form of regional forest projects to assess the resource potential for the industry.

Moreover, to benefit from large-scale production, joint pulp and paper production projects or a specialization scheme might usefully be organized among producing countries of the region. This applies particularly to countries with plentiful supplies of raw material and with paper industries in the early stages of development.

IV. CONCLUSIONS

This review of industrial development in the region in the past decade shows that while in relative terms significant progress has been made, in absolute terms the progress has been very limited, and that, in relation to its size and vast population, the region's contribution to world industrial output has been meagre. However, the discernible trend towards a change-over from light to heavy industry in many of the countries of the region, the fact that in many cases the "gestation" period is about to end and, above all, the current low rates of consumption of essential articles, all support the hope that the second half of the Development Decade will witness a much more rapid increase in industrial growth: but it would seem that adequate advance planning and close intra-regional and international co-operation are necessary to achieve this end.

[a] See notes to table 51 for definitions of these terms.

ENGINEERING INDUSTRIES IN THE ECAFE REGION[1]

I. INTRODUCTION

The engineering industries included in this review have been classified into six main branches: mechanical engineering; electrical engineering; transport equipment; precision instruments; watch and clock-making; and metal products.

II. GENERAL STAGES OF DEVELOPMENT

Stage of development

The ECAFE countries are at different stages of development in both engineering and general economic activity. The degree of development of the engineering industries generally corresponds to the relative degree of industrialization reached in these countries. By world standards, the production of engineering goods in countries of the region other than Australia, China (mainland), Japan, India and New Zealand, may be considered insignificant, although some progress has been made during the last decade. This progress has raised industrial output and increased employment in those countries.

In the ECAFE region, Australia, China (mainland), India, Japan and New Zealand have achieved a relatively high degree of industrial development and are also its main producers of engineering goods. Japan may be considered comparable in rank to the advanced engineering countries of Europe and the United States. India has made an impressive advance in both mechanical and electrical engineering. Australia has, in recent years, made remarkable progress in the diversification and expansion of heavy and light engineering production. New Zealand is almost self-sufficient in agricultural machinery (except tractors) and has also made considerable progress in the production of miscellaneous engineering goods. Export capacities for engineering goods have also rapidly developed in these countries.

Countries such as Burma, China (Taiwan), Hong Kong, Indonesia, South Korea, Pakistan, the Philippines, Malaysia, and to a lesser degree, Thailand and Iran, have increased production of durable consumer goods such as metal manufactures, mechanical and electrical appliances, utensils, building materials, hardware and accessories. The manufacture of small engines, complete units of simple agricultural machinery, electrical goods and food processing machinery has also been started to meet part of the domestic demand. The assembly of motor vehicles and bicycles has also increased considerably in some of these countries.

The remaining countries in the region produce little in the way of engineering goods and have only a few small-scale repair shops.

III. STRUCTURE, CHARACTERISTICS, POSITION AND PROGRAMME OF DEVELOPMENT OF THE ENGINEERING INDUSTRIES IN THE ECAFE COUNTRIES

The lack of adequate statistical information about the structure and characteristics of the engineering industries in most countries of the region does not permit an exhaustive analysis of these industries. Some features of the progress made and plans for developing them are described here country by country.

A. Countries with more advanced engineering industries

AUSTRALIA

Economic structure[2]

Australia is regarded as one of the leading producers in primary products in the world. Three-fifths of the area of the country is utilized for the production of agricultural products or for the raising of livestock, the production of livestock products and related industries. Of about 4.3 million[3] in the work force of 1962, about 1.2 million were engaged or employed in the manufacturing industry. Agriculture contributed about 13 per cent and manufacturing about 28 per cent respectively to the national income in 1961/62, compared to about 14 per cent and 29 per cent respectively in 1958.

SOURCES OF NATIONAL INCOME

Economic sector	*1958-59*	*1959-60*	*1960-61*	*1961-62*
Agriculture, forestry, fishing, etc.	14.4	13.6	13.2	12.6
Manufacturing	28.5	29.1	28.7	28.2
Others	57.1	57.3	58.1	59.2

[1] Based on ECAFE document E/CN.11/I&NR/Sub.2/L.32, prepared for the tenth session of the Sub-Committee on Metals and Engineering.

[2] *Yearbook National Account Statistics 1962.*

[3] *The Industrialization of Australia*, Third Edition Revised, pp.1-5, F.G. Davidson.

Engineering industries

The engineering industries of Australia by world standards are small. They are, however, well established and diversified. In recent years, from the experiences gained in the last two decades, the industrial emphasis shifted from subsistence industries producing food, clothing and other consumer goods to the manufacture of industrial and farm machinery, electrical goods, construction and transport equipment and miscellaneous metal products. Australian manufacturers have produced most of the consumer goods needed to meet domestic demand, about 60 per cent of the rolling stock and about 50 per cent of the motor car and commercial vehicle requirements.

Some aspects of the structure and characteristics of the engineering industries of Australia are shown in the following table.[4]

ENGINEERING INDUSTRIES

1959-60

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*[a]
			A£'000
Manufacturing	*56,657*	*1,131,677*	*2,074,882*
of which:			
Engineering industries[b]	*19,107*	*342,860*	*541,749*
1. Plant, equipment and machinery (including machine tools)	2,518	76,096	138,402
2. Other engineering	2,318	25,780	42,264
3. Electrical machinery, cables and apparatus	1,360	53,089	90,199
4. Tramcars and railway rolling stock	129	36,746	41,473
5. Motor vehicles, construction, assembly and repairs, etc.	12,089	120,231	182,260
6. Agricultural machines and implements	404	11,359	16,847
7. Wireless and amplifying apparatus	289	19,559	30,304
% *Engineering industries/manufacturing*	*33.7*	*30.3*	*26.1*
Basic metal industries[c] . . .	383	15,291	32,827
Total engineering industries including basic metal industries . .	*19,490*	*358,151*	*574,576*
% *Engineering industries including basic metal industries/manufacturing*	*34.4*	*31.6*	*27.2*

[a] Value of output less value of materials and fuel etc. used.

[b] Individual industries.

[c] Foundries, extracting and refining of non-ferrous metals and alloys.

[4] *Yearbook of the Commonwealth of Australia No.48, 1962*, Chapter VI — Manufacturing industry.

POSITION OF THE ENGINEERING INDUSTRIES FOR 1960

	Per cent
Share of total manufacturing output	26.1
Share of total manufacturing employment	30.3

Mechanical engineering

Heavy capital goods

Existing facilities for the production of heavy capital goods are limited. Most of the heavy electrical equipment required for large hydro-electric projects and large-capacity thermal generating stations and heavy machinery for the iron and steel industry is imported.

Industrial machinery

Food products including food packaging

There are a number of plants producing food processing machinery in the following categories.

Sugar mills

One large company manufactures a complete range of equipment for sugar mills, including crushing, clarification, evaporation and crystallization units. Domestic demand for machinery and equipment is met from local production. Several other companies are producing only individual industrial items and components.

Beverage making and food product machinery

About twelve firms manufacture a complete range of equipment for the wine and aerated water industry, including carbonating plants, wine filters, distillation units and bottling plants. Other food product machinery manufactured in the country includes flour mills, confectionery, canning and milk products, etc. About fifty firms manufacture food packing machinery. The items produced include weighing machines, carton and paper bag filling machines, sealing and labelling machines, fastener and stripping machines.

Textile machinery, fibre processing and miscellaneous industrial machines

Only a few firms manufacture complete units of textile machinery and fibre processing equipment, which includes opening, cleaning and dusting, carding, spinning, bleaching, dyeing, printing and finishing machines and knitting looms. Many others manufacture individual items of textile plant such as carding and spinning machines, textile wires and wool preparation machines. Some small firms specialize in the manufacture of individual items of a limited range of special equipment. A few large enterprises make machines for pulp, paper and paperboard, rubber and plastic goods and chemical plants. Some major components are however imported, i.e. fourdrinier and cylinder machines for the paper industry.

Clothing plants and sewing machines

A world-wide sewing machine organization has established an assembly, repair and overhaul plant in the country. Production is more than sufficient to meet the domestic demand for both the household and industrial types of sewing machine. A household sewing-machine head is now being produced by a local establishment in a new assembly plant. Three small firms manufacture power operated cloth-cutting machines and pressing machines.

Prime movers and boilers

There is no manufacture of heavy prime movers such as hydraulic turbines or large steam turbines for power generation, most of which are imported. There are, however, ship engine builders making oil diesel engines of up to 6,000 HP. A few shipyards produce complete steam turbine units and gears in multiple sets for the propulsion of 10,000-ton vessels built in the country. There are also a few firms producing alternators and generators to order for small power generating units.

About four companies associated with United Kingdom manufacturers build high pressure boilers for power generation with pressures up to 1,500 psi. Certain components such as headers, drum ends and superheaters are imported. Package-type boilers are also built in the country.

Internal combustion engines

Production of small stationary diesel and small petrol engines of up to about 75 HP and 40 HP respectively is a well-established industry of about twenty-six firms, excluding ship engine builders. The increased production of earth-moving and other construction machinery has created a large demand for diesel and petrol engines. In 1961, about 3,000 units of small diesel engines other than marine were built compared to about 2,500 units in 1957; production of small petrol engines other than marine increased from about 180,000 units in 1957 to about 195,000 units in 1961. There are plans to manufacture high-powered diesel engines to meet the requirements of small power plants and the transport industry.

Machine tools

Machine tool production in Australia has progressed substantially during the last few years. Most of the machine tools produced are standard lathes, shaping and drilling machines, precision grinding and milling machines, gears and cutters, and boring machines. Some firms specialize in the manufacture of machine tool parts such as lathe chucks, tool holders, milling cutters and tapping attachments. The present capacity of the industry is not sufficient to meet domestic demand: only 40 per cent of the lathes and 25 per cent of the other machine tools required can be supplied by domestic establishments, the remainder being imported.

Metal-working

The machines produced for metal working include presses (mechanical, manual and hydraulic), bending machines, shearing and punching machines, forges, guillotines and drop and pneumatic hammers. Many establishments have licence agreements with overseas firms for the production of their goods. Domestic establishments can supply only 50 per cent of the domestic demand for metal-working equipment.

Pumps and compressors

There are about seventy firms engaged in the manufacture of various types of pump. Most are small, producing a limited range of simple power driven and hand pumps. The larger manufacturers produce multi-stage centrifugal pumps up to 14 inch diameter and deep well turbine pumps up to 8 inch diameter. Larger pumps for special applications are also produced. About 85 per cent of the domestic demand is supplied by local manufacturers. Special purpose pumps and very large sizes are imported. Large industrial compressors up to about 5,000 cfm and 30 to 100 lb pressure are produced by several establishments. The smaller types of compressor for automobile service units, paint spraying and power driven small tools are manufactured by a number of small-scale enterprises.

Transmission equipment and bearings

A wide range of transmission equipment is manufactured in the country, including variable-speed drives and reduction units. Ball-bearings are made in a limited range of sizes. A new plant for the manufacture of tapered roller bearings has recently been started. Roller chains of small pitch are also produced to meet domestic demand for agricultural implements. Other types of bearings and chain drives are imported.

Agricultural implements and machinery

There are more than 700 establishments classified as manufacturers of agricultural machinery and implements in the country. Only sixteen mostly associated with overseas organizations, are capable of producing the wide range of implements required in farming. These establishments produce wheeled tractors, harvesting, cultivating and seeding machinery, plough discs, spraying and irrigation equipment, sheep shearing and dairy equipment, etc. The smaller firms generally assemble units or manufacture a few particular kinds of implement.

Construction and mechanical handling equipment

About forty firms regularly produce construction equipment and parts, mainly excavators, dozers, graders, road ploughs, road rollers, crawler tractors, concrete mixers and crushers. Large-scale production methods are not used because of the limited domestic demand.

The mechanical handling equipment produced consists principally of cranes, hoists and conveyor systems. The range of crane production includes overhead electric travelling cranes with a maximum lifting capacity of about 500 tons, travelling gantries, jib cranes and builder's derricks. Various types of electric and hydraulic hoisting equipment and conveyor systems such as aerial rope ways, belt, chain and pneumatic conveyors and elevators, are also built by several manufacturers. Export capacities have been developed for these items.

Structural steel fabrication

It has been estimated that there are more than 250 firms in the industry, employing about 8,000 persons. The annual outpart of about 400,000 tons of steel valued at about £A50 million has remained steady for the last few years.

Electrical machinery, apparatus and appliances

Power generators

The alternating current generators manufactured in the country only go up to 150 kVA and the direct current generators to about 100 kW. Most of the large power generating units needed for the electric power expansion and development programmes are imported.

Electric motors

About forty-four establishments produce electric motors, of which eleven are major producers and the remainder are medium and small-scale enterprises. The industry has the capacity to produce almost a complete range of fractional and integral HP alternating current units up to 800 HP (single-phase and three-phase) and direct current motors up to 500 HP. Totally enclosed fan-cooled and flame-proof, drip-proof and explosion proof motors are among the special types produced.

Production in 1961, mostly of fractional and small integral motors, was about 1.8 million units, compared to 1.3 million units in 1958, an increase of about 40 per cent. Annual imports of electric motors average about 13 per cent of total production in the country for fractional HP motors and about 17 per cent for integral HP motors. Exports amounted to about £A65,000 in 1962.

Electric power transformers

There are six large plants and eight small plants engaged in this industry. Most of the production consists of units not exceeding 1,500 kVA. The present capacity is sufficient to meet current local demand for most sizes of transformer. Imports of high voltage transformers represent about 20 per cent of the total demand.

Switch and control gear

About thirty establishments manufacture switchgear and other regulating apparatus. The production of heavy switchgear in Australia was until recently principally concentrated in ranges below 1,500 kVA. Domestic manufacture supplies about two-thirds of the requirements. Most of the demand for switchgear is for power transmission and distribution schemes controlled by the state governments, and for industry and mining. The continued expansion of electricity consumption of about 8 per cent annually assures the industry of steady growth.

Electric wire and cable

There are about twenty manufacturers in this industry. Almost all types of electric wire and cable used for power transmission and distribution, telecommunication, electric motors, domestic appliances and motor vehicles are produced by them.

Electrical appliances

Many firms manufacture electrical appliances such as refrigerators, air conditioners, domestic washing machines, vacuum cleaners, floor polishers, food mixers and miscellaneous kitchen utensils. Most of them produce a wide range of appliances. Production of air conditioners in 1962 amounted to about 30,000 units, vacuum cleaners about 75,000 units, and refrigerators about 200,000 units. There is adequate capacity to meet domestic demand and a surplus for export.

Radio receivers and television sets

The radio receiver industry is well organized and capable of meeting most of the domestic demand. The greater part of the output comes from four large enterprises. About 30,000 units are produced annually. The demand is mainly for transistor portable receivers. Most of the television receivers are produced by eight large manufacturers. Total production ranges from 300,000 to 400,000 units annually. Export markets have been developed.

Metal manufactures

A comprehensive range of metal manufactures is produced by numerous establishments: ferrous and non-ferrous building hardware, metal containers, household utensils, metal closures, metal furniture for offices and households, etc. Other metal manufactures include wire products such as barbed wire, wire mesh, steel coiled springs, safety pins and fasteners, steel, copper and brass nails and screws, bolts and nuts. Several firms also manufacture specialized items such as welded chain links, precision rollers, bushed chains for power transmission and conveyors, hand tools, pipes and extruded metal products.

Precision and scientific instruments

Several manufacturers produce a wide range of medical, surgical, dental and allied equipment and laboratory apparatus. Four companies manufacture diagnostic equipment such as X-ray units and electrocardiographs. Engineering and research instruments are produced by about three companies.

Clocks and watches

Various types of clock for domestic, office and factory use are produced to meet internal requirements. Chronometers are made by a specialized instrument and technical equipment firm. Most of the wrist-watch cases are produced by four firms; clock and watch movements are mostly imported.

Transport industry

Locomotives and rolling stock

Most of the steam, diesel and diesel-electric locomotives required are built by the State Railways and a few large private companies. Most of the manufacturers of diesel and diesel-electric locomotives have licence agreements with overseas makers. Railway rolling stock is also built by the workshops of the State Railways and by several private firms. Traction motors are built locally.

Motor vehicles and bicycles

The motor vehicle industry has made impressive progress during the last few years. Peak production has totalled about 300,000 units yearly. Major producers of popular makes are mostly associated with overseas organizations. About 50 per cent of the demand for motor vehicles is met by domestic production. Several firms produce bicycles and bicycle components; production is adequate to meet domestic demand. The manufacture of motor-cycles is limited, although 60 per cent of the motor-cycle accessories are made in the country.

INDIA

Economic structure

The economy is still predominantly agricultural. In 1955 and again in 1962, agriculture contributed 45 per cent to the national income. Manufacturing contributed 18.5 per cent in 1955 and about 20.1 per cent in 1962.

SOURCES OF NATIONAL INCOME
(Percentage of total income)

Economic sector	*1955*	*1959*	*1961*	*1962*
Agriculture (including forestry, fishing)	45.3	48	47	45.3
Manufacturing and mining	18.5	17.9	19.5	20.1
Commerce, banking insurance, transport and communications	18.9	17.2	16.8	17
Other services	17.3	16.6	16.7	17.6

Engineering industries

During the decade which ended with the second five-year plan (1960-61) the country achieved remarkable progress in the engineering industries, which underwent wide diversification. The foundations have been laid for heavy electrical, heavy machine-tool and heavy machine-building industries and a complementary foundry and forge plant. Relative self-sufficiency has been achieved in such products as bicycles, sewing machines, agricultural implements, metal fittings and miscellaneous hardware.

ENGINEERING INDUSTRIES
1961
(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
			Rs. Lakhs
Manufacturing of which:	*8,672*	*2,878,459*	*90,297*
Engineering industries	*1,705*	*519,267*	*16,934*
1. Metal products except machinery and transport equipment	334	61,335	2,204
2. Machinery except electrical	406	100,095	3,439
3. Electrical equipment	242	77,063	3,436
4. Shipbuilding and repairing	34	23,775	573
5. Railway equipment	104	140,592	3,278
6. Motor vehicles manufacture	59	27,460	1,678
7. Motor vehicles, repair of	252	37,515	717
8. Motor-cycles and bicycles	48	14,813	421
9. Aircraft	8	5,463	273
10. Transport equipment n.e.c.	6	1,146	41
11. Professional and scientific instruments	25	5,080	192
12. Photographic and optical goods	4	647	15
13. Watches and clocks	8	1,105	29
14. Musical instruments and manufacturing industries n.e.c.	175	23,178	638
% *Engineering industries/manufacturing*	*19.7*	*18.0*	*18.8*
Basic metal industries[a]	412	187,335	7,218
Total engineering industries including basic metal industries	*2,117*	*706,602*	*24,152*
% *Engineering industries including basic metal industries/manufacturing*	*24.4*	*24.5*	*26.7*

Sources: Annual Survey of Industries 1961, India.

[a] Iron and steel + Non-ferrous metals.

The position of the main engineering industries are shown below for 1961.

	Per cent
Share of total manufacturing output	18.8
Share of total manufacturing employment	18

Mechanical engineering

Heavy capital goods

The manufacture of heavy capital goods, primarily for the iron and steel and mining industries, was started in November 1963. This is the first venture of its type in India. Production is in its initial stage. The four major units of this huge undertaking are: a heavy machine-building plant, a heavy forge-foundry plant, a heavy machine-tool plant and a coal-mining machinery plant.

Industrial machinery (other than heavy capital goods)

Textile machinery, cotton and jute

The manufacture of cotton textile machinery started in 1949 with the manufacture of parts of spinning machinery, i.e. spinning ring frames and carding engines and looms. Currently, major portions of complete units of textile machinery are manufactured domestically. A few specialized items of equipment such as fully-automatic winding and warping machines, single-spindle automatic winders, flat-grinding and flat-milling machines, calenders and testing fabric machines are still being imported. Most components of cotton textile machinery are produced by about 500 small-scale industry units.

There are about ten manufacturing plants for jute mill machinery and components; production increased from Rs 2.96 million in 1956 to about Rs 21.8 million in 1960. Production for 1965-66 is estimated at Rs 25 million. Exports of parts and units of jute mill assemblies were made mostly to neighbouring countries.

Sugar mill, oil mill and tea processing machinery

Six plants can supply complete units for sugar mills. In addition, seventeen plants in the organized sector can manufacture general items of sugar mill machinery such as vacuum pumps, evaporators, condensers, filter presses, crystallizer pumps, graders, and sugar elevators. Sugar machinery has been exported to Ceylon, East Africa, Indonesia and Singapore.

The production of oil mill machinery has reached a stage of self-sufficiency. Complete oil mills including expellers, filter presses, decorticators, disintegrators, conveyors and elevators, etc., are now being manufactured. There are at present about fifty manufacturing plants in the organized sector. The machinery requirements for the tea processing industry can now be met by indigenous production and parts such as tea rollers, green leaf sifters, tea dryers, stalk extractors, density sorters and packing machines, are now being completely manufactured in the country. There are about sixteen units in the organized sector.

Cement and paper-making machinery

Selected items of cement machinery, i.e. excavating and drilling equipment, grinding mills, crushing plant, rotary kilns and clinker coolers, conveying and transport equipment, dust collecting equipment, thickeners, slurry mixtures, fans, blowers, grab cranes, reduction gear boxes and other miscellaneous equipment, are manufactured in the country. Prior to 1960, production of paper-making machinery was practically negligible. Paper mill machinery manufacture was begun in 1961. Up to 1965-66, the capacity will be raised annually by four plants of 50 tons daily capacity and four plants of 10 tons daily capacity to a total of 820,000 tons. Schemes for future production of paper mill machinery in 1966-71 contemplate units of 100 tons daily capacity.

Sewing machines

Eleven units in the organized sector with an annual rated capacity of about 140,000 units on a single-shift basis manufacture sewing machines. Production in the organized sector increased from 110,000 in 1956 to about 295,000 in 1961. The small-scale sector produced about 50,000 units in the latter period, making a total production of over 300,000 units in 1960-61. With the increase in internal production of domestic and industrial sewing machines, imports of these items are banned. Only special parts may be imported. Export markets have been developed.

Prime movers and boilers

Plans have been completed for the manufacture of steam turbines, and of water turbines in connexion with the electrical projects contemplated in the third five-year plan. The turbines envisaged range from 3,000 kW to 150,000 kW output. The production scheme of Heavy Electrical Ltd., includes the construction of prime movers required for the generation of power from 3,000 kW to 150,000 kW. The subsequent expansion plans for the manufacture of prime movers will be implemented in 1965 with the collaboration of countries in Eastern Europe. The manufacture of vertical and water-tube boilers is being undertaken by a private company with an installed capacity of about Rs 30 million on a single-shift basis of production. Subsequent expansion includes the production of high-pressure boilers for up to 100,000 lbs per hour evaporation. Capacity of production will be equivalent to about 350 MW per year.

Diesel engines

Significant progress was made during the last decade in the production of diesel engines from 3.5 to 50 HP. Most of those produced up to 1955 were slow-speed horizontal engines. Since then, with the expansion and diversification of the industry, multi-cylinder high speed engines of 16 to 650 HP have been manufactured; the target for the third plan was 66,000 units, while actual production in 1963 reached about 40,000 units. Prior

to 1955, production was primarily for agricultural purposes. Now the diesel engines manufactured are used as prime movers for road rollers, air compressors, crushers and other miscellaneous purposes in industry. Exports of diesel engines increased from Rs 1,292,342 in 1959 to 5,015,173 in 1962 to the ECAFE countries, Cuba, East Africa the United Kingdom and other countries.

Agricultural machinery and implements

The bulk of the agricultural machinery and other farm equipment required is now being produced in the country. Except for agricultural tractors, India has reached the stage of self-sufficiency in the production of agricultural implements such as ploughs, spades, shovels, hoes, hand operated water pumps, persian wheels, seeding, planting and threshing machinery, wheelbarrows, and sprayers. There are about sixty comparatively large factories in the organized sector and a widely diffused group in the small-scale sector engaged in the production of these implements.

Machine tools and metal processing machinery

Rapid progress and diversification in machine tool production has been made since the establishment of Hindusthan Machine Tools Ltd (HMT), the Machine Tool Prototype Factory, the Pragas Tools Corporation and 15 organized units in the private sector. The diversification programme included the production of radial presses, cylindrical grinding machines, milling machines, low-priced lathes, high precision lathes, polishing and buffing machines and bench grinders. There are also about 344 units in the small-scale sector in the machine tool field. The high priority accorded to this industry and the gap that will remain in meeting estimated demand from indigenous sources requires further expansion of manufacturing capacity. It is planned to double the capacity of the HMT from 1,000 to 2,000 machine tools yearly and to establish a new unit with a capacity of 1,000 machine tools per annum in Punjab. The Ranchi project will produce about 10,000 tons of machine tools when in full production.

Other metal processing machines such as mechanical presses, stamping and die-making machines are manufactured by a few firms. Production on a larger scale is contemplated at the heavy engineering works of the Ranchi plant.

Miscellaneous machinery, pumps and compressors

The manufacture of power-driven pumps of both the centrifugal and turbine types is a well established industry. Special purpose pumps for the chemical and petroleum industries, paper and pulp and food processing, cement and sugar and oil industries have also been developed during the last decade. About 67 establishments now produce pumps, with an installed capacity of about 150,000 units per year. The pump manufacturing industry has almost reached the stage of self-sufficiency. Raw materials for impellers and bushings are produced locally. Exports in 1960 to countries in the region and in Africa amounted to about Rs 500,000.

Prior to 1958, there were no firms engaged in regular production of compressors. Most of the requirements for industry and miscellaneous purposes were imported. As of 1962 twelve firms were licensed to manufacture compressors of various types and capacities. The indigenous content of production is about 95 per cent in the smaller compressors and about 75 per cent in the larger sizes. Such parts as crankshafts, valves, main bearings, internal and external coolers are imported.

Ball and roller bearings

Present production is about 3.9 million pieces per annum. Bearing requirements by the end of the third plan have been estimated at about 13 million pieces. There is expected to be adequate capacity to meet this demand.

Construction machinery and structural fabrication

The production capacity for complete units of construction machinery such as bulldozers and crawler tractors is not adequate to meet requirements. Most of the firms engaged in this industry primarily produce only parts and attachments for these machines. The structural fabrication industry has rapidly progressed during the last few years. The most important fabrications produced are power transmission towers, ropeways, cableways and storage tanks.

Electrical machinery, apparatus and appliances

Heavy electric

The Heavy Electricals Factory in Bhopal, the first of its kind to be established in India, was completed in 1960 for the production of heavy electrical equipment such as hydraulic and steam turbines, high tension switchgear and large capacity power transformers. It also includes a foundry unit, machine tool and fabrication shops. The factory started limited production in July 1960 and has since increased production steadily. Deliveries of power transformers ranging from 10,600 kVA to 175,000 kVA were made to various hydro-electric projects and high-tension switchgear and circuit-breakers to large enterprises. The first consignment of 1,500 V D C traction motors has been delivered to Indian Railways.

Two other heavy electrical projects are being built with the collaboration of the Soviet Union and Czechoslovakia to supplement the Bhopal Heavy Electrical Plant for the production of steam turbines, turbo-alternators,

hydro-turbines and generators, large diesel engines and high-pressure boilers for thermal stations. It is expected that production at these two plants will commence early in 1965. The combined production capacity of the three plants is estimated to meet power generation requirements for the next few years.

Electric transformers and motors

At the end of 1961 eighteen units in the organized sector were manufacturing low-rating power and distributor transformers with an annual installed capacity of about 1,404,000 kVA. The requirements for distribution transformers are almost being met by indigenous production. Export capacity has also been developed for small size transformers. At the end of the second five-year plan twenty-seven units in the private sector manufactured electric motors of various types below 30 HP with an annual capacity estimated at about 1.3 million HP. In addition, there were over seventy-five small-scale factories with an annual capacity of approximately 80,000 HP. The demand for 1965-66 is estimated at 3.0 million HP. By working on a double-shift basis, this demand could be met by existing manufacturers. A small export market has also been developed: in 1962, exports amounted to approximately Rs 86,437 and in 1963 Rs 175,743.

Switchgear and control gear

Prior to 1953, there was hardly any production of these electrical items in the country, but now about twenty-six establishments located in various states manufacture them in the organized sector. Imports supplement indigenous production. Plans for the expansion of existing facilities in the private sector and the two units in the public sector (the Government Electric Factory at Bangalore and the Heavy Electrical Plant at Bhopal) will enable production to meet future requirements.

Electric cables and wires

Almost all types of electric wire and cable such as ACSR and other aluminium conductors, bare copper conductors, enamel-covered winding wires, paper- and cotton-covered winding wires, rubber- and plastic-insulated cables for telephone and telegraph are manufactured in India. The manufacture of axial and co-axial cables also started recently. About forty units in both the public and private sectors are engaged in these manufactures.

The following table summarizes the programme of development for the electric cable and wire industry during the third plan period:—

	1960-61		1965-66	
	Capacity	*Production*	*Capacity*	*Production*
ACSR conductors (tons)	19,300	23,561	55,000	44,000
Bare copper conducts (tons)	18,700	10,700	18,700	15,000
Winding wires (i) Enamel-covered (tons)	4,592	3,830	20,000	15,000
(ii) Paper, cotton etc. covered wires and strips (tons)	2,185	1,115	12,000	9,000
Rubber and plastic-coated cables (million yd)	463.24	214.2	800	600
Telephone cables (miles)	471	1,077	2,000	2,000
Coaxial truck cables (miles)	300	57	300	300
Paper-insulated power cables (miles)	884	620	4,500	4,000

Capacity will be adequate to meet all domestic requirements.

Electric fans

About twenty-four units manufacture electric fans; with an annual capacity of about 1 million fans the country has reached self-sufficiency. The types of fan have been diversified and can compete in world markets. The industry is a major foreign exchange earner: exports rose from Rs 1.8 million in 1957 to Rs 8.7 million in 1963, an increase of 400 per cent. The demand in the domestic and export markets is estimated at 2.5 million items in 1965-66. Plans now being implemented to expand production in some existing plants and to rationalize the smaller-scale factories are expected to achieve this target.

Refrigerators and air-conditioners

Four establishments in the organized sector manufacture domestic refrigerators. The present installed capacity has increased from 3,000 units in 1951 to about 12,000 in 1961, and in 1962 was 13,600 units. Most parts of refrigerators including condensers and evaporators are of indigenous manufacture, but the components of sealed units, such as compressor motors, oil pumps and receivers, and copper tubing are still being imported. A manufacturing firm, however, has recently started the manufacture of these components in collaboration with a foreign firm. The demand for refrigerators has increased yearly and present production has expanded to meet this demand.

Ten establishments in the organized sector manufacture air-conditioners of various types and capacities

for household and special purposes. Production increased from 5,000 units in 1956 to 20,000 units in 1962. A small export market has been developed recently in Asian countries.

Electronics industry

About twenty establishments in the private sector manufacture radio receivers, with an annual installed capacity of about 325,000 sets. There are also about 180 small enterprises in this industry, with an estimated capacity of about 65,000 sets per annum. Many components are imported, although manufacture of radio receiver parts has considerably increased. Currently, all the metallic parts and fittings, including transformers, coils, cabinets, dials and knobs, are manufactured in the country. Production of transistorized sets was started recently by some radio manufacturers. Export markets have been developed for radio receivers in neighbouring countries; in 1962, exports totalled Rs 93,447 and in 1963 Rs 407,517.

Metal manufactures

Wire products, bolts, nuts and screws

Several large manufacturing firms in the organized private sector produce wire products, with a combined capacity of about 100,000 tons per annum. There are also a number of "re-rollers" in the iron and steel industry producing steel wire from billets, with an estimated wire production capacity of 50,000 tons yearly. Imports supplement the balance of steel wire requirements.

Most manufacturers of bolts and nuts are in the small-scale sector, with an installed annual capacity of about 50,000 tons. There are also a few large units in the organized private sector with an installed capacity of about 95,000 tons per annum. Exports to Asian countries amounted to about Rs 392,000 in 1963. About twenty units in the small industry group with an annual capacity of 7 million gross, manufacture various types of wood screw and machine screw. Screws are now exported to countries in the region and to the United Kingdom. Exports in 1962 amounted to Rs 395,000 and in 1963 to Rs 372,000.

Wire rope

The demand for wire rope in the country has been estimated at over 10,000 tons per annum. Imports averaged about Rs 9 million yearly. Indigenous production was started during the second five-year plan by two firms in the private sector with a capacity of about 6,000 tons per annum on a two-shift basis. The demand for wire rope was estimated at about 40,000 tons for 1965-66 and new licences were approved for ten units with a production capacity of about 33,000 tons per year on a double-shift basis. It is expected that production in 1965-66 will meet the demand.

Metal furniture

The manufacture of furniture covers a variety of requirements for modern homes, offices and hospitals. There are about twenty-five units in the organized sector engaged in metal furniture manufacture, with an aggregate installed annual capacity of about 35,000 tons equivalent weight in steel. Steel furniture is exported to countries in Asia and South America, exports in 1962 totalling Rs 2,015,000 and in 1963 were Rs 2,100,000.

Metal containers

Many small, medium and big firms manufacture metal containers. "Sanitary" cans for food processing and general line containers for consumer products, collapsible and rigid tubes in soft metal and aluminium and closures for tin containers and bottles are the main products of the industry. Exports of stainless steel utensils were valued at Rs 2,582,000 in 1962 and Rs 6,303,000 in 1963, an increase of 144 per cent. Aluminium utensils increased by 15 per cent from Rs 1,667,000 in 1962 to Rs 2,835,000 in 1963.

Building hardware and fittings

About twenty-five establishments in the organized sector manufacture all types of hardware and fittings, including iron tower bolts, door bolts, safety hasps, staples, hinges, pad bolts, sanitary fittings and accessories. The rated annual capacity of the industry is about 15,000 tons. Goods are manufactured in accordance with British Standard Specifications. Exports were Rs 1,423,000 in 1962 and Rs 2,452,000 in 1963, an increase of 72 per cent.

Transport industry

Railway rolling stock

The railway equipment industry has progressed significantly in recent years and exports of railway equipment have grown steadily.

Locomotives

Two established firms produce steam locomotives: the Chittaranjan Locomotive Works (CLW) and the Tata Locomotive and Engineering Co. (TELCO). The CLW has an established capacity of about 170 steam locomotives WG per annum and TELCO 100. The CLW plant has been expanded recently for the production of electric locomotives. The first 1,500 volt DC electric locomotive was completed in 1961 with imported electrical equipment. This plant will produce about 150 electric locomotives, with the electricals supplied by the Heavy Electricals Factory at Bhopal. Another new plant with an annual production of 150 diesel-electric locomotives is under construction at Varanasi in Uttarpradesh. The electrical equipment will also be supplied by the heavy Electricals Factory at Bhopal.

Approximate production in the third plan period will be:

Locomotives:	Steam	1,191
	Diesel	115
	Electric	164

Wagons, coaches and track materials

There are thirteen establishments manufacturing wagons with an installed capacity of about 26,000 units a year. Production lagged behind capacity owing to an inadequate supply of steel materials: in 1961, only 10,000 units were produced and about 13,000 units in 1962. The manufacture of coaches, however, increased considerably in the last decade. The main suppliers are in the public sector the Integral Coach Factory at Perambur, the largest plant in India equipped with modern machinery to manufacture coach shell bodies and large coach components, and the Hindustan Aircraft Factory at Bangalore. All crossing, switch, signalling equipment and track fastenings, fish-plates etc., are manufactured in the country by thirty-three establishments in the organized sector. Export markets have been developed in Asian countries; in 1962, exports amounted to Rs 4,256,000.

Automobile industry

The industry has grown rapidly in the last few years in collaboration with foreign makers. The indigenous content ranges from 49 to 74 per cent. In 1962 about 18,000 diesel trucks about 3,400, petrol driven vehicles and about 15,000 Jeeps and Landrovers were produced. Parts imported include fuel-resistant rubber, safety glass, large drop-forgings, free-cutting steel, thin seamless tubes, terneplate and critical raw materials such as cold-rolled strip and roller section, which cannot be supplied from indigenous sources.

Motor-cycles, scooters and bicycles

There are two established factories for motor-cycles, three for scooters, three for three-wheelers, twelve for trailers, nineteen for complete bicycles and twenty-seven for bicycle spare parts and accessories. Exports of bicycles to the Middle East, Hong Kong and Oceania islands amounted to about Rs 916,000 in 1962 and Rs 2,429,000 in 1963, an increase of 165 per cent.

Precision instruments, medical apparatus, etc.

Six firms in the organized sector manufacture surgical instruments, optical instruments, theodolites, binoculars, microscopes, pressure gauges, recording instruments, hypodermic syringes, etc. Three firms in this group now make parts of X-ray equipment and one has started to manufacture a simple X-ray apparatus. Many of these goods are manufactured in collaboration with foreign makers. The Small-scale manufacturers make dental chairs, sterilizers, galvanometers and simple laboratory equipment, and a few specialized items such as balances and microscopes.

Production was worth Rs 30,000,000 in 1961, Rs 40,000,000 in 1962 and Rs 55,000,000 in 1963. Various materials used in the industry are imported, such as special types of glass, silver, stainless and other alloy steel. Production in the small-scale sector has been low owing to an inadequate supply of essential materials. Exports of surgical and medical apparatus to countries in Asia amounted to Rs 172,521 in 1962 and Rs 118,355 in 1963 and exports of scientific instruments amounted to Rs 104,273 and Rs 148,580 respectively.

Printing machinery

The printing machinery industry is still in its infancy; output in 1961 was worth one million rupees. The demand for printing machinery has been estimated at Rs 75 million per year by the end of the third plan and Rs 120 million per year by the end of the fourth plan. A printing machine manufacturing plant shortly to be set up in Coimbatore in financial and technical collaboration with a United States firm will manufacture about Rs 150 million worth of machinery annually, including 250 pattern machines, 250 cylindrical machines, 50 cutting machines, 24 offset machines and 12 rotaries.

Clocks and watches

The manufacture of clocks and watches has steadily risen. Until 1959, only clocks were produced and the demand for watches and recording instruments was met by imports. There are now five establishments engaged in the manufacture of watches, with an annual capacity of about 70,000 pieces on single-shift basis. New programmes have been scheduled both in the private and public sectors and in the small-scale industry to meet the estimated demand for about 2.5 million (clocks and watches) in 1965-66. Manufacturing will be in collaboration with foreign makers. It is expected that the indigenous content by value in these manufactures will range from 54 per cent to 84 per cent. Most of the components will be imported in the initial stages.

Problems of the engineering industries

The most serious problem in the engineering industries is the acute shortage of essential raw materials to meet the requirements of existing manufacturing capacity. Indigenous production is not adequate. The critical shortage of foreign exchange is one of the root causes of production lag and under-utilization of engineering plant.

The present availability of pig iron is only about 1.1 million tons per year (all Indian production) and the aggregate demand of the engineering industries is estimated at 2.5 million tons annually. Only about 200,000 tons has been alloted to commercial foundries

while the balance of 300,000 tons has been earmarked for steel works maintenance, railway sleepers, spun pipe factories, defence requirements, export promotion quotas and castings. Pig iron foundries are getting only 12 per cent of their installed capacity needs.

Production of steel in 1962-63 amounted to about 3.9 million tons; total demand from the engineering industries was about 1.5 million tons, while their allocation amounted to 430,000 tons or only 29 per cent of their demand. The estimated production of steel for 1963-64 is about 4.3 million tons, thus no relief from shortage is expected for the engineering industries. Demand will continue to grow and the solution clearly lies in the expansion of pig iron and non-ferrous metal, i.e. copper and aluminium, production capacity.

The cost of production in India's engineering industries is higher in certain instances than in other countries, but in the case of such items as bicycles and other durable consumer goods costs are competitive.

Export promotion[5]

In five years, engineering industries have already exported to about 100 countries more than 120 engineering items such as sewing machines, diesel engines, metal furniture, cast iron products, transmission towers, wagons, railway track and materials and a host of mechanical and electrical appliances.

JAPAN

Economic structure and production trends

Japan relies primarily on imports of raw materials to support its industries. The industrial structure of the country underwent sweeping changes during the last decade. Emphasis was placed on the simultaneous production of heavy machinery and durable and non-durable consumer goods to meet the increasing domestic demand and for export.

In 1955, agriculture and its related activities contributed about 23 per cent to the national income and 13 per cent in 1963. Manufacturing and its related industries contributed about 30 per cent of the national income in 1955 and 39 per cent in 1963. The ten-year income doubling programme anticipates a continuous average growth of 9 per cent in the GNP so as to reach a scale in 1970 approximately 2.7 times larger than that of the base year (1958) with a *per capita* income estimated at the equivalent of about $579.

Japan's *per capita* income in 1962 was 19 per cent of that of the United States, 37 per cent of that of West Germany, 39 per cent of that of France, and 73 per cent of that of Italy.

[5] Engineering Export Council.

INDUSTRIAL ORIGIN OF NET DOMESTIC PRODUCT

(at current factor cost)

Percentage of total income

Economic sector	*1955*	*1959*	*1960*	*1961*	*1962*	*1963*
Agriculture, forestry, fishing, etc.	23	17	15.4	14.4	14.2	13.5
Manufacturing, mining & construction	29.8	35	37.7	39	38.8	39.1
Commerce, banking, insurance, transport & communications	30.7	33.1	33.1	33	32.9	33.4
Others	16.5	14.9	13.8	13.6	14.1	14

Some aspects and the structure of the engineering industries are given in the following table.

ENGINEERING INDUSTRIES

1961

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
Manufacturing of which:	*553,170*	*8,950,446*	*4,837,125*
Engineering industries	*98,531*	*2,700,090*	*1,741,127*
1. Fabricated metal products	40,858	529,068	225,347
2. Machinery	28,048	747,443	497,693
3. Electrical machinery, equipment and supplies	10,661	683,824	499,593
4. Transportation equipment	12,393	557,707	444,193
5. Measuring and survey instruments, medical instruments, physical and chemical research instruments, photographic and optical instruments, watches and clocks	6,541	180,248	73,678
6. Ordnances and accessories	30	1,800	623
% *Engineering industries/manufacturing*	*17.8*	*30.2*	*36.0*
Basic metal industries*	8,531	551,794	561,938
Total engineering industries including basic metal industries	*107,062*	*3,251,884*	*2,303,065*
% *Engineering industries including basic metal industries/manufacturing*	*19.4*	*36.3*	*47.6*

Sources: Japan Statistical Yearbook 1962 (Table 31 Establishments and Persons engaged by type of organization and industry, page 60) — for Number of establishments and Number of persons engaged.

Economic Statistics of Japan 1962 (Table 112 Census of Manufactures, page 222) — for Added Value.

* Iron and steel — Non-ferrous metals and products.

From the above table, the position of the engineering industries in 1961 was as follows.

	Per cent
Share of total manufacturing output	36.0
Share of total manufacturing employment	30.0

The position of the engineering industries in Japan compares favourably with that in the highly industrialized countries of the world.

Mechanical engineering[6]

Machinery industry

The machinery industry's share in total industrial output rose from 18 per cent in 1955 to about 36 per cent in 1962. During 1955-1959, it mainly produced durable consummer goods, but since 1960, there was a major shift to heavy capital goods such as heavy electrical machinery, machine tools, general industrial machinery and automobiles.

Heavy capital goods

The manufacture of heavy capital goods has been firmly established since the early thirties. Post-war production was centred on the electrical, petro-chemical, mining and construction industries. The capital goods requirements of less developed countries also created an export demand.

Industrial machinery

Textile machinery

Textile machinery for silk and rayon, hemp weaving, wool spinning and knitting is now produced in large quantities to meet domestic demand. Exports, consisting mainly of cotton spinning machinery and parts, cotton looms and dyeing machines, accounted for $73 million in 1962 compared to $27 million in 1958, an increase of about 170 per cent. Japan imports about 10 to 20 per cent of the textile machinery it needs, mainly knitting machines for stockings and high pressure dyeing machines for synthetic fibres.

Sewing machines

Production of sewing machines started in 1921. The pre-war production record (1940) was 157,000 units monthly. In 1962, production reached 3.27 million units, stimulated by the ban on imports of sewing machines. Formerly, most of the makers were in the small-scale sector, but recently modern, large-scale establishments have entered the field. Export markets have been developed in about 140 countries. Exports of sewing machines in 1962 exceeded $59 million as against $47 million in 1957. Industrial types of sewing machine are also produced but over 95 per cent of the total production are of the household type.

Prime movers

The manufacture of prime movers including boilers and steam turbines in Japan followed upon the establishment of the shipbuilding industry, which reached a peak production comparable in scale to that of developed countries in the early twenties. The development of hydroelectric projects in the early thirties spurred the industry to produce large hydraulic turbines. This was followed by the manufacture of large-capacity steam turbines for the thermal power stations as a complementary development to the hydroelectric projects. Foreign technology was imported to improve and expand production facilities.

In the last decade, steam turbine production increased from about 150,000 kW in 1953 to about 3.27 million kW in 1962. Hydraulic turbine production was about 1 million kW in 1953, and in 1962 reached 1.2 million kW. Boiler production doubled during the last few years.

Internal combustion engines (excluding those for use in rolling stock and vehicles)

Production of internal combustion engines in the last five years has consisted mainly of diesel, gasoline and petroleum engines of light-weight, high-speed types. Diesel engines constitute about 45 per cent of total production, gasoline engines about 35 per cent, and heavy oil engines about 20 per cent. These engines are mainly used for agricultural, electric power generation and construction purposes. Most of them were previously manufactured by small-scale enterprises, but, with the big demand which recently developed in various industrial sectors and agriculture, a number of large enterprises have entered this field, using mass production methods.

Agricultural machinery and appliances

Mechanization of farms has created a large domestic demand for modern farm tools and implements. Most small-scale enterprises engaged in the industry have modernized their production facilities. Exports of farm equipment, worth about $5.8 million in 1962, consist mainly of power cultivators and small tractors which are supplied to many ECAFE countries and some countries in Latin America.

Miscellaneous machinery, pumps and compressors

Production of pumps for agriculture and for industry increased from about 189,000 units in 1953 to about 428,000 units in 1962. Special types of pump for the petrochemical and mining industries have been developed. Compressors of various types and capacities ranging from portable to large industrial types used in

[6] Economic Survey — Bank of Japan, 1963 pp.58-74.

the chemical and iron and steel industries are produced by both large and medium sized factories; production increased from 11,804 units in 1953 to about 50,350 units in 1962.

Construction machinery and structural fabrication

The manufacture of machinery for road construction, ports and harbours and for other construction purposes is of recent origin in the country. Construction machines such as bulldozers, excavators, power shovels, rock drilling machines, concrete mixers and crawler tractors, cranes, conveyors and miscellaneous types of elevator, increased considerably in the last few years to meet the requirements of public works and harbour development programmes and of industries.

Most enterprises engaged in the industry have licence agreements with foreign makers. Tractor production rose in 1962 to about 14,000 units, an increase of about 60 per cent over 1961 and about 6 times that of 1958; concrete construction equipment increased by 49 per cent over 1961. The increase in the production of cranes and excavators has also been significant. Owing to heavy domestic demand, export of these items has been restricted. The structural fabrication industry has made very rapid progress during the last few years and industrial expansion programmes and government development works have taxed the capacities of the industry.

Bearings

Since 1956, the industry has developed rapidly with modern capital equipment to meet the large domestic demand of the machinery and chemical industries. Manufacture covers all types of bearings used in automobiles, heavy electrical machines, machine tools and for processing equipment and appliances.

Metal processing and machine tools

In the industry's early stages, the emphasis was primarily on manufacture of universal types of machine tools. It was only in 1951 that highly productive and specialized machine tools were manufactured by mass production methods. Production capacity did not keep pace with the domestic demand of about $405 million in 1962, when output reached only about $280 million. Imports in 1962 reached $132 million, about 32 per cent of domestic demand. Exports for 1962 amounted to about $4 million, about 2.6 per cent of production.

The machine tools produced in the country, such as drilling, rolling, horizontal and vertical boring and copying machines and some large machine tools, compare favourably with those produced in other developed countries. New production techniques have also improved the quality of specialized muliple-spindle automatic lathes, multiple-spindle hobbing machines and gear cutters.

Heavy electrical machinery

Japan's highly developed heavy electrical industry has developed parallel with the exploitation of power resources and the demand for large thermal power stations. The production of electric motors, regulators, switchgear and high-tension transformers has followed the trend in the production of large generating units. In the last few years, the development of large hydroelectric generating units has approached saturation point. The shift to large thermal stations using bunker oil instead of coal has been intensified.

Most of the manufacturers of heavy power generating equipment are also major producers of heavy electrical machinery for the metallurgical and construction industries.This has lowered production costs and enabled Japan to compete in world markets. Most of the manufacturers have technical co-operation agreements and contracts with leading foreign makers. The industry covers a wide range of products such as large-capacity generators, hydraulic and steam turbines, high-power transmission switchgear and transformers.

Exports of various types of heavy electrical machinery continue to increase substantially to less-developed countries in the Middle East, South-east Asia and South America. In 1962, exports of generators amounted to $7 million compared to $4.3 million in 1961; transformers increased from $5.5 million in 1961 to $6.3 million in 1962; power distributors or controllers from $3.9 to $20.8 million for the same period and parts of heavy electrical machinery increased from $4.9 million to $8.7 million. Other machinery items produced in the country are: mercury rectifiers, condensers, electric furnaces, electric arc welders, electric hand tools, etc. Japan ranks second to the United States in the production of heavy electrical machinery.

Electronics industry

Full-scale production of electronic goods started in 1955. In 1957, Japan ranked fourth in their production and by 1962 it had outstripped all other countries except the United States. The remarkable increase in production was due to the large domestic market and export demand for transistorized radio and television receivers in many countries including the United States, western Europe and countries of South-east Asia. In 1962, thanks to mass production methods, transistor radio output reached about 14.5 million sets, compared to the former peak production of about 300,000 vacuum tube radios; about 4.8 million television sets were manufactured in 1962 compared to 100,000 sets in 1958. The production of tape recorders also expanded at a very fast rate. Exports of radio receivers (vacuum tube and transistorized) increased from about $5 million in 1956 to about $150 million in 1961. Exports of television sets reached $17 million in 1962 compared to about $5 million in 1961. Tape recorder exports increased from $3 million in 1959 to $34 million in 1962.

The production of electric industrial gauges, a new branch of the country's electronics industry resulted from the recent introduction of automation in some enterprises, especially in the petro-chemical industries.

Household appliances

Electric household appliances are produced in increasing quantities for the large domestic market and for export.

Electrical industrial instruments and batteries

A variety of electrical instruments are produced, such as electric watt-hour meters, electric calculating machines and indicators. All types of dry cell for the electronics industry and other purposes and storage batteries for domestic, vehicular and industrial use are produced by both large and small-scale enterprises.

Communication apparatus

Most communication apparatus, such as telephone sets, automatic switchboards, vacuum tube receivers, direction finders and radar, is supplied by modern specialized plants. About 70 per cent of the demand is from the Japan Telegraph and Telephone Public Corporation and 30 per cent from broadcasting firms and transportation companies. Export markets have also been developed for telecommunication apparatus in South-east Asian countries. Production has increased considerably since 1956.

Metal manufacture

Wire rods and wire products

Almost 94 per cent of the wire rods and wire products are made by seven large manufacturers, most of which are also the major iron and steel producers in the country. The ordinary products made are: iron wire, galvanized iron wire, barbed wire, regular nails, special nails (finishing) welded mesh, nuts and bolts, deformed wire, paper clip wire, etc. Special products include hard steel wires, wire ropes, galvanized wires and copper sulphate coated wires. Exports of ordinary wire products increased from 496,689 metric tons in 1960 to 718,600 metric tons in 1962, an increase of 44 per cent. The special wire products increased from about 76,269 metric tons to 137,164 metric tons in the same period, or by about 80 per cent.

Miscellaneous metal manufactures

Most of the miscellaneous metal manufactures, such as household utensils and other aluminium ware, metal furniture, building hardware and fittings, metal toys, are produced by many medium and small-scale enterprises and are an important export item. In 1962, these exports aggregated about $577 million, or about 11.7 per cent of the total exports.

Transport industry

Rolling stock

The rolling stock industry already well established in the early twenties, has kept pace with the high rate of industrial growth. Most of the deliveries are for the National Railways Corporation and the private railways. The industry has maintained a high level of manufacturing techniques and modern technology. Diesel and electric locomotives are now produced.

Exports have gradually increased since 1955. In 1962, total exports of passenger coaches, and steam and electric locomotives amounted to about $63 million, or about double those of 1961. In performance and price, Japan's rolling stock equipment compares favourably with that manufactured in the United States and western Europe. The long range expansion programme of the National Railways Corporation, the commuter train replenishment programme of the private railways and export markets will ensure a stable demand for the rolling stock industry for the next decade.

Motor vehicles

The production of commercial trucks and midget cars started in the early twenties. The post-war recovery of the motor industry started in 1946 with the manufacture of three- and four-wheeler small utility trucks. In 1949, large enterprises in collaboration with leading foreign makers started the production of passenger cars, buses, industrial and commercial vehicles and cycles. Domestic demand and export increased rapidly. Passenger car output rose from 50,800 in 1958 to 68,800 in 1962. Small four-wheeler trucks increased from 130,000 in 1958 to 700,000 in 1962. Total production of motor vehicles increased by 500 per cent from 1958 to 1962.

Manufacture of commercial and industrial vehicles has grown steadily to meet the increasing demand of the mining, manufacturing and construction industries. Production in 1962 was about five times that of 1958. Cycles also increased from 504,000 units in 1953 to about 1.67 million in 1962. Exported motor-cycles increased from 20,100 in 1959 to 183,900 in 1962.

Watches and clocks

The production of watches and clocks, firmly established since the early twenties, reached a pre-war peak of about 5.1 million pieces in the early thirties. Clocks and watches are mass-produced by three large manufacturing firms in Japan, unlike Switzerland where there are numerous small makers. Production in 1962 reached about 20 million pieces. With the large domestic demand, only about 6 per cent of the watches are exported; these have gone to many countries in North America, Europe, Asia and Oceania.

Precision instruments

The precision instrument industry in Japan has made considerable progress in production techniques and

craftsmanship, excelling in the manufacture of optical instruments, such as cameras and telescopes. Other specialized items include surveying instruments, micrometers, metal testing machines and recording apparatus for industry and research. In 1962 about 3,120,000 cameras valued at about $92.7 million were produced. Exports of cameras to the United States, Europe and Asia valued at about $29.5 million comprised about 30 per cent of total production. The production of lenses as a related industry has also made considerable progress: about 480,000 pieces were produced in 1962 representing an increase of 30 per cent over 1961. Most of the manufacturers of optical instruments specialize in making lenses and die-casting cases. Large manufacturers have entered the business machine and instrument industry.

Business machines

The production of business machines is a new industry in the country and is still limited to specialized makers. Most of the business machines needed are still imported. The present scope of manufacture includes computers, recopying machines, cash registers, time recorders, time stamps and adding machines.

NEW ZEALAND

Economic structure

The principal resources of New Zealand are its farm products, which consist chiefly of wool, meat and dairy products. Manufacturing has steadily progressed not only in the processing of farm products, but also in the production of engineering goods such as electrical appliances, motor vehicles, wire products and the manufacture of metals and common building materials. Agriculture and its related industries contributed about 40 per cent to the national income in 1955 and about 34 per cent in 1961. The share[7] of manufacturing in national income was approximately 29 per cent in 1955 and 33 per cent in 1961.

SOURCES OF NATIONAL INCOME
(Percentage of total income)

Economic sector	*1955-56*	*1959-60*	*1960-1961*
Agriculture (including forestry and fishing)	40.5	37.7	34.3
Manufacturing, mining and construction	28.8	29.9	33
Others	31.2	32.4	32.7

Engineering industries[8]

The steady growth of the engineering industries during the last two decades has been stimulated by farm mechanization, the increasing demand for durable consumer goods and the high level of investment in the country. The pattern has shifted recently from the import substitution industries, which relied primarily on imported raw materials for their operation, to basic engineering industries which make greater use of available raw materials. Industries which will produce basic and intermediate products to replace imports of such materials have been given a high priority in the programme of industrial expansion.

The expansion of the engineering industries may be gauged by the continuing rise in the average horse-power per person engaged in them. In 1945, the average horse-power per person was 2.97; in 1955, 4.42; and in 1961, over 5. The greater use of machinery has been assisted by the growth in electric power generation. In 1960-61, electric motors accounted for about 95 per cent of the total rated horse-power for all types of drives used in factories.

The engineering products include steel drums, fork-lift trucks, water-jet engines, forage harvesters and other agricultural machinery, household electric appliances and motor vehicle components; two of the most important enterprises established recently are a wire rope factory and an aluminium sheet and foil mill, which it is estimated will save about £650,000 a year in foreign exchange.

Plans are now being implemented to establish the following engineering industries in the country.

Aluminium fabricating machinery

A subsidiary of a major foreign aluminium producing company is establishing an aluminium fabricating plant which will make aluminium products from imported ingots. The plant will have an initial production capacity of about 5,000 tons a year of aluminium sheet and foil products and 2,000 tons of aluminium wire and cable for electrical transmission lines. This company has started production of corrugated aluminium sheet from imported aluminium strip.

Copper fabricating

This plant will be established on a joint venture basis by a United Kingdom overseas firm and by investors in New Zealand. The capacity of the plant will meet all the country's copper and brass tube, plate sheet and strip requirements.

It is expected that these two plants (copper and aluminium) will fill the gap in New Zealand's metal processing industry.

Iron and steel industry

The Government is now establishing this industry after making a thorough study for the utilization of rich iron sands in the northern part of New Zealand. The

[7] New Zealand Yearbook 1962, p. 401 and p. 495.

[8] New Zealand Official Yearbook 1963. Output, Employment and Productivity Growth in New Zealand Manufacturing Industries — Research Paper No. 4 C.A. Blyth and P. Palmer, 1963.

initial plant will have an annual capacity of 150,000 tons and will be capable of expansion to 270,000 tons. It will use a non-conventional iron-making process. Construction of the plant will be started in 1965 and completed in 1967. It will be located in South Auckland. A United States controlling firm assisted in the investigations and in the choice of a suitable process for the exploitation of the indigenous resources.

Some aspects of the structure and characteristics of the engineering industries are shown in the following table.

ENGINEERING INDUSTRIES

1960-61

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
			(£'000)
Manufacturing	*8,745*	*181,346*	*287,097*
of which:			
Engineering industries	*3,221*	*49,572*	*72,291*
1. Manufacture of metal products except machinery and transport equipment	447	9,659	16,237
2. Manufacture, assembly and repair of machinery, (except electrical machinery)	530	10,775	16,160
3. Manufacture of electrical machinery, apparatus, appliances and supplies	150	5,514	8,035
4. Manufacture of transport equipment	2,067	23,443	31,608
5 Optical, surgical, dental, etc. equipment	27	181	251
% *Engineering industries/ manufacturing*	*36.8*	*27.3*	*25.2*
Basic metal industries	85	1,068	1,919
Total engineering industries including basic metal industries . . .	3,306	50,640	74,210
% *Engineering industries including basic metal industries/manufacturing* . .	*37.8*	*27.9*	*25.8*

Source: New Zealand Official Yearbook 1963.

The position of the engineering industries was as follows in 1960-61.

	Per cent
Share of total manufacturing output	25.2
Share of total manufacturing employment	27.3

There are only a few large enterprises in New Zealand; most of the engineering industries are on a relatively small scale and, though representing about 61 per cent of the total number of establishments in the country, contribute only about 13 per cent of the total factory output.

Mechanical engineering

There are no heavy engineering establishments producing heavy capital goods. About 513 mechanical engineering enterprises manufacture or assemble agricultural and pastoral equipment, or manufacture or repair component parts of simple industrial and construction machinery. Most heavy industrial and construction machinery is imported.

Imports ranged from £26 million to £38 million during the last two years. Exports amounted to about £590,000 in 1959 and £530,000 in 1960.

Electrical engineering

Most of the electrical engineering establishments produce household electrical appliances. About 56,000 refrigerators, 40,000 electric cookers and about 50,000 vacuum cleaners are produced annually. Several establishments produce radio and television assemblies; about 100,000 radio receiver assemblies have been produced annually during the last few years. Production of television sets is of very recent origin; about 1,500 units are produced annually. Some twenty-two enterprises produce radio and television sets and seven produce electric cookers of various types. Exports and imports of electrical equipment in 1960-61 amounted to about £170,000 and £15 million respectively.

B. Countries with gradually advancing engineering industries

BURMA

Economic structure

Burma has rich natural resources of forests and minerals, but its economy depends largely on rice production. Agriculture contributed about 41 per cent to the gross domestic product in 1955 and about 32 per cent in 1963. The share of manufacturing was about 11 per cent in 1955 and 16 per cent in 1963.

SOURCES OF GROSS DOMESTIC PRODUCT[a]

(Percentage of total GDP)

Economic sector	*1955*	*1959*	*1961*	*1962*	*1963*
Agriculture (including fishing and forestry)	40.7	39.8	32.4	32.1	32.3
Manufacturing, mining and construction	11.3	12.7	17.9	18.6	16.1
Others	48.2	47.5	49.7	49.3	51.6

[a] Economic Survey of Burma 1964 — Ministry of National Planning — The Revolutionary Government of the Union of Burma. Burma has revised data on national income from 1961.

An eight-year programme of economic development prepared in 1952 included the expansion of industries producing such items as durable consumer goods and

the establishment of basic industries. In 1962, an Industrial Production Board was organized to assist in the expansion and rationalization of existing industries and the establishment of new industries primarily utilizing domestic raw materials. In line with the rural electrification and farm mechanization programmes, a diesel engine plant and a tractor assembly unit will be established by the Government.

The establishment of an integrated iron and steel plant is under consideration. Assistance has been received from a number of countries in connexion with some of these industrial and engineering projects. In 1962, a United Nations Industrial Mission made a study of industrial undertakings in the country. The present manufacturing industry consists mainly of the processing of primary products — rice, sugar and teak — the production of cement, bricks, tiles and some steel, and of consumer goods such as pharmaceuticals, jute and cotton cloth.

Some aspects of the structure and characteristics of the engineering industries are shown in the following table.

ENGINEERING INDUSTRIES

1957-58

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
			('000 kyats)
Manufacturing	*2,759*	*175,769*	*360,834*
of which:			
Engineering industries	*116*	*14,694*	*106,542*
1. Manufacture of metal products except machinery and transport equipment	71	3,310	85,401
2. Manufacture, installation and repair of machinery, except electrical machinery	6	452	402
3. Manufacture, installation and repair electrical machinery, apparatus, appliances and supplies	8	446	555
4. Manufacture and repair of transport equipment	31	10,486	20,184
% *Engineering industries/manufacturing*	*4.2*	*8.4*	*29.5*
Basic metal industries	9	884	1,508
Total engineering industries including basic metal industries	*125*	*15,578*	*108,050*
% *Engineering industries including basic metal industries/manufacturing*	*4.5*	*8.9*	*29.9*

Source: Annual Survey of Manufactures 1957-58—Burma.

The position of the engineering industries as shown by the available statistical data for 1958 was as follows:

	Per cent
Share of total manufacturing output	29.5
Share of total manufacturing employment	8.4

Mechanical engineering

There are no facilities for the manufacture of industrial machinery. Most of the small establishments only repair machinery and construction equipment. A tractor assembly plant will be established by the Government in connexion with the farm mechanization programme. A machine tool plant is under consideration in connexion with a recent agreement with a foreign government. Most of the industrial machinery used in the country is imported.

Metal manufactures

Aluminium products

A number of enterprises manufacture aluminium ware, household utensils and ferrous metal containers and furniture. A few make nails, bolts and nuts, screws and other wire products. A limited quantity of aluminium sheets is produced from imported ingots by a small aluminium rolling mill and sold to the small aluminium ware enterprises. Aluminium sheets are imported to supplement domestic production for use in household utensils. About 94 factories make aluminium ware; 54 make containers and about 22 make buckets.

The Rangoon steel mill owned by the Government is the only establishment making wire products for use in the several small nail, bolt and nut manufacturing enterprises. It also produces merchant bars, flats, small shapes and galvanized sheets. It has complementary units producing bolts and nuts, barbed wire, nails and galvanized sheets. One plant coats electrodes for use in repair shops.

Umbrellas and sewing machines

Five large and thirty-seven small establishments make umbrellas, the indigenous content of which is about 60 per cent. A sewing machine assembly plant has recently been established on a joint venture basis. Most of the parts will be imported; its production capacity will meet domestic demand.

Electrical machinery and appliances[9]

A recently established plant for the manufacture of electrical appliances will manufacture refrigerators, electric fans, fractional and small integral electric motors and transistor radios. There is also an establishment for plastic sheathing imported copper wire.

[9] Extracts from Trade and Industry of Japan 10-1963/No.66/page 55; Published by JETRO Tokyo, Japan.

Radio receiver assembly and batteries

Four establishments assemble radio receivers. A new plant has been established to produce transistorized radio sets. Wet- and dry-cell batteries are produced in adequate numbers to meet domestic demand. The total output for 1959-60 was valued at about K 400,000.

Transport industry

Rolling stock

The National Railways workshops possess modern equipment for the maintenance and repair of locomotives and rolling stock. Part of the structure of passenger coaches is built in the workshops. Locomotives, goods wagons and the main chassis of the passenger coaches are imported.

Motor vehicles

Two new factories have recently been established as joint ventures with foreign firms for the assembly of midget four-wheel cars small trucks and bicycles, all parts of which will be imported. Most of the existing small workshops only repair commercial vehicles.

Problems of the engineering industries

Some of these are:

(1) Under-utilization of production capacity in some small-scale enterprises. Some units are only operating at about 50 per cent of installed capacity.

(2) High production cost of locally made items such as sheets, because of the small market and seasonal demand.

(3) Dependence on imports for semi-finished raw materials. Foreign exchange difficulties have been encountered in the import of these materials.

CHINA (TAIWAN)

Economic structure

Taiwan's economy is based largely on agriculture and the processing of agricultural commodities for local consumption and export. Most of the arable land is already under intensive cultivation. Since 1949, rapid progress has been achieved in the programme of industrialization. The shift to industry is significant and salutary in view of the obvious physical limitations on further agricultural development. As of 1963, agriculture contributed about 29 per cent to the gross domestic product, compared with 34 per cent in 1955. The share of manufacturing and mining increased from 24 per cent in 1955 to about 27 per cent in 1963.

INDUSTRIAL ORIGIN OF GROSS DOMESTIC PRODUCT

(Percentage of total at current factor costs)

Economic sector	*1955*	*1960*	*1961*	*1962*	*1963*
Agriculture (including forestry and fishing)	33.6	33.2	31.1	29.0	28.6
Manufacturing, mining and construction	24.1	24.8	25.3	25.9	27.3
Commerce, banking insurance, transport and communications	23.2	24.1	24.8	24.8	23.4
Other services	19.1	17.9	18.8	20.3	20.7

Progress of engineering industries

Since 1951, the production of engineering goods has grown consistently at a high rate. During the first and second plans many engineering plants were rehabilitated and expanded and new ones established. The country has almost reached self-sufficiency in such manufactured products as bicycles and sewing machines, electric fans and aluminium ware. A substantial surplus of these items for export has been produced. Metals and machinery, which represented about 1 per cent valued at about US$1.2 million of total exports in 1952, increased to 12 per cent valued at about US$25.6 million in 1962.

During this period the engineering industries were diversified to include such manufactures as ACSR aluminium cables, aluminium extrusion, electrical appliances and small diesel engines. Plans are under consideration for a modern factory for the manufacture of machine tools and other capital goods. The establishment of an integrated steel plant as a complementary unit to this programme of industrial diversification and export promotion has been given prominence in the third four-year plan.

Some aspects of the structure and characteristics of the engineering industries as of 1961 are shown in the following table.

ENGINEERING INDUSTRIES

1961

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
			(NT$'000)
Manufacturing	*52,152*	*455,667*	*19,302,183.5*
of which:			
Engineering industries	*13,468*	*78,927*	*2,292,589.4*
1. Metal products	3,137	20,167	666,258.4
2. Machinery	1,748	16,528	444,416.5
3. Electrical machinery, equipment and supplies . . .	1,539	13,039	463,134.6
4. Transport equipment . . .	6,271	28,042	701,214.0
5. Clocks & watches and clock-work devices	773	1,151	17,565.9
% *Engineering industries/ manufacturing*	*25.8*	*17.7*	*11.9*
Basic metal industries	92	10,899	846,117.5
Total engineering industries including basic metal industries	*13,560*	*89,826*	*3,138,706.9*
% *Engineering industries including basic metal industries/ manufacturing*	*26.0*	*20.2*	*16.3*

Sources: Manufacturing General Report 1961, Industries and Commerce Census of Taiwan, Volume III, 1963.

The position of the engineering industries in 1961 was as follows:

	Per cent
Share of total manufacturing output	11.9
Share of total manufacturing employment	17.7

Industrial machinery

There were at the end of 1961 about 1,748 large and small registered factories in Taiwan manufacturing components and complete units of a few types of industrial equipment.

Sugar, cement, textile and other machinery[10] and machine parts

Most of the major components and parts required in rehabilitation and expansion of such industries as sugar, cement and cotton textiles were manufactured by domestic establishments. Recently, evaporators, crystallizers for sugar mills, rotary kilns for cement plants and cotton textile power looms have been exported to various countries of the region. Existing facilities are adequate to meet the domestic and export demand for these items. Other miscellaneous equipment such as rice-polishing, rice-milling, straw rope-making and oil-extracting machines, are produced by some of the smaller manufacturers. Components of mining and construction equipment and paper mills are produced by the Taiwan Machinery Company.

Diesel engines[11]

The manufacture of small diesel engines of the stationary and marine types from 5 to 20 HP was started a few years ago for use on farms and in the fishing industry. Domestic demand is estimated at about 40,000 HP yearly. Production increased from about 280 units in 1955 to about 500 units in 1961. Expansion of the facilities for the manufacture of diesel engines and small prime movers for export has been given a high priority in the third four-year plan.[12]

Agricultural implements and sprayers

The manufacture of agricultural implements has reached a high level. In 1961, two large manufacturing units were established in collaboration with Japanese companies for the manufacture of power tillers. The present installed capacity for this product is 6,000 sets per year as against a yearly domestic demand for about 3,000 units. The surplus will be exported.

Sewing machines and parts[13]

There are about twenty factories with a total annual capacity of about 80,000 sewing machines, well above the present domestic demand of about 30,000 machines yearly. Exports of sewing machines have grown steadily in the last few years.

Pumps and boilers

The manufacture of pumps for agriculture has steadily progressed during the last decade and the production of centrifugal pumps has started, also mostly for agriculture. In 1955, production was about 1,800 units and in 1961 rose to about 2,500 units, an increase of about 40 per cent. The estimated domestic demand for power driven pumps is about 100,000 HP per annum. Production in 1961 was 71,000 HP. Boilers of the simple vertical and horizontal economic types are also made by some leading manufacturers.

Machine tools[14]

The manufacture of simple machine tools of the ungraded type is of very recent origin and production is limited. In 1961 about 2,319 units were produced and in 1962 about 2,400 units.

[10] *China Yearbook 1961-62.*

[11] The third four-year plan, Ministry of Economic Affairs, Taiwan, 1961.

[12] *Ibid.*

[13] *Industry of Free China*, January 1964, Vol. XXI No.1. *China Yearbook 1961-62.*

[14] *Industry of Free China*, August 1963, Vol. XX, No.2, p.68; September 1963 Vol. XX No.3, p.74; January 1964, Vol.XXI, No.1, p.64.

Electrical machinery, apparatus and appliances

Prior to 1960, almost all electrical machinery and appliances had to be imported. There are numerous small units engaged in this industry but the main output of electrical machinery comes from twenty large modern factories. The existing installed capacity is adequate to meet domestic demand for small items of electrical equipment, i.e. distribution transformers, electric fans and other appliances and export markets have been developed for them. There is no capacity for the production of heavy electrical machinery.

Switchgear

A modern plant has recently been completed for the manufacture of the power transformers, oil circuit-breakers, switchgear capacitors and switchboards.

Electric cable and wire[15]

There are over twenty-four units engaged in the manufacture of rubber, paper- and plastic-insulated cable and wire. Power transmission cables of bare copper, ACSR aluminium and insulated cables for telecommunication are also produced. In 1955, about 19,836,000 metres of insulated cables were produced, compared to about 56.6 million metres in 1961 and 61.5 million metres in 1962. There is sufficient capacity to meet the domestic demand for these products. Exports of ACSR cables have been developed in South-east Asia and western Europe.

Electric fans and watt-hour metres

The production of electric fans has increased considerably since 1960. In 1961,[16] over 200,000 sets were produced, compared to about 53,000 sets in 1955. Electric meter production has reached about 180,000 sets compared to about 50,000 sets in 1955. Electric fans are a major export item.

Transformers and capacitors[17]

Over 3,000 distribution transformers, were produced in 1961 compared to about 1,000 in 1955. The manufacture of high voltage electric capacitors is of recent origin: about 10,400 units were produced in 1961 and about 14,000 in 1962.

Refrigerators, motors, telephone apparatus

Manufacture of household refrigerators and small electric motors started recently. In 1961, only about 123 refrigerators were produced, increasing to over 1,000 in 1962. The production of small electric motors in 1961 was about 16,000 units and in 1962 about 19,000 units. The manufacture of telephone apparatus is also of recent origin. About 17,000 units were produced in 1961.

Other electrical products

Other electrical goods now produced in Taiwan such as radio receivers and transistor radios are primarily intended for export since domestic demand is limited.

Metal manufactures[18]

Steel wire, nails and cable

Steel wire manufactures come mainly from a few major producers. Many small manufacturing plants also make barbed wire, wire netting, nails and other miscellaneous wire products. Production of steel wire increased from about 4,000 metric tons in 1955 to about 30,000 tons in 1961 and about 32,500 tons in 1962. Nail production increased from 2,000 tons in 1955 to about 6,000 tons in 1962. The production of steel cables started in 1961 with about 2,700 tons, increasing to about 5,000 tons in 1962.

Metal containers, metal furniture and utensils

The food processing industry has created a large demand for metal containers. Domestic production of tin-coated plate has provided a continuing supply of raw materials for the canning factories. Manufacture of collapsible and rigid tubes in soft metal and aluminium and closures for bottles, etc., are also produced. The growing use of metal furniture in homes, offices and hospitals has created a demand for these items. Present production of household utensils is adequate to meet domestic requirements.

Building hardware, bolts and nuts, screws and hand tools, etc.

Miscellaneous items such as bolts and nuts, screws, washers, metal fittings for doors and windows and hand tools, are produced by small scale plants. Most of the essential steel and non-ferrous materials are produced locally.

Pipes and extrusions

Steel welded pipes, centrifugal cast iron pipes and aluminium extruded pipes are produced in quantities to meet both domestic and export demands. Most of the materials used in the industry are indigenous. Production of extruded aluminium products for doors, windows and other building purposes has increased considerably to meet domestic and export demand. About 1,600 metric tons were produced in 1962, compared with about 400 tons in 1955. The major producer of aluminium

[15] *Industry of Free China* — August 1963, Vol. XX No.2 p.68, January 1964 — Vol. XXI No.1 p.64. The Republic of China: *Taiwan Production Monthly Statistics*, May 1963.

[16] *Ibid.*

[17] *Ibid.*

[18] General Report 1961, Industry and Commerce Census of Taiwan, the Republic of China, Vol. III.

and semi-finished materials is the Taiwan Aluminium Corporation, with a production capacity of about 10,000 tons annually.

Structural fabrication

Only one large firm is engaged in structural steel fabrication for residences, offices and other buildings. Roof trusses of welded steel bars are used extensively in building factories and warehouses. Other structural shapes are formed from steel strips for use as beams and small columns. Most of the merchant bars used in construction are of indigenous production.

Transport industry

Motor vehicles

The production of passenger vehicles and trucks started in 1956. The Yue Loong Motor Company, the only manufacturer in this industry, started with the assembly of jeeps. In collaboration with Japanese and United States makers, assembly lines were established for the passenger cars, trucks and buses. In 1960,[19] the combined production of automobiles, trucks and buses was 1,000 units. In 1962, the production of automobiles was about 1,000, trucks and buses 1,400. Present yearly capacity of the plant for passenger cars is about 2,000, trucks about 1,800 and buses about 1,000 respectively. Indigenous manufacture of parts of cars and trucks has recently been started by this company. It is expected that production will keep pace with demand.

Motor-cycles

A new manufacturing firm, the Sang Yang Industry Co., in collaboration with a Japanese firm has recently established a factory for the manufacture of Honda motor-cycles. The capacity of this plant is about 3,000 motor-cycles per month.

Bicycles

The manufacture of bicycles is a well established industry. There are about 155 large and small registered factories manufacturing bicycles, bicycle frames and parts. Present production capacity is about 80,000 units per annum. In view of the limited domestic demand, production in 1961 remained at about 30,000 units. An export market is being developed to utilize the excess capacity.

Railway rolling stock

The Taiwan Railway Bureau is equipped to manufacture its rolling stock requirements such as wagons, passenger coaches and trailers; tyres and other parts are also manufactured in its workshops. Locomotives are imported.

[19] *China Yearbook 1961-62*. General Report 1961, *Industry and Commerce Census of Taiwan*, The Republic of China, *Vol.III*.

Problems of the engineering industries

The manufacturing group is one of the most dynamic sectors of economic development. The installed capacity of a number of modern factories engaged in large-scale operations, has exceeded domestic demand. The domestic market has reached saturation point, to the extent that the substantial surplus capacity can only be absorbed by export demand. Many of the small-scale industries are not in a position to face the competitive features of the export market and are therefore meeting great difficulties in maintaining operations.

Other problems are (*i*) high production cost and sub-standard methods of quality control in the small-scale sector; (*ii*) inadequate supplies of some semi-finished raw materials such as semi-finished steel products, and shortage of foreign exchange for their purchase; and (*iii*) sub-standard financial structure in the small-scale sector.

HONG KONG

Economic structure

Since 1941 the products of Hong Kong's light manufacturing industry have played a more vital role in its economic life than its entrepot trade. As of 1962, the locally manufactured products valued at about HK$3,317 million represented about 76 per cent of the value of Hong Kong's total exports. The following table shows the structure and characteristics of the important engineering industries as of 1963.

ENGINEERING INDUSTRIES
July-September 1963

Economic sector	*Number of establishments*	*Average number of persons employed*
Manufacturing . . . . . of which:	*7,791*	*341,922*
Engineering industries	*1,779*	*67,377*
1. Manufacture of metal products, except machinery and transport equipment . . .	964	32,930
2. Manufacture of machinery, except electrical machinery	469	6,943
3. Manufacture of electrical machinery, apparatus, appliances and supplies . . .	186	10,876
4. Manufacture of transport equipment . .	117	13,722
5. Miscellaneous manufacturing industries: Scientific equipment	1	8
Manufacture of photographic and optical goods	22	1,564
Manufacture of watches and clocks . .	20	1,324
% *Engineering industries/manufacturing* . .	*22.8*	*21.4*
Basic metal industries	116	3,738
Total engineering industries including basic metal industries	*1,895*	*71,115*
% *Engineering industries including basic metal industries/manufacturing*	*24.3*	*22.6*

Source: Labour Department and Mines Department Quarterly Report, July-September 1963, Hong Kong.

The position of the engineering industries was as follows:

	Per cent
Share of total manufacturing employment	21.4

Mechanical engineering[20]

Machinery parts and injection-moulding machines

Most of the machinery manufacturers produce components for domestic light industries such as small textile mills and canning plants, and replacement parts for construction machinery. Complete small machines for the manufacture of some metal products are produced locally. The manufacture of plastic injection-moulding machines is of recent origin; all the parts are made locally. An export market has been developed for this product in various countries of the region. Other machines manufactured are printing presses and paper-cutting machines.

Machine tools and metal processing machinery

Machine tool manufacture has made rapid strides during the last few years. A few units manufacture machine tools such as lathes, shapers, drilling machines, mechanical and power presses. The workmanship and quality of these tools compare favourably with those of other countries. An export market has also been developed for these products.

Diesel engines

A few units manufacture small gas and diesel engines for home lighting and for small craft. The maximum size of engines built is 80 HP. Plans are now under consideration for the manufacture of larger diesel engines by one of the leading shipbuilders in collaboration with a foreign maker.

Electric machinery, apparatus and appliances

The manufacture of electrical apparatus and appliances such as flashlight cases, electric torches, batteries, bulbs, assembly of transistor radios, electric fans, fractional motors and batteries has made remarkable progress in recent years. Most of these products are manufactured for export. About 469 manufacturing units are engaged in this industry. Exports of these goods amounted to about HK$106.4 million in 1962 compared to HK$47.3 million in 1960.

Metal products

About 964 units manufacture such metal products, as household utensils, needles, umbrella ribs, slide fasteners, safes, nails, screws, fire extinguishers, pressure stoves, lanterns, cutlery and metal household and office furniture. Metal containers, vacuum jugs, flasks and building hardware are also manufactured for export.

[20] *1963 Hong Kong Directory — Commerce, Industry and Finance.*

Transport industry

Aircraft engineering

One large establishment provides maintenance and repair facilities for most of the airlines engaged in international passenger and cargo traffic. These facilities, also used by several national air forces, include complete engine overhaul and complete air frame repair services.

Automobile industry

There are three small assembly plants, whose capacity is not sufficient to meet the demand for passenger cars and buses. Most of the existing facilities are engaged in repair of motor vehicles.

Clocks and watches

Only one unit manufactures clocks, both spring and electrically driven models. The manufacture of transistorized models started recently. Mainly only watch cases, dials and hands or made locally. Watch movements are imported and fitted into locally made watch cases. Seventeen small plants manufacture watch cases and two make watch dials and hands.

INDONESIA

Economic structure

The country is predominantly agricultural and mostly dependent on primary products such as rubber, sugar, coffee, tea, copra and other food products. It has abundant mineral and oil resources. Agriculture contributed to the net domestic product about 55 per cent in 1955 and about 56 per cent in 1959. Manufacturing and its related activities contributed about 15 per cent in 1955 and about 12 per cent in 1959.

INDUSTRIAL ORIGIN OF NET DOMESTIC PRODUCT[21]

(Percentage of total at factor cost of 1955)

Economic sector	*1955*	*1957*	*1959*
Agriculture, fishing and forestry . . .	55.2	50.6	55.5
Manufacturing, (mining, construction, electricity, gas and light industries)	15.2	17.7	11.9
Others	29.6	31.7	32.6

Development plan[22]

The eight-year national development plan started in 1961 places emphasis on certain industrial products which can be produced locally with indigenous raw

[21] United Nations, *Yearbook, National Account Statistics 1961.*

[22] Asian Annual 1963 — Eastern World Handbook.

materials. The plan calls for an investment of about 270 million Rupiahs of which industry will get a major share. Among the projects included in the plan is the construction of iron and steel plants in west Java and in south-eastern Kalimantan and light metal engineering industries.

Some aspects of the structure and characteristics of a selected number of engineering industries are shown in the following tables.

ENGINEERING INDUSTRIES
END OF 1960

Economic sector	*Number of establishments*	*Average number of persons employed*
Manufacturing	*11,960*	*458,626*
of which:		
Engineering industries	*1,067*	*49,931*
1. Manufacture of metal products, except machinery and transport equipment . .	435	17,328
2. Manufacture and repair of machinery, except electrical machinery	148	7,897
3. Manufacture and repair of electrical machinery, apparatus, appliances and supplies	34	4,186
4. Manufacture of transport equipment	450	20,520
% *Engineering industries/manufacturing*	*8.9*	*10.9*

Source: Statistical Pocket Book of Indonesia 1962 (pp. 91-95).

ENGINEERING INDUSTRIES
1958

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
	(at end of year)	'100	Milllion Rupiahs
Manufacturing	*10,175*	*447.2*	*8,480.1*
of which:			
Engineering industries			
1. Metal products	979	46.2	924.0
% *Engineering industries/ manufacturing*	*9.6*	*10.3*	*10.9*

Source: United Nations, *The Growth of World Industry 1938-1961* — National tables p.397.

Engineering industries

The Government has endeavoured to promote both large and small scale industries, extending protection and incentives to enterprises working with domestic capital. Arrangements have been made with some foreign countries for the importation of capital goods under liberal credit terms for metal goods works, transport assembly plants and foundries. Work has started on the steel works in western Java which will supply some basic steel products required by industry. New mechanical and electrical factories are being considered under certain foreign assistance programmes.

Mechanical engineering[23]

Most of the large mechanical engineering industries primarily manufacture components of industrial machinery, agricultural implements and metals and assemble motor vehicles.

Machinery parts

About fifty-two large units produce components of sugar mills, textile mills, food processing machinery, mining equipment and farm implements. No complete units are produced in the country and most of the heavy machines and equipment are imported.

Metal manufactures

The large firms make a wide range of products including aluminium ware, metal furniture, metal containers, wire products, building hardware and tin-coated sheets. Eight large firms manufacture various types of aluminium ware. Total production is adequate to meet most of the domestic demand. About fifty-three establishments manufacture other metal ware including containers, metal furniture household utensils, and cans for food preserves and beverages.

The domestic products consist mainly of nails, barbed wire, fencing wire and wire mesh, bolts, nuts and screws. There are about fourteen large factories engaged in this industry. Production capacity is adequate to meet most of the domestic demand. About thirty-one factories are engaged in galvanizing and tinplating; most of the black sheets they use are imported.

Sewing machines and umbrellas

Four large factories assemble sewing machines. Production capacity is about 15.000 units per annum. Four plants produce about 200,000 umbrellas a year from indigenous materials.

Structural fabrication

The manufacture of structures such as roof trusses, columns and other assemblies for bridges and related work is of recent origin. The structures are mainly welded assemblies of merchant bars and shapes. Most of the steel products required for them are imported.

[23] Biro Pusat Statisk Djakarta 1961.
Statistical Handbook of Indonesia 1962.

Electrical accessories and appliances[24]

Most of the existing establishments manufacture electrical accessories such as safety switch boxes, motor boxes, small electrical distribution items and storage batteries. Most of the electric workshops repair small electric motors and generators; some manufacture graphite brushes and produces low-capacity transformers. High-rating transformers are imported. Seven large units produce wet and dry batteries and meet most of the domestic demand.

Radio assembly and transistors

Ten establishments assemble radio receivers and transistor sets. Production is about 20,000 units yearly. All the parts are imported.

Transport industry

Motor vehicle assembly

Four establishments assemble cars and commercial vehicles. Production is about 2,000 trucks, 900 jeeps and 100 passenger cars. Most of the vehicle parts are imported. Ten establishments are engaged primarily in building bodies for buses, trucks and ambulances. Three other establishments manufacture radiators and accessories such as tail lamps and spring brackets.

Bicycles

Four large establishments make about 10,000 to 15,000 bicycles a year. Bicycle forks are also manufactured in some of them. Most of the other parts are imported.

Scientific instruments

One enterprise produces ordinary laboratory apparatus and simple instruments for medical and dental use. Annual production averages about 60,000 pieces.

KOREA, REPUBLIC OF

Economic structure

The country is endowed with large deposits of anthracite coal, tungsten and graphite. Agriculture ranks foremost in the economy and contributed to the gross domestic product about 40 per cent in 1955 and 33 per cent in 1963. Manufacturing contributed 13.1 per cent and 20.2 per cent respectively in the same periods.

[24] *Ibid.*

SOURCES OF GROSS DOMESTIC PRODUCT

(Percentage of total at factor cost of 1960)

Economic sector	*1955*	*1959*	*1961*	*1962*	*1963*
Agriculture (fishing and forestry)	39.8	36.5	38.5	34.3	32.8
Manufacturing, mining and construction	13.1	16.4	16.8	18.8	20.2
Others	47.1	47.1	44.7	46.9	47.0

Development plan[25]

The first five-year plan which started in 1962 includes among the high priority projects expansion of the key basic metal industries and the advancement of technological and managerial skills.

The total capital investment over the five-year period will be approximately $2,472 million, including foreign exchange valued at about $683.6 million. The breakdown of investments contemplated in the plan is as follows:

	Per cent
Agriculture, including forestry and fishing	17.2
Manufacturing and mining	34.0
Transport, communications, power, etc.	48.8

Engineering industries

Most of the engineering industries consist of small-scale enterprises. During the last few years, some of these have been modernized and expanded and new ones organized on a larger scale to meet the increasing demand for durable consumer goods. With the implementation of the first five-year plan, the manufacturing index rose from 104.3 in 1961 (1960=100) to 121.9 in 1962. The electrical appliance and metal product industries have registered high percentage increases in output. Most of the engineering industries are heavily dependent on imported raw materials. Instability in the supply of raw materials greatly affects their efficiency and output.

Some of the aspects and characteristics of the engineering industries are shown below:

[25] Summary of the First Five-Year Economic Plan 1962-1966, Republic of Korea 1962, Economic Planning Board.

ENGINEERING INDUSTRIES

1960

Economic sector	Number of establishments	Average number of persons employed	Value added in process of manufacture
			'000 H.W.
Manufacturing	*15,204*	*275,254*	*218,655,583*
of which:			
Engineering industries (metal)	*1,980*	*35,266*	*23,971,787*
1. Manufacture of metal products, except machinery and transport equipment	678	10,936	7,174,835
2. Manufacture of machinery, except electrical machinery	528	9,584	6,582,233
3. Manufacture of electrical machinery, apparatus, appliances and supplies . .	129	4,458	2,810,949
4. Manufacture of transport equipment	614	9,527	6,761,679
5. Miscellaneous manufacturing industries:			
(*a*) Medical, scientific, measuring and controlling instruments	21	551	394,668
(*b*) Manufacture of photographic and optical instruments	10	210	247,423
% *Engineering industries/manufacturing*	*13.0*	*12.8*	*11.0*
Basic metal industries . . .	190	7,027	5,351,342
Total engineering industries including basic metal industries/manufacturing	*2,170*	*42,293*	*29,323,129*
% *Engineering industries including basic metal industries/manufacturing*	*14.3*	*15.4*	*13.4*

Source: Final Report, Census of Mining and Manufacturing 1960, Korea.

The position of the engineering industries was as follows:

	Per cent
Share of total manufacturing output	11
Share of total manufacturing employment	12.8

Mechanical engineering

Industrial machinery

About 400 establishments are engaged mainly in the manufacture of components and in a few cases complete units of farm machinery, textile mills, construction and milling equipment and other machinery used in the paper and pulp, canning and other industries. The major products for agriculture are complete units of threshers, weeders, rice-polishing and rice-husking machines and flour mill equipment. Textile equipment consists mainly of shuttles, circular knitting machines, looms, straw rope makers and looms.

Only components of construction and mining equipment are manufactured to replace damaged or worn-out parts. Most of the heavy industrial equipment is imported. Value of imports in 1961 amounted to $12.4 million.[26]

Diesel and kerosene engines and pumps

About eighty establishments manufacture small diesel and kerosene engines used as prime movers for farm equipment, pumps, irrigation and rural lighting units. About 2,000 of these small engines are produced yearly. Small capacity diesel and electric pumps are built in many small enterprises. Production ranges from 4,000 to 5,000 units yearly.

Sewing machines and metal-working

The sewing machine industry produces from 20,000 to 30,000 units yearly. Simple metal stamping and forming machines, jigs and fixtures are manufactured by a few enterprises.

Electrical machinery and appliances

The industry mainly produces small electric motors, electric fans, apparatus, electric wire, cable, transformers, radio receivers, batteries and incandescent lamps. Most of the large enterprises are of foreign origin. In 1961, production of low capacity transformers reached about 5,000 units and electric motors about 1,800 units. Imports of electrical equipment averaged about US$11 million for the last few years.

Production of radio receivers started recently; in 1961, about 60,000 were produced. The present production capacity can supply about 74 per cent of the total domestic demand. The growth of the industry in the last two years has contributed greatly to the high production index of the metal industry.

Metal manufactures

Some of the major items produced are aluminium ware, pressed and enamelled products, cutlery, hand tools and hardware, metal containers and wire products. There are about 600 enterprises engaged in this industry, of which about 90 per cent are small-scale.

Production in 1960 was as follows: aluminium ware about 6,000 metric tons; wire products about 8,000 tons; hand tools about two million units. The present production of metal manufactures can supply about 74 per cent of the total demand. Most of the raw materials used are imported, except for a few items such as wire rods, wire and sheets which are produced by domestic steel plants. Annual imports of materials have averaged about US$1.5 to US$1.8 million during the last few years.

[26] *Economic Statistics Yearbook 1962*, Korea.

Transport industry

Rolling stock

The government railway shops are equipped to produce a limited number of passenger coaches and freight cars. All locomotives and major equipment are imported.

Motor vehicles, bicycles, bodies and parts

Only three-wheelers are produced: annual capacity is about 1,500 units. A number of establishments manufacture bodies for buses and jeep taxies. Most of the chassis are imported. Several establishments produce automobile springs, pistons, piston rings, engine valves and other accessories. Two establishments manufacture bicycles, total productive capacity in 1961 being 53,000 units.

MALAYSIA

Economic structure[27]

Agriculture occupies a dominant position in the economy and contributed about 39 per cent to the gross domestic product in 1956 and about 38 per cent in 1961. Manufacturing contributed about 18 per cent in 1956 and about the same in 1961. The production of tin is one of the major lines of activities next to agriculture. The country is the largest producer of tin in the world, accounting for about 33 per cent of the total world production. The extent of secondary industries is limited and their activities have been associated with the production of tin.

INDUSTRIAL ORIGIN OF THE GROSS DOMESTIC PRODUCT

(Percentage of total at factor cost of 1960)

Economic sector	*1956*	*1959*	*1961*
Agriculture (fishing and forestry)	39.3	39.8	37.6
Manufacturing, mining and construction . . .	17.8	16.2	18.3
Others	42.9	44.0	44.1

Development plan

The total scheduled investment under the second five-year plan which started in 1961 is about $M5,050 million. The investment allocated for accelerating industrial development is about $M27 million. The Government endeavours to stimulate the growth of secondary industries by: (*i*) creating the infrastructure of basic facilities and services necessary for industrial development; and (*ii*) encouraging private enterprise (both local and overseas) by means of policies conducive to investment and expansion in the private sectors of the economy. Some of these measures include the establishment of the Malayan Industrial Development Finance Ltd, the award of tax reliefs to pioneer industries, and anti-dumping legislation.

[27] *Official Yearbook 1962* — Federation of Malaya.

Engineering industries

The country is in the early stages of establishing new large-scale engineering industries as envisaged in the second five-year plan. Some of the important projects recently established are connected with the expansion of the facilities of the National Iron and Steel Mill Ltd. in the Jurong Industrial Estate; the completion of the first aluminium rolling mill at Petaling Jaya; and the establishment of two new pipe-making factories. A new motor vehicle assembly plant recently commenced operation in Singapore. Two other assembly plants are under consideration.

There are about 1,600 establishments engaged in the engineering industries; they mainly manufacture wire and wire products, aluminium ware, hardware, components of industrial machinery and pipes and assemble bicycles and small commercial vehicles.

Some of the aspects of the structure and characteristics of the engineering industries are shown in the table below:

ENGINEERING INDUSTRIES

1961

Economic sector	*Number of establishments*	*Average number of paid employees at Dec. 31*[a]	*Net value of output '000 $M*
Manufacturing	*1,634*	*47,525*	*221,312*
of which:			
Engineering industries	*236*	*4,882*	*17,778*
a. *Metal products manufacturing industries*			
1. Architectural metal products	33	317	975
2. Wire and wire products . . .	14	290	1,307
3. Hardware, tools and cutlery	10	24	75
4. Metal containers (tin, cans and metal boxes)	19	745	2,517
5. Zinc and tinplate products, including tin smithing . . .	34	123	415
6. Brass, copper and aluminium products	10	355	1,310
7. Other metal products industries[b]	15	611	3,362
b. *Machinery manufacturing industries*			
1. Industrial machinery and machinery parts	64	1,439	4,245
c. *Transport equipment manufacturing industries*			
1. Shipbuilding and repairing and wooden boatbuilding and repairing	7	553	2,067
2. Motor vehicle bodies	18	307	1,178
3. Motor vehicle parts and accessories	3	11	39
4. Bicycle, tricycle and trishaw parts and accessories	9	107	288
% *Engineering industries/ manufacturing*	*14.4*	*10.3*	*8.0*
Basic metaal industries (iron foundries)	10	224	748
Total engineering industries including basic metal industries	*246*	*5,106*	*18,526*
% *Engineering industries including basic metal industries/ manufacturing*	*15.0*	*10.7*	*8.4*

Source: Survey of manufacturing industries, Federation of Malaya 1961 (Table 1).

[a] Full time + part time (including home workers).

[b] Includes fabricated and structural steel and boilers, tanks and plate-work.

The position of the engineering industries was as follows:

1961

	Per cent
Share of total manufacturing output	8
Share of total manufacturing employment	10.3

Mechanical engineering

Industrial machinery, pumps and parts

Most of the existing factories and workshops mainly manufacture components of industrial machinery for the mining and manufacturing industries, i.e. rubber products factories, food processing plants and rice mills. The small enterprises are engaged generally in repair services. There are also small plants which produce gravel and other types of pumps used in the mining industry. Production, however, is limited. There are about sixty-four establishments engaged in this sector. The total combined output in 1961 was estimated at about $M8,944,000.

Metal manufactures

Wire and wire products, hardware, tools and cutlery

About seventy-four establishments manufacture wire and wire products such as bolts, nuts, screws, gears, shafts, wire fencing and mesh metal window frames. The total output of this industry as of 1961 was about $M3,708,000. Output of the hardware, tool and cutlery plants was valued at approximately $M140,000 in 1961. There are about ten small plants engaged in this industry.

Metal containers and zinc and tinplate products

About ten fairly large establishments manufacture metal containers valued at about $M8,402,000 in 1961. Zinc and tinplate products consist mainly of household utensils, pails, buckets, crown corks, lamps and other miscellaneous goods. Output in 1961 was valued at approximately $M1,381,000.

Brass, copper and aluminium products

These consist of aluminium utensils sign boards and brass and copper wares such as sprayers, door and locker handles. The total value of these products in 1961 was about $M4,000,000.

Pipes

Two new enterprises have recently been established to produce: (*i*) about 1,500 tons yearly of ½ in to 4 in dia. galvanized pipes; and (*ii*) about 30,000 tons yearly of 5 in to 80 in spiral welded pipes.

Miscellaneous metal products

These include architectural metal products such as metal doors and windows frames, chain link netting, metal furniture, grill work. There are about thirty-four establishments engaged in this industry. Production was worth about $M2,000,000 in 1961.

Motor vehicles

The motor vehicle industry was until recently confined to the manufacture of bicycles and tricycles, motor vehicle parts and accessories and a limited quantity of motor vehicle bodies. A new automobile assembly plant was completed in 1963. About eighteen establishments produce motor vehicle bodies; three—motor vehicle parts and accessories, and nine—bicycles and tricycles. The total output of these industries (not including the new assembly plant) was valued at about $M4,000,000 in 1961.

PAKISTAN

Economic structure

Agriculture contributed about 51 per cent to the national income in 1962 compared to about 55 per cent in 1955. The share of manufacturing was about 14 per cent in 1955 and more than 18 per cent in 1962.

SOURCES OF NATIONAL INCOME[28]

(Percentage of total income)

Economic sector	1955	1960	1961	1962
Agriculture (including forestry and fishing)	54.8	52.2	52.2	50.9
Manufacturing, mining and construction	13.6	16.2	16.7	17.7
Commerce, banking, insurance, transport and communications	13.2	13.4	13.4	13.6
Others	18.4	18.2	17.7	17.8

Engineering industries

Since 1948, the Government has encouraged the establishment of engineering industries. Starting from a very low base, significant progress has been made in establishing light industries for the manufacture of producer and consumer goods. The plans for the expansion of existing engineering industries include the complementary establishment of an integrated iron and steel industry and heavy foundries to provide the basic steel materials required by the engineering industries. It is expected that, during the third plan period (1965-70), the installation of the Karachi and Chittagong steel mills, with an annual capacity of 350,000 tons and 150,000 tons respectively, will be completed. These two plants will provide the base for the manufacture of some of the capital goods needed in industry.

Under the third five-year plan[28] (1965-70), industry's share of the total investment of Rs 47,000 million will be about Rs 13,000 million, or about 28 per cent. Within the industrial sector, the emphasis will be on the establishment of heavy capital goods industries, for which about 60 per cent of the industrial budget under the third plan has been allocated.

The progressive liberalization of imports which has ensured an adequate supply of industrial raw materials and spare parts, the incentives given to industries and the establishment of technical institutions have helped to increase production. A degree of self-sufficiency has now been achieved in such engineering products as electric fans, small electric motors, pumps and small diesel engines. Export markets have also been developed for such items as surgical instruments and cutlery.

The index of industrial production, which recorded a rise of 7.8 per cent in 1960-61, rose by about 10.6 per cent in 1961-62 (1959-60 = 100),[29] mainly as a result of more effective utilization of installed capacity, modernization and balancing of industrial units and greater domestic and foreign investment.

Some aspects of the structure and characteristics of a selected number of the engineering industries are shown in the following table:

ENGINEERING INDUSTRIES[a]

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added in process of manufacture*
			'000 Rs.
Manufacturing of which:	*3,465*	*449,942*	*1,544,715*
Engineering industries (metal only)	*910*	*55,678*	*170,243*
1. Manufacture of metal products, except machinery and transport equipment	425	21,543	60,135
2. Machinery, except electrical machinery	258	10,871	32,534
3. Electrical machinery, apparatus, appliances and supplies	95	7,260	28,561
4. Manufacture of transport equipment	107	14,667	45,358
5. Instruments (metal)	25	1,337	3,655
% *Engineering industries/ manufacturing*	*26.3*	*12.4*	*11.0*
Basic metal industries	84	10,678	39,141
Total engineering industries including basic metal industries	*994*	*66,356*	*209,384*
% *Engineering industries including basic metal industries/ manufacturing*	*28.7*	*14.7*	*13.6*

[a] Central Statistical Office, *Statistical Bulletin*, November 1961, Pakistan (Table — Census of manufacturing industries — pp. 1534-39).

[28] *Pakistan Commerce and Industry*, Vol. II & III, December 1963, January 4, 1964, p. 160.

[29] Government of Pakistan Statistical Office, *Statistical Bulletin*.

The position of the engineering industries in 1961 was as follows:

	Per cent.
Share of total manufacturing output	11
Share of total manufacturing employment	12.4

Mechanical engineering[30]

Heavy capital goods

There is no production of heavy machinery but plans are under consideration for a plant to manufacture heavy capital goods including steam turbines and heavy machinery parts. A modern heavy machine tool plant is contemplated in conjunction with this plant.

Industrial machinery

Jute and cotton textile machinery, power looms and cotton ginning plant

Only parts of jute mills are produced in the country, for the rehabilitation and modernization of the existing machinery in jute processing factories. Plans are under consideration for the manufacture of complete jute looms. The manufacture of cotton spinning machinery consisting of spindles, top roller arbors, spinning rings and spare parts and card clothing machinery has been sanctioned. The manufacture of power looms for cotton textiles has been developed in West Pakistan with an installed capacity of about 1,300 units per annum; the country's annual requirement is about 3,000 units. There are also new plants engaged in the manufacture of cotton ginning machinery. Over thirty-two establishments produce textile machinery and accessories.

Rice, oil and sugar mills

Even before the five-year plan establishments in Lahore manufactured rice-husking, grain-milling and other processing machines. There has been a large increase in the production of components of sugar mills, such as sugarcane crushers, sugar-boiling pans and other auxiliary units. Quality has been improved by modernization of facilities. The Government Ordinance Factory has extended assistance in the production of a limited quantity of special steels for use in these manufactures.

Agricultural implements, farm tractors and power tillers

There are over fifty-four small-scale plants engaged in the manufacture of simple agricultural machinery and implements. Schemes have recently been sanctioned for the progressive manufacture of farm tractors in collaboration with a foreign firm, with an initial capacity of

[30] *Statistical Bulletin* — Census of manufacturing industry — No. 2, Government of Pakistan, Nov. 1961; Karachi Commerce, Aug. 17, 1963; Commerce & Industry, Pakistan, Chamber of Commerce & Industry — December to January 1964.

1,500 28 HP tractors per annum. In conjuction with this plan, the manufacture of modern farm implements to be used with tractors has also been sanctioned. The production of garden-type tractors and power tillers for small farms is being organized.

Sewing machines

The present installed capacity for the production of sewing machines is estimated at about 83,000 units per annum. There is adequate indigenous production of sewing machines in West Pakistan where new facilities are being established for the production of industrial-type sewing machines and the mass production of components hitherto imported. In East Pakistan, additional production facilities are under consideration. Production in 1962 in the country was about 100,000 units.

Machine tools and metal working machinery

The Government has approved the establishment of a modern machine tool factory and the details are being worked out with foreign consultants. There are facilities for the manufacture of simple machine tools such as general purpose lathes, shaping machines, drilling machines and handsaws. The lathes and shaping machines are of the ungraded type to meet the demand for low-price machines. Other metal-working machines of the ungraded type such as hand and power presses are also manufactured. Small-scale units manufacture hand tools to meet domestic demand. A high-quality hand tool factory is being established in the organized private sector in collaboration with a foreign maker.

Diesel engines

Slow, small vertical and horizontal diesel engines of up to 20 HP and 50 HP respectively have been produced for many years. Higher-speed diesel engines are now to be produced, with the modernization of existing facilities. The envisaged development of inland water transport in East Pakistan is expected to create a substantial demand for marine engines. Provision for the establishment of a new plant for manufacturing more powerful diesel engines has been included in the industrial investment schedule of the third plan. Present production meets only about 20 per cent of domestic demand. Existing facilities are being rationalized and modernized to meet the increasing domestic demand.

Pumps and compressors

Over ten units in the organized sector manufacture small pumps and compressors. There is adequate indigenous capacity to meet present demand which is estimated at 2,000 foot pumps, 30,000 hand pumps and 150,000 cycle pumps. The importation of centrifugal (2 in × 3 in to 6 in × 7 in) and deep well turbine pumps (1 to 4 cusec capacity) has been banned. New production facilities for improved types of submersible pumps are under consideration. Small-capacity air compressors for various uses in industry are also manufactured.

Metal manufactures[31]

About 425 units consisting of a few large plants and numerous small ones manufacture a wide field range of metal goods from arms, accessories and utensils to bolts, nuts, nails and hurricane lanterns.

Metal containers

Some twelve relatively large units in the private sector manufacture tin-coated metal containers and about four make metal drums for oil and other purposes. There is adequate indigenous capacity to meet demand.

Building hardware, fittings, stoves and metal furniture

Over 100 units in the small-scale sector manufacture building hardware, cooking and heating equipment and metal furniture for households and offices in both West and East Pakistan. The manufacture of stoves for natural gas is of recent origin. Both pressure type and non-pressure type kerosene cookers are produced to meet the entire domestic demand. Export markets in the countries of the region have been developed for hardware articles and metal furniture.

Safe and cabinets

About forty establishments produce safes and cabinets. Most of the products are now used by domestic banks. Production in West Pakistan was about 4,000 units and in East Pakistan about 8,000 units in 1962. The quality of workmanship is comparable to that of foreign makes and export markets are being developed.

Cutlery and utensils

The cutlery manufacture is one of the small-scale industries (eight small units) whose capacity utilization depends on export prospects. The present capacity is about Rs 3.8 million and local demand about Rs 2.1 million. About 123 units produce sufficient household utensils to meet local demand. Exports to the United Kingdom, the United States and countries of eastern Europe totalled about Rs 650,000 in 1962.

Steel wire products, wire netting bolts and nuts[32]

Two units in East Pakistan and one unit in West Pakistan produce steel wire with a total combined capacity of about 1,000 tons per annum. Most of the

[31] Central Statistical Office, *Statistical Bulletin 1961*, Pakistan—Table of manufacturing industries.

[32] Central Statistical Office, *Statistical Bulletin 1961*, Pakistan. Letter, Government of Pakistan, 31 January 1964.

materials used are imported. There is manufacturing capacity for about 800 tons of bolts and nuts; two additional large units, one in East Pakistan and one in West Pakistan, have been sanctioned recently to meet increasing demand. Five units with an installed capacity of 540,000 gross per annum are producing wood screws; provision of additional capacity for 60,000 gross is under consideration. Wire netting of ferrous metal is produced in about 88 small plants. Copper and brass wire netting is also produced in small quantities. Locally made hand looms are generally used and only eight units are mechanized. The total capacity is about 43 million sq ft per annum.

Hurricane lanterns[32]

Five relatively large plants manufacture hurricane lanterns, meeting all domestic demand; imports are banned.

Pipes[32]

The installed capacity for pipes is about 11,600 tons per annum on a single-shift basis; one plant in East Pakistan has a capacity of 5,000 tons per annum and another in West Pakistan 6,000 tons per annum. A seam-welded spiral plant with a capacity of about 9,000 tons per annum has been sanctioned.

Other metal manufactures

Numerous other small industries manufacture metal goods such as trunks, sanitary fittings, plumbing supplies and hardware.

Electrical machinery, apparatus and appliances[32]

This industry is of recent origin and mainly produces small electric motors of upto 50 HP, power and distribution transformers, switchgear, electric fans, household electrical appliances, electric motors, electric incandescent lamps, fluorescent tubes, dry cells, storage batteries and radio receivers. Production of electric fans and small electric motors is adequate for domestic needs. Most of the basic materials used, such as copper and special steels, are imported. There is no indigenous production of raw materials. Establishment of some basic industries to supply most of the materials needed by the electrical industry is being considered under the third plan.

Electric motors and electric fans

Three establishments produced 2,261 electric motors of less than 50 HP in 1961 and about 2,800 in 1962. About thirty plants manufacture electric fans with an installed capacity of about 250,000 units per annum; production increased from about 135,000 in 1961 to about 146,000 in 1962. Indigenous production is adequate to meet domestic demand and about 20,000 electric fans are exported yearly.

Transformers, switchgear and electric motors

The manufacture of power distribution transformers has progressively increased since the beginning of the second plan. Installed capacity is about 280,000 kVA. Industrial switchgear for up to 33,000 V is now being fabricated by five units. Oil circuit-breakers for voltages ranging from 660 V to 1,100 V with various rupturing capacities are also produced.

Electrical accessories, fittings and appliances

A large number of small units manufacture bakelite switches, plugs, holders, fuses, light fittings, electric irons, electric bells, hot plates and other electrical items. Generally, their production is adequate to meet domestic demand. Some items are exported to countries of the region. Most of the materials are imported.

Wire and cable

There is an adequate yearly capacity of about 3,000 tons of drawn wire to meet the requirements of the electrical industry. Rubber- and plastic-insulated wire is produced in limited quantities. Sanction has been given for the establishment of one large manufacturing unit for the production of all types of wire cable, aluminium conductor, underground power cable and telephone cable, with a capacity of about 25,000 tons per annum.

Radios

The assembly of radio sets has progressively increased during the last few years. Existing facilities are adequate to meet internal demand. The manufacture of components is under consideration to reduce imports. There are at present fifteen units assembling radios, with an annual capacity of about 62,000 sets per annum. Six more units have been sanctioned.

Transport industry[32]

Under the second plan, the Government provided Rs 66 million for the rehabilitation and modernization of transport. In the manufacturing sector, emphasis was placed on the manufacture of commercial vehicles, bicycles and craft for sea and inland water transport. The production of automobiles was not given a high priority rating. Now about 107 units including repair shops manufacture transport equipment.

Railways[33]

Activities during the last few years were primarily directed towards the replacement of rolling stock, rehabilitation of other equipment, improvement of line capacity and modernization of signalling. Replacements of steam and diesel locomotives were all made by imports.

[33] Second Five-Year Plan 1960-65.

No locomotives are built and no capacity for building them is envisaged in the plan.

The workshops of the North-Western and Eastern Bengal Railways have been expanded and new facilities for servicing diesel engines were sanctioned. A plan for the construction of a new spring factory is under consideration. The North-Western Railway workshop has the capacity to manufacture 1,000 broad-gauge wagons per annum and to assemble 100 broad-gauge passenger coaches. Plans are under consideration for the establishment of a manufacturing section with a capacity of 100 coaches yearly. The Eastern Bengal Railway workshop has the capacity to manufacture 250 wagons per annum. New capacity is being developed for the assembly of 70 metre-gauge passenger coaches a year.

Commercial vehicles[34]

The first assembly line for trucks was started in 1953 in Karachi in collaboration with a United States maker. The assembly line for cars commenced in 1955 at the same plant. Recently, sanction has been given for the construction of a new factory in West Pakistan for the manufacture of heavy trucks, with a capacity of 2,000 units per annum. The progressive manufacture of jeeps in that part of the country has also been approved. New plants are being built for the production of three-wheelers and motor-cycles in both East and West Pakistan. Small ancillary industries have been developed in both East and West Pakistan for the manufacture of rear axles, propeller shafts and spare parts for trucks, jeeps, etc.[35] This production will increase the percentage of indigenous content at the new assembly plants.

Bicycles

The total yearly requirement is estimated at 300,000 bicycles. Four relatively large plants manufacture them and two others are under construction. The overall production capacity of these plants is about 290,000 bicycles per year on a single-shift basis. Most of the metal tube used for bicycles is manufactured by the Government Ordinance Factory. There is adequate capacity to meet internal demand.

Precision instruments

Surgical[34]

Pakistan produces a wide range of surgical and veterinary instruments of high quality. Present production is worth about Rs 3 million, about two-thirds of it being exported. Other miscellaneous items of hospital equipment are manufactured locally, chiefly in the Sialkot area of West Pakistan.

Problems of the engineering industries

The country is almost totally dependent on imports of machinery and equipment for light engineering and processing industries. Only very limited quantities of intermediate products are manufactured to supply the needs of factories. Shortage of foreign exchange has resulted in under-utilization of production capacity.

The recent steps taken by the Government to establish one steel mill in each wing of the country to produce wire and sheet, etc. will alleviate the shortage of these goods. The construction of a machine-building plant in conjunction with the proposed integrated steel plant will help to solve some of the problems of the engineering industries. Other problems particularly affect the small-scale sector: (1) limited domestic market; (2) sub-standard financial structure; (3) lack of marketing organization; (4) relatively high production costs; (5) inadequate control of quality.

PHILIPPINES

Economic structure

The economy is still basically agricultural although abundant natural and mineral resources are capable of more intensive exploitation. In 1963, agriculture contributed about 33 per cent to the national product, as against 41 per cent in 1955. Manufacturing contributed about 17.8 per cent in 1955 and about 21 per cent in 1963.

SOURCES OF NATIONAL INCOME[a]

(Percentage of total income)

Economic sector	*1955*	*1958*	*1959*	*1960*	*1961*	*1962*	*1963*
Agriculture, including fishing, forestry, etc.	41.5	33.5	34.3	32.5	32.3	32.6	33.0
Manufacturing, including mining and construction	17.8	20.2	20.2	20.4	21.1	20.8	21.3
Commerce, banking, transportation and communications . . .	14.6	15.1	14.5	15.1	15.5	15.5	14.6
Others	26.1	31.2	31.0	32.0	31.1	31.1	31.1

[34] *Pakistan Commerce and Industry*, Vol. II and III, Dec. 1963, Jan. 1964.

[35] Government Report, letter dated October 1963.

[a] National Economic Council of the Philippines, National Accounts of the Philippines 1961-1963.

Engineering industries

There were no engineering industries of any importance before 1950. Minor engineering industries, if any, were destroyed in the last war. During the last decade, however, new engineering industries were gradually established in line with the industrial programme of the Government. The objectives of this programme were[30] (*i*) to expand production of import substitutes in finished, intermediate and capital goods; and (*ii*) to increase production of exportable manufactures.

Since then, there has been a progressive change in the industrial structure from the traditional pattern of primary commodity production for export to one including manufacture of goods for the home market. Light engineering industries producing durable consumer goods have grown steadily and a start has been made with the production of ordinary iron and steel products such as merchant bars and castings. Very recently, the construction of an integrated iron and steel plant started. With the completion of this project in 1967, it is expected that essential steel products now imported for the engineering industries will be produced indigenously. Plans are being considered, under the five-year socio-economic programme (1963-67), for the establishment of other basic plants for the production of non-ferrous metals such as copper and zinc and special steels. These plans, if implemented, will accelerate the establishment of other engineering industries in the country.

Some aspects of the structure and characteristics of a selected number of engineering industries are detailed in the following table.

The position of the engineering industries in 1959 was as follows:

	Per cent
Share of total manufacturing output	11.1
Share of total manufacturing employment	12.3

Industrial machinery

Sugar plant, rice-hullers and oil expellers

The manufacture of components of sugar mills such as crushers and rollers started in the early thirties, as sugar was a major export. There are two moderately large factories engaged in this industry. Recently, a licence agreement with a European firm was concluded by a leading manufacturer for the production of clarifiers, crystallizers and evaporators.

[30] Five-Year Socio-Economic Programme for the Philippines, President Diosdado Macapagal.

ENGINEERING INDUSTRIES 1959

(Value added and employment)

Economic sector	*Number of establishments*	*Average number of persons employed*	*Value added[a] in process of manufacture*
			'000 Ps.
Manufacturing	*7,386*	*238,666*	*1,526,858*
of which:			
Engineering industries (metals)			
a. *Engineering industries*	*687*	*29,413*	*170,144*
(employing 5 or more workers)			
1. Metal products, except machinery & transport equipment	259	10,486	64,222
2. Machinery, except electrical machinery	145	4,309	18,070
3. Electrical machinery, apparatus, appliances and supplies	84	6,457	48,886
4. Transport equipment . . .	199	8,161	38,966
b. *Large manufacturing establishments*	*233*	*22,641*	*148,576*
(employing 20 or more workers)			
1. Metal products, except machinery & transport equipment	99	9,296	60,731
2. Machinery, except electrical machinery	33	1,826	9,884
3. Electrical machinery, apparatus, appliances and supplies	42	5,028	42,520
4. Transport equipment . . .	59	6,491	35,441
% *Engineering industries/ manufacturing*			
a. Employing 5 or more workers	9.3	12.3	11.1
b. Large manufacturing establishments	3.2	9.5	9.7
Basic metal products			
a. Employing 5 or more workers	34	3,174	26,363
b. Large manufacturing establishments	24	3,064	26,098
Total engineering industries including basic metal products			
a. Employing 5 or more workers	721	32,587	196,507
b. Large manufacturing establishment	257	25,705	174,674
% *Engineering industries including basic metal products/manufacturing*			
a. Employing 5 or more workers	9.8	13.6	12.9
b. Large manufacturing establishments	3.5	10.8	11.4

Source: Annual Survey of Manufactures 1959, Vol. IV, Bureau of Census and Statistics, Republic of the Philippines.

[a] Value added by manufacture measures the approximate value created in the process of manufacture. It is calculated by subtracting the cost of raw materials, containers, fuels consumed, purchased electric energy and contract work from the total value of products sold, by-products and receipts for contract and repair work for each reporting establishment.

The manufacture of rice mills, hullers and separators started a few years ago. There are six fairly large factories engaged in this work, besides a number of small workshops repairing small parts of machines used by rice and corn producers. In 1961 production of rice hullers, rice mills and corn and rice separators amounted to approximately about 1.3 million pesos. The present combined capacity of these units is adequate to meet internal demand. Materials such as pig iron, steel and alloys are imported. Oil expellers for the coconut oil industry are now produced in the country. The manufacture of a machine for the removal of coconut husks and coconut meat to replace the traditional manual practice is being introduced by a local firm.

Agricultural machinery, implements and farm tractors[37]

Four modern establishments manufacture farm implements. Their combined production capacity in 1961 was valued at about 1.4 million pesos. One of the leading manufacturers has an annual capacity of about 18,000 steel ploughs and 100,000 spare parts. The other plants are smaller.

Production of farm tractors is of recent origin. Four fairly large plants assemble them from imported parts. A leading manufacturer recently installed a new assembly line in collaboration with a foreign maker, with a complete machine shop and auxiliary facilities for the manufacture of components; production capacity is about 70 units per annum. Additional facilities in the planning stage will increase production to 110 units per year within the next few years. The total production value of all the plants engaged in this industry is estimated at approximately 3.5 million pesos annually.[38]

Sewing machines[37]

The manufacture of sewing machines under licence agreements with foreign makers started a few years ago; four firms produce sewing machine heads and cast iron parts, other parts being imported. Their combined capacity is about 150,000 units per annum and most of them are equipped with modern foundry, machining and finishing facilities. The indigenous content of their manufactures is about 80 per cent. Imports of household sewing machines fell from 994.047 pesos in 1958 to 128,545 pesos in 1962, a reduction of about 87 per cent.

Auxiliary machinery (pumps, industrial fans, blowers)[39]

One modern factory manufactures power-driven pumps, mainly centrifugal up to about 100 HP. Production increased from 126 units in 1961 to 220 in 1962, which represented about 50 per cent of installed capacity. Most of the other varieties of pump used in mining and other industries are imported. The same manufacturer also makes industrial fans and blowers to help meet domestic demand.

Structural fabrication

Four modern establishments fabricate structural assemblies such as roof trusses and columns for residences, office buildings, warehouses, storage tanks for petroleum products and oil. Most of the steel materials except merchant bars used in these assemblies are imported. Output is sufficient for domestic requirements.

Construction equipment and parts

There are no facilities for the production of heavy construction equipment. A few establishments, however, recondition war-surplus construction equipment such as cranes, power shovels, earth-moving equipment and tractors. Simple castings for replacement are manufactured locally but major components such as prime movers and driving gears are imported.

Tractor parts and diamond drills

The manufacture of undercarriage parts such as bottom and top roller assemblies and component parts was recently started by two plants with modern forging, machining and heat treatment equipment and precision gauges for testing and measurement. Their combined production capacity is adequate to meet domestic requirements. Export markets are being developed for their surplus products. One of them also manufactures diamond drills, bits and dies.

Electrical machinery, apparatus and appliances[40]

Prior to 1953, there were no establishments manufacturing electrical equipment or appliances. Those now producing electric motors, appliances and apparatus are of very recent origin but the growth in their production has been one of the highlights of engineering progress in the Philippines.

Electric motors, fans, transformers and polishers

Only two establishments manufacture fractional and integral HP electric motors of up to 50 HP. Present production capacity for fractional motors is about 500 units and for the integral types about 700 units per annum. They are manufactured in accordance with international standards and specifications. Most of the electric motors required are nevertheless still imported. Distribution-type transformers from 5 to 50 kVA, safety switches and switchboard panels are also produced in small quantities, but most of the domestic demand is met by imports. The manufacture of electric fans

[37] Letters from Philippine Producers — Annual Survey of Manufactures, 1959, Bureau of Census and Statistics, Chamber of Industries, Philippines.

[38] *Annual Survey of Manufactures*, Bureau of Census and Statistics, 1959, Republic of the Philippines.

[39] Philippines Chamber of Industries, October 1963.

[40] Central Bank of the Philippines — Annual Report, 1962.

for household and industrial use and of floor polishers has increased appreciably during the last few years. Three units manufacture electric fans but production capacity is not sufficient to meet domestic demand. In 1962, production amounted to about 1 million pesos.

Refrigerators, air-conditioners and freezers

Twelve modern plants manufacture household refrigerators, freezers and portable air-conditioning units. Production of components has progressed steadily and only sealed units and parts are now imported. Production of household refrigeration and portable air-conditioning units amounted to about 15 million pesos in 1962. The workmanship and quality of manufacture are up to international standards.

Radio sets, transistor receivers and television accessories[41]

The internal demand for radio sets, including transistorized receivers has increased continuously. About ten firms are engaged in their manufacture, but production capacity is not adequate to meet demand and many types of radio receivers and transistorized sets are imported. Domestic production amounted to about 150,000 units in 1962, most of the components being imported. Assembly of television sets and accessories has recently started in these factories; almost all the components are imported.

Electric wire and cable[41]

Three modern plants produce drawn copper wire and rubber and plastic insulated cable. Their combined production was about 95 million feet in 1960, valued at 5.5 million pesos, and about 115 million feet in 1961, valued at 8.5 million pesos. Plans are being considered for the production of other plastic-coated conductors of larger size and metal-covered wire for household and industrial use. There is no indigenous production of copper rods and all the copper materials for wire drawing are imported.

Metal manufactures

Steel wire

One plant manufactures low-carbon mild steel wire; its installed capacity is about 36,000 tons per annum. No high-tensile steel wire is produced in the country. A factory for the manufacture of special steels now under construction will have a section producing low- and high-carbon steel wire with an installed capacity of about 20,000 tons yearly. Most of the wire rods drawn into wire by the two wire-rope factories are imported. Wire rods for drawing into wire nails are imported to supplement the inadequate domestic supply of this product.

[41] Bureau of Census and Statistics, Republic of the Philippines.

Wire products

The manufacture of nails, barbed wire, wire netting and fences has grown steadily during the last few years. A large number of nail-making machines have been installed. The installed capacity is more than sufficient to meet internal demand. Imports of these items in 1962 were insignificant.

Electrodes

Two plants produce flux-coated electrodes for welding purposes. Installed capacity is sufficient to meet requirements. Bare electrode wires are imported by these plants.

Metal containers and utensils

Four fairly large modern plants produce metal drums for petroleum products and vegetable oils and containers for the food canning and processing industries. Before 1963, most of the tin-plate was imported, but two modern factories recently established for the production of cold-rolled and tinned sheet (electrolytic and hot-dipped) can meet the requirements of the container industry. Metal container production amounted to about 10 million pesos and installed capacity is adequate to meet domestic requirements. Household utensils are now produced by ten small plants. In 1962, about 5 million pesos worth of aluminium utensils were produced. Aluminium sheets are produced locally from imported aluminium slabs.

Metal appliances and furniture, safes and vaults

The manufacture of modern metal appliances and furniture for office and household use started only a few years ago. There are four major manufacturers engaged in this industry. The items manufactured are comparable in quality and in price with foreign makes. Production was worth about 2.5 million pesos in 1963. Manufacture of safes and vaults was begun very recently by two of the four major producers of metal products.

Small metal manufactures

The manufacture of bolts, nuts, screws, rivets, zippers, paper fasteners, clips, window fittings, etc., has grown steadily during the last decade. Most of the units in this sector are equipped with modern machinery and installed capacity is sufficient to meet domestic requirements, except for small-size screws which are still imported. Specialized materials such as small steel sections for metal windows are still imported, but otherwise most of the steel for the manufacture of bolts and nuts, etc. is produced by small steel mills in the country.

Pipes and castings

Galvanized welded pipes up to 1½ in diameter and centrifugal cast iron pipes up to 6 in diameter are now

manufactured by two plants of recent origin. Their installed capacity is adequate to meet domestic requirements but their production has not kept pace with demand through shortage of basic materials, skelps and pig iron, which are imported. A number of small-scale units produce soil pipes, reducing imports considerably. Most small and simple castings for use in industrial plants or for construction are now produced by workshops with casting facilities for alloy steel and cast iron. There is sufficient production capacity to meet internal demand.

Transport industry

Railway rolling stock and parts

Only minor parts such as brake shoes and fishplates are produced by the railway workshops. All diesel and steam locomotives, wagons and coaches are imported. Plans for establishing a foundry shop and expanding railway workshops to permit the manufacture of components of wagons, coaches and trailers are under consideration.

Automobiles, trucks and jeeps

Most of the popular car manufacturers have established assembly plants in the country, but there is no indigenous production of any part except tires. The installed capacity of the assembly plants is not adequate to meet domestic demand and a large number of passenger cars are still imported. Assembly lines for popular makes of truck up to three tons gross weight have also been established in the last few years. Apart from the tires, all truck parts and assemblies are imported. Production capacity is limited and the requirements of industrial and other consumers are supplemented by imports. The manufacture of jeep bodies by small workshops is widespread in many of the large cities. Most of the parts such as springs, wheels, radiators and gear drives are salvaged from war-surplus stock. Engines and parts also come from this source but are thoroughly reconditioned before installation. There are, however, a few units which manufacture jeep chassis, with some locally made components, i.e. axles, main chassis, radiators etc. Gear drives, engines, etc. are imported.

Bicycles, motor-cycles and pedicabs

About five units assemble imported bicycle parts and frames. No parts are manufactured locally except tires. There are two assembly lines for popular makes of motor-cycle. Present capacity is adequate to meet local demand for cycles. Pedicabs are manufactured locally from indigenous materials by small workshops; demand is limited.

Problems of the engineering industries

One of the most serious problems is the almost total dependence on imports of essential materials for the production of engineering goods. In most cases imports of intermediate products (raw materials for goods) for further processing requires a large amount of foreign exchange. The total imports of base metals and materials used in the manufacturing sector amounted to $58 million in 1961 and $50 million in 1962. Capital goods imports for the machinery and electrical industries in 1962 amounted to about $105 million and $26 million respectively.

THAILAND

Economic structure[42]

The economy of the country is primarily agricultural: about 80 per cent of the working population is engaged in agriculture and related activities. Thailand is also one of the largest producers of tin in the world. Agriculture contributed about 39 per cent to the gross domestic product in 1958 and about 35 per cent in 1963. The share of manufacturing was about 18 per cent in 1958 and about 10 per cent in 1963.

INDUSTRIAL ORIGIN OF GROSS DOMESTIC PRODUCT

(at market prices)

Economic sector	*1958*	*1961*	*1962*	*1963*
Agriculture, fishing and forestry . . .	38.6	36.7	35.6	35.1
Manufacturing mining and construction	18.2	17.8	18.9	19.0
Commerce, banking, transport communications	26.6	28.5	29.3	29.6
Others	16.6	17.0	16.2	16.3

Development plan[43]

The main objective of the first six-year plan, promulgated in 1961, is to increase agricultural, industrial and power production. The total investment required in the plan was estimated at Baht 21,178,410,000 of which Baht 13,887,970,000 will come from the national budget, Baht 458,300,000 from the income of government-owned corporations and the remainder from external loans and foreign aid. Private investment in industry is encouraged. Preference is given to those industries which use indigenous raw materials.[44]

The present Industrial Promotion Investment Act was promulgated in February 1962 to encourage industrial development generally and to promote foreign investment through incentives and special benefits.

[42] Report by the United States Operations Mission to Thailand, November 1962.

[43] Asian Annual Eastern World Handbook 1963. The Report of the Consultative Committee, Colombo Plan, November 1962.

[44] The Industrial Promotion Investment Act, National Promotion Investment Board.

Engineering industries

The engineering industry consists mainly of small engineering workshops, an estimated 30,000 manufacturing establishments including small machine shops, tinsmithing and welding shops, metal shops producing cutlery, utensils, hardware and fittings. Since the Industrial Promotion Act was promulgated in 1962, the Board of Investment had issued by 30 June, 1963 about 178 promotion certificates to firms, 80 of them owned by Thai nationals, 10 by foreign companies and 88 joint ventures.

The industries promoted include: (1) machine tool manufacturing; (2) a wire, wire product and pipe-making factory; (3) a metal container plant; (4) a steel rolling and tinplate mill; (5) a galvanizing plant for sheet and other ferrous metal product; (6) electric bulb and radio assembly; (7) motor vehicle spare part manufacturing; (8) tractor and motor-car assembly; and (9) electrical appliance and wire/cable manufacture. Some of these factories have recently been completed and plans for others are being implemented. The capacity of these industries is intended to be sufficient to meet current demand.

Mechanical engineering

Besides the small engineering workshops and small foundries overhauling and repairing industrial machinery there are a few establishments which produce: (1) machine tools such as standard lathes, shapers and drilling machines (one establishment); (2) leaf springs for commercial vehicles (one small enterprise with limited production); (3) metal drums and containers (a new plant recently established); (4) small galvanized pipes (a new plant recently completed).

Electrical supplies, wire and batteries

Many of the plants given promotion certificates by the Board of Investment are being built. There is, however, a new plant which is now producing plastic-coated electrical wire from imported wires. An electric bulb manufacturing company which has started production of incandescent electric bulbs has a capacity to meet most of the domestic demand. A battery plant has also been established to meet domestic demand for storage batteries for commercial vehicles. An export market has been developed for this product.

Motor vehicles and rolling stock

The National Railway has its own workshops and foundry for repair and maintenance of equipment and rolling stock. All locomotives (steam and diesel) and rolling stock are imported. A new assembly plant for motor cars has recently been completed, but all components and spares are imported.

C. Other countries

Afghanistan, Cambodia, Ceylon, Iran, Laos, Nepal and the Republic of Viet-Nam, have included in their development plans schemes for more rapid industrialization; but higher priorities have been given to power development, mineral resource exploitation and increased production in agriculture and its related activities.

Most of these high priority programmes are being implemented. In some of the countries, complementary schemes for the establishment of small steel rolling mills and small engineering industries are being prepared or in the early stages of construction. Many of these countries have workshops for repair of construction, mining and agricultural machinery. The trend is to expand these workshops and diversify production for greater utilization of existing facilities. New engineering industries, also under consideration, include the manufacture of farm implements and tools, assembly of farm tractors, small foundries and the manufacture of pumps for irrigation purposes, household utensils, building hardware and common electrical appliances.

AFGHANISTAN

Considerable emphasis has been placed on agricultural and irrigation projects. Under the second five-year plan,[45] estimated investment is to be about Afg. 44.5 billion, about 30 per cent of it allocated for industrial development. Projects in this sector include metal manufactures and consumer goods: bicycles (6,000 yearly), a welding plant (in Kabul) and pipe manufacture. There is a plan to establish a farm implement factory and a tractor assembly plant.

CAMBODIA

The main emphasis in economic development is on agriculture, including livestock and cotton production. The Government has encouraged industrial production in the private sector by granting exemption from customs duty on imports necessary for engineering and other manufacturing industries. Under the current five-year plan,[46] a National Development Fund Organization has been created to extend financial assistance on liberal terms to small manufacturing industries. The engineering industries established during the past few years include:

Mechanical engineering[47]

Agricultural implement workshop

This plant produces farm implements such as ploughshares, hoes and rakes and assembles small agricultural machines. It was established in 1963.

[45] Asian Annual 1963, *the Eastern World Handbook*.

[46] *Ibid.*

[47] Letter from the Government of Cambodia.

Mechanical engineering shops

Six workshops have been established primarily for mechanical repair of construction and mining machinery and other miscellaneous equipment; foundry units have also been installed. These shops have been in operation since 1960.

Wire products, nails, bolts and nuts and metal furniture[47]

Two nail-making factories established in 1958-60 produce all common sizes of nails. Nail wire is imported. Production per month ranges from 160 to 300 tons of nail products. Two bolt and nut factories each with a capacity of about 20 tons a month were established at about the same time. Three metal furniture enterprises established since 1960 produce household and office furniture, metal shutters and safes.

Aluminium ware

A plant for the manufacture of household aluminium ware was established in 1958. The output is about 160.000 utensils (rice bowls, cooking pots) monthly.

Metal containers

Two enterprises established in 1962 produce small oil containers of 1-10 litres capacity. Output ranges from 100,000 to 150,000 containers per month for each unit.

Sheet metal and sections

In 1962, two large engineering workshops were completed for the production of drums and metal frames. Monthly output is 100 tons of sections and sheet. Another product is 200-litre oil drums.

Weighing machines

A factory completed in 1958, produces weighing machines ranging from 5 kg spring-balances to 500 kg weigh-bridges including platform scales and Roberval balances. About 1,000 weighing machines are produced annually.

Sewing machines and bicycles

There are two assembly plants producing sewing machines each with a capacity of about 400-600 machines monthly. All parts are imported. There are five workshops producing bicycle accessories.

Electrical wire and batteries

One establishment produces plastic-insulated wire. Bare wires are imported. Three small plants produce about 48,000 dozen dry batteries per month.

Workshops

Several small workshops repair passenger cars and commercial vehicles. They also manufacture simple machinery.

CEYLON[48]

The economy of the country is largely agricultural. Mining activities are mostly concentrated on the extensive graphite deposits for export. In 1959, the National Planning Council formulated a ten-year development plan for the entire economy covering both the public and private sectors. The emphasis in a subsequent short-term programme for the period 1961-64 is on the effective use of existing capital for establishing less capital-intensive and more labour-intensive industries. Restrictions on imports and complementary measures for the protection of domestic industries have furthered the growth of industry.

Under the Industrial Act of 1957, the Government organized government corporations which now operate large industrial undertakings producing cement, mineral sands, chemicals, etc. One of them is the Ceylon Steel Corporation whose steel plant, now under construction with foreign assistance, will supply the basic steel products for some engineering and other metal industries. Initial operation of the plant is scheduled for early 1965. Two other government enterprises organized to stimulate industry are the Institute of Scientific and Industrial Research and the Development Finance Corporation.

Engineering industries[49]

Significant progress has been made during the last few years in the engineering industry. In 1962, the growth rate in the industrial sector was 12.9 per cent, compared to 10.9 per cent in 1959 and 5.5 per cent in 1958. The metal products industry contributed a high percentage to this rate of growth. Most of the engineering industries consist of small-scale private establishments. The principal engineering products are: (1) wire and wire products (nails, barbed wire, bolts, nuts and screws); (2) metal manufactures (metal fittings and hardware, oil stoves, hurricane lanterns, metal containers including tin-coated wares); (3) aluminium ware (aluminium doors, windows, fittings, etc); (4) enamelled hollow ware (household utensils, etc); and (5) radio assembly (radio receiving sets).

Most of the materials used in the production of these goods are imported. Average annual imports for

[48] *Ceylon Yearbook 1961*, Department of Census and Statistics — Annual Report Ceylon Steel Corporation 1961-62 — Colombo Plan, Eleventh Annual Report of the Consultative Committee Nov. 1962 — Bulletin One — State Industrial Projects — Development Division 1961, Ministry of Industries, Colombo.

[49] Report of the Development Division, Ministry of Industries, Ceylon 1961-62. Ceylon Yearbook, Department of Census and Statistics 1961.

the last few years (1959-61) for iron and steel manufactures amounted to about 2.7 per cent of total imports: machinery other than electrical, about 4.3 per cent; and electrical machinery and appliances, about 2.7 per cent. A great number of small engineering workshops repair motor vehicles and manufacture small parts for machines used in the rubber and tea processing industries. The new workshop of Ceylon Railways is equipped for major overhaul and repair of railway machinery and equipment; it builds some rolling stock bodies.

IRAN[50]

The economy of Iran is predominantly based on its extensive oil resources. Agricultural products are the second biggest item of export.

Engineering industries

With the financial and technical assistance of the Government, the engineering industries have made considerable progress during the last decade. A wide range of products previously imported are now produced in the country. New assembly lines have been installed for the manufacture of accessories and equipment for the oil industry (coolers and heaters) and the manufacture of motor vehicles (jeeps). The manufacture of electronic equipment such as television sets, radio receivers and other electrical appliances under licence agreements with foreign makers is also planned.

Other engineering products include: (*i*) agricultural and farm machinery and equipment; (*ii*) simple textile machines such as weaving and knitting machines and presses; (*iii*) metal manufactures such as oil stoves; (*iv*) electric motors, transformers, electric light fittings, etc; and (*v*) components of industrial machinery including boilers, industrial pumps and other miscellaneous metal products. Aluminium and copper wares such as household utensils are also manufactured. There are about 4,000 large and small factories, excluding workshops, engaged in the engineering industries.

LAOS[51]

Laos is exclusively agricultural. Mineral resources such as tungsten, copper, bauxite, tin and gold are found, but only tin and gold are exploited to any extent. A five-year economic development plan was adopted in 1959, envisaging an investment of about 5,700 million Kip ($US71.2 million), but internal difficulties slowed down the development projects. External aid continues to be the main source for the development of power projects, mining, etc. There are no engineering industries of any importance at present.

[50] *Iran Almanac 1962.*

[51] Asian Annual 1963; *Eastern World Handbook.*

NEPAL[52]

The economy of Nepal is predominantly agricultural. The extent of mineral deposits such as zinc, graphite and limestone is being assessed for future exploitation. The second three-year plan (1962-65) with a total investment of about Rs 670 million envisages, among other objectives, power development and the establishment of new industries. There are plans to establish a small re-rolling mill for the production of merchant bars for construction purposes, and a farm implement workshop for the manufacture of simple tools and implements. There are no engineering industries of any importance only small repair workshops. The country at this stage is largely dependent on external assistance for its development.

REPUBLIC OF VIET-NAM

Agriculture is the mainstay of the economy in South Viet-Nam. Mineral resources such as tin, zinc and lead phosphates exist, but transport difficulties prevent their exploitation. A second development plan, launched in 1956, envisages, among other objectives, increased industrialization and power development.

Engineering industries

The engineering industries are made up of many workshop-type small-scale enterprises. Relative progress has however been made in some engineering sectors, including the following:

Nails

There are about thirty-seven small enterprises engaged in nail manufacture with a combined capacity of about 7,000 tons yearly. Production is adequate to meet domestic demand. Wire is imported.

Metal furniture

About twenty workshops manufacture metal office and household furniture. Present capacity is adequate to meet local demand. Most of the raw materials are imported.

Aluminium ware

About sixty-five workshops manufacture household and other aluminium ware. Present production capacity is more than adequate to meet domestic demand, with surplus capacity for export. Raw materials are all imported.

Motor scooters, bicycles and buses

Popular makes of motor scooter are assembled by a few small enterprises. All parts are imported except

[52] Eleventh Annual Report, Colombo Plan Consultative Committee; Asian Annual 1963.

hub caps. A limited number of bicycle components are made by one facotry and assembled by small workshops. Wheel spokes, hubs and rims are imported. Most of the bus bodies are built in the country, but chassis are imported.

Electrical appliances

Small electrical appliances are produced, such as radio receiving sets, incandescent lamps and storage batteries for automobiles and commercial vehicles.

Other miscellaneous industries

There are a few establishments engaged in tin-plating and the manufacture of tin-coated tops for the beverage industry. Most of the materials are imported.

IV. CONCLUSIONS AND FINDINGS OF THE SUB-COMMITTEE ON METALS AND ENGINEERING (TENTH SESSION)

At its tenth session held in Tokyo in July 1964 the Sub-Committee on Metals and Engineering considered, *inter alia*, the progress of the engineering industries in the ECAFE countries. Its findings and recommendations on the subject are given below.

The Sub-Committee emphasized the important role of the engineering industries in the over-all economic development of the ECAFE region and noted with satisfaction the significant progress made by some of the countries in the engineering industries during the last decade.

Trends in production, demand and delivery of engineering goods

In the relatively more advanced countries of the region, such as Japan and Australia and to a certain extent India, domestic production of engineering goods in the mechanical and electrical groups is over 45 per cent of the total demand for them. In China (Taiwan), South Korea, Pakistan, the Philippines and Thailand, a very high percentage of the demand for mechanical and electrical machinery is supplied by imports. Existing capacity of engineering industries appears to have been developed primarily to meet the domestic demand for durable consumer goods. Considerable progress has been achieved in the manufacture of household utensils and appliances, which include transistor radios, air-conditioning units, refrigerators, dry batteries, metal containers, household furniture and office equipment and miscellaneous hardware items and fittings. Manufacture of components of oil and sugar mills, textile machinery (jute and cotton) and, in some cases, complete units of food processing machinery has been developed in some of these countries. Manufacture of selected tractor parts (rollers and linkages) and assembly of tractors has also started in some of them. The manufacture and assembly of agricultural machinery and automobiles has reached a moderate level. Export markets have been developed for a few durable goods such as sewing machines, bicycles, pumps, utensils and appliances.

In a few countries of the region, the large increase in production of passenger cars, commercial vehicles and bicycles in the last few years has been one of the highlights of engineering industry development. Japan has strengthened its position as a major world exporter of passenger cars and commercial vehicles. In Australia and India, domestic manufacture of passenger cars has started. In China (Taiwan), the Philippines, Pakistan, Malaysia and Thailand, assembly plants for different makes of passenger cars and trucks are increasing output from year to year. The production of bicycles in India and China (Taiwan) has reached considerable proportions and these countries can export part of this production. Some countries in the region also build and repair ships, barges and other types of craft.

Factors determining rate of growth

Although, by and large, many countries of the region have in the last few years initiated and maintained production of new items, difficulties in obtaining access to technical know-how (especially where it is shared by a relatively small number of firms in the world) and satisfactory collaboration agreements appear to have hindered progress. In the case of certain products, obsolescence is so rapid that entrepreneurs in developing countries hesitate to invest in such industries.

Degree of utilization of existing facilities

While output in the engineering industries producing durable goods has increased progressively in the region, the capacity of certain sectors in some of the countries has not been fully utilized. Lack of continuity and inadequate supplies of essential materials, such as pig iron, steel sheet, special steel products and alloys, have limited output. This is attributable among other things to the shortage of foreign exchange for purchases abroad. Indigenous production has not kept pace with the increasing demand. There is evidently a need for new basic facilities for the production of these essential raw materials to meet the expanding demand and to utilize fully the existing capacity of engineering industries.

Export promotion

Most of the engineering goods produced in the countries of the region are intended primarily to meet domestic demand, except in Japan and Australia. Export of manufactured goods is, however, being encouraged to supplement the inadequate foreign exchange earnings of the primary export products, one of the root causes of the slow progress made with industrialization in developing countries. The opening of new markets in the more advanced countries to engineering goods

produced in the developing countries would also help the growth of their engineering industries.

Trends in investment

Continued expansion in engineering output can only be achieved with considerable investment in the establishment of new industries and the improvement of existing facilities. Most of the important engineering industries of the region are of recent origin. The trends and characteristics of investment vary from country to country: In Japan and India, the greater portion of investment is channelled to capital-intensive engineering industries. In Pakistan, the Philippines and China (Taiwan), investment is concentrated in light engineering industries, although the present and future development plans of these countries include heavy engineering industries.

Employment

Employment in the engineering industries in most countries of the region, particularly the machinery, electrical and transport groups, grew rapidly in the more advanced countries (Japan and Australia) and steadily in the other countries from 1955 to 1962.

Prices

Raw materials, semi-finished products and salaries and wages are undoubtedly the most important factors, but transportation and distribution costs, investment and interest rates are also significant. Wages have increased generally in the engineering sector in most countries by more than 30 per cent since 1955. The cost of raw material imports, particularly steel products, has a great influence on the price structure of finished engineering goods in these countries. Except in Japan, the costs of engineering goods production in ECAFE countries are relatively higher than in the major producing countries of the world, particularly those using mass-production methods.

There are, however, goods and machine parts, such as sewing machines, bicycles, simple agricultural implements, simple castings and metal furniture, which can be produced competitively in the ECAFE countries. The manufacture of these products requires a relatively high labour component compared with the other more complex items made by processes involving mass-production and automation. The relatively cheaper labour in ECAFE areas, coupled with the application of modern technology and efficient machinery, has made it possible to manufacture some of these goods at competitive costs. Improved methods of organization and know-how will further reduce production costs.

Trade in engineering goods

Statistical data on world trade in engineering goods show an increasing volume of trade among the highly-developed countries and a continued increase in imports by the less-developed areas. The flow, if any, of complementary exports of engineering products to the highly developed areas has been very insignificant.

The Sub-Committee drew attention to the recurrent shortage of foreign exchange in many of the countries in the region for the purchase of knocked down, semi-finished/finished products for package/assembly plants and other durable goods industries. It stressed the need to establish ancillary engineering industries for the manufacture of some of these components from indigenous materials. This would relieve to some extent the severe drain on the foreign exchange reserves of these countries and at the same time provide new employment. It also recommended that technical know-how in these new employment. It also recommended that technical know-how in these new ventures in the initial stages be imported from foreign sources for training local personnel. Quality control and high-grade workmanship will be required to meet the stringent specifications required in the production of these specialized items.

The Sub-Committee emphasized the need for accelerated development of suitable engineering industries in some of the less-developed countries of the region. Existing engineering industries in some of the other countries need modernization, expansion or diversification. The problem of under-utilization in some industries also exists in a few countries. Bearing in mind the various problems faced, the Sub-Committee recommended the following steps for orderly and rapid development of engineering industries in the ECAFE region:—

1. The first and obvious step appears to be for each country to determine, as early as possible, the types of industry it can establish or expand with the greatest advantage. For this purpose, countries might take advantage of the direct advisory services rendered by the secretariat through the organization of surveys and provision of consultants.

2. The development of some "basic service" engineering industries such as foundries, forges, metal works, welding, electroplating and machine shops, is necessary in all countries before substantial progress in engineering industries as a whole can be made. For this purpose, the establishment of "regional pilot plants" in connexion with these facilities can be recommended and the attention of the countries of the region drawn to the facilities now available from many sources, e.g. the United Nations Special Fund. These plants should be strategically located in various parts of the region; they should assist in training personnel from different countries and lead to the establishment of similar plants in all countries. The Sub-Committee felt that development of engineering industries was a field in which regional co-operation could be most rewarding and noted that steps in this direction were already being taken in some phases of the industry.

3. Several countries in the region have already made arrangements for the exchange of study and observation teams in engineering industries. The scope of such exchanges could usefully be extended. It would be particularly valuable if arrangements could be made for trainees from the less-developed countries to receive in-plant training at some of the newly-established engineering factories in other countries. This would provide them with all-round experience in some of the practical problems encountered in the establishment and operation of new factories.

4. Since arrangements for international joint ventures in the form of equity participation or licensing agreements are becoming increasingly important for the development of engineering industries in the countries of the region, exchanges of information between them on the experience gained in this field would be useful. The secretariat could usefully collect such information from all sources and undertake a study of ways of overcoming the difficulties experienced in obtaining access to technical know-how, equitable terms of collaboration, etc.

5. The secretariat might also study the causes of under-utilization of capacity in different branches of the engineering industry and make the results of this study available to the ECAFE countries.

6. The Regional Industrial Promotion and Planning Centre should be adequately staffed with suitable experts to carry out these two tasks. It can also play an active role in bringing to the notice of the countries of the region opportunities for development of complementary industries, with more efficient utilization of available resources and know-how through market-sharing and economies of scale.

7. In view of the importance of standardization in the engineering industries, the ECAFE secretariat should keep this subject under continuing review. This should be included as a regular item in the agenda of the next and/or subsequent sessions. The secretariat could also be used as a clearing house for information in this field and countries could provide it regularly with full particulars of any new standard specifications adopted by their national standards agencies. These specifications could then be circulated to all member countries for their information.

8. The Sub-Committee recommended that efforts be made to establish in a suitable location in the region a Design and Consulting Engineering Institute, to assist the ECAFE countries in the early stages of engineering industry development. To make a start in this direction, the Sub-Committee felt that perhaps the Regional Industrial Promotion and Planning Centre could include a small design and consulting unit adequately staffed by suitable experts in this field.

SMALL-SCALE INTEGRATED ALKALI PLANTS

Developing countries of the ECAFE region intending to establish a basic chemical industry, especially caustic soda and chlorine manufacture, might find useful the following information on the production of caustic soda and the utilization of chlorine in a small-scale integrated alkali plant.

Small-scale integrated alkali plant

A 5 TPD caustic soda plant would produce in a year about 1,500 tons of caustic soda, 1,320 tons of chlorine and 37.5 tons of hydrogen at the cells. A 10 TPD plant would produce double those quantities.

The utilization of chlorine is always a problem in developing countries. The manufacture of benzene hexachloride and copper oxychloride present the least complications. Of the two, benzene hexachloride would be preferable as it is an insecticide used widely for malaria and filaria eradication, whereas copper oxychloride is a fungicide used mainly in tea plantations.

The integrated alkali plant proposed for developing countries consists of the following units:

1. Electrolytic caustic soda plant with a capacity of 5 TPD of caustic soda, with built-in provision for expansion to 10 TPD as demand increases.
2. Liquid chlorine plant with a capacity of 3 TPD, with built-in provision for expansion to 6 TPD.
3. Hydrochloric acid plant with a capacity of 15 TPD of acid (33 per cent HCl).
4. Zinc chloride plant with a capacity of 1 TPD.
5. Benzene hexachloride plant with a capacity of 3 TPD, with built-in provision for expansion to 5 TPD.

Built-in provision for expansion from 5 TPD caustic soda to 10 TPD is recommended in order to ensure that capital investment after expansion is not appreciably more than what a 10 TPD caustic plant with its subsidiaries would cost. Without the built-in provision, practically every piece of equipment and the process buildings would have to be duplicated. The 10 TPD caustic plant with its subsidiaries would then cost double the 5 TPD plant with its subsidiaries, whereas with built-in provision it will cost about 50 per cent more.

Principles for selecting items for 'built-in stretch' are:

(*a*) the extra cost should not increase the capital cost of the item by more than 25 per cent, where the alternative would be duplication for expansion. Thus, the prospective saving would be 75 per cent of the cost of the item. For example, a chlorine cooling installation for 10 TPD chlorine is estimated to cost not more than 25 per cent of the 5 TPD unit.

(*b*) the bigger unit should have some secondary advantages during recruitment of technical staff for the operation of a new industry. For example, the silicon rectifier and the cells are rated to operate at 30,000 amps; by operating them in the initial stages at 24,300 amps, much less heat will be generated thus eliminating one problem for the operators during the period of their familiarization.

(*c*) the item should not be a heavy cost item, otherwise the increase in cost for larger capacity will add substantially to the initial investment.

Electrolytic caustic soda plant

Selection of electrolytic cell

Electrolysers for the manufacture of caustic soda are of two types, known in the industry as the diaphragm cell and the mercury amalgam cell.

The diaphragm cell consists of a sealed chamber of steel plate or concrete in which the electrodes are suitably supported. The anode is of graphite and the cathode of perforated steel plate. Between the anode and the cathode is placed a porous asbestos diaphragm. The electrolyte, a hot saturated solution of common salt (NaCl), is fed continuously into the inner chamber containing the graphite anodes. As the electric current passes through the electrolyte from the anode to the cathode, the sodium chloride is decomposed and chlorine (Cl_2) is evolved in the anode chamber. The sodium ions liberated at the cathode combine with the water in the electrolyte to form caustic soda (NaOH) and liberate hydrogen (H_2) in the cathode chamber. The caustic soda remains in solution. Chlorine gas is continuously withdrawn from the anode chamber and

hydrogen gas and the caustic soda, with undecomposed common salt in the brine, from the cathode chamber. The percentage of NaOH in the cell liquor discharge varies from 8 to 11 and the corresponding percentage of NaCl from 14.37 to 10.70 according to the design and operation of the diaphragm cell.

The mercury amalgam cell consists of two separate chambers with pipe interconnexions at each end of the chambers. The first chamber, generally built of hard rubber-lined steel, is the electrolytic cell in which the graphite anodes are suspended from the roof. On the floor of the cell a continuously flowing thin stream of mercury serves as the cathode. The electric current from the anode to the mobile cathode is maintained by allowing it to flow over an iron plate connected to the negative terminal of the rectifier. The second chamber is known as the decomposer. Here, too, the same mercury from the cell flows through and is returned to the cell from the other end. The mercury flow is maintained by means of a mercury pump.

The electrolyte, a saturated solution of common salt, is fed continuously into the cell. The chlorine gas evolved at the graphite anode is withdrawn continuously. The sodium ions liberated at the mercury cathode combine with the mercury to form an amalgam, the mercury mixed with the amalgam flowing into the decomposer. Here, it meets a stream of pure water, which splits the amalgam, combines with the sodium to form caustic soda and releases hydrogen gas. The pure solution of NaOH and the gas are continuously withdrawn from the decomposer.

The essential difference between the diaphragm cell and the mercury cell is that in the former the liquor withdrawn contains a mixture of NaCl and NaOH and the strength of NaOH is only about 8 per cent to 11 per cent, whereas in the latter the liquor withdrawn from the decomposer is a pure solution of NaOH and the strength can be adjusted to as much as 73 per cent NaOH, though generally it is withdrawn at 50 per cent NaOH strength. The liquor from the diaphragm cells is concentrated to 50 per cent NaOH in a multiple-effect evaporator to recover the bulk of the undecomposed salt for re-use. The caustic soda from diaphragm cells generally has about 2 per cent NaCl; owing to this impurity it cannot be used in the rayon industry and has to be further processed to eliminate the chloride. For most end uses, however, such as soap, paper and pulp and aluminium manufacture, the chloride impurity is not a disability and the diaphragm cell caustic can be used.

Although several types of diaphragm cells were manufactured until lately, the Hooker cell is considered to be the best in this category and competitive in performance with the mercury amalgam cell. Furthermore, for outputs of 5 to 10 TPD, the mercury amalgam cell involves far higher investment costs. Operating costs are also somewhat greater on account of higher power consumption and higher maintenance costs. These disadvantages of the mercury cell disappear when the output is of the order of 50 TPD and over.

In the light of these considerations, Hooker cells are proposed for the manufacture of caustic soda in developing countries.

There are four types of Hooker cell designated S-1, S-3C, S-3D and S-4, the main distinguishing feature being the current rating. S-1, rated at 10,000 amps, is designed to produce 0.345 tons of NaOH per day, S-3C at 30,000 amps—1.036 tons of NaOH per day, S-3D at 40,000 amps—1.382 tons and S-4 at 55,000 amps—1.900 tons. The installed cost of a cell of each type is, according to the makers, $2,200 for S-1, $3,600 for S-3C, $4,600 for S-3D and $5,800 for S-4. The installed cost per ton of NaOH produced will be $6,380 for S-1, $3,478 for S-3C, $3,300 for S-3D and $3,050 for S-4. Though the total capital cost for a 5 TPD caustic soda plant may be somewhat less with the S-1 type, it will not be so when the capacity has to be increased to 10 TPD and over. The S-3D and S-4 types will not be suitable for outputs of less than 50 to 100 TPD NaOH on account of the higher cost of electrical equipment. Therefore, the S-3C cell is recommended for this plant.

Electrolyser and caustic soda section

A Hooker S-3C cell is built in three main sections. The bottom section is a rectangular dish-shaped concrete base, in which the graphite anodes are embedded. The middle section supports the cathode grid built of wire netting, with the grid members suitably placed between each pair of graphite anodes. The asbestos diaphragm is deposited on the cathode grid by an ingenious process. The top section is a concrete dome into which are fixed the level indicator, brine inlet and chlorine inlet. The hydrogen outlet and the cell liquor outlet lead from the cathode chamber.

The built-in provision for expansion of a 5 TPD electrolytic caustic soda plant to 10 TPD should be as follows:

(*a*) The area of the land on which the factory is sited should be sufficient for future expansion of all the sections viz. the caustic soda, liquid chlorine, hydrochloric acid, zinc chloride and benzene hexachloride sections and should also have some space for unforeseen development. An area of 3 hectares will meet this requirement.

(*b*) All the buildings should have sufficient room to accommodate the additional equipment needed when caustic soda production reaches 10 TPD.

(*c*) The layout of the buildings should be such that no modification of the roads, drainage and sanitation will be required for the expansion.

(*d*) The electric switchgear in the sub-station should be designed to suit the loads of the plant after expansion.

(*e*) The silicon rectified should be designed to take the additional diode cubicles needed for expansion, although the initial supply will be only sufficient to meet the load of the 5 TPD plant. The rectifier transformer should, however, be for the higher load.

(*f*) The chlorine gas coolers should be designed for the full output of 9 TPD of chlorine gas at expanded capacity and located in the electrolyser section. The cooled but wet chlorine gas will be fed to the hydrochloric acid section and the balance sent to the chlorine dryers at the liquid chlorine plant.

On this basis the electrolyser plant will consist initially of six S-3C Hooker cells operating at 24,300 amps instead of their rated load of 30,000 amps. According to the manufactures, the six S-3C cells operated at 24,300 amps will give 5 TPD of NaOH. When operated at 30,000 amps, they will produce 6.216 TPD of NaOH and 5.508 TPD of cholrine. As the rectifiers will be designed for the full rated load of 30,000 amps, the cells can be operated at any desired current load up to the maximum. The expansion to 10 TPD can be done by adding 4 more cells, and operating at 29,100 amps. When the 10 cells are operated at 30,000 amps, the output will be 9.18 TPD chlorine and 10.36 TPD NaOH. The extra capacity in the cells will provide flexibility in operation, which is highly desirable in starting a new plant. It will make it easier to maintain the desired average production. By the time the staff acquire technical proficiency, the market demands will have increased and the higher capacity will become useful.

APPROXIMATE CELL CHARACTERISTICS

Cell	*S-3C*
Current, amperes	30,000
Current efficiency, %	96.2
Cell volts, average	3.95
DC, kWh/ton	3,100
Cl_2, ton/day	0.918
NaOH, ton/day	1.036
NaOH, %	11.6
Graphite, kg/ton	3.0
Anode life, days	248
Steam, kg/ton	3,300
Weight of full cell, kg	7,250
Weight of anode, kg	3,040
Number of anode blades	128
Weight of graphite, kg	680

Liquid chlorine plant

From every kilogramme of NaCl decomposed by electrolysis, 0.686 kg of NaOH, 0.608 kg of chlorine and 0.017 kg of hydrogen are produced. In relation to NaOH, for every kg of NaOH produced by electrolysis, 0.886 kg of chlorine and 0.025 kg of hydrogen are also produced.

Both chlorine and hydrogen are hot gases, saturated with moisture, as they emerge from the cells. They are cooled as near to the ambient atmospheric temperature as possible for further utilization.

Flow sheet 1 attached hereto illustrates the various stages through which chlorine passes before it is liquefied for storage and subsequent marketing.

The capacity of the chlorine liquefaction plant proposed for the first stage is 3 tons of chlorine per day. The average production of chlorine corresponding to an average production of 5 tons of caustic soda is about 4.5 tons.

Chart 1 illustrates the utilization of the products from electrolysers on the basis of daily average production. It will be observed that the average daily production of liquid chlorine is only 2.19 tons, whereas the capacity of the plant proposed is 3 TPD. The extra capacity will ensure the maintenance of average production after allowing for possible stoppages due to breakdowns and equipment repairs.

The expansion of caustic soda capacity to 10 TPD will follow an increase in demand for chlorine and chlorine products corresponding to an average utilization of about 9 TPD of chlorine. This may be due to an increase in demand for either one or all of the chlorine products, viz. liquid chlorine, hydrochloric acid, zinc chloride and benzene hexachloride, or because the manufacture of another chlorine-based product such as copper oxychloride, DDT, is to be undertaken.

The built-in provision for expansion of the liquid chlorine plant from 3 TPD to 6 TPD should be as the follows:

(*a*) Chlorine coolers to be designed for processing 9 TPD of chlorine gas;

(*b*) Refrigeration plant to have capacity for liquefying 6 TPD chlorine;

(*c*) Liquid chlorine storage tanks to be in three units each of 10 tons capacity;

(*d*) Layout of plant to provide space for additional chlorine drying towers, chlorine compressors, after coolers and chlorine liquefier.

The extra investment on this account will be within 10 per cent of the total investment in the plant, whereas the additional investment for duplicating the capacity without this built-in provision will be far more.

Flow Sheet 1. Liquefaction of Chlorine

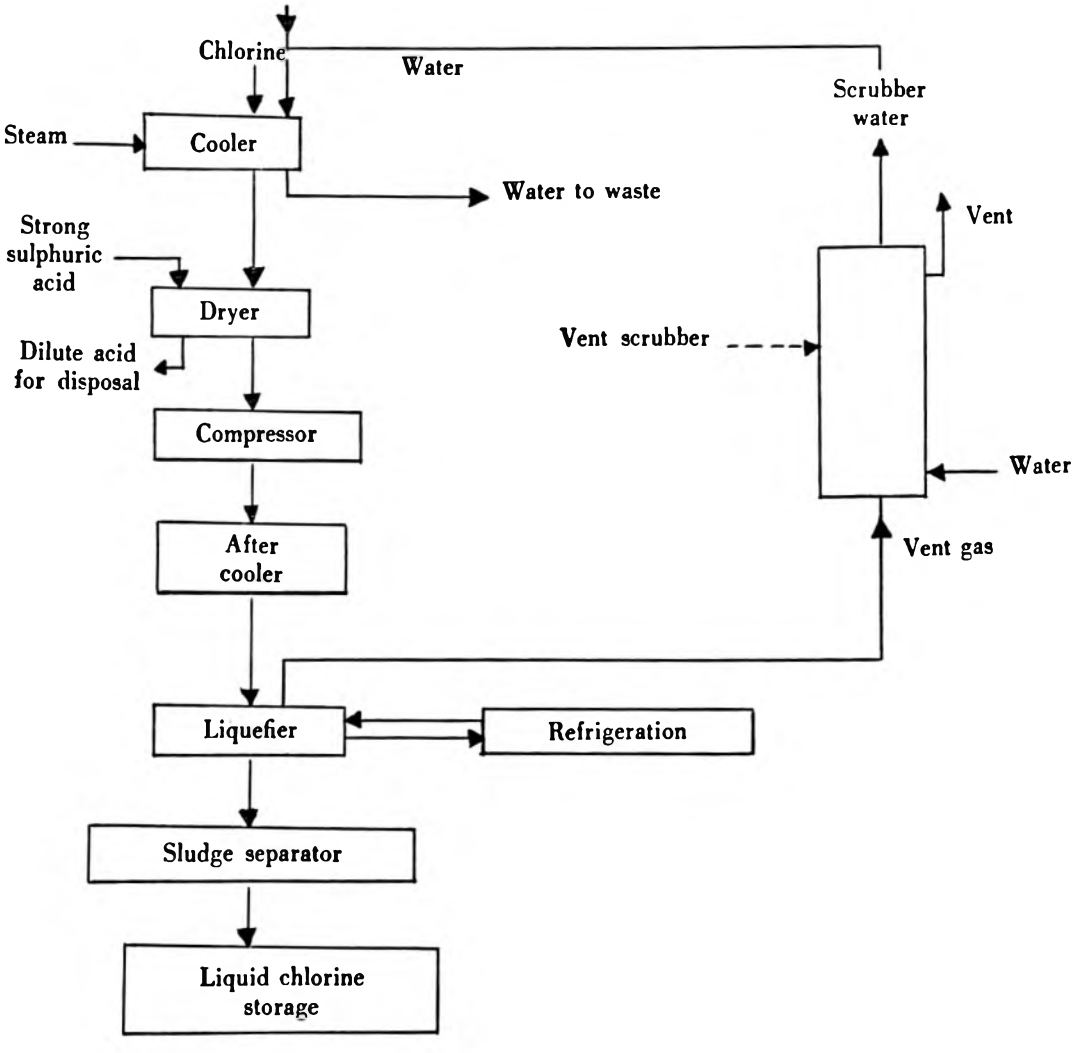
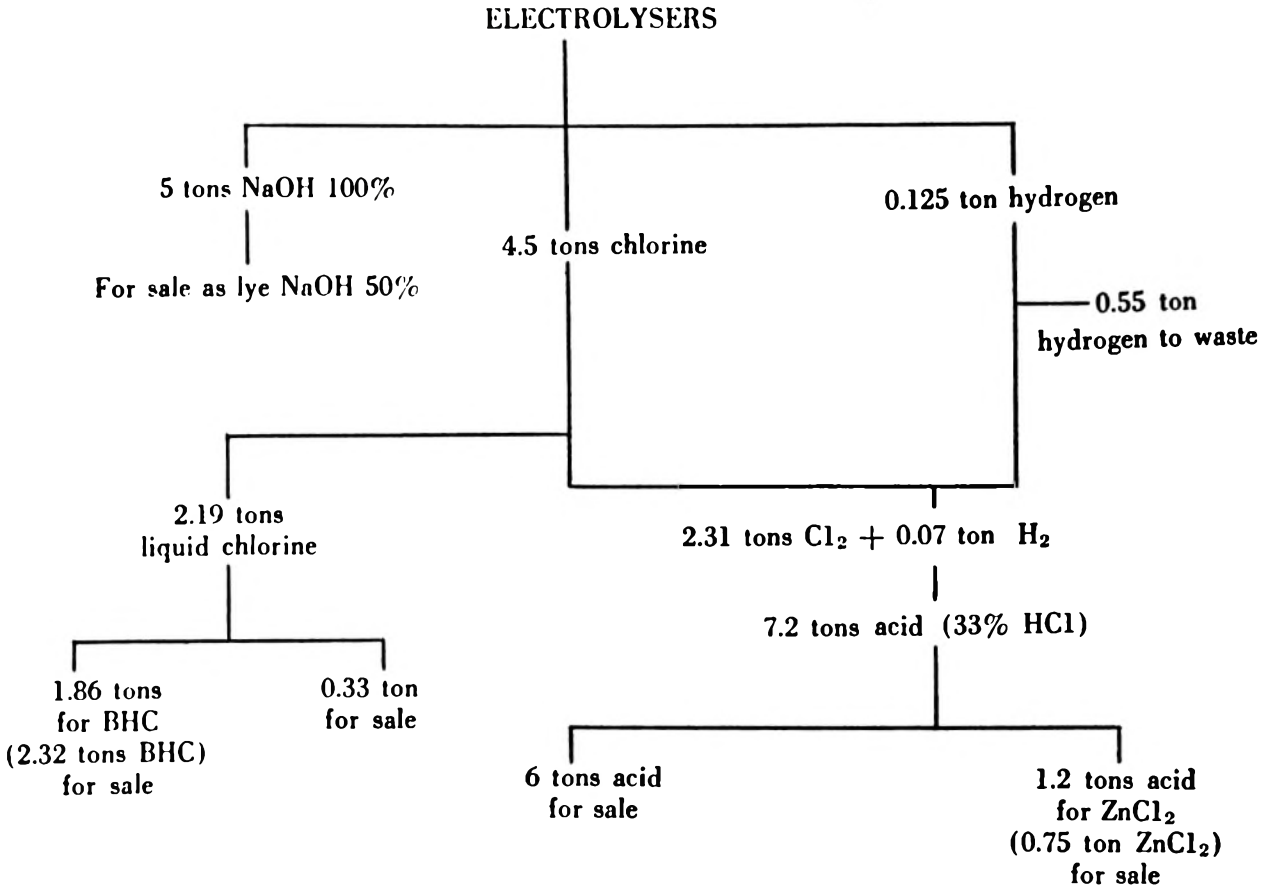


Chart 1:- Utilization of daily production-First Stage



Hydrochloric acid plant

When a stream of hydrogen and chlorine in the ratio of 1 mol of hydrogen to 1 mol of chlorine is ignited with a flame, the mixture forms hydrochloric acid gas and if the stream of mixed gases is maintained, it continues to burn as the chemical reaction generates sufficient heat to maintain ignition. The hot HCl gas is cooled and absorbed in pure water to form commercial acid of 33 per cent HCl strength.

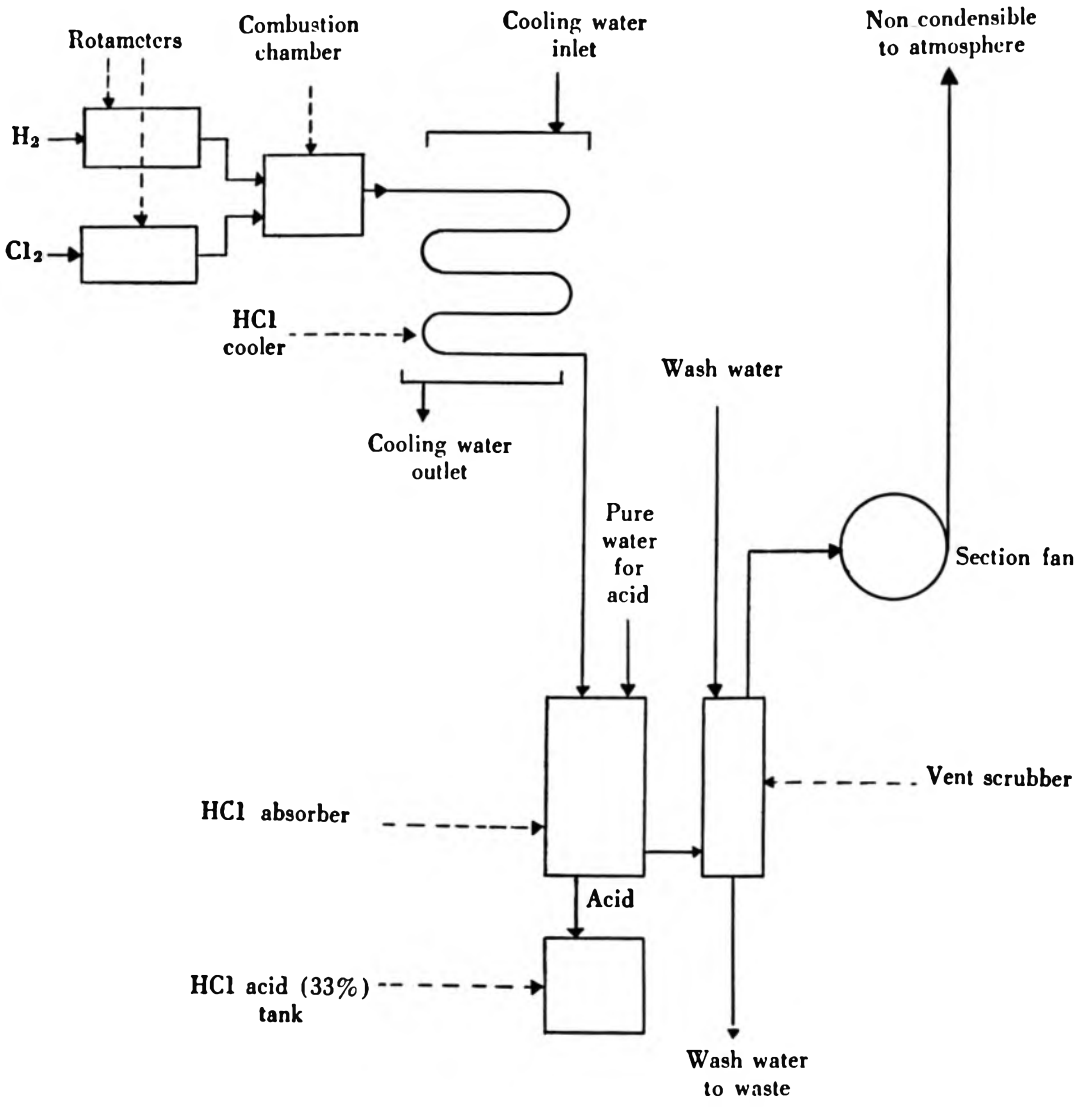
Flow sheet 2 illustrates the various stages of the process of manufacture.

The capacity of the plant proposed is 5 tons of chlorine per day, though, according to Chart 1, the average allocation of chlorine for HCl manufacture is 2.31 TPD. The main object in providing this increased capacity is to ensure continuity of electrolyser operation. In electrolysis of brine, chlorine is continuously evolved. Being a poisonous gas, it is essential to ensure continous disposal. In the case under consideration, part of the chlorine gas will be used by the liquid chlorine plant and the balance by the hydrochloric acid plant. When either of them has a breakdown, the electrolysers have to be immediately regulated to bring down the generation of chlorine to the capacity of the working section. Of these two, the liquid chlorine plant and the hydrochloric acid plant, the latter is more reliable in operation and can be regulated to consume the extra chlorine diverted from the liquid chlorine plant. Furthermore, the disposal of surplus hydrochloric acid is much simpler and cheaper than the disposal of surplus liquid chlorine. The acid can be let into a pit filled with any cheap grade of limestone for immediate absorption. The acid reacts with the calcium carbonate in the limestone to produce calcium chloride and hydrogen. Both can be disposed of to waste without any hazards. Surplus chlorine, on the other hand, has to be circulated in an absorption tower where it is absorbed in milk of lime. Thus special equipment and costly material are required to dispose of surplus chlorine to waste.

Another reason for providing this extra capacity in the hydrochloric acid plant is that its investment cost per ton of chlorine utilized is perhaps the lowest among chlorine-consuming plants and the extra capacity can be provided for little additional cost.

No provision can, however, be economically made in any part of the plant for future expansion to consume 9 TPD chlorine. It will, therefore, have to be duplicated when the occasion arises.

Flow Sheet 2:- Hydrochloric acid manufacture



Benzene hexachloride plant

Benzene hexachloride (14 per cent gamma-isomer) is an insecticide used widely for eradication of mosquitoes which are carriers of malaria and filaria germs. It is also used for eradication of some agricultural pests.

The basic principle of the process consists in chlorinating benzene in the presence of ultra-violet light. The product, benzene hexachloride, consists of several isomers, of which the 'gamma-isomer' is the active insecticide. The maximum proportion of this isomer in the final product is about 14 per cent.

Flow sheet 3 is a diagrammatic illustration of the process. A measured quantity of chlorine is bubbled through a stream of benzene passing through a set of primary chlorinators in series. These chlorinators have sets of ultra-violet tubes dipping into the liquid stream. Chlorine reacts with the benzene to form benzene hexachloride. The chemical reaction is represented by the equation:

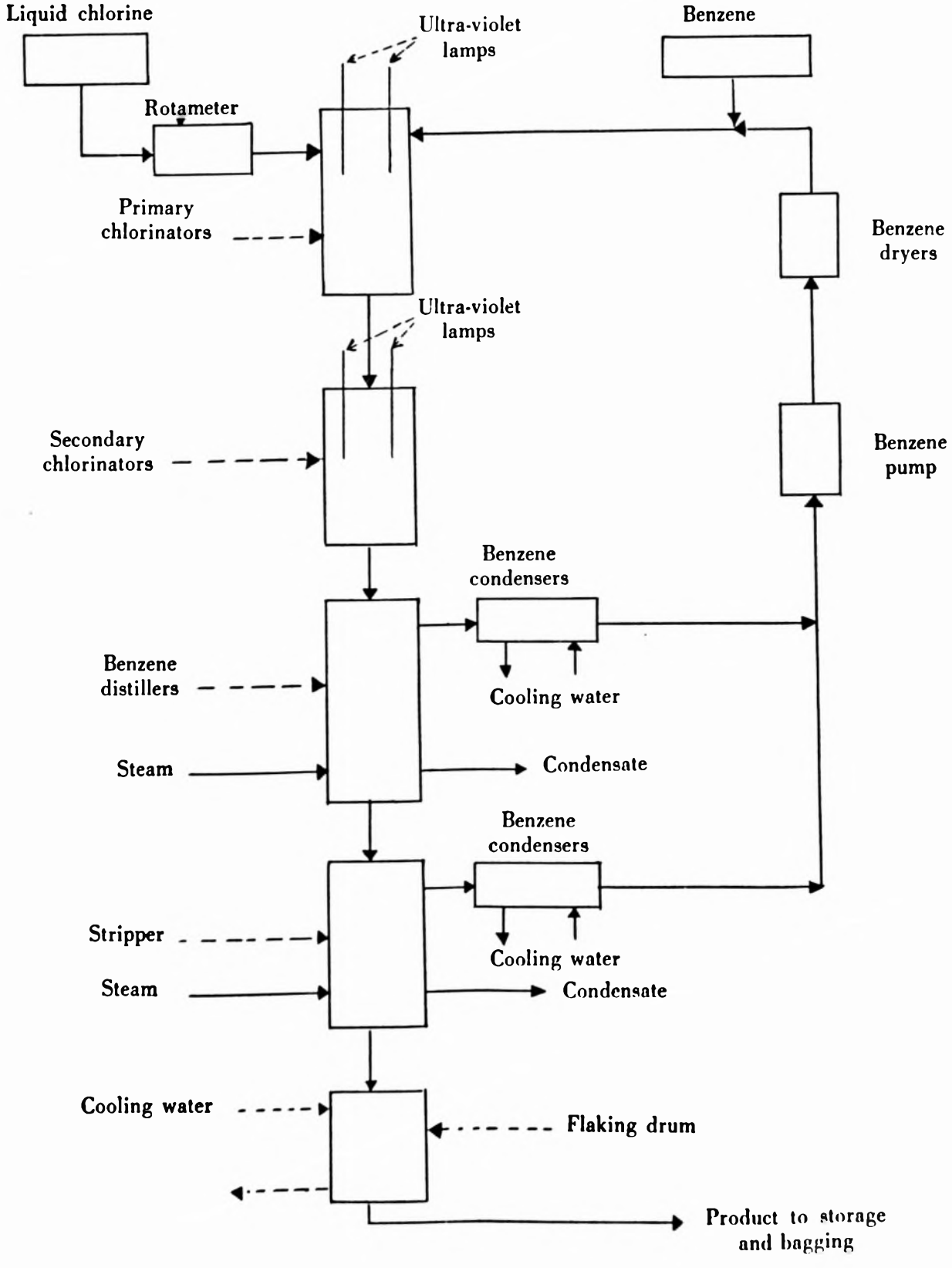
$$C_6H_6 + 3\ Cl_2 \longrightarrow C_6H_6Cl_6$$

From the primary chlorinators, the stream containing free benzene, benzene hexachloride in solution and some free chlorine passes through a series of secondary chlorinators for all the free chlorine to react with the benzene. The flow of chlorine into the primary chlorinators is so regulated that there is no free chlorine in the stream emerging from the secondary chlorinators. The solution of BHC in benzene thence passes forward to the steam-heated benzene distillers. The distilled

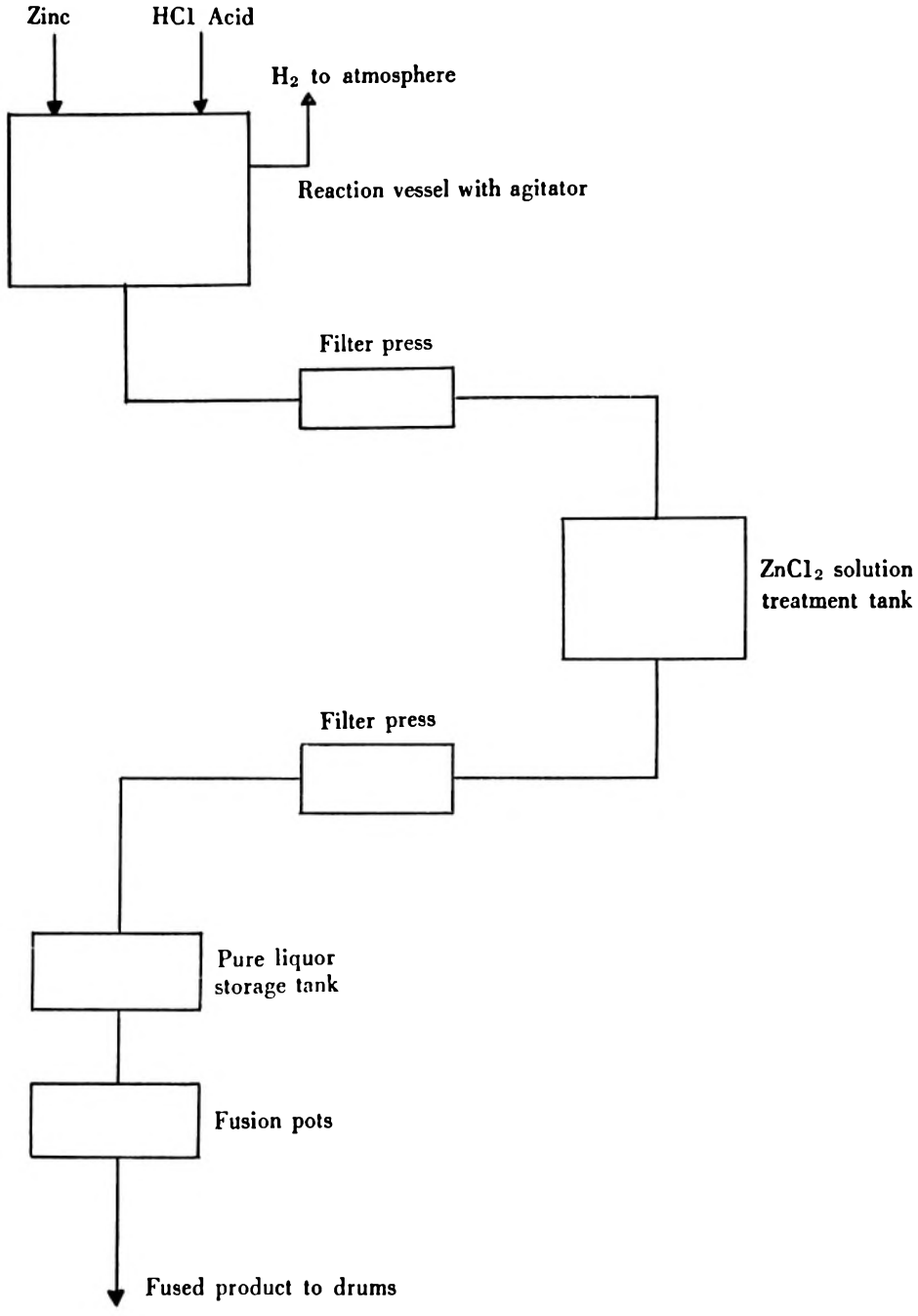
benzene is condensed and returned to the primary chlorinators. The product BHC in molten state passes to a stripper for removal of the last traces of benzene and then on to a flaker, where it is cooled on a revolving drum provided with water cooling and scraped off with a knife.

As benzene is a costly material and evaporates at ambient temperatures in the tropics, it is necessary to supply chilled water at about 12°C to the benzene condensers to ensure that all the benzene is condensed. A refrigeration plant is therefore required to provide chilled water.

Flow Sheet 3:- Manufacture of Benzene Hexachloride (BHC)



Flow Sheet 4: Manufacture of zinc chloride



Manufacture of zinc chloride

The major uses of zinc chloride are (1) as a component of the electrolyte in dry cells for electric torches, (2) as a starch sizing preservative in the textile industry, and (3) as a flux for soldering and for tinplating of iron sheet. For use in dry cells, it has to be very pure and free from heavy metals such as iron, manganese, etc. For use as a flux, it is generally mixed with up to 15 per cent ammonium chloride. As a sizing preservative, zinc chloride is used without any admixture, though the specification is not so stringent. Hence three grades are marketed for the three end uses.

The process of manufacture depends on the raw material. If the raw material is some waste product containing zinc and zinc salts, the process has to be based on its composition. If the raw material is zinc spelter, which is likely to be the case in Thailand, the process is considerably simplified. The spelter ingots are charged in small quantities into a reaction tank containing hydrochloric acid and provided with an agitating device. As the spelter reacts with the acid, hydrogen is evolved and the zinc chloride goes into solution. The chemical reaction is represented by the equation

$$Zn + 2\ HCl \longrightarrow ZnCl_2 + H_2$$

After all the acid has reacted with zinc, the solution is filtered and let into a treatment tank of appropriate chemical treatment depending on the impurities and the grade of zinc chloride to be manufactured. It is again filtered. The filtered liquor is evaporated until all the water in the solution is evaporated. As the temperature required for this is about 300°C the solution is generally heated on an open fire. The product, in a fused state at this temperature, poured directly into galvanized iron drums for sale. On cooling, it sets into a homogeneous block.

In view of the corrosive action of hydrochloric acid and zinc chloride, it is important to see that all surfaces coming into contact with the material in process are resistant to corrosion. While hard rubber lining will meet the situation as long as the material is cold, the fusion pot has to be of enamel or silica ware. Cast iron containing 14 per cent Si can also be used for the fusion pot, but it is extremely brittle and great care is required in its use.

Instead of having only one fusion pot, a cascade system is sometimes employed to obtain better thermal efficiency from the fuel. Another variation is to have a submerged-flame evaporator. As the capital cost of these variations can only be justified for large capacities, whereas the capacity desired for the proposed plant is only 1 TPD, they have not been considered here.

Estimates of capital expenditure—

(1) Caustic soda plant. Installed cost

	First stage *$ 000*	*Second stage* *$ 000*
A. Alternative I — *Hooker cell installation*		
Current rectification plant	40	15
Electrolytic cells: Hooker S-3C	35	20
Brine resaturation	8	—
Cell room piping	10	4
Busbars and switches	25	5
Overhead crane	10	—
Cell renewal equipment	30	—
Caustic evaporation plant	100	30
Brine treatment plant	40	10
	298	84
Contingencies 10%	30	8
	328	92
B. Alternative II — *Pestalozza Mercury Amalgam Cell Installation*		
Current rectification plant	40	15
Electrolysers	190	190
Brine saturating and treatment plant	30	30
Ion-exchange water softener	4	—
	264	235
Contingencies 10%	26	24
	290	259

(2) Chlorine product plants

	First stage *$*	*Second stage* *$*
1. Liquid chlorine plant	75,000	25,000
2. Hydrochloric acid plant	80,000	70,000
3. Zinc chloride plant	50,000	—
4. Benzene hexachloride plant	150,000	50,000
	355,000	145,000
Contingencies 10%	36,000	15,000
	391,000	160,000