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asian industrial development news

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ASIAN INDUSTRIAL DEVELOPMENT COUNCIL

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Part I

NEWS IN BRIEF

ASIAN INDUSTRIAL DEVELOPMENT COUNCIL NEWS

New projects for investigation

The fifth session of the Asian Industrial Development Council (AIDC), held from 15 to 21 January 1970, endorsed the recommendation of a preliminary survey that further studies on the development prospects of the following industries in the region should be undertaken on a national basis or a multinational basis, or both: the dyestuffs industry, industries based on detrital heavy minerals, and the plywood industry. (Some technical and economic data on these industries will be found in part II, below.)

Dyestuffs

A report prepared by the ECAFE secretariat shows that the demand for dyestuffs in the developing countries of the region is met almost entirely from imports. Between 1960 and 1967 imports increased from 12,700 tons to slightly over 17,200 tons in quantity and from US$38.5 million to US$56 million in value. China (Taiwan), Hong Kong, India, Indonesia, Iran, the Republic of Korea, Pakistan, the Philippines and Thailand are the largest importers, having accounted for over 80 per cent of the total imports of the developing countries of the region. The rapid growth of the textile industry in the region, particularly in the sector of man-made fibres, is bound to raise the demand for these products still further during the coming years.

At present, India, China (Taiwan) and Pakistan are producing limited quantities for part of their own requirements. Almost all the developing countries of the region have considerably increased their imports during the last decade.

The Government of Japan kindly offered the Council the services of experts for conducting studies and surveys on these industries.

Industries based on detrital heavy minerals

The Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP) had already prepared studies on the possibilities of developing these industries and, in view of the growing interest in the matter in certain countries of the region, it was decided to make further investigations.

Plywood industry

Production of plywood in the region has increased considerably during the last decade. In 1965, it reached 3.9 million m^2, accounting for 16 per cent of the world's output; the following year this share rose to 19 per cent. Although 75 per cent of the region's output came from Japan, production in the Philippines, the Republic of Korea, China (Taiwan) and India was increasing rapidly and prospects for further development in several other countries of the region appeared to be extremely good. This industry has assumed considerable importance in the export trade of several countries.[1] Thus, the Asian countries which in 1966 accounted for almost a fifth of total world trade were favourably placed owing to the availability of abundant resources particularly of raw materials. According to the UNCTAD study, exports of plywood and veneer from all developing countries increased from US$38.3 million in 1960 to US$143.4 million in 1966, showing a growth trend of 25.5 per cent. Significant progress was made by the seven following countries, whose exports rose from US$2.4 million in 1960 to US$47.6 million in 1966, representing 33 per cent of the total from all developing countries in the latter year: Republic of Korea (US$25.3 million), Mexico (US$6.3 million), Brazil (US$4.9 million), Ivory Coast (US$3.6 million), Malaysia (US$3.1 million), Ghana (US$2.5 million) and Singapore (US$1.9 million).

The new studies will take into consideration the diminishing supply of peeler logs as well as the favourable opportunities for regional or subregional co-operation in research and development of secondary wood species for the manufacture of veneer and plywood.

Agro-industrial complexes

In discussing the possibilities of developing Nuplexes — the integrated development of agro-industrial complexes centred around nuclear power plants — the Council felt that although at the moment prospects for developing nuclear plants for such industrial complexes would involve high capital costs, the ECAFE secretariat in co-operation with countries and international organizations, should undertake detailed studies and investigations on the feasibility of developing agro-industrial complexes on the basis of low-cost conventional power.

[1] See the United Nations Conference on Trade and Asian Development (UNCTAD), "Trade in Manufactures of Developing Countries, 1968 Review", United Nations, New York, 1969.

Status of present AIDC projects

During the past few years, the Council has carried out several surveys of the possibilities of industrial development in the fields of iron and steel, agricultural machinery, rice-processing, rice-bran oil, petrochemicals and the forest-based industries. This work has reached various stages of maturity but the Council has been unable to proceed further owing to a lack of resources. A special appeal has therefore been made to the Secretary-General of the United Nations to appoint an executive director who might assist the Council in the formulation of projects and the mobilization of resources for surveys and studies and help implement regional and subregional projects.

The present position with regard to individual projects undertaken by the Council is as follows

Southeast Asia Iron and Steel Institute

The Southeast Asia Iron and Steel Institute, sponsored by AIDC, will be the first regional industrial project to be inaugurated by the Council in October 1970. This was decided at the Meeting of Six on the Southeast Asia Steel Industry held in Bangkok, November 1969.

The project was recommended by the first iron and steel survey mission sponsored by the Council in 1967. It was approved by an AIDC Working Group in February 1969. Mr. L. C. Bogan of Australia and Mr. T. Onaka of Japan took care of the preparatory work, which included among other things the drafting of a constitution for the institute. The services of these officers were made available by their Governments, free of charge.

The Institute will be set up in Singapore, where the Government has agreed to provide office space as well as certain other facilities free of charge.

According to the draft constitution adopted by the Group of Six, the objectives of the Institute will be:

(i) to provide a forum for the exchange of knowledge and discussion of problems relating to all aspects of the development of the iron and steel industries in its member countries;

(ii) to provide advisory services and carry out, commission or promote the study of scientific, technological and economic aspects of iron and steel industry development in its member countries;

(iii) to encourage the establishment and extension of training programmes for all categories of iron and steel industry personnel employed in the member countries of the Institute;

(iv) to promote steel product standardization and utilization within its member countries;

(v) to collect, collate and publish statistics of iron and steel production, consumption and trade;

(vi) to disseminate the results of its activities, by publications and other means, to regional, national and international organizations and agencies, and to the public in general;

(vii) in general, to do any and all lawful things necessary in connexion with, or incidental to, the accomplishment of any of the purposes above enumerated without pecuniary profit to the Institute or any member thereof.

The Institute will collaborate with members in various countries, through national committees.

Iron and steel

The Group of Six also endorsed the following projects:

(i) the establishment of an integrated flat-products plant in China (Taiwan);

(ii) the construction of an integrated flat-products plant in Thailand;

(iii) the construction of a billet centre in Singapore;

(iv) the construction of a merchant-bar mill and wire-rod mill in Indonesia, to meet that country's total domestic requirements.

The above projects were studied by specialists from Japan and included in reports which were discussed by the Governments concerned. A further study was prepared for Singapore by the Government of India. An interim report of the AIDC survey mission on the iron and steel industry in India, Iran, Pakistan and Nepal which was also considered by the Council indicated that there were prospects of increasing output. It was estimated that by 1975 cold steel demand in the four countries would amount to 16.3 million tons, rising to 25.2 million tons in 1980 and 37.2 million tons in 1985. While the expansion of existing steel facilities could help meet part of this

demand, it was considered necessary, from the long-term point of view, to consider the possibility of developing new plants in the region. A shortage of small ingots, billets, and scrap had considerably curtailed output and immediate attention should be given to increasing the supply of these items at reasonable prices. A major recommendation was that coastal plants be set up in deep-water sites at Bandar Shapour in Iran, Goa Vishakhapatnam in India and Karachi in Pakistan. The Council also endorsed the following recommendations:

1. The organization of an advisory panel of experts to evaluate previous feasibility reports and to make a pre-investment study of the possibility of a basic iron and steel industry in Nepal.

2. The implementation of the Indian project for manufacture and testing of formed coke from non-coking coals. The United Nations Development Programme (UNDP) (Special Fund) might be asked for financial assistance.

3. A study of the application of special reduction processes by natural gas, in connexion with the establishment of coastal steel plants in Iran and Pakistan.

4. A study of the possibility of ferro-alloy production in the region.

5. A study of the utilization of non-coking coals for iron- and steel-making in Iran and Pakistan.

6. A study tour or roving seminar of experts from the ECAFE developing countries, to observe the operations of special reduction plants located in Mexico, the Republic of Korea and New Zealand.

Iron and steel in the Lower Mekong basin

The Council examined the report on the possibilities of developing an iron and steel industry in the riparian countries of the Lower Mekong basin — Cambodia, Laos, the Republic of Viet-Nam and Thailand. These countries had increased their imports of steel products from 550,000 tons in 1964 to 940,000 tons in 1967. Their demand for finished products was expected to be in the region of 1 million tons by 1970, rising to 2.3 million tons in 1980. The report considered that efficient semi-integrated or non-integrated steel mills, or both, should be planned for the production of merchant bars and flat products. Future investigations would thus probably centre on the following projects:

1. An integrated flat-products plant with an initial capacity of about 600,000 metric tons of cold-rolled sheets; to be located in Thailand. The plant could start with a cold-tandem mill with cleaning lines and annealing, shearing and slitting facilities and an electrolytic tin line. These facilities would be designed for a capacity of about one million metric tons. Subsequent expansion could be envisaged to include a hot-strip mill, LD converters and a blast-furnace for hot-metal (iron) production.

2. An integrated billet plant, equipped with continuous-casting machines for the production of billets, to supplement the ingot production of some of the semi-integrated steel installations at the national level; to be located in the Republic of Viet-Nam. The plants capacity would be about 500,000 metric tons of billets per annum. The installation would also include a structural mill with an annual capacity of about 100,000 metric tons of shapes up to about 12 in, to meet the demand of a regional market.

3. A few semi-integrated or non-integrated merchant-bar and rod mills, or both, suitably dispersed in each of the countries, to meet domestic demand.

Petrochemical industries

A fact-finding team which visited India, Indonesia, Iran, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore and Thailand in September 1968 identified sixteen possible joint-venture projects, including:

A petrochemical complex in Singapore

A petrochemical complex in Thailand

Styrene monomer, DMT, DOP, TEL, carbon-black and aromatics projects in Iran

A propylene project in Pakistan (West wing)

A methanol/vinyl acetate project in Pakistan (East wing)

Melamine and TDI projects in India

Ethylene glycol and acrylonitrile projects in the Republic of Korea

A caprolactam project in Indonesia

A BHC project in the Philippines.

In July 1969, government officials from the Republic of China, India, Indonesia, Iran, the Republic of Korea, the Philippines, Singapore and Thailand met to consider the team's recommendations.

As a result of their deliberations and further suggestions, it was agreed that the secretariat should prepare detailed feasibility studies in respect of the following four projects:

Project	*Location*	*Participating countries*
(i) Southeast Asia Petrochemical complex	Philippines or Singapore	Indonesia, Philippines, Singapore
(ii) Caprolactam	Indonesia	Indonesia, Philippines
(iii) Melamine	India	India, Iran, Philippines and possibly Indonesia
(iv) Tetra Ethyl Lead (TEL)	India	India, Iran

Additional projects proposed by the representative of the Government of the Republic of China in the petro-chemical field were as follows:

Project	*Capacity*	*Completion date*	*Remarks*
1. Petroleum coke	250 tons per day	End 1971	—
2. Synthetic ethanol from ethylene	34,000 tons per year	1971	Part of a new complex which will have an ethane cracker to produce 120 million lb per year of ethylene
3. Acetic acid from ethylene	34,000 tons per year		Part of another new complex which will have a naptha cracker to produce 200,000 tons per year of ethylene
4. Styrene monomer	40,000 tons per year	1973	

The position with regard to projects (i) - (iv), above is as follows:

(i) Southeast Asia petrochemical complex: It was agreed that AIDC should try to obtain consultancy services in order that a feasibility study might commence in 1970. The economics of two plant sizes should be taken into consideration, namely, 65,000 tons/yr and 100,000 tons/yr.

(ii) Caprolactam plant: It was hoped that the report being prepared by UNIDO should be ready at an early date.

(iii) Melamine plant: The Government of India had completed a project report for a production of 50,000 tons a year of melamine. The capital costs, factors in the location of the plant, and a projected sales programme for this project have been discussed in this report in detail and comprehensive data on export possibilities provided. The plant was expected to take four years to complete. According to preliminary estimates, profitability would increase from 4.5 per cent during the initial years to 26 per cent when the plant was in full operation.

(iv) Prospects for product sharing had been identified in regard to styrene monomer, tetra ethyl lead (TEL), ethylene glycol and petroleum coke.

Regarding projects 1-4, above, the Republic of China was setting up a petroleum coke plant (30,000 tons per year) and a styrene monomer plant with a capacity of 40,000 tons per year. The discussions indicated that the viability of those two plants could be ensured in view of the demand for these products in the Republic of Korea and the Philippines (for the latter) and in the Republic of Korea (for the former). The Meeting agreed that bilateral trade talks on product sharing should be held among those countries.

The governmental officials likewise acknowledged the prospects of promoting joint-venture production of pesticides and plant hormones and suggested that steps should be taken to prepare pre-feasibility studies in these areas also.

Association of Petrochemical Producers

The government officials also recommended that an association be formed of the region's petrochemical producers, to deal with the various aspects of production, distribution, joint investment and exchange of technical information.

Industries manufacturing agricultural machinery and the rice-processing and rice-bran oil industries

Further studies are to be undertaken by the Council in these fields.

The Council felt that the interested ECAFE countries would be able to produce most of the modern rice-processing machinery they required, provided they could secure sufficient intraregional and international co-operation in matters of design and manufacture. It endorsed the observation of an expert team that "a pre-investment study is essential for evolving correct and suitable types of machinery to suit the different rice varieties and that this should be correlated with the programme for development of manufacturing facilities of modern equipment".

In addition to calling for pre-investment investigations, the work programme requires the secretariat "to assist in the establishment of integrated modern rice-processing pilot projects and in the formulation and implementation of action programmes in the interested countries in the region such as the Philippines, Indonesia, Ceylon, Thailand, Nepal, Iran and the Republic of Korea".

The problems of the rice-bran oil industry are both technical and economic: the rapidity with which the oil in the bran deteriorates and the widely dispersed location of small milling units make it uneconomical to collect the bran. The Council therefore recognized that the development of the bran oil industry had to be preceded by a re-organization of the rice processing and milling industry.

It was pointed out that should some countries find it feasible to produce rice bran oil, this would release proportionate quantities of coconut oil for export, with prospects of earning higher foreign exchange than at present.

Development of the coconut industry

This year, an expert study group on the coconut-processing industry will undertake the high-priority project of examining the prospects of technological development, co-ordinating its work with the Asian Coconut Community (see the **News** No. 4, part I, page 1).

Assistance to AIDC activities

So far, the following offers of assistance have been received in connexion with various AIDC activities'

i) Australia, China (Taiwan), India, Japan, Malaysia, the Netherlands, the Republic of Korea, the Republic of Viet-Nam, Singapore and the Asian Development Bank (ADB): to assist with the industrial survey for regional co-operation.

ii) Singapore: to provide host facilities for the Southeast Asia Iron and Steel Institute.

iii) UNIDO: to provide one regional adviser for the Expert Study Group on Rice-Bran Oil and another for the Iron and Steel Survey Mission to the Western Part of the ECAFE Region.

iv) The Food and Agriculture Organization of the United Nations (FAO): to provide one expert for the Expert Study Group on Rice-Bran Oil and another for the Expert Study Group on the Coconut-processing Industry.

v) The United Kingdom: to provide an expert to lead the Expert Team on Rice-processing Machinery.

vi) Japan: to provide experts to serve in the Expert Team on Rice-processing Machinery and the Expert Study Group on Rice-bran oil. This country contributed also an expert to help with work on agricultural machinery.

vii) India: to provide experts in the fields of forest-based industry, petrochemicals and industries manufacturing agricultural machinery. This country contributed also an expert for the Rice-processing Team and another for the Iron and Steel Survey Mission to the Western Part of the ECAFE Region.

Industrial survey for regional co-operation

The contributions received for this survey amount to US$384,200, including US$40,000 in non-convertible currency from the Government of India but excluding offers of expert services from several Governments. An additional US$200,000 is required before the survey can be officially inaugurated.

In July 1969, a meeting of government officials from the countries to be covered by the survey agreed that the main objectives of the exercise should be as follows:

(a) to assess the potential for industrialization of the developing ECAFE countries to be studied, taking into account the size of markets, availability of raw materials, production costs, economies of scale and other relevant factors:

(b) to make concrete proposals for the formulation of industrial programmes and projects based on a co-ordination of investment, production and trade policies between some or all countries of the area to be covered, with the specific object of triggering industrial investment decisions.

The survey will be neither a macro-economic forecast nor a detailed collection of pre-feasibility studies of particular projects. Rather, it will first attempt to present a framework of industrial growth in the countries of the subregion in order to relate the possibilities of specific projects to the general economic development of the countries and region. This will be followed by an analysis of key industrial sectors, which it is hoped, will indicate opportunities for specific industrial projects, particularly of a subregional character. Finally, the survey will suggest various policy alternatives, on both a national and a subregional level.

The survey will deal with the problems of industrial growth in the decade 1970-1980: for the purposes of detailed analysis the two five-year periods, 1970-1975 and 1976-1980, will be examined separately.

One of the survey's aims is to assess for the various industries (or branches of industry) the geographical scope of the markets for which multinational co-operation is desirable. This scope will depend on a number of factors, such as the location of natural resources, size of markets, the importance of economies of scale, transport costs, etc.; consequently, co-operation between two or three countries might be desirable for some industries and between more for others. It is proposed to cover, in principle, the territories of Burma, Cambodia, Ceylon, China (Taiwan), Indonesia, the Republic of Korea, Laos, Malaysia, Philippines, Singapore, Thailand and the Republic of Viet-Nam, countries where the development of various industries is inhibited by the limited domestic markets, making regional co-operation desirable.

As the availability of information varies from country to country, the studies will differ in extent of detail.

Provisional outline of the survey:

I. **A summary of the present situation and problems of industrialization and regional co-operation in the area**

II. **Macro-economic framework 1970-1980**

(i) Macro-economic projections and sectoral analyses.

(ii) Growth rates and levels of production of major industries.

III. **Industry studies**

Economic analyses of major (manufacturing) Industries laying stress on those branches of industry which have special significance from the viewpoint of regional co-operation.

For each industry the analysis will be based on existing production and trade flows. The availabilities of raw materials, power, transport facilities, the necessary manpower and technical know-how will be examined. A report will then be prepared for each industry covering general technical and economic analyses, taking into consideration potential domestic and foreign markets, input requirements, scales of production and investment requirements, production and transport, possible locations and prospects of subregional co-operation. An effort will be made to identify the production and investment possibilities meriting further detailed project preparation; and, in general terms, the policy decisions and other conditions, training needs, and so on, necessary to establish the production facilities required.

IV. **Country studies**

For each country the changes in structure of production, employment and trade and industrial policy and their consequence with regard to investment requirements, sources of financing and manpower requirements will be analysed to ensure compatibility with the specific industry studies and recommendations.

The Survey will recommend suitable policies for industrial development and promotion of trade and suggest institutional arrangements required for the co-ordinated industrial investment and trade policies needed to implement the industrial projects identified.

On the basis of and consistent with a macro-economic framework for the countries studied, a report will be prepared for each of the eight major sectors of manufacturing industry according to the divisions of the International Standard Industries Classification (ISIC). In these reports a further breakdown of subsectors, as defined by ISIC, will be made wherever feasible. For each major sector the present situation of production and trade and of their inputs structure with respect to raw materials, energy, transport facilities and manpower will be examined, together with present and expected availabilities. Next, the development of domestic, regional and extraregional demand will be considered for the relevant time period, taking into account comparative advantages.

The Survey will also recommend regional projects for joint investment among the various countries, with a view to harmonizing individual country projects with larger regional undertakings.

It is understood that a full-time co-ordinator will be appointed to manage the Survey. He will be assisted by economists and other technical personnel. The Survey itself will be carried out through ECAFE's Division of Industry and Natural Resources (functioning as secretariat to AIDC).

Close liaison will be maintained with other parts of the ECAFE secretariat, in particular the Research and Planning Division's Regional Centre for Economic Projection and Programming, and with, for example, UNIDO, ILO, FAO, OECD and ADB.

The Survey will be conducted in three stages: the first, which will take three or four months, will include the compilation of an inventory of available studies, statistical data, etc., completion of the methodology, formulation of a provisional macro-economic framework for the period 1970-1980, selection of industries and countries to be studied in detail, and formulation of methodology for the industrial studies; the second stage, which is expected to require from four to eight months, will be devoted to the country and sectoral studies; and the final stage, of approximately six months, will allow for the preparation of recommendations on regional and subregional industrial development.

TWENTY-SECOND SESSION OF THE COMMITTEE ON INDUSTRY AND NATURAL RESOURCES

The twenty-second session of the Committee on Industry and Natural Resources was held at Bangkok from 22 to 29 January 1970.

The Committee discussed the following matters: i) industrial growth prospects and policies for the Second United Nations Development Decade; ii) application of science and technology to development, including the world plan of action for application of science and technology to development, the fifth session of the Regional Group for Asia of the Advisory Committee on the Application of Science and Technology to Development, and areas of proposed co-operation between ECAFE and UNESCO in the field of science and technology; iii) reports of subsidiary and technical bodies, including the Seminar on Mining Legislation and Administration, and the Fourth Symposium on the Development of Petroleum Resources of Asia and the Far East, and preparation of an inventory of mineral resources of the ECAFE region; iv) housing, building and physical planning-reports of the Sub-Committee on Housing, the Roving Seminar on Standardization and Modular Co-ordination; and v) the Working Party on Small Industry and the Preparatory Meeting on the Asian Handicraft Centre.

The main item was a discussion of development possibilities and problems in the Second United Nations Development Decade. On the basis of past trends, the Committee concluded that the region should be able to achieve an average growth rate in manufacturing industry of over 12 per cent per annum during the forthcoming decade. Once again, attention was drawn to the need for developing countries to strengthen their agricultural sectors through land reforms and mechanization. Other factors in need of careful consideration were (a) maximum utilization of domestic resources, (b) mobilization of adequate capital from public and private sources, domestic as well as foreign, (c) development of infrastructure to keep pace with industrial growth, (d) improvement of administrative machinery, (e) adoption of appropriate policies, in particular, those pertaining to regional co-operation and industrial planning, and (f) acceleration of transfer of technology on favourable terms.

Since there appeared to be a direct correlation between industrial growth and the growth of exports in manufactures and semi-manufactures, the Committee urged that specific attention be paid by countries to the acceleration of such exports. In order to develop this trade on a self-sustained basis, it was recommended that country studies as well as studies pertaining to industrial sectors, with specific reference to their position in the export trade, should be undertaken during the coming years.

In regard to the need for accelerated investment in the field of industry, it was considered that, in the light of the existing pattern of growth, greater reliance should be placed on the regional approach. It was again stressed that the industrial survey should provide guidance for regional development on a co-ordinated basis. The Committee reiterated the need for a greater flow of domestic and foreign capital into the industrial sector, and considered the development of regional capital markets important in that context. Furthermore, it was recommended that special conferences of government representatives and private investors be convened in collaboration with interested financing agencies, such as the Asian Development Bank (ADB) and the Private Investment Corporation for Asia (PICA).

Science and technology

The Committee felt that more resources should be devoted to research and development activities; that the goal of one per cent of the gross national product (GNP) should be reached as soon as possible, in any case not later than 1980; and that the advanced countries should examine the possibility of allocating 10 per cent of their research and development resources to projects of concern to the low-income countries, with an additional 5 per cent to help in the creation of institutional infrastructure for science and technology in developing countries.

It was also recommended that consideration be given to the establishment of a regional technology transfer and information centre which could, among other things, assist the countries of the region in the following matters:

(a) likely sources of technology;

(b) the acquisition of technology on equitable terms;

(c) the collection and dissemination of scientific and technological information, including information on patents;

(d) the progressive elimination of restrictive business practices, for example, prohibition of export of manufactured goods, imposition of quotas, tied buying and selling agency agreements;

(e) the arranging of training facilities for scientists and technologists, including scientific managerial personnel, of developing countries; and

(f) the framing of model agreements for adoption under various circumstances.

It was most important that the developing countries should pay greater attention adapting technology to national requirements and devising new technology suitable for processing domestic raw material and industrial waste, and that they should bear in mind the development of labour-intensive techniques which if systematically approached could have far-reaching consequences in the region.

In the field of mineral resouces development, the subject of mining legislation and administration was considered in the light of the report of the Seminar on Mining Legislation and Administration held at Manila, the Philippines, in October 1969. On the recommendation of the Seminar, it was decided that a comprehensive compilation of mining laws of the ECAFE area should be prepared and published during 1970. Such a compilation, the Committee felt, would assist in attracting investment towards the exploration of the region's mineral deposits.

In view of the rapid developments in the field of petroleum exploration, particularly offshore, the Committee recommended that a seminar on petroleum legislation should be convened at an early date. It endorsed the recommendations of the fourth Petroleum Symposium held at Canberra in 1969, which emphasized the need for obtaining the services of technical staff to provide assistance to regional member countries in the preparation of stratigraphic data on sedimentary basins, the determination of future consumption patterns of energy with particular reference to petroleum and natural gas and in regard to matters pertaining to the compilation of data on petroleum legislation. It was agreed that an inventory of mineral resources in the countries of the region should be made and that a small working group, consisting of geologists and mining engineers from national organizations, should be set up in order to complete the building up of index cards. Up to 1969, information from about twelve countries, resulting in 114 index cards, had been prepared.

In the field of joint prospecting for mineral resources in offshore areas, the Committee reviewed the work done during 1969, in particular in East Asia where the exploratory activities of the Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian offshore areas (CCOP) had given rise to a growing interest in investment.

The secretariat had also organized a preparatory meeting for the establishment of a co-ordinating body for offshore prospecting of the mineral resources of the marine shelves bordering the Indian Ocean. The terms of reference for consideration by Governments had been drafted and preparations completed for the formation of a Committee for co-ordinating exploratory work in the West Asian region.

COUNTRY NOTES

News on industries and industrial planning

India — 8-10 per cent annual growth rate in industry envisaged in the fourth five-year plan

Investment in industry and growth rates

India's fourth five-year plan covers the period 1969-1974.

Total investment in the public and private sectors is estimated at Rs243,980 million. Of this, the largest amount of Rs52,400 million, or 21.5 per cent of the total, has been earmarked for the industrial sector (Rs30,550 million in the public sector and Rs21,500 million in the private sector). An additional sum of Rs7,950 million (3.3 per cent) has been allocated to the cottage and small-scale industries.

The plan envisages a 3 per cent annual net increase in per capita income, the increase in population being estimated at 2.5 per cent per annum. In order to meet the higher rate of growth in income and investment, domestic savings are to be stepped up from the present level of 8 per cent per annum to 12.6 per cent, and investments from 11.5 per cent to 13.8 per cent. Exports of items other than food are expected to increase by an annual average rate of 7 per cent. It is further envisaged that " . . . the requirements of foreign aid, net of debt repayments

and interest paymens, in the terminal year of the plan will be brought down to half its present level . . . ".

Policy Measures

As in the past, the main objectives of the industrial programme are to provide maximum employment opportunities and to reduce disparities between the various regions of the country. The planners have placed considerable emphasis on the utilization of existing capacities in order to bring about the anticipated increases in output. Where existing capacities are inadequate to meet domestic requirements they will be expanded. Much attention has also been given to improving the administrative efficiency of commercial enterprises, particularly in the context of existing systems of control. The industrial licensing policy during the fourth plan is also likely to undergo some changes. It has been recommended that:

1. All basic and strategic industries, involving significant investments or foreign exchange, should be carefully planned and subject to industrial licensing. In such instances, the State would allocate foreign exchange and raw material as well as credit facilities on the basis of projected development. This would cover both the public and private sectors.

2. Industries requiring only marginal assistance by way of foreign exchange and capital equipment should be exempted from the licensing system. However, a foreign exchange ceiling of about 10 per cent of total value of capital equipment might be imposed on such undertakings. Release of foreign exchange should continue to be regulated and a Capital Goods Committee would screen the import of capital requirements for such industries. This would also apply to industries which have a high component of imported maintenance requirements.

3. Industries which do not call for foreign exchange for the import of capital equipment or raw materials should be exempted from the requirements of industrial licensing.

The Government is at present reviewing the entire licensing system.

Foreign collaboration

All proposals involving foreign collaboration will be closely examined, so that investments of this nature will be approved only for meeting critical gaps and will not inhibit the maximum utilization of domestic know-how and services; for example, foreign collaboration in the production of consumer goods, irrespective of whether or not the latter could be produced within the country, would not be permitted unless they were mainly export-oriented. Import of foreign know-how into sophisticated industrial fields will continue. The Government has set up a Foreign Investment Board in order to identify the fields into which foreign investment would be welcome and to facilitate such investments with procedures of approval which are simple and less time-consuming.

Public sector investments

Central government investments in the public sector of mining and manufacturing projects will amount to approximately Rs34,000 million, including a substantial amount for the completion of continuing projects. New undertakings of specific importance are fertilizers, pesticides, petrochemicals, the development of non-ferrous metal industries, and iron ore and rock-phosphate resources. There will be no large-scale investments in the engineering industries, except in areas where there are critical gaps. The textile industry will be reorganized and modernized, the anticipated investment in this sector being Rs175 million. A sum of Rs500 million has been allocated to expanding the capacity of the paper industry.

Individual sectors

Iron and steel

It is estimated that, by 1973/74, the demand for finished steel and market pig-iron will be 7.12 million tons and 1.95 million tons, respectively. Plans have been finalized for the expansion of the Bhilai plant from 2.5 million tons to 3.2 million tons, and for the completion of the Bokaro plant with 1.7 million tons. At the same time, a sum of Rs1,220 million is being allocated for expanding the capacity of the Bokaro plant to 4 million tons during the fourth plan. This will include the construction of a fifth converter and the establishment of a plate unit. By 1973/74, steel ingot capacity will have reached 12 million tons per annum, and pig-iron output will be in the region of 3.8 million tons by 1974. During the plan period, India will begin to export iron and steel products, it being estimated that, by the end of the plan, 1 million tons of finished steel and 1.5 million tons of pig-iron will have been exported.

Non-ferrous metals

Production of aluminium is due to rise from the present 12,000 tons to 220,000 tons by 1974, with production facilities being set up at Korba and Koyna. Similarly, the Indian Copper Corporation's production capacities will be increased from 9,600 tons to 16,500 tons by the end of the plan, and zinc will double in capacity to 76,000 tons.

Engineering industries

The Government will give priority consideration to what will be a major problem in the engineering industries—the utilization of existing capacity—as well as to the completion of projects in hand. At the same time, some attention will be paid to the diversification of existing units. In the shipbuilding sector, annual capacity will be increased from the present 2.5 ships to 6.

Fertilizers

Projects currently under implementation provide for an annual capacity of approximately 2.3 million tons. The plan envisages seven projects in the private sector, with a capacity of 1.1 million tons, and eight public sector projects during the plan period; Rs2,620 million has been set aside for this expansion. By 1974, nitrogenous fertilizer capacity will have increased to 3.7 million tons. In the phosphatic fertilizer field, plants under construction should provide a capacity of 1 million tons. In addition, new plants are due to be built for the manufacture of complex fertilizers; by 1974 there should be a capacity of 1.8 million tons of P_2O_5.

Petrochemicals

The plan provides for the completion at Koyali of plants for the manufacture of aromatics and naptha, which will provide basic intermediates for synthetic fibres, synthetic rubber and plastics. An important project in the private sector is the establishment of a caprolactam plant by Gujarat Fertilizers.

Other projects

Among other projects of significance are the plans to increase capacity in the fields of petroleum refining, coal-mining, lignite, iron ore, cement, newsprint and textiles. In petroleum refining, it is envisaged that the present shortfall of almost 10 million tons can be met by expanding existing plants. Production of cement is expected to rise to 18 million tons, including 1 million tons for export. Newsprint capacity will expand to 165,000 tons.

Indonesia — Five-year plan proposes rehabilitation of industry

The first five-year plan of development (1969/70-1973/74) gives much to the development of agriculture. Inflationary pressures, though subdued to a considerable extent during recent years, together with shortages of foreign exchange, have become the primary determinants of economy policy. Stress is placed also on investment in areas which have a foreign exchange earning potential and a capacity for import substitution. Mining, owing to its place in exports, takes precedence over manufacture, while in the latter sector the textile industry is considered to be of major importance for concentrated development, in view of its role in import substitution as well as employment.

The following are some of the targets:

Sector	*Unit*	*1969/70*	*Target 1973/74*	*Percentage increase*
Mining				
Crude oil	million barrels	293	440	50.1
Tin	thousand metric tons	16.16	19.4	19.9
Bauxite	thousand tons	1,000	1,200	20.0
Industry				
Textile	million meters	450	900	100.0
Fertilizers				
— N	thousand tons	46.5	403.5	767.0
— P	thousand tons	18 (1971)	168	833.0
Cement	thousand tons	600	1,650	175.0
Newsprint	thousand tons	16	166.5	940.6

Financial resources

The deficits in current transactions, expected to increase from US$520 million in 1970 to US$876 million by 1974, and the outstanding foreign debts which at present exceed US$2,200, are matters of grave concern to the planners. It has been estimated in the plan that annual repayments alone will exceed US$200 million.

The investment programme involves a total of Rp1,420 billion.[1] A major part (Rp1,059 billion) of the financing is expected to come from state development funds. Of the budget appropriations, public savings from the government and savings from domestic revenues would account for Rp226 billion and Rp833 billion, respectively. Domestic revenue is expected to total about Rp1,630 billion; and it is anticipated that Rp266 billion will come from private sources, both domestic and foreign. The estimates of expenditure in the Plan are in respect of fixed capital investment.

Investment in industry

The Plan takes into account the fact that the industrial contribution to national production has been declining for several years owing to shortages of managerial personnel and skilled labour as well as of foreign exchange for essential inputs. Inflationary trends also have had an adverse influence on the manufacturing industry. As several industries have been operating on outmoded and obsolete equipment, maintenance costs have increased significently.

An increase of 90 per cent, in terms of value of production, is anticipated by the end of the plan period, from new investments, rehabilitation and expansion of capacity. Major priority is being given to the industries which:

1. support and complement the agricultural sector by producing equipment required in agricultural output and processing;
2. earn foreign exchange or which save foreign exchange by producing import-substituting commodities;
3. process large quantities of domestic raw materials.
4. utilize relatively more manpower than capital;
5. help to promote regional development efforts.

The Government is to pay special attention to the development of: (a) the fertilizer, cement and chemical industries; (b) the textile industry; (c) the pulp, paper and printing industries; (d) pharmaceutical industries; (e) light and cottage industries; (f) the metal, machinery, equipment and infrastructure industries. The following are the relevant targets (in billions of rupiahs):

[1] One US dollar = approximately Rp 370.

Sector	*1969/70*	*1973/74*	*Percentage Increase*
Fertilizers, cement and chemicals	10,300	48,650	372.3
Textiles	30,000	90,000	200.0
Pulp, paper and newsprint	11,200	20,860	86.3
Pharmaceuticals	5,250	7,350	40.0
Light and cottage industries	99,000	130,000	31.2
Metal, machinery, communication equipment and infrastructure	25,000	48,000	92.0
Total	180,750	344,860	90.8

Investment programme (in billions of rupiahs):

	Development budget	*Other sources*	*Total*	*Percentage*
Fertilizers, cement and chemicals	39.28	75.14	114.42	45.65
Textiles	29.73	11.86	41.59	16.59
Pulp, paper and newsprint	23.35	18.70	42.05	16.78
Pharmaceuticals	—	3.70	3.70	1.48
Light and cottage industries	7.50	17.50	25.00	9.97
Metal, machinery, communication equipment and infrastructure	10.30	13.60	23.90	9.53
Total	110.16	140.50	250.66	100.00

Fertilizer

The plan provides for an increase in fertilizer production, from 46,500 tons in 1970 to 403,500 tons in 1974, the corresponding figures for phosphatic fertilizers being 18,000 tons and 168,000 tons respectively. Five plants are being planned at Pusri, Gresik petrochemicals, Tjilatjap (Pusri II), Djatibarang and Tjilatjap. Investment in this sector is expected to come largely from foreign sources.

Cement

Cement production is to be increased from 600,000 tons in 1970 to 1,650,000 tons in 1974, mainly by expanding the capacity of existing plants. Much of the investment is expected to come from foreign sources, in the form of joint ventures.

Other industries

These include textiles; pulp, paper and newsprint; pharmaceuticals; light and cottage industries; and the metal, machinery and equipment industries. Production of woven textile is to be increased from 300 square meters million in 1969 to 900 square meters million in 1974, and that of raw cotton from 200,000 bales to 400,000 bales. Imports of yarn are expected to rise from the present 184,000 bales to 295,000 bales. In the paper industry, where most of the capital will be from abroad, output is due to soar from 10,000 tons to 166,000 tons.

The programme has also provided for expansion in oil and natural gas production, tin, bauxite, nickel, manganese, sulphur and coal. It is estimated that coal production will increase from 293 (10^6BBL) in 1970 to 440 (10^6BBL) in 1974, tin in concentrates from 1,600 tons to 1,930 tons and bauxite from 1 million tons to 1.2 million tons.

Republic of Korea — Preparations for the fourth five-year plan, 1972-1976

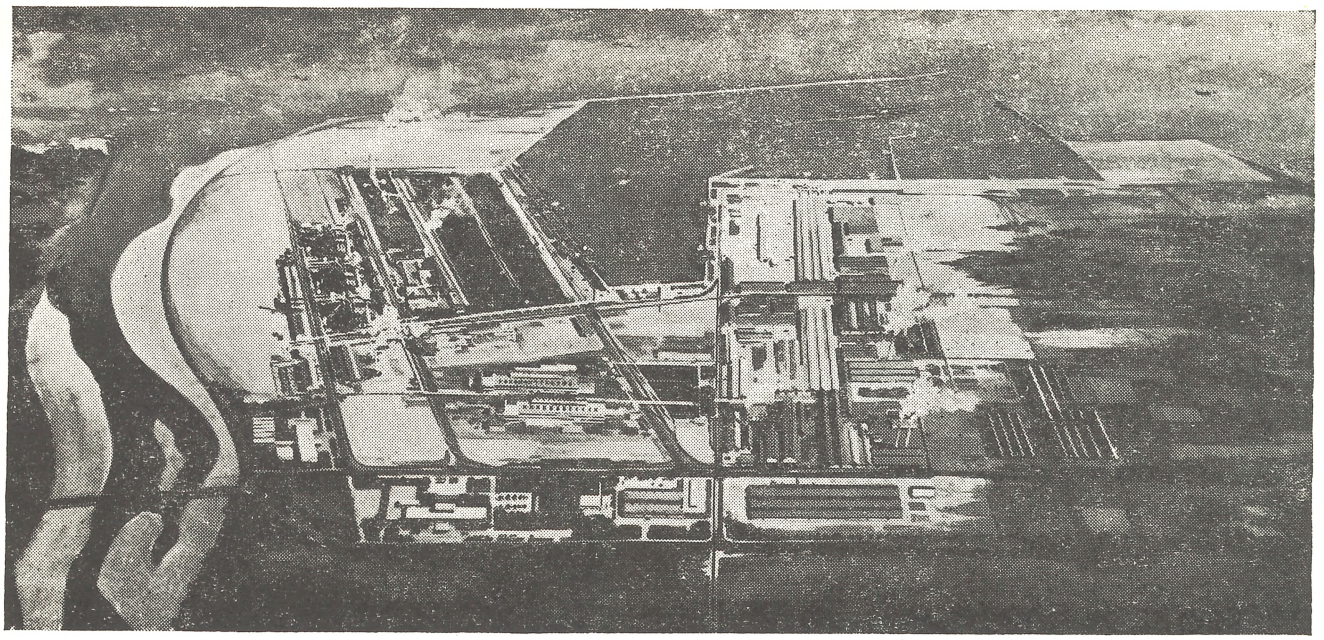
Despite agricultural difficulties during 1967/68, this country has been able to make considerable headway in industrial development during its third five-year plan, which is due to be completed in 1971, particularly in the field of exports of manufactures and semi-manufactures. The manufacturing growth rate which was 25.9 per cent and 23.9 per cent, respectively in 1968 and 1969, is expected to drop to 19.8 per cent in 1970. In 1967, the rate of growth of manufactured exports declined to 28 per cent, having averaged about 40 per cent since 1962; in 1968 it recovered to reach 42 per cent. Maintaining exports of manufactures and semi-manufactures at consistently high levels is of considerable importance to the country's industrial development, a point which is duly stressed in the Government's development plan.

Incentives and efforts to build up and maintain export-oriented industries have paid considerable dividends. In 1968, exports of manufactures totalled US$500 million, twelve times higher than in 1961, and in 1969, they increased to US$700 million. The principal items of exports are plywood, clothing, wigs, raw silk, shibori, dried laver, electronic products, footwear and tuna fish. About 30 per cent of the total goes to the United States and approximately 15 per cent to Japan and the Republic of Viet-Nam (Japan receiving almost three times as much as the Republic of Viet-Nam), while Hong Kong, Canada, Malaysia and Singapore each absorb about half as much as Japan.

The Korea Trade Promotion Corporation, a government agency, has provided the export industries with considerable assistance, in particular by arranging for the free training of technical employees at government and other laboratories in the country. The National Industrial Research Institute, operated by the Ministry of Commerce and Industry, also provides free pre-training facilities as well as technical assistance, cost free, to as many as 860 factories manufacturing export commodities. The latter form of assistance concerns the development of innovations in manufacturing techniques, quality improvement and measures to lower cost of production. At the same time, the Government extends to officials and technical personnel facilities for quality control, information on industrial development, both local and foreign, and opportunities to gain export experience in various industrial enterprises.

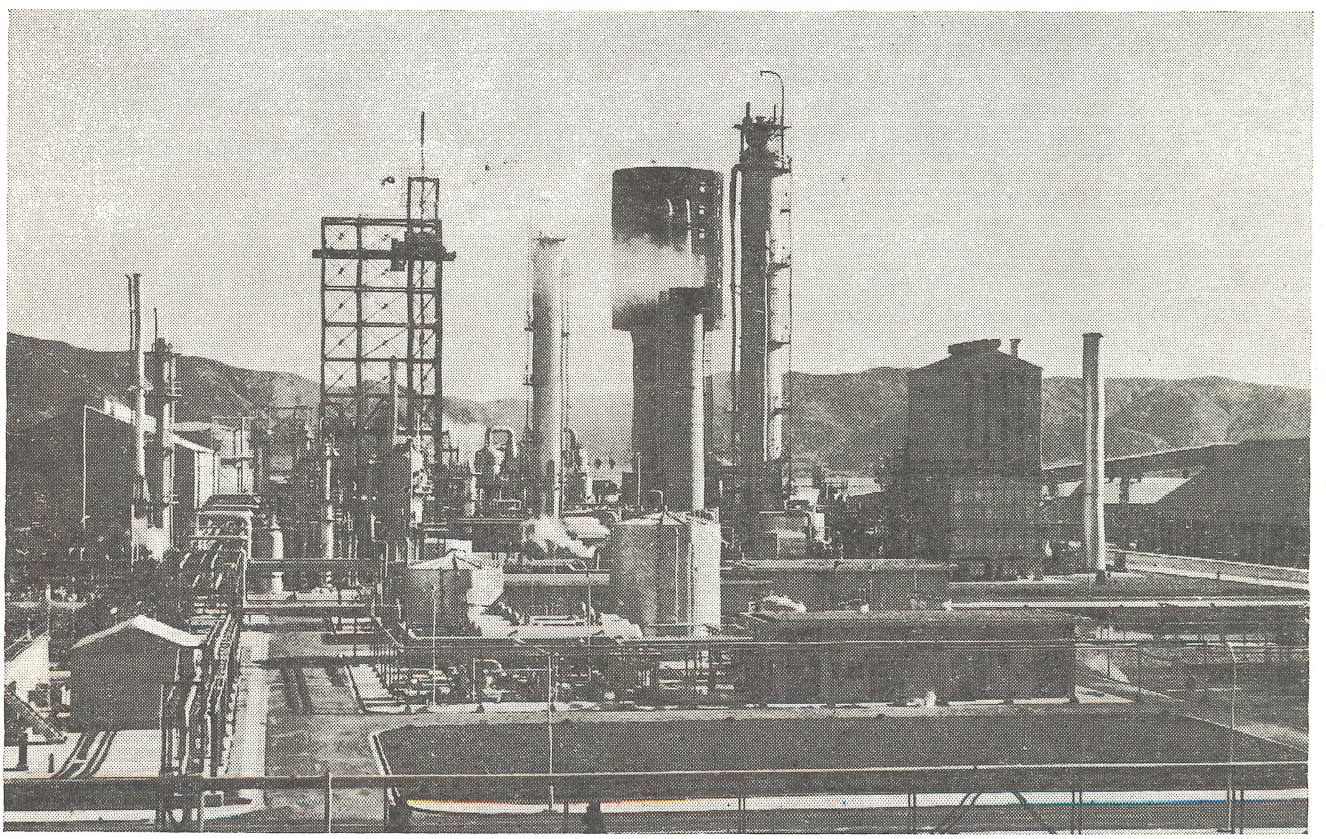
The latest export target of US$2,800 million has to be reached by 1976. So far, exports have consisted mainly of clothing and plywood, but the fourth five-year plan aims at diversifying them through improvement of the export capacity, in terms both of quantity and quality, of more sophisticated manufactured products. Particular importance will be given to development of the machinery industry; for example, motors, pumps, threshing machines, sowing-machines, electrical equipment, lathes and boilers. The electrical and transport equipment industries also will be given high priority.

The over-all growth rate in industry during the fourth plan is expected to be in the region of 15 per cent, less than that reached during the third: an average of nearly 20 per cent had been reached by 1969, but in 1970 there was a drop to 19.8 per cent. The main reason for the anticipated slow-down is the structural change in the industrial sector. The plan is expected to concentrate on the building up of heavy industry, taking into consideration development of the iron and steel, machinery and petrochemical industries. It is expected that approximately US$160 million will be invested in iron and steel and machinery plants. The following twenty-two items have been selected for



A bird's-eye view of the Pohang Synthetic Steel Mill

Capacity	:	*Blister steel — 1.03 million tons/year*
Investment	:	*foreign capital — US$16 million*
		domestic capital — $18 billion
Completion date	:	*1973*
Location	:	*Pohang, Kyongsanboo-do, Republic of Korea*



Korea fertilizer plant

Capacity	:	*urea — 330,000 tons/year*
Investment	:	*foreign capital — US$42 million*
		domestic capital — $4,200 million
Completion date	:	*April, 1967*
Location	:	*Ulsan, Kyongsangnam-do, Republic of Korea*

priority consideration: boiler engines, diesel engines and engine parts; bearings; power transmitters; metalworking machinery and lathes; mining equipment and parts; equipment for the manufacture of textile fibres; agricultural equipment; valves and fittings; measuring equipment; washers and parts; optical apparatus; sewing-machines; transformers and electrical equipment; communications equipment; automobiles; bicycle parts; equipment for the construction of railroads; shipbuilding equipment; civil engineering equipment; chemical machinery; castings; and locks and hinges. It is anticipated that the domestic manufacture of these items will save annually at least 50 per cent of the US$500 million or so which is at present spent on importing them.

In the field of petrochemicals and other chemical products, priority will be accorded to the manufacture of fertilizers, in particular phosphatic and potashic fertilizer, 160,000 tons of which is at present imported. At present, there are eight or so fertilizer manufacturing units which produce approximately 370,000 tons per annum of sulphatic fertilizer; a limited amount of this is exported within the region. Investment of approximately US$200 million is anticipated for the expanded manufacture of various petrochemical intermediates, mainly in the Ulsan area, with annual capacities as follows: polyethylene 50,000 tons; PVC — raw material for monomer (PCM) 60,000 tons; monomer (AN) 27,000 tons; caprolactam 33,000 tons; SPR 15,000 tons; Naptha cracking 100,000 tons; polypropylene 20,000 tons; acetate alderhydrate 25,000 tons; ethanol 20,000 tons; and alkybenzyne 10,000 tons.

The plan's main objectives will be:

1. To strengthen the country's competitive position through managerial improvement and enlarged production capacity.

2. To further replace imported raw materials and machinery, to expand the facilities of export industries and to diversify exportable goods.

3. To further strengthen the industrial structure by means of an integrated steel plant and a petrochemical complex.

4. To manage the volume of foreign capital investment within the allowable range, taking into account the realistic prospects of foreign exchange earnings and long-term repayments.

5. To further raise domestic savings so as to build up an enlarged basis for the self-financing of development investment.

China (Taiwan) — Fifth four-year plan, 1969-1972

This country's fifth development plan covers the period 1969-1972. Total gross investment has been estimated at NT$179.9 billion, i.e. a 40 per cent increase over that of the previous period. The main objectives are to provide additional employment to 170,000 persons annually, to expand exports by 12.5 per cent yearly and to maintain the minimum annual economic growth rate of 7 per cent. Per capita income, previously at US$237, is expected to increase at an average rate of 4.71 per cent. Gross capital formation is expected to rise at an average annual rate of 9.9 per cent, and savings at 11.6 per cent. The growth rate in industry has been estimated at 9.2 per cent per annum, and it is expected that this sector's contribution to gross domestic product (GDP) will increase from 33.1 per cent in 1969 to 35.2 per cent in 1972, while agriculture's contribution will be reduced from 19.8 per cent to 18.3 per cent. Total exports should increase at the rate of 12.5 per cent per annum, reaching a record value of US$1,399 million in 1972 as against US$982 million in 1969. Industrial products are expected to account for 54.6 per cent in 1972 of total exports, compared to 49.2 per cent in 1968, and the proportion of processed agricultural products and agricultural products to be reduced accordingly.

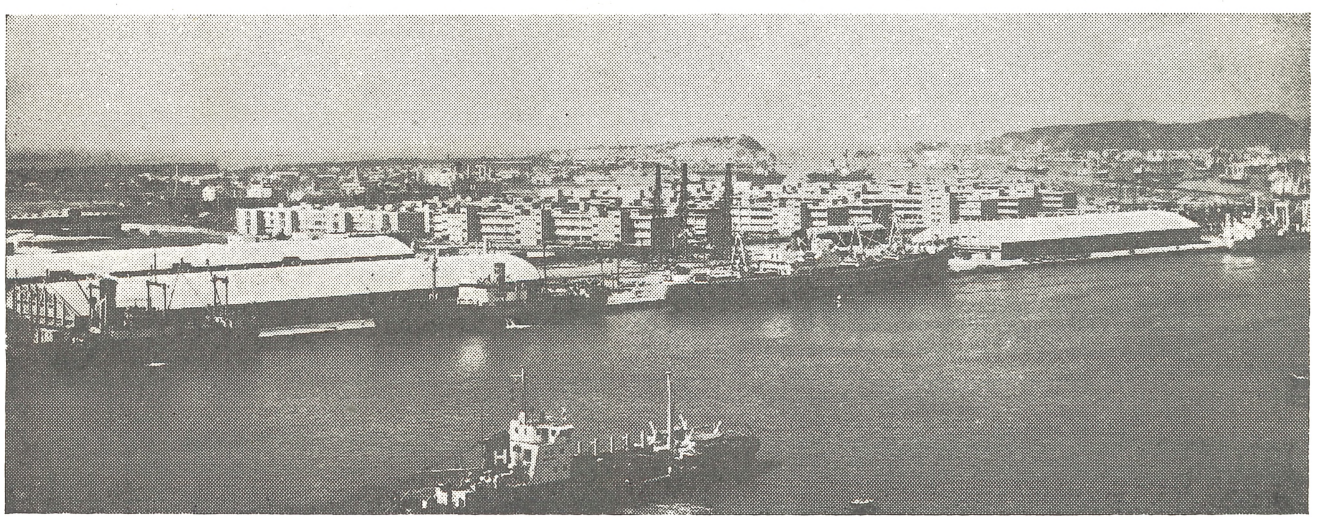
Of the total fixed investment of NT$156.5 billion, the manufacturing industry will account for NT$43.3 billion, i.e. 30.2 per cent; and the total share of transport, communications and electricity will increase to NT$45.4 billion.

The anticipated structural change in the industrial sector is one of the plan's basic considerations. There will be a shift of emphasis from labour-intensive light industry to skill-intensive heavy industry. A greater proportion of investment will be diverted to the electronic, petrochemical and integrated iron and steel industries. In China (Taiwan), as in the Republic of Korea, exports of manufactured products have assumed considerable importance in industrial development. Of the several measures introduced by the Government to promote and assist the development of export industries, the most important are the provision of technical assistance, the low rate of interest (6 per cent per annum) in some cases, and the subsidizing of inland transport up to almost 30 per cent. Further, industries concentrating on exports will have the facility of importing their materials and machinery free of duty.

Progress of export processing zones

The introduction of export processing zones, one of the main features of the export development programme, has attracted considerable interest from other developing countries. The first zone was set up in January 1965, by special statute, on 68.5 ha of reclaimed land at Kaohsiung, one of the principal harbours of China (Taiwan) and a centre of heavy industry. In addition to a population of about 750,000 this town also has an oil refinery and an aluminium refinery, plants for the manufacture of iron and steel, machinery,

The sewing department of a shirt factory (KEPZ), China (Taiwan).



Distant view of the Kaohsiung Export Processing Zone, (KEPZ), China (Taiwan).

plastics, plywood, fertilizers, alkalis plants, thermal power and cement, and a well-developed packaging industry. The zone is administered by a special government agency which is responsible for registering and issuing licenses to import and export commodities.

By the end of 1969, there were 109 industrial enterprises operating in the zone, representing a total investment of US$23 million and a sales turnover of US$120 million and employing 32,000 persons. In addition, thirty-three units were being commissioned and eleven units were pending approval. Eventually, with all 153 undertakings, it is estimated that total capital investment will amount to US$33 million, the sales turnover US$182 million and the number of employees 40,000. The manufacture of electronic products, with twenty-three units in operation, is the zone's most important feature. This industry has a sales turnover of over US$75 million, on an investment of US$14 million, and employs almost 30 per cent of the zone's staff. More than 50 per cent of the investment has come from foreign sources—Japan, the United States, the Netherlands, the United Kingdom and Turkey, the balance having been undertaken by overseas Chinese on the basis of joint undertakings.

The principal tax concessions are as follows:

1. Profit-seeking enterprise income tax: Export enterprises conforming to the "criteria of encouragement" and falling under the "categories of enterprises eligible for encouragement" may apply for a five-year tax holiday, and are entitled to a 10 per cent reduction of the payable income tax as of the sixth year. As far as the other, export enterprises are concerned, the tax, including all forms of surtax, will not exceed 18 per cent of their total annual income.

2. Stamp tax:

   (i) Books recording capital investments, one yuan (NT$3) apiece per year;

   (ii) Agreements of loans, mortgages, or pledges, and written acknowledgement of debts and debentures, 0.02 per cent apiece on the amount involved if less than 500,000 yuan or 100 yuan apiece if the amount exceeds 500,000 yuan;

   (iii) Discount contracts, acceptance contracts, promissory notes, bank drafts, or bills of exchange, one yuan apiece if the amount involved is less than 100,000 yuan, or 4 yuan apiece if the amount exceeds 100,000 yuan;

   (iv) Contract for future delivery of goods or services, 4 yuan on each contract and 0.20 yuan apiece for receipts or other written evidence in respect thereof;

   (v) Invoices issued for transactions referred to in article 17 of the Statute for Encouragement of Investment, 0.1 per cent apiece on the amount stated in the invoices.

   (vi) Stamp tax rates on other types of document are in accordance with the provisions prescribed in the existing Stamp Tax Law.

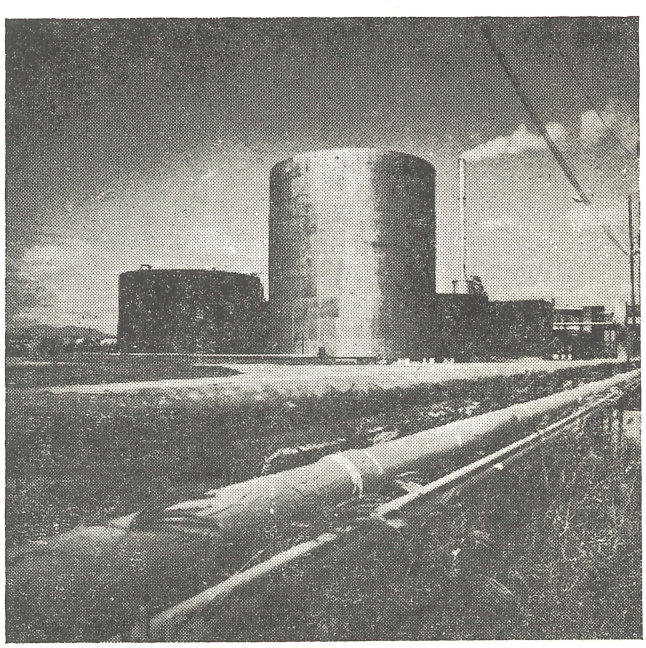
3. House tax: Factory buildings, if owned and directly used by the owner for manufacturing purposes, are taxable at the rate of 1.5 per cent of their assessed value. A 3 per cent Defence surtax is to be added thereto.

4. Vehicle licence plant tax, levied in accordance with the existing Licence Plate Tax Law.

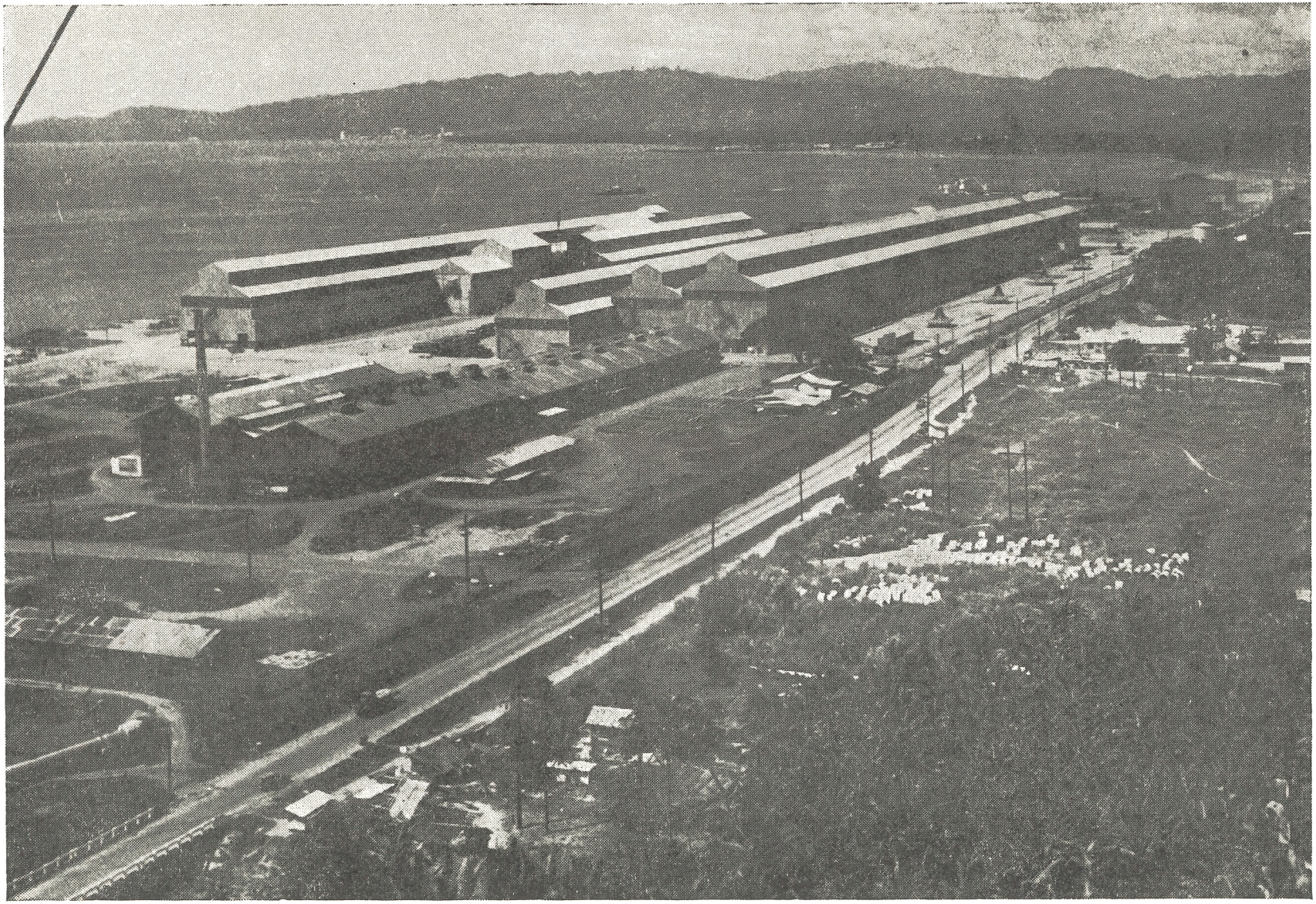
One of the most important aspects of export promotion is relaxation of import and export procedures. The agency responsible for the export zone at Kaohsiung has stipulated the following: (a) no import duty for machinery or equipment; (b) no import duty for raw materials, parts or semi-finished goods; (in addition these items are exempt from any import levy, or other duty or tax) (c) immediate issuance of import and export licences; (d) import exchange settlements require a deposit margin of only 20 per cent; (e) customs inspection for incoming and outgoing commodities to be completed within 24 h.

Philippines — Provisional five-year development plan

The five-year plan of the Philippines, 1970-1974, envisages a gross investment of ₱39,480 (approximately US$9,000 million). Of this, ₱6,355 million has been earmarked for manufacturing industries, the largest allocated to any single sector after the construction



Integrated Coconut-Chemical complex in the Philippines.



Iligan integrated steel mill located on the Southern Island of Mindanao in the Philippines.

and services sector (₱23,677 million). Investment in industry is to come entirely from the private sector. As in the past, the Government will determine the quantum and direction of investment by fiscal and administrative measures.

The annual rate of growth of gross domestic capital formation during the plan period will average over 8 per cent, the over-all annual growth rate 7.1 per cent, and the industrial growth rate 7.8 per cent. The share of the manufacturing sector in the contribution to net domestic product will be in the region of 14.6 per cent per annum throughout the period.

The planners are conscious of the fact that, during the second investment priorities plan, there will be an acute shortage of foreign exchange, the requirements of which for industrial projects has been estimated at US$833 million. A savings gap of ₱3.2 billion is anticipated as a whole for the economy. In the manufacturing sector, it is hoped to obtain US$45 million in foreign assistance, US$185 million in direct assistance and a balance of US$371.4 million in private foreign investment. The position with regard to availability of the foreign component in investment has been greatly complicated by the continuing adverse balance of payments.

The major contribution to industrial output during the plan period is expected from the following areas:

1. Metal industries—the manufacture of primary products is to be developed, mainly in the form of inputs for secondary industries. Some exports also are anticipated. At present, the Philippines imports metal products to the value of US$400 million per annum. It is hoped to replace some of these with local production. New investments will concern mainly iron and steel integrated plants.

2. Wood industries.

3. Textiles, particularly cotton.

4. Engineering industries.

5. Chemicals, particularly pulp and paper manufacture.

In the field of foreign trade, a 7 per cent average annual growth rate of manufactures and semi-manufactures is expected. The main difficulty will be to provide employment for the additional number of 430,000 persons each year. The rate of unemployment for 1970 is expected to remain in the region of 6.3 per cent.

Ceylon — A major breakthrough in industrial development

For several years, Ceylon's industrial sector has been almost stagnant: up to 1966, its industrial growth rate was among the lowest of the ECAFE developing countries. The major difficulties were due to the tardy development of agriculture and an acute shortage of foreign exchange. Since 1968, however, and particularly in 1969, there has been a tremendous upsurge in both investment and production. In 1968, the manufacturing sector as a whole, which excludes the tea, rubber, coconut and construction industries, registered an increase of 18.2 per cent in value added; the increase came largely from the manufacture of electrical machinery, rubber goods, garments, fabricated metal products and confectionery in the private sector; and from cement, hardware, ceramics, tyres and tubes, and animal and poultry food in the public sector. Basically, there has been no change in the structure and pattern of industrialization since 1967. In 1968, the processing of foodstuffs, beverages and tobacco accounted for nearly 44 per cent of the total value of industrial output, and in 1969 the growth rate of heavy industry was higher, particularly in the metal and fabricated metal industries. Recent developments in iron and steel manufacture, petroleum refining and the expansion in cement and paper will combine to bring about a change in the structure of industry during the 1970s, reflecting the predominance of the heavy industry sector. The percentage contributed to total industrial output by basic metals and fabricated metal products increased from 7.2 per cent in 1964 to 18 per cent in 1969, whereas the corresponding figure for the consumer goods industries dropped sharply from 63.3 per cent to 48.7 per cent in 1968. During 1968, employment in industry rose by 27,000 persons.

The most notable changes were in the public-sector industries, where seventeen state corporations are concerned with the manufacture of, for example, iron and steel, hardware, ceramics, petroleum, textiles, paper and as well as flour-milling. The total value of output of public-sector corporations increased from Rs136 million in 1967/68 to Rs271 million in the following year. The value of foreign exchange saved by these enterprises almost doubled, from Rs39 million to Rs67 million. During the last two years the Government has attached considerable importance to the utilization of installed capacities in industrial enterprises, a policy which has enabled several important undertakings to reach capacity production. A report entitled "Review of the Activities of State Corporations, 1968/69" shows that the manufacture of tiles and drugs exceeded installed capacity while that of cement

attained 93 per cent, paper 88 per cent, plywood 86.7 per cent, ilmenite 84 per cent, and ceramics 83.3 per cent. For iron and steel, and rubber tyres and tubes, however, the figures were only 31.6 per cent and 23 per cent, respectively.

Industrial exports also played a satisfactory role in 1969: in the public-sector, five of the state industrial undertakings earned Rs8 million by exporting fatty acids and glycerine and ilmenite; the last-mentioned accounting for nearly 40 per cent of the total earnings. Other exports included tyres, tubes and tyre flaps, plywood and processed fish. The plywood, and oils and fats industries are gaining importance in the export market.

ASIAN PRODUCTIVITY CONGRESS AUGUST 1970

The year 1970 having been designated Asian Productivity Year (APY), the Asian Productivity Congress will be held in Tokyo from 31 August to 3 September 1970.

The main objective of the Congress, which will include the thirteen member Governments of the Asian Productivity Organization[1] (APO), will be to focus attention, in the Asian region, on the dynamic action necessary in governmental and non-governmental areas for the promotion of productivity as a means of fostering and stimulating economic growth. The Congress will bring together, for the exchange of experience, opinions and observations, experts concerned with the various aspects of productivity.

Invited participants and observers will come from both Asia and the West, and will include high-level representatives of governments as well as men and women from the fields of management and labour, from academic circles, from institutes and foundations concerned with economic development, and international organizations such as the United Nations and its specialized agencies and the Organization for Economic Co-operation and Development (OECD). It is expected that more than 300 persons will attend.

The four-day programme will comprise:

First day:

General Congress session

Second and third days:

Sectional meetings on:

(a) the role of productivity in economic growth; and

(b) the role of different agencies in promoting productivity action.

Fourth day:

General Congress session.

All delegates will be invited to participate in a post-conference tour to "EXPO '70".

The Congress will be preceded by the eleventh session of the Governing Body of APO, from 11 to 14 August, 1970.

[1] These are: Ceylon, China, Hong Kong, India, Indonesia, Iran, Japan, the Republic of Korea, Nepal, Pakistan, the Philippines, Thailand and the Republic of Viet-Nam.

THIRTEEN ECAFE MEMBERS CELEBRATING 1970 AS ASIAN PRODUCTIVITY YEAR; HEADS OF STATE TO BE PATRONS OF APY[1]

Thirteen member nations of ECAFE, namely, Ceylon, China, Hong Kong, India, Indonesia, Iran, Japan, the Republic of Viet-Nam, forming the present membership of APO, Tokyo, Japan, have pledged to observe 1970 as the Asian Productivity Year under the over-all guidance of APO. The concerted effort of the thirteen Government will, it is expected, help them to raise the productivity of the region and to improve the living standards of the Asian people through the attainment of the following objectives:

Objectives

— To achieve greater prosperity through productivity;

— To increase productivity consciousness; and

— To intensify productivity action for accelerating economic growth.

The principal motto will be "Prosperity through productivity."

The theme of APY will be "Quality reliability."

It is open for the member countries to supplement the principal motto by secondary ones where necessary, to foster the national movement. The selection of "Quality reliability" (QR) as the theme was in consideration of the universal need in Asian countries for improving the quality and reliability of their products through the application of productivity techniques assimilated from the wider dissemination of knowledge and acquired from training programmes. The introduction of productivity techniques will therefore be stimulated during APY.

In addition to the regular and integrated regional programme to be carried out in 1970, additional programmes intended to strengthen their activities will be

[1] This paper has been specifically prepared for the *News* by the APO.

implemented in conjunction with national productivity organizations in all member countries. Such programmes will lay emphasis on the role of productivity in national economic growth and on the results of application of appropriate techniques for productivity improvement.

Areas of emphasis

On the basis of the programmes in APO's five-year plan (1969-1973), the decisions and recommendations of the Government Body Meeting, and the preparatory work done by the secretariat, the Chairman, Vice-Chairmen, and Secretary-General, in their meeting in Tokyo in July last year, identified the following areas as those of major concern and emphasis during APY:

1. Creating productivity consciousness
2. Light engineering industries
3. Small industries development
4. Trade promotion techniques
5. Agricultural productivity
6. Industrial relations

Creating productivity consciousness

As is the case with respect to other aspects of APO's activities, APO feels that as much as it has done and accomplished in the past, much more should be done in the immediate future with respect to publicity activities aimed at creating and intensifying productivity consciousness. In keeping with the expanded activities in the form of special APY programmes, and also utilizing the interest these programmes will generate, APO will increase publicity activities on all levels, with particular emphasis at the level of national economic planning and top management in industry and agriculture.

An important aspect of the information activities in 1970 is APO's concern with propagating the concept and application of "total productivity." In keeping with APO's objective of strengthening the linkage between productivity and economic planning through the efforts of APO and the national productivity organizations, on a number of occasions officials of member Governments have realized that rather than concentrate on the construction and equipping of as many factories as possible, it was of primary importance to first see that the existing factories were being used at as close to installed capacity as possible. This is but one example of how productivity may be advantageously considered in connexion with national economic planning and development.

During APY, APO will seek to propagate the concept of total productivity, that is the sum of capital productivity, of labour productivity, and of material productivity. In this respect, important differences between productivity factors in advanced nations of the West and developing nations of Asia must be kept in mind. In some western countries labour costs have risen to the point that labour productivity has been made the primary area of concern within the over-all productivity drive. In these countries, unemployment tends to be low, and there is often a shortage of labour. However, in Asia, most countries have a relatively large potential labour force, and unemployment or underemployment is common. Labour productivity is therefore not considered to be of primary importance at the present stage of development; productivity in the field of capital and materials, both of which are in scant supply in Asian countries, should receive higher priority.

Light engineering industries

The light engineering industries are considered to be of basic and great importance for over-all industrial development. Within this category, areas of primary importance include foundry practice, tool and die engineering, die casting and basic machine-tool operation. But Asian countries are generally weak in these vital areas. During APY, APO will attach great importance to providing the light engineering industries in member countries with in-plant guidance on modern production techniques, utilizing the service of experts. In addition, short-term seminars and training programmes will be organized. Emphasis on quality reliability will be particularly evident in this aspect of APY endeavours. Low-cost automation will also be the subject of concentration among activities implemented with expertise for light engineering industries.

Small industries development

Since the small industry sector constitutes the largest number of industrial units and also engages a great percentage of labour in this region. APO has been devoting attention to the improvement of productivity performance in small and medium industries. Training industrial consultants, stimulating entrepreneurial talent, hastening the modernization process of small industries, and emphasizing quality reliability are aspects on which programmes are being developed.

To make such an attempt more co-ordinated and also to institutionalize these endeavours, a Regional Institute for Small Industries Development (RISID) is proposed to be set up as soon as possible. This institute will concentrate on the training and re-training of trainers, the promotion of suitable consultancy and

managerial capability in the Asian region, and improvement of the capability of production engineers in actual operations. It will also study the problems of small industries with a view to modernizing their structure and performance.

Trade promotion

Almost all APO member countries suffer from an unfavourable balance of trade. While APO is not concerned with trade policies, it does feel that it is essential to strive for better export promotional techniques, through activities in such fields as export marketing, industrial design, product packaging and quality reliability. Improvements in these techniques will contribute a great deal toward improving export trade of member countries.

Agricultural productivity

Since 1966, agricultural productivity has also been included in APO's activity. The general orientation of APO programmes in agriculture is toward taking advantage of the experience of industrial productivity, in so far as it is applicable to agriculture. Inputs such as fertilizers, insecticides and machinery, selected aspects of management and overall necessities for raising yields are receiving increasing attention. Some important projects are economies in the use of inputs, area development, survey on agricultural chemicals, and application of some of the results of the survey of loss in storage and preservation of food grains. Agricultural productivity activities cover area-wise and commodity-wise approaches; they are designed for policy-farmers and extension-level types of personnel. In this regard, these programmes take into account the work programme of other international organizations, such as FAO and ECAFE, in order to avoid duplication of effort.

Industrial relations

APO, ever since its inception, has attached great significance to industrial relations. It believes that productivity improvement should be achieved with the active support and full participation of the labour sector. For this purpose, it has organized a series of regional symposia. The national productivity centres are being encouraged to emphasize the role of labour in the productivity drive. For APY, several facets of labour-management co-operation for the increase of productivity are being examined, and study teams for the observation of progressive practices in industrial relations organized.

Special projects for APY

In line with the areas of emphasis, APO, during APY, will implement the following projects and programmes:

I. Creation of productivity consciousness throughout the region will take the form of:

(a) An intensified and expanded information programme through all mass communication media, issuance of APY symbol and postage stamps, holding of exhibitions, and preparation and distribution of printed and audio-visual materials especially designed for plant managers and owners to improve their productivity consciousness and the techniques of productivities. A booklet on "Asian Productivity Year (APY)" explaining what APY is and how to organize APY programmes is under print and copies will be distributed all over Asia. Special information projects such as: an essay contest, a poster contest, productivity awards, an APY symbol, a postal stamp cachet, a special APY postal stamp design, a special cover design for APY publications, posters and sample kits are also included. Preparatory work on almost all of these has been completed and the necessary action taken;

(b) A productivity observation mission of economic journalists from all APO member countries, to visit Asian countries in order to acquaint themselves with the progress of productivity and its actual contribution to economic growth;

(c) Special programmes on the "Role of productivity in economic growth," in the form of short-term seminars for top management and government officials, to be conducted in member countries by top-level experts;

(d) Special seminars or discussions to augment top management's understanding of productivity.

II. Generation of new trends and induction of techniques will include the following types of programme:

(a) Training projects in foundry and die-casting to induct new techniques into the light engineering industry;

(b) Symposium on Development of Entrepreneurial Talent, to consider problems relating to the motivation of talents to participate in industrial programmes and to the development of needed business abilities and attitudes in prospective entrepreneurs;

(c) Establishment of a Regional Institute for Small Industries Development (RISID) to supply small industries in the region with guidance for modernization and productivity performance, and to train and re-train trainers to promote suitable consultancy and managerial capability as well as that of production engineers;

(d) Training programmes in subjects relating to international trade expansion such as international marketing, industrial designs, quality reliability and containerization;

(e) Agricultural productivity projects, including a symposium on fertilizer economy, a survey to assess inputs for area development and a survey on agricultural chemicals, seminars on farm management, and avoidance of food-grain wastage. All these projects will be aimed at achieving tangible results in raising agricultural productivity; and

(f) Other projects such as training courses, seminars, symposia and surveys in the fields of human resources development, economic planning and the like.

III. Formation of industry-wise productivity associations

It has been suggested that the possibilities be explored of enlisting the full participation of industries in APY, and for this purpose the formation of industry-wise productivity associations, productivity cells and the like will be promoted by national productivity organizations at the national level, for which necessary assistance will be provided by APO.

The "quality reliability" theme by APY will be highlighted throughout the year and quality control seminars and training programmes have been organized in previous years to pave the way for QR campaigns in 1970. Since the standard of quality and reliability in a product is determined by the relationship between design, materials, process and workmanship, and effective utilization of feedback from the customer, attention will be paid to these aspects. A suitable self-education manual on quality control for the supervisory level will be published, and productivity awards for outstanding performance in quality control will be awarded to persons, institutions and business concerns at national and regional levels.

IV. Asian Productivity Congress

An Asian Productivity Congress will be organized in Japan from 31 August to 3 September, 1970. The main objective of this Congress will be to focus attention, in the Asian region, on the dynamic action necessary, at governmental and non-governmental areas, for productivity promotion as a means of economic growth and to pool the several resources of thought at this meeting. The Congress is expected to bring out a declaration on productivity for the Asian region and to be a highlight of APY.

The invitees will be ministers, other representatives from Governments, management, labour, heads of several specialized associations, persons from international organizations and other specialists.

V. Patronage of Heads of State

Having sought the patronage of the Heads of State of each member country during APY, APO has been greatly honoured and encouraged by the acceptance so far of the following:

Ceylon	Hon. Mr. Dudley Senanayake, Prime Minister of Ceylon
China	HE C. K. Yen, Vice President of the Republic of China and concurrently President of the Executive Yuan (Prime Minister)
Hong Kong	HE Sir David C. C. Trench, KCMG, MC, Governor of Hong Kong
India	Dr. Zakir Husain, President of India
Japan	HE Eisaku Sato, Prime Minister of Japan
Republic of Viet-Nam	HE Nguyen-van Thieu, President of the Republic of Viet-Nam

It is hoped that similar intimation will soon be received from each of the other member countries.

Illustrative list of the tentative APY programmes suggested by the member countries of APO

The following very tentative plans for the celebration of APY in APO member countries have so far been submitted:

1. Ceylon

(a) An exhibition, in Colombo, depicting the very real progress made in the country in the fields of agriculture, industry, commerce and social services, with special emphasis on productivity and performance.

(b) A similar exhibition, but on a much smaller scale, in each province if possible.

(c) Seminars on as many aspects of productivity and performance as can be organized throughout the year.

2. **China**
   (a) To designate 1970 as China Productivity Year also.
   (b) National seminar with participation by representatives of all sectors of the economy.
   (c) Regional seminars.
   (d) Productivity prizes, to be awarded to industries and commercial units as well as agricultural firms.
   (e) Essay contest for college and university students.
   (f) Poster contest, production of placards.
   (g) Pamphlets to be published.
   (h) Mobile productivity exhibit to tour the island.
   (i) Screening of films.
   (j) Postal stamp and cachet to be issued.
   (k) National productivity conference.

3. **Hong Kong**
   (a) Prizes for inter-industry productivity contests and intercompany productivity contests.
   (b) Essay contest, on better living standards through productivity; also on QR.
   (c) Posters on topics of essay contest.
   (d) Industrial fair participation to promote productivity consciousness.
   (e) Radio, television broadcasst, programmes; use of newspapers and magazines to increase productivity consciousness.
   (f) Screening of films on productivity consciousness, QC, value analysis, etc.

4. **India**
   (a) Productivity prizes, for QC consciousness, to foremen and supervisors.
   (b) Publication, distribution of leaflets, brochures on APY, "Prosperity through Productivity", training kits and manuals for foremen, QC manuals and guides.
   (c) Co-operation of all mass media.
   (d) Releasing of cine-slides to sustain interest in APY, also screening of QC film.
   (e) Patronage by Head of State.
   (f) Impressive inaugural and closing functions.
   (g) National study group to deal with QR workshop.

5. **Japan**
   (a) National seminar on "Present and Future of the Productivity Movement in Asia".
   (b) Regional seminars on "The Role of Top Management in Promoting the Productivity Drive".
   (c) Essay contest on "My Hopes for the Productivity Drive in Asia".

6. **Republic of Korea**
   (a) National seminars and training courses on special APY subjects.
   (b) APO itinerant seminars on (i) top management, (ii) the role of productivity in economic growth and (iii) agricultural productivity.
   (c) Symposium on the role of productivity drive in economic development.
   (d) Productivity congress on the occasion of the thirteenth founding anniversary of the Korea Productivity Centre (KPC).
   (e) Public lecture meetings on the productivity movement.
   (f) Enlisting the co-operation of 130 member industries of KPC in the APY celebration.
   (g) National productivity prizes in (a) quality control, (b) personnel management, (c) marketing management and (d) new product development.
   (h) Essay contest for university and college students.
   (i) Issuance of special postage stamp.
   (j) Productivity exhibition.
   (k) Production of colour film on the productivity movement, and screening of films on productivity subjects.
   (l) Publicity campaign through the media of radio and television, newspapers and magazines, also the publication of brochures and leaflets.

7. **Pakistan**
   (a) National seminar in January 1970, with sessions to be presided over by a central minister.
   (b) Five regional seminars, of short duration, presided over by either central ministers or governors.
   (c) Productivity prizes, in five categories, to be awarded by the Head of State in December.

(d) Agricultural productivity seminar.

(e) Productivity prizes, local, in three categories, to be awarded by the Head of State.

(f) Essay contest on "Better Living Standards through Productivity".

(g) Publication, distribution of brochures.

(h) PITAC participation in the international industrial fair, in Pakistan, on APY themes.

(i) Use of mass communication media.

(j) Production and screening in public of films.

(k) Issuance of postage stamp.

8. **Philippines**

(a) Regional seminar, on "Production Management-Quality Control", etc.

(b) Productivity exhibit for the participation of industrial concerns.

(c) Press conference with the President of the Republic to inaugurate APY in the Philippines; press releases.

(d) Broadcasting media to be utilized.

(e) Screening of films.

9. **Thailand**

(a) National seminar on "Prosperity through Productivity", to be inaugurated by the Prime Minister in the first week of January.

(b) Regional seminars on "Productivity in General", to be inaugurated by Governors or the Minister of Industry.

(c) Productivity prizes for waste reduction, market expansion, plant maintenance and cost reduction.

(d) Essay contest on "Prosperity through Productivity".

(e) Poster contest.

(f) Publication and distribution of brochures, leaflets about APY in the Thai language.

(g) Co-operation of newspapers for publishing success story series.

(h) Television and radio to be utilized.

(i) Patronage by the Executive Head of Government.

(j) Impressive closing ceremony attended by high officials.

The above list is only illustrative. Bearing the objectives of APY in mind, each member country will organize its own national productivity year programme to suits its own needs. The over-all coverage, to summarize the above individual items, can be indicated as follows:

(a) The Head of State as patron;

(b) Enlist co-operation and support of all industrial and agricultural institutions, professional bodies, manufacturers' associations, trade unions, employees' associations and training institutes;

(c) Issuance of postage stamps;

(d) Publicity through all mass communication media;

(e) Essay, poster and other contests, exhibitions and productivity fairs or participation by NPO in industry or agricultural fairs;

(f) Publication and distribution to plant managers, engineers and supervisors, government officers and professional workers, brochures on APY and training manuals on selected subjects, including QR;

(g) Production or screening of films on productivity in general and on selected subjects for technical training programmes.

In the field of training, the following programmes will be undertaken:

(a) National seminars on subjects to meet the identified needs of industry or agriculture, or both, conducted by local or international experts recruited with the help of APO;

(b) Zonal seminars to complement and supplement the national seminars;

(c) APO-sponsored itinerant seminars, to suit national needs and at the same time to fit into the APO regional programme;

(d) Training courses on QR, or relevant subject such as quality control, value analysis, etc.;

(e) Productivity prizes, one each for industry and agriculture.

In the follow-up and evaluation of results, the most effective way would be to form intermediate associations. The local chapter of the APO Society will be used for this purpose.

At the plant level

To ensure the success of APY, the organizing of effective programmes at the plant level is of prime importance. Since the theme of APY is QR, a hypothetical QR programme is suggested for reference:

(a) Convince the top management of the benefits of the QR system; that it is not a cost but a saving, etc.;

(b) Set up a master plan for organizing QR campaigns at the plant level, with a central committee consisting of members drawn from the top management down to representatives from the shopfloor, and set targets and encourage competitive ideas;

(c) Keep a regular flow of publicity both to the public and within the plant so as to prepare everybody for the campaign;

(d) Hold competitions — e.g. product-of-the-year competitions — based on either interdepartmental rivalry or individual prizes, or both;

(e) Conduct in-plant training courses, with the support and assistance of NPO, or QR subjects; and

(f) Keep the campaign going by arranging factory visits to similar plants, publicizing regularly feed-back information and results and improvement achieved, and hold film shows, discussion groups and exhibitions of good and bad quality or performance.

Co-operation with international agencies

As outlined above, APO is endeavouring to implement APY projects most successfully and effectively in order to make the people productivity conscious and to orient newly developing productivity techniques in Asian countries. It is imperative that the efforts of the various organizations or agencies in promoting and accelerating economic development of Asia should be jointly undertaken. In view of this, the assistance and active participation of international organizations, such as ECAFE, ADB, the ILO, OECD, the Colombo Plan, UNIDO, etc., in observing APY will contribute to the programme's success. Fortunately, such collaboration has already been ensured in making the productivity movement dynamic. All opportunities, as indicated in the foregoing, will be fully explored to achieve this close unison of activities in every possible instance.

PART II

RESEARCH AND TECHNOLOGY

The **News** reproduces below extracts from three reports submitted to the fifth session of AIDC; they deal with the region's development possibilities of (a) the dyestuff industry, (b) industries based on detrital heavy minerals and (c) the plywood industry.

THE DYESTUFF INDUSTRY

Demand in the developing ECAFE countries

With the exception of India, China (Taiwan) and Pakistan, the demand for dyestuffs in the developing ECAFE countries is met entirely by imports. Table 1 shows the region's imports for the period 1960-1967, during which, there was an increase from about 12,700 tons to a little over 17,200 tons, or, in terms of value, from a little over US$38.5 million to US$56 million. Owing to lack of data, a detailed market survey would be necessary to ascertain the demand for dyestuffs by category. Future demand will depend on the plans of the domestic textile industries.

Table 1: ECAFE COUNTRIES: IMPORT OF DYESTUFFS, NATURAL INDIGO AND COLOUR LAKAS

Country	1960		1961		1962		1963		1964		1965		1966		1967	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Afghanistan	43	232	75	273	—	—	39	221	52	187	191	433	188	417	—	—
Brunei	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Burma	539	2,009	531	1,969	516	2,005	138	1,379	179	845	411	1,396	229	522	293	291
Cambodia	80	40	11	5	11	16	64	66	—	—	—	—	—	—	—	—
Ceylon	1	2	69	248	69	310	34	380	56	567	139	697	164	849	198	942
China (Taiwan)	238	494	427	767	507	805	501	875	751	1,320	778	1,794	870	2,109	1,220	3,169
Hong Kong	2,020	5,590	2,067	5,762	2,188	6,151	2,016	6,999	2,226	8,647	2,332	7,208	2,967	8,821	3,483	10,998
India	2,232	13,514	3,199	14,822	2,404	11,193	1,479	9,354	1,462	11,309	1,560	8,220	1,109	6,371	1,103	6,489
Indonesia	1,016	3,740	2,139	6,823	676	2,000	823	3,328	856	3,002	1,274	5,343	620	2,609	1,108	3,618
Iran	1,184	2,502	1,317	3,744	1,383	3,693	1,250	4,476	1,462	5,714	1,803	6,452	1,792	5,859	2,192	7,550
Korea, Republic of	135	169	495	499	553	634	800	1,560	708	1,426	1,122	2,327	769	2,159	1,172	3,415
Laos	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Malaysia	—	—	—	—	—	—	32	237	172[a]	838[a]	301[a]	840[a]	215	582	273	666
—Malaya, Fed. of	85	126	—	—	—	—	—	—	...	...	...	...	...	...	...	...
—Sabah	—	—	—	—	—	—	—	—	...	...	...	...	...	...	...	...
—Sarawak	—	—	—	—	—	—	—	—	...	...	...	...	...	...	...	...
Nepal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pakistan	2,129	6,212	1,912	7,372	1,555	6,535	1,567	7,227	2,157	10,870	2,465	9,186	2,073	7,064	1,768	8,242
Philippines	660	2,354	505	1,948	1,522	2,325	732	2,351	744	2,647	1,044	2,928	1,543	4,459	1,661	4,372
Singapore	89	183	390	700	255	445	125	479	...	...	...	...	124	301	194	523
Thailand	805	1,015	810	1,317	973	1,463	846	1,785	939	2,437	1,308	2,405	1,475	2,963	2,165	4,549
Viet-Nam, Republic of	396	335	667	726	1,013	1,139	824	1,244	594	1,332	816	1,391	1,780	2,804	414	1,216
Total developing ECAFE countries	12,652	38,517	14,614	46,975	13,625	38,714	11,270	41,961	12,358	51,141	15,544	50,584	15,918	47,889	17,244	56,040

Note: Q = quantity; V = value (in US dollars).

[a] Including Singapore.

Sources: OECD, *Commodities Trade: Exports 1960-1967.*

United Nations, *Foreign Trade Statistics of Asia and the Far East, 1962 and 1963.*

Ministry of Finance, *Trade of Japan, 1960 and 1961.*

Raw materials for the dyestuff industry

With rare exceptions, the dyes in modern use are synthetic. Until recently, they have been referred to as coal-tar dyes because they are synthesized from such hydrocarbons as benzene, methyl derivatives of benzene, naphthalene and anthracene, all of which can be obtained directly from coal tar. These hydrocarbons are converted into intermediate products, such as aniline, naphthols, benzaldehyde, benezidine, anthraquinone, nitroanilines and a host of others. The intermediate products used in the manufacture of direct and acid dyes, naphthol dyes, pigment dyes and optical bleaches are given in the annex.

Economics of dyestuffs manufacture

In the production of dyes in any country, but especially in a developing country, the plants must be highly versatile in order to be able to produce as wide a range of colours as possible. The following illustrations[1] show the economics of producing (a) direct acid and sulphur dyes; (b) naphthol dyes; (c) organic pigment dyes; and (d) optical bleaches. It should be borne in mind that the production schedule for various colours could be varied within wide limits.

[1] *The Dyestuff and Pigments Industry in the RCD Countries*, a report prepared for Ministry of Economics, Government of Iran by Chemical Consultants (Pakistan) Ltd.; 1966.

A. Economics of producing direct, acid and sulphur dyes

(Annual production capacity of the plant: direct dyes, 750 tons; acid dyes, 400 tons and sulphur black, 600 tons).

	Local	*Foreign*	*Total*
I. Capital cost (in US dollars)	1,334,000	2,615,000	3,949.000

II. Cost of manufacture of individual acid, direct and sulphur dyes (in US dollars)

Type and colour of dye	*Production (tons/yr)*	*Cost of manufacture per ton*		*Total*
		Raw material	*Fixed charges and utility cost*	
(a)	(b)	(c)	(d)	(e)
1. Acid fast red	200	818	587	1,405
2. Acid chrome green	45	1365	587	1,952
3. Acid dye nigrosine black	30	570	587	1,157
4. Acid black	30	570	587	1,157
5. Acid dye yellow	30	552	587	1,139
6. Acid dye bluish black (navy blue)	30	437	587	1,024
7. Acid dye orange	25	512	587	1,099
8. Acid amaranth	10	1,141	587	1,727
9. Color sulphur black	600	516	587	1,079
10. Congo red	250	984	587	1,570
11. Direct dye black	250	415	587	1,002
12. Direct dye yellow	14	968	587	1,555
13. Direct dye yellow	5	706	587	1,293
14. Direct dye orange	3	792	587	1,378
15. Direct dye orange	3	925	587	1,511
16. Direct dye orange	3	680	587	1,267
17. Direct dye red	18	696	587	1,283
18. Direct dye red	14	1,479	587	2,066
19. Direct dye violet	3	681	587	1,267
20. Direct dye violet	6	1,357	587	1,944
21. Direct dye blue	30	579	587	1,166
22. Direct dye blue	30	1,252	587	1,839
23. Direct dye blue	20	409	587	996
24. Direct dye blue	10	872	587	1,458
25. Direct dye green	26	615	587	1,202
26. Direct dye green	9	558	587	1,145
27. Direct dye brown	8	1,270	587	1,857
28. Direct dye brown	42	913	587	1,500
29. Direct dye brown	6	620	587	1,207

III. Calculations on the profitability of the project

	Name of dyestuff	*Quantity to be produced (tons)*	*Cost of production (US$/kg)*	*Total cost of production (US$)*	*Sale price (US$/kg)*	*Total sale proceeds (US$)*
1.	Acid fast red W3B	200	1.40	280,000	1.80	366,000
2.	Acid chrome green G	45	1.95	87,750	3.88	174,600
3.	Acid dye nigrosine black	30	1.16	34,800	1.51	45,300
4.	Acid dye black 10B	30	1.16	34,800	1.51	45,300
5.	Acid dye yellow 19, 140	30	1.14	34,200	4.34	130,200
6.	Acid dye navy blue 20,470	30	1.02	30,600	1.81	54,300
7.	Acid dye orange, 15,510	25	1.10	27,500	1.51	37,750
8.	Acid dye amaranth	10	1.73	17,300	3.94	39,400
9.	Colour sulphur black	600	1.08	648,000	0.98	588,000
10.	Colour Congo Red	250	1.57	3,892,500	1.81	452,000
11.	Direct dye black	250	1.00	250,000	1.51	377,500
12.	Direct dye yellow 24,895	14	1.50	21,000	2.31	29,820
13.	Direct dye yellow 10,555	5	1.29	6,450	2.71	13,550
14.	Direct dye orange 22,375	3	1.38	4,140	1.90	5.700
15.	Direct dye orange 22,130	3	1.51	4,530	2.41	7,230
16.	Direct dye orange 40,215	3	1.27	3,810	2.25	6,750
17.	Direct dye red 29,100	18	1.28	23,040	2.41	43,380
18.	Direct dye red 29,185	14	2.07	28,980	3.11	43,540
19.	Direct dye violet 22,480	3	1.27	3,810	3.62	10,860
20.	Direct dye violet 27,905	6	1.94	11,640	3.72	22,320
21.	Direct dye blue black 22,590	30	1.17	35,100	1.53	45,900
22.	Direct dye blue 24,410	30	1.84	55,200	2.24	67,200
23.	Direct dye blue 22,610	20	1.00	20,000	1.77	35,400
24.	Direct dye blue 24,175	10	1.46	14,600	2.36	23,600
25.	Direct dye green 30,280	26	1.20	31,200	2.41	62,660
26.	Direct dye green 30,295	9	1.15	10,350	1.83	16,470
27.	Direct dye brown 22,311	8	1.86	14,880	2.41	19,280
28.	Direct dye brown 35,660	42	1.50	63,000	2.08	87,360
29.	Direct dye brown 30,145	6	1.21	7,260	3.14	18,840
	Total:	1,750				

	Total sales	US$ 2,870,710
—	Total cost of production	2,196,440
		674,270
—	Sales expenses 2%	57,420
	Profit before taxes	US$ 616,850

From the foregoing, profit before taxes is US$616,850. Assuming that there will be a tax holiday of five years for this project, the net profit will also be US$616,850. Thus **pay-out time** will be:

$$\frac{\text{US\$3,803,580}}{\text{US\$616,850} + \text{US\$320,598}}$$

$$= \frac{\text{US\$3,803,580}}{937,448}$$

= about 4.2 years.

B. **Economics of producing naphthol dyes**

(Production capacity of the plant: 1,200 tons per year).

	Local	*Foreign*	*Total*
I. Capital cost (in US dollars)	1,155,000	2,068,000	3,223,000

II. Cost of manufacture of individual dyes (in US dollars)

Type and colour of dye	*Production (tons/yr)*	*Cost of manufacture per ton*		*Total*
		Raw material	*Fixed charges and utility costs*	
(a)	(b)	(c)	(d)	(e)
1. Naphthol AS	400	1,106	674	1,780
2. Naphthol AS-BS	100	925	674	1,599
3. Fast red KB base	500	3,248	674	3,922
4. Naphthol D	50	2,667	674	3,341
5. Naphthol SW	50	3,632	674	4,306
6. Fast yellow base	50	358	674	1,032
7. Fast scarlet base	50	1,994	674	2,668

III. Calculations on the profitability of the project

Type and colour of dyes	*Quantity (tons)*	*Cost of production (US$/kg)*	*Total cost of production (US$)*	*Sale price (US$/kg)*	*Total sale proceeds (US$)*
1. Naphthol AS	400	1.78	712,000	1.94	776,000
2. Naphthol AS-BS	100	1.60	160,000	3.08	308,000
3. Fast red KB	500	3.92	1,960,000	4.93	2,465,000
4. Naphthol D	50	3.34	167,000	1.44	222,000
5. Naphthol SW	50	4.31	215,500	3.70	185,000
6. Fast yellow base GC	50	1.03	51,500	2.45	122,500
7. Fast scarlet RC base	50	2.67	133,500	2.50	125,000
Total:	1,200				

Total sales:	US$ 4,203,500
— Total cost of production:	3,399,500
	804,000
— Sales expenses 2%	84,000
Profit before taxes	US$ 720,000

Assuming that there will be a tax holiday for this project, the net profit will be US$720,000. The **pay-out time** will be:

$$\frac{\text{US\$3,012,610}}{\text{US\$720,000 + US\$261,000}}$$

$$= \frac{\text{US\$3,012,610}}{961,000}$$

= about 3.4 years.

C. **Economics of producing pigment dyes**

(Production capacity of the plant: 1,000 tons/yr)

		Local	*Foreign*	*Total*
I.	Capital cost (in US dollars)	1,223,000	1,305,000	2,528,000

II. Cost of manufacture for individual dyes (in US dollars):

	Type and colour of dye	*Production (tons/yr)*	*Cost of manufacture per ton*		*Total*
			Raw material	*Fixed charges and utility costs*	
	(a)	(b)	(c)	(d)	(e)
1.	Pigment yellow G	100	2,411	626	3,037
2.	Pigment yellow 10G	100	3,263	626	3,889
3.	Pigment yellow GR	80	3,114	626	3,740
4.	Pigment yellow 3R	80	3,688	626	4,314
5.	Pigment orange G	80	4,751	626	5,377
6.	Pigment red F2R	160	2,029	626	2,655
7.	Pigment scarlet R	80	2,322	626	2,948
8.	Pigment bordeaux F2R	80	3,339	626	3,965
9.	Pigment green G	80	1,056	626	1,642
10.	Pigment red B	160	1,201	626	1,827

III. Calculations on the profitability of the project

	Type and colour of dye	*Quantity (tons)*	*Cost of production (US$/kg)*	*Total cost of production (US$)*	*Sale price (US$/kg)*	*Total sale proceeds (US$)*
1.	Colour pigment yellow G	100	3.03	303,000	3.02	302,000
2.	Colour pigment yellow 10G	100	3.89	389,000	2.70	270,000
3.	Colour pigment yellow GR	80	3.74	299,200	3.02	241,600
4.	Colour pigment yellow 3R	80	4.31	344,800	5.00	400,000
5.	Colour pigment orange G	80	5.38	430,400	5.52	441,600
6.	Colour pigment red F2R	160	2.66	425,600	3.06	489,600
7.	Colour pigment scarlet R	80	2.95	236,000	2.80	208,000
8.	Colour pigment bordeaux F2R ..	80	3.96	316,800	7.40	592,000
9.	Colour pigment green G	80	1.64	131,200	2.50	200,000
10.	Colour pigment red B	160	1.83	292,800	2.64	422,400
	Total:	1,000		3,168,800		3,567,200

	Total sales	US$ 3,567,200
—	Total cost of production:	3,168,800
		398,400
—	Sales expenses 2%	71,400
	Profit before taxes	US$ 327,000

It may be assumed that net profit for this project will be US$327,000, as it is expected that it will enjoy a tax holiday of five years. The **pay-out time** will be:

$$= \frac{\text{US\$2,277,800}}{\text{US\$327,000 + US\$168,805}}$$

$$= \frac{\text{US\$2,277,800}}{\text{US\$ 495,805}}$$

= about 4.5 years.

D. **Economics of producing optical bleaches**

(Production capacity of the plant: 250 tons/yr)

	Local	*Foreign*	*Total*
I. Capital cost (in US dollars)	401,000	248,000	649,000

II. Cost of manufacture (in US dollars)

Type of dye	*Production (tons/yr)*	*Cost of manufacture per ton*		*Total*
		Raw material	*Fixed charges and utility costs*	
(a)	(b)	(c)	(d)	(e)
1. 2BC extra	100	7,484	791	8,275
2. BGC extra	75	6,485	791	7,276
3. 2SP extra	75	3,539	791	4,330

III. Calculations on the profitability of the project

Name of product	*Quantity (tons)*	*Cost of production (US$/kg)*	*Total cost of production (US$)*	*Sale price (US$/kg)*	*Sales values (US$)*
1. Heliofor 2BC	100	8.28	828,000	9.00	900,000
2. Heliofor BGC	75	7.28	546,000	9.00	675,000
3. Heliofor ZSP	75	4.33	324,750	4.50	337,500
Total:	250		1,698,750		1,912,500

Total sales	US$ 1,912,500
— Total cost of production	1,698,750
	213,750
— Sales expenses 2%	38,250
Profit before taxes	US$ 175,500

Assuming that US$175,500 is the net profit, then the **pay-out time** will be:

$$= \frac{\text{US\$543,700}}{\text{US\$175,500} + \text{US\$46,000}}$$

$$= \frac{\text{US\$543,700}}{\text{US\$221,500}}$$

= about 2.5 years.

Planning for dyestuffs production in the developing ECAFE countries

The development of a dyestuff comprises three stages: (a) the manufacture of dyes from imported intermediates, (b) the production of intermediates and (c) the production of basic organic chemicals needed for the manufacture of intermediates.

With the exception of India, where the production of organic chemicals has reached a reasonable level, no developing country in the region is in a position to consider the production of intermediates for a dyestuff industry. Therefore, the most logical thing to do would be to consider the possibility of producting dyes from imported intermediates.

The foregoing illustration of the preliminary economics of four projects show that the production of dyestuffs from imported intermediates could be profitable. Furthermore, a substantial annual saving in foreign exchange would result: US$1.7 million for project (A), US$1.6 million for project (B), US$1 million for project (C) and US$0.4 million for project (D).

These savings are quite considerable in relation to the foreign exchange component of the projects' capital cost, or to total sales, as may be seen from the following figures (in million US dollars):

Project	*Capital cost in foreign exchange*	*Total sales*	*Foreign exchange savings*
A	2.6	2.9	1.7
B	2.1	4.2	1.6
C	1.3	3.6	1.0
D	0.25	1.9	0.4

Further benefits to be derived from the establishment of these plants would be additional employment, acquisition of know-how and skill at the national level and, if the countries came together and were willing to plan for the manufacture of certain lines of products under specialization agreements to improve the economics of production, there would be an expansion in intra-regional trade in manufactured products.

According to the preliminary economics of production indicated earlier and the data on imports in table 1, it would appear that the developing ECAFE countries fall into three categories: (a) countries which might start producing dyestuffs economically by themselves; (b) countries which might start economic production of dyestuffs if their markets were to be combined and (c) countries whose domestic markets are too small to make such production feasible.

Hong Kong, with its annual market of about 3,500 tons, may be said to belong to category (a); China (Taiwan) and the Republic of Korea with their combined annual import of about 2,400 tons, the Philippines, Indonesia and Thailand (4,900 tons) and Iran and Pakistan (about 4,000 tons) belong to category (b); and the remaining countries — again with the exception of India — fall into category (c).

There is a *prima facie* case for economic production of dyestuffs in the countries mentioned above. Surveys and studies could be undertaken, with the cooperation of the countries concerned and with the assistance of interested Governments and international organizations, for the purposes of:

(a) ascertaining the present consumption of dyestuffs, by type and colour; and assessing the future demand for dyes, by type and colour, in each group of countries;

(b) suggesting a development programme for the dyestuff industry in each group of countries, to be based upon (a). This programme should consist of projects to be located in different countries in each group. Each project should specify the quantities of specific types and colours of dyestuff to be produced annually either for a national market or for the combined market of each group, the basic consideration being to achieve maximum benefits to the countries concerned through the specialization of lines of production;

(c) preparing detailed feasibility reports on those projects for which at least agreement in principle has been reached between the countries concerned regarding their location and production programmes.

Annex

INTERMEDIATES AND OTHER CHEMICALS USED IN THE MANUFACTURE OF DYESTUFFS

Project A: Manufacture of Direct, Acid and Sulphur Dyes

1. O-Toluidine
2. H-acid
3. Acetic acid anhydride
4. Sodium nitrate
5. Hydrochloric acid
6. Soda ash
7. Sodium sulphate
8. Sodium chloride
9. O-nitro-amino-phenol
10. Sodium nitrate
11. Butyl alcohol
12. Aniline
13. Ferrous chloride
14. Nitrobenzene
15. Sulphuric acid
16. Sodium bicarbonate
17. Sodium hydroxide
18. P. nitroaniline
19. Ammonia
20. Sulfanilic acid
21. 3-carboxyl 1-(4-sulfopheny)-5 pyrazolone
22. 1-amino-8-hydroxynaphtalene-3-6 disulphonic acid
23. Beta-naphtol
24. Naphtionic acid
25. R-salt
26. Dinitrochlorobenzene
27. Sulphur
28. Sodium sulphide
29. Benzidine base
30. 1-aminonaphtalene-4-sulphonic acid
31. 1-3-diamine benzene
32. 4, 4-diamino Stibene-2, 2^1-disulphonic acid
33. Phenol
34. Ethyl chloride
35. Dihydrothio toluidine mono-sulphonic acid
36. Salicylic acid
37. Chloridesodium hydroxide
38. O-Cresolinic acid
39. 2-hydroxynaphtalene 6-sulphonic acid
40. 1-hydroxynaphtalene 4-sulphonic acid
41. P-amino azobenzene sulphonic acid
42. $4\text{-}4^1$ dinitrostilbene 2^1-disulphonic acid
43. Glycerine
44. Di-J-acid
45. J-acid urea
46. 2-amino-1-methoxyberzene
47. P-toluidine base
48. Sodium acetate
49. 1-hydroxynaphtalene 3, 6-disulphonic acid
50. Cresidine
51. M-xylidine-o sulphonic acid
52. Phenyo-J-acid
53. 2-amino-8-hydroxynaphtalene-3, 6-disulphonic acid
54. 1-amino-8-hydroxynaphtalene, 4-disulphonic acid
55. Dianisidine
56. 2-amino-5 oxynaphtalene-7-sulphonic acid
57. O-cresol
58. 2-amino-8-hydroxynaphtalene-6-sulphonic acid
59. 1-amino naphtalene-4-sulphonic acid
60. 2-amino-8-hydroxynaphtalene-3, 6-disulphonic acid
61. 2-amino-1-hydroxynaphtalene-4-sulphonic acid
62. Resorcin
63. Copper sulphate
64. Sodium metaphosphate

Project B: Manufacture of Naphthol Dyes

1. 2-hydroxy-3-naphthoic acid
2. Aniline
3. Phosphorous trichloride
4. Iolune
5. 3-hydroxy-3-naphthoic acid
6. 3-nitroaniline
7. P-toluidine
8. Sodium nitrite
9. Cupric sulphate
10. Sodium chloride
11. Hydrochloric acid
12. Soda ash
13. Sulphuric acid monohydrate
14. Nitrosa (88% HNO_3)
15. Iron filings
16. Zinc dust
17. Active carbon
18. Betaoxynaphthoic acid
19. O-toluidine
20. Xylene
21. Beta-naphthylamine
22. O-nitrochlorobenzene
23. Formic acid
24. O-anisidine

Project C: Manufacture of Organic Pigment Dyes

1. 3-nitro-4-toluidine
2. Acetoacetanilide
3. Sodium nitrite
4. Precipitated chalk
5. Hydrochloric acid
6. Sodium hydroxide
7. 4-chloro-2-nitroaniline
8. Acetoaceto-chloroanilide
9. Acetic acid
10. Sodium acetate
11. Soda ash
12. Acetoacet-m-xylidide
13. Sodium nitrate
14. 3-nitro-4-anisidide
15. Acetoacet-p-toludide
16. Phenylome-thylopyrazolene
17. Dichlorobenzidine
18. 4-chloroaniline
19. 2, 3-hydroxynaphthoic acid anilide
20. Betanaphthol
21. 5-nitro-2-toluidine
22. 2, 3-hydroxynaphthoic acid O-toluidide
23. Ferrous sulphate
24. Bisulphite
25. 4-nitroaniline

Project D: Manufacture of Optical Bleaches

1. Cyanuric chloride
2. Diaminostilbenodisulphonic acid
3. Soda ash
4. Caustic soda
5. Ammonia
6. Sulphuric acid
7. Sodium chloride
8. Active carbon
9. Aniline
10. Urea
11. Sodium sulphate anhydrous

INDUSTRIES BASED ON DETRITAL HEAVY MINERALS

A growing interest in the resources of detrital heavy minerals in certain countries of the region has been stimulated as a result of projects promoted by CCOP. The Government of Australia provided the expert services of Mr. L. C. Noakes of the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development of Australia, who made the first preliminary investigations of heavy mineral prospects in China (Taiwan), the Republic of Korea, the Philippines and Thailand, in 1967, and reported that an inquiry into the possibilities of development of such resources appeared, *prima facie,* worth while. Accordingly, the Government of Australia provided the expert services of Mr. E. H. MacDonald, mining and treatment engineer (detrital heavy minerals), who visited the four countries mentioned between March and May 1969. Mr. MacDonald also visited Indonesia and Malaysia, at the request of their Governments, and went on to Japan and the Philippines to gather additional data and to study aspects of the current situation regarding detrital heavy minerals in those two countries. Mr. MacDonald's reports on each country he visited and his recommendations for the further investigation and development of their respective resources of detrital heavy minerals are summarized below.

China (Taiwan)

An estimated 10 million tons of beach sands, believed to contain 500,000 tons of magnetite, is reported in the northern beaches. In addition, about 34 million tons of sands containing 500,000 tons of monazite, zircon, ilmenite and rutile is estimated to occur in some of the off-shore sand bars of west-central Taiwan.

Current mining operations consist mainly of manual separation methods for the recovery of the heavy minerals from northern beaches, mainly in areas where the sands contain about 15 per cent or more of the heavy minerals. Further investigation would be necessary to establish more substantial reserves of these and lower-grade deposits which might be mined economically by mechanical methods.

Republic of Korea

The valuable minerals in the beach placers are predominantly magnetite and ilmenite in the north, and monazite and zircon in the central west coast. Fluvial placers may contain significant quantities of gold and monazite. The higher-grade deposits in five localities aggregated about 2.9 million cubic metres, containing about 2.14 per cent of heavy minerals, mainly ilmenite (48.6 per cent), zircon (37.2 per cent), monazite (9.1 per cent) and magnetite (2.9 per cent). Another deposit on the east coast (Hwajinpo) has probable reserves of 1.36 million tons, containing 264,000 tons of heavy minerals, and possible reserves of 4.13 million tons, containing 938,000 tons of heavy minerals, mainly ilmenite, garnet, monazite and zircon; ore-dressing tests show that a salable ilmenite concentrate, with a good FeO/Fe_2O_3 ratios can be extracted. The beneficiation of the zircon, magnetite and monazite content has not yet been worked out successfully.

A Japanese company has shown interest in the beach sand deposits in the islands of Jumondo and Achado near the western coastline; these are roughly estimated to contain 2.68 million tons of probable reserves (with 133,000 tons of ilmenite) and 16.32 million metric tons of possible and probable reserves (with 600,000 tons of ilmenite), respectively. Assay of the ilmenite concentrate indicates 47.18 per cent of TiO_2 and 46.84 per cent of FeO. It was considered that small-scale mining operations would probably be justified for the beach placer deposits, but the estimates of tonnage and grade could be subject to considerable modification because of the methods used for sampling and the small number of samples taken. Determination of the mineral assemblages, experimental dressing tests, and studies of the economics of mining and treating the higher-grade deposits were recommended by the expert.

Extensive monazite placer deposits, containing zircon and ilmenite also, are present in the Ichon District, but more reconnaissance holes, drilling and sampling would be required for evaluation of their economic potential.

Philippines

Magnetite sands are currently being exploited in the northwestern and southeastern coasts of Luzon island. The magnetite concentrates have a good market in Japan because of their relatively low titanium content (4-6 per cent TiO_2) and iron content of 60 per cent, which makes them suitable for blending with the high-titanium magnetite sands produced in Japan. Three mining companies are currently producing magnetite sands in the Philippines to fulfil total annual production commitments of 600,000 tons, mostly for iron and steel works in Japan. The cement industry in the Philippines is using some iron sands as an additive to correct the chemical composition of the cement produced.

Filmag (Phil.) Inc., the largest producer of magnetite concentrate in the Philippines, is studying the feasibility of utilizing iron sand for the production of sponge iron or pre-reduced iron ore. The sponge iron or pre-reduced iron ore could be a substitute for the expensive scrap iron presently being imported. Filmag (Phil.) Inc. is reported to have reserves containing 38 million tons of magnetite.

Beach sands along the northwestern coast of Palawan Island (south-western Philippines) have been reported to contain significant amounts of allanite and monazite, as well as ilmenite, zircon and rutile in small amounts; these deposits have not yet been evaluated, and further investigation is justified.

West Malaysia

It was considered that the western coast appeared to have a greater potential for detrital heavy mineral deposits because of the more intensive mineralization of the source rocks in that area. Along the east coast, small quantities of rutile, zircon, monazite and ilmenite occur in beach sands, but no economic concentrations have yet been proved.

On the west coast, concentrations of heavy minerals, including cassiterite, ilmenite, zircon, monazite and xenotime occur in beach sands in the Sumut District of Perak State; its proximity to the tin-rich Kinta Valley makes it a very attractive target for prospecting. While cassiterite (for tin) is the main mineral of interest, the other minerals could be of significance in providing additional income to the operator. The recovery and beneficiation of the by-product minerals is, therefore, a very important consideration in the exploitation of the reserves.

Apart from the tin mines currently operating in Malaysia, a small industry has been developed for treating the residues from tin-dressing operations and recovering concentrates of cassiterite, ilmenite, zircon, monazite and xenotime. There are a number of small separation plants which treat concentrates from small mines in various parts of Malaysia, but each plant produces only a small amount of refined concentrates. The concentrates produced from the various plants are not of standard grade, and are sold in small lots which only command low prices. The production suffers from lack of continuity and uniformity of supply and from a low standard of purity. The products usually do not fit the specifications of the users of the concentrates, resulting in the low prices offered for them; these difficulties could be overcome by establishing a central refining plant which would finally process, blend and market the refined concentrates produced from the processing of the rough concentrates of the smaller plants. The setting up of such a central plant should, however, be preceded by a careful examination of reserves, quantitatively as well as qualitatively, in order to determine the appropriate capacity and the set of standards which should be adhered to. It would also involve determination of the final treatment processes, estimation of plant and establishment costs, estimated production costs, market survey and economic assessments. The utilization of certain of the detrital heavy minerals for establishing chemical-process industries within Malaysia might also be studied.

Indonesia

The better-known detrital heavy mineral deposits in Indonesia are the titaniferous iron sands along the southern coasts of Java and Bali, and the minerals associated with tin in the islands of Banka, Belitung and Singkep.

The total proved reserves in Java are 12.7 million tons and possible reserves are about 68 million tons. In Bali, possible reserves amounting to 1.5 million tons are known, with grades ranging from 24 per cent to 70 per cent of magnetic minerals.

More investigation is needed to evaluate the economic potential of the deposits in Java and Bali, and the following steps were recommended: (a) check sample the areas indicated as "proved" reserves; (b) conduct geologic mapping, test drilling and sampling of deposits at present classed as "possible" reserves and investigation of associated older dune systems; (c) make mineralogical and chemical analyses of the various deposits; (d) test the suitability of the material for treatment by one of the new processes for smelting titaniferous iron sands (pilot testing); and (e) conduct a feasibility study on the basis of the results obtained. The feasibility study would require a co-ordinated effort from specialists in the fields of beach-mining and mineral-processing, steelmaking, marketing and economics.

The lighter heavy minerals associated with the tin minerals at Banka, Belitung and Singkep islands include monazite, xenotime, zircon, rutile, columbite and ilmenite. Monazite and xenotime appear to be the more important by-product minerals and ilmenite is sometimes found in significant amounts, but further investigation is required to determine their potential. As a first step, all available reports and data should be re-studied and correlated.

Thailand

A number of large low-grade tin placers occur along the beaches of southwestern Thailand and Phuket Island; some of the smaller deposits may prove suitable for a mobile plant operation. Varying proportions of zircon, rutile and ilmenite occur with the cassiterite, but their probable net value is not large, although the niobium-tantalum content may be important.

Tests conducted to compare the panning method and the heavy-liquid separation method for the analysis of samples indicated that the former method could result in considerable error and undervaluation in excess of 200 per cent; redrilling and resampling, according to standardized methods, of some deposits which appeared to be of lower than marginal grade from the results of panning was recommended.

No figures for proved reserves were available, but about 60 million m^3 of sands which appeared to have reasonable values were known in the more promising beach areas.

The following facts may be of use in deciding what steps, if any, might be taken to develop industries based on heavy detrital minerals in the region:

Developments in the past twenty-five years have produced a number of technically feasible processes for steel production from titaniferous iron sands, of varying engineering and economic merits and developed to varying scales of pilot or commercial operation. Recent progress has been so rapid that many of the more attractive techniques have not yet been proved out in full commercial-scale operations. However, commercial plants for these processes are under construction and operation of these plants in the near future will be of great interest in comparing the commercial performance of the various processes for smelting titaniferous ores. They should also help towards the development of the extensive iron-sand resources of the Asian region for commercial steel production.

The following particulars of the techniques in use in some countries may be of interest to Asian countries wishing to utilize their beach sands for the production of iron and steel as well as such products as titanium dioxide.

Titaniferous iron ore deposits of significant size, usually titano-magnetite beach sands or related deposits, may be used for iron- and steel-making after the ore has been prepared to render it suitable for use in the blast furnace. Such deposits should be easily accessible, amenable to low-cost mining and beneficiation and preferably accessible to existing or potential markets. For the export trade, the deposits should be located near deep-sea harbour facilities.

Titaniferous ores are considered as complex ores. The main ore mineral is magnetite (Fe_3O_4), with titanium present either as ilmenite ($FeTiO_3$) or as titano-magnetite. The difficulty of melting such ores because of their titania contents (usually 8 per cent or higher) has so far restricted their commercial exploitation for iron and steel production. In the right proportions, however, titanium improves the mechanical properties of steel and, for certain types of steel alloy, ferro-titanium is added to the steel bath.

Acceptable iron-sand concentrates for blast-furnace use in Japan contain about 60 per cent Fe; less than 7 per cent T_1O_2; S_1O_2 not exceeding 8 per cent; Al_2O_3 not exceeding 3 per cent; P not exceeding 0.2 per cent. High-grade iron sands exported to Japan with an Fe content of about 60 per cent and low TiO_2 (less than 6 per cent) are blended with iron-sand concentrates produced from Japanese iron-sand mines.

Concentration

Magnetic separation of the low-intensity type and the wet process are generally used for recovering the highly magnetic sands in titaniferous and deposits (magnetite). Concentration can be made by a number of single and multi-stage processes if necessary. The number of stages depends on the nature of the ore and the qualities required of the concentrates.

The high-intensity separator is used to recover the weekly magnetic materials, such as hematite, siderite and iron hydroxides. The maximum iron content which it is technically possible to achieve in magnetic concentration depends not only on technical improvements or the quality of the product but also on the composition of the magnetite itself. Usually the iron content of the concentrate should be lower than the theoretical iron content of magnetite (72.4 per cent). The ores usually contain admixtures and intergrowths which cannot be removed mechanically from the ore by concentration: hence the need for a low TiO_2 content in the chemical composition of the ore. In the final stages of separation, the concentrates should preferably contain an Fe content of not less than 60 per cent; TiO_2 not over 8 per cent and P_2O_5 of less than 0.07 per cent.

Pelletization and sintering

The concentrates must be agglomerated into larger-sized particles by sintering or pelletizing. For blast-furnace use, either sintering or pelletizing would be appropriate. For electric-arc furnaces, "pellets" would be more convenient to handle.

Pelletizing comprises "ball-milling" the moist concentrates to about 40 microns, de-watering with vacuum filters and mixing with 0.5 - 1 per cent bentonite, then rolling the mixture in drums, cones or discs to form pellets of about 10 mm diameter. The green pellets may be used directly in a reduction smelting process or hardened by furnace sintering at about 1,050 °C before smelting.

Thermodynamic aspects of titaniferous iron-ore smelting

The presence of TiO_2 in the concentrates has a vital controlling effect in the smelting operations. At smelting temperatures in the range of 1,400-1,500 °C, about 96 or 97 per cent of the titanium passes into the blast-furnace slag as non-fusible titanium carbide and nitride. These are compounds of high melting point, with limited solubility in liquid iron, which can form accretions in smelting furnaces making smooth operation difficult or impossible. A slag of over 17 or 18 per cent TiO_2 will be viscous and sticky. It will cause difficulties in a smelting operation or block the slag notch.

In practice, close control of the ore-carbon ratio in the charge should in effect supply sufficient carbon to reduce the iron oxides but leave no excess to reduce titanium oxides. This implies production of iron undersaturated with carbon and slags with a relatively high FeO content.

Smelting methods

(1) Blast furnace

In Japan, iron sands with TiO_2 of about 7 per cent, sintered or in pellets, are blended with conventional ores as burden in blast furnaces. In the Soviet Union, successful use has been reported of a blast-furnace ore charge with about 25 per cent TiO_2. American practice has shown that the successful smelting of even low titania ores in the blast furnace depends largely on the mechanical flushing action of slag and metal to remove titanium carbide and nitride accumulations during tapping.

(2) Electric pig-iron smelting

Electric pig-iron smelting, developed by Elkem of Norway, opened up the commercial possibility of controlling the smelting of titaniferous ores. The carbon charge in these furnaces can be controlled independently of the electrical heat input so that selective reduction can be applied to suppress the formation of titanium carbide and to lower Ti_2O_3 oxides. Several commercial plants have been established which use iron-sand concentrates with TiO_2 contents up to 12 per cent, with coke breeze, limestone and quartz as burden charge. Fixed carbon consumption in furnace coke is about 0.32 t/THM. Power consumption has been reduced from 2,300 kWh/ton to about 1,000-1,800 kWh/THM by the pre-reduction of the concentrate in rotary kilns.

The ore is pre-reduced in the furnace charge, thus lowering the electric power requirements for providing the sensible and potential heat to complete the smelting operations in the electric pig-iron furnace. This type of operation eliminates the need for an iron-sand pelletizing plant but still requires coke production for the furnace operation, and the kiln, if anthracite or low-volatile coal is not available. The hot-metal product can be converted into steel by conventional steel-making processes. Much of this pig-iron is used for high-quality steel.

There are now a number of types of kiln and process for pre-reducing lumpy ores, pellets or concentrates (partially) in the furnace charge. Some of the commercial types are: SL (Stelco Lurgi); RN; Elkem and Yawata.

(3) Electric-arc furnace (60/40 sponge-scrap heats)

The SL process is used in the New Zealand steel plant, utilizing Waikato high-volatile coals as fuel. Sponge-iron pellets produced from titano-magnetite concentrates are directly charged to electric-arc furnaces, thus avoiding the costs of intermediate pig-iron smelting operation. The sponge-iron pellets contain approximately 72 per cent metallic iron; 0.2 per cent carbon, 0.02 per cent S, 0.02 per cent P and 20 per cent gangue consisting of: TiO_2 — 11 per cent, Al_2O_3 — 5 per cent, MgO — 2 per cent, SiO_2 — 1 per cent and V_2O_5 — 0.5 per cent. The high gangue content gives a comparatively high slag volume and high TiO_2, Al_2O_3 and MgO contents require considerable FeO left in the slag to control fluidity and slag flushing. Power consumption is about 800 kWh/ton of steel in 60/40 sponge-scrap heats. Kiln operation consumes about 0.4 ton of fixed carbon per ton of Fe in the sponge. A similar plant has also been erected in the Republic of Korea. Anthracite coal is used in the SL kiln.

For developing countries, the utilization of iron sand for steel production will require, basically: a mining/concentrating/sintering or pelletizing plant, or both, a kiln plant, electric-arc furnaces and rolling-mill facilities. The concept offers attractive conservation of capital equipment. With favourable location of raw materials and market, the economical production of steel may be possible on a small initial scale, ranging from 200,000 to 300,000 metric tons of finished products annually.

The typical composition of the pig-iron/hot metals produced in these processes is given below (in percentages):

C	— 1 - 4	Ti	— 0 - 0.3
Si	— 0 - 0.3	P	— 0.05 - 0.2
S	— 0.07 - less than 0.05		

There are indications that significant reserves of titaniferous magnetite sands exist in certain countries of the region. Indonesia has a proved reserve of 12.7 million tons and possible reserves of about 70 million tons, with the prospect of finding other reserves along its extensive coastline. The Philippines has 38 million tons proved in Luzon island alone, with prospects of finding more in other islands. China (Taiwan) has possible reserves of 10 million tons. The utilization of these resources for the optimum benefit of the countries concerned deserves consideration.

The Philippines is now producing 400,000-500,000 tons of magnetite sand concentrates annually, for export, and a private company has a plan to produce sponge iron or pre-reduced iron ore which would serve as a substitute for the high-cost imported scrap iron. In Indonesia, it might be possible to establish a steel industry based on magnetite sands, on a scale similar to that which is being established in New Zealand.

Before any one country or a group of countries could seriously embark on any of the processes outlined above, various preliminary arrangements would have to be made. The recommendations made by Mr. Noakes and Mr. MacDonald are as follows:

(1) In regard to the magnetite sand deposits already being mined in the Philippines, the efficiency of mining operations could be improved by proper choice of equipment and adoption of the most suitable method of mining; exploration of the deposits should be extended and intensified to prove sufficient positive reserves to justify larger-scale mining operations, especially in those areas where preliminary assessment has indicated sizable deposits.

(2) In Indonesia, for deposits with sufficient "proved" or "positive" reserves, final evaluation should be undertaken, including pilot testing and feasibility studies for establishing a commercial-scale iron and steel industry.

(3) Of immediate concern in West Malaysia, Indonesia and Thailand is the processing of the waste or residue from tin-dressing operations. The feasibility of establishing a central refining plant in Malaysia, to up-grade the rough concentrates now being produced from the many small plants in order to meet the specifications required by buyers and thus obtain much higher prices for them, should be studied. The feasibility of establishing chemical-process industries based on certain of the minerals recovered as concentrates should then be considered. These recommendations would apply to the other tin-producing countries if the quantity and mineral contents of the rejects from their tin-mining operations justified the setting up of central refining plants.

(4) Co-operation and collaboration in co-ordinating the exploration projects of the countries concerned is recommended so that they might share the expert services of a team of advisers and a pool of exploration equipment. The team might consist of a geologist, a mining engineer, a mineral processing expert and, perhaps, a mineral economist, all with background and experience in the field of heavy minerals. The exploration cost of each country might thus be considerably reduced and the results of exploration work would have greater reliability.

(5)Also recommended is the forming of a joint study group, consisting of experts from the participating tin-producing countries as well as processing and marketing experts, to conduct a feasibility study for the setting up of one or more separation and refining plants which would treat or process the waste or residues discarded in tin-dressing plants, as well as rough concentrates produced by smaller plants, in order to produce refined concentrates of ilmenite, rutile, monazite, and other minerals which would conform to the specifications of buyers and thus command much higher prices than those received for the rough concentrates. The group would study the quantities and composition of the raw materials available and those being produced by the tin-ore producing mines and dredges, determine the capacities and decide on suitable locations for central processing plants, and examine the economics of the various schemes that might be set up. The exploitation of the mineral by-products of tin mining would certainly increase the economic yield of the industry.

(6) A study group might also be formed, subsequently, to consider the feasibility of establishing smelting plants to produce pig-iron on the basis of magnetite sand concentrates. Since high-quality steel may be produced from pig-iron, a better market might be developed. Alternatively, the production of sponge iron or pore-reduced iron ore might be considered.

(7) The study group might consist of experts from the countries participating and consultants from developed countries, such as Japan and the Federal Republic of Germany. Visits of the country experts to smelters and other facilities using magnetite sands might be of benefit. The study might be integrated with consideration of the iron and steel industries which have already been proposed and might also be brought to the notice of the proposed Southeast Asia Iron and Steel Institute.

(8) If separation and refining of the individual minerals from rough concentrates in central separation and refining plants is successful, consideration could be given to the feasibility of establishing chemical-process industries. This has been suggested for Malaysia, but might be equally applicable in the other tin-producing countries. A company in India is reported to be producing monazite concentrate and also making rare-earth chloride and fluoride in its monazite-processing plant at Alwaye, Kerala State. In Japan, several companies are producing rare-earth metals and oxides, probably from monazite and zircon concentrates. Australia, Malaysia and India are significant producers of monazite concentrates and Ceylon, Indonesia and the Republic of Korea produce small amounts. Concentrates of other heavy minerals are, possibly, being produced. On the basis of their production of concentrates, the developing countries might

wish to consider establishing chemical-process industries. The consideration of this possibility should be an item for study by the joint study group for establishing central separation and refining plants for detrital heavy minerals.

(9) There is a need for more personnel trained in the various aspects of the exploration of beach sand and fluvial deposits. Skilled workers for reconnaissance and exploration drilling and sampling, and technicians experienced in the mineralogical and chemical analysis of samples, are in short supply. Personnel specially trained for these purposes are necessary if reliable data on reserves are to be obtained. When sufficient reserves have been proved, specialists in the beneficiation and separation of the minerals into refined concentrates are required. Geologists, mineralogists, mining engineers and metallurgists need to be trained for the special methods and techniques related to the detrital heavy minerals in order to guide the technical work of exploring, developing and exploiting these mineral resources.

(10) On-the-job training of young geologists, mineralogists, mining engineers and metallurgists, in countries where actual operations are going on, would provide the experience required. This is one area in which the joint efforts of the countries concerned might facilitate the availability of the manpower for the development of their detrital mineral resources.

THE PLYWOOD INDUSTRY[1]

Production

In the early 1950s, the region's plywood industry was still in its infant stage. Between 1950 and 1960, production soared from 200,000 m^3 to about 2 million m^3, an increase of 900 per cent. This spectacular breakthrough made the region the third largest producer of plywood after North America and Europe.

In 1965, with a production of 3.9 million m^3 which was equivalent to more than 16 per cent of the world's total plywood production, the region had overtaken even Europe and now ranked second, next to North America. This position remained unchanged the following year, when Asia's production rose to 4.76 million m^3, a 20 per cent increase over the previous year. Whilst North America's share dropped from 60 per cent in 1965 to 58 per cent in 1966, it is encouraging to note that, in contrast, Asia's contribution to world output again showed a considerable increase, from 16 to almost 19 per cent.

Table 2 lists the region's most important producing countries.

[1] *Sources:* 1. FAO, *Yearbooks of Forest Products Statistics.*
2. FAO, *Report of the International Consultation on Plywood and other Wood-based Panel Products,* Rome 1963.

Table 1. PRODUCTION OF PLYWOOD, BY REGION

(Q = quantity in thousand cubic metres)

Region	1950		1955		1960		1965		1966	
	Q	%	Q	%	Q	%	Q	%	Q	%
Asia	215	3.6	870	8.4	1,940	12.4	3,946	16.2	4,763	18.8
Pacific area	80	1.4	112	1.1	152	1.0	142	0.6	127	0.5
Europe	1,377	23	1,941	18.7	2,586	16.5	3,327	13.7	3,320	13.2
North America	3,488	58.3	6,072	58.5	9,138	58.4	14,510	59.7	14,611	57.7
Other regions	828	13.7	1,371	13.3	1,930	11.7	2,384	9.8	2,495	9.8
World total	5,988	100	10,367	100	15,646	100	24,309	100	25,316	100

Table 2. PRODUCTION OF PLYWOOD, BY COUNTRY

(Thousand cubic metres)

Country	1950	1955	1960	1963	1964	1965	1966
Japan	149	683	1,286	2,073	2,453	2,627	3,101
Philippines	5	40	287	354	208	270	319
Republic of Korea	2	11	29	53	216	317	353
China (Taiwan)	6	21	97	160	240	250	312
India	31	55	71	93	97	97	99
Others	22	60	170	235	316	385	579
Asia total	215	870	1,940	2,968	3,530	3,946	4,763

It will be seen that Japan is by far the most important producer. Together with the Philippines, it accounted in 1963 for 81 per cent of the region's total production.

There have been major developments in the industry since 1963, mainly in the Republic of Korea and in China (Taiwan). They had a great impact on Japan's share in the region's total plywood production which dropped from 70 per cent in 1963 to 65 per cent in 1966 despite a notable increase in the country's own domestic production. The Republic of Korea, the Philippines and China (Taiwan), in that order, followed Japan with 7.4 per cent, 6.6 per cent and 6.5 per cent respectively while the remaining 14.5 per cent was shared between India and the other minor producing countries.

Exports

A little more than 20 per cent of Asia's plywood production entered world trade in 1966 while exports amounted to only about 17,000 m^3 in 1950, by 1963 they had increased fiftyfold, to 855,000 m^3.

The region has made very rapid strides not only in production, but also in its contribution to world trade of plywood. In 1950, its share in world trade was insignificant. But the 42 per cent contribution achieved in 1963 transformed Asia into the largest plywood exporting region, surpassing even Europe which until then had always been the leading exporter.

North America's 12-13 per cent share shows that, owing to an ever-increasing domestic demand, the world's largest producer releases only a very small portion of its output onto the international market. Most of Asia's exports go to the United States and Canada where more than 60 per cent of the world's production is consumed.

In contrast with the rapid achievements in world trade there is very little trading in plywood among the countries of the region, apart from a few special lines. In view of the policy adopted by most countries to process their veneer logs domestically, the growing competition for overseas markets and the intimate relationship between potential domestic markets and the development of the industry, a further detailed study of the markets would appear to be warranted.

Table 3. EXPORTS OF PLYWOOD, BY REGION

(Thousand cubic metres)

Region	*1950*	*1955*	*1960*	*1963*	*1964*	*1965*	*1966*
Asia	17	250	520	855	953	1,090	1,284
Pacific area	—	10	10	8	9	10	9
Europe	272	490	620	705	810	865	865
North America	35	90	125	206	315	314	365
Other regions	82	151	229	278	324	336	359
World total	406	991	1,504	2,052	2,411	2,615	2,882

Table 4. DIRECTION OF TRADE: EXPORT OF PLYWOOD

(Thousand cubic metres)

From \ *To*	*Canada*		*United States*		*Europe*		*Rest of world*	
	1965	*1966*	*1965*	*1966*	*1965*	*1966*	*1965*	*1966*
Japan	37	41	303	309	42.0	32.5	20.0	19
Republic of Korea	—	—	—	247	—	—	—	—
China (Taiwan)	—	41	—	227	—	4.0	—	—
Philippines	—	—	132	171	0.1	—	—	—
Others	30	—	367	18	13.0	11.5	7.5	10

Imports

The past very low figures for Asian plywood imports are not likely to grow rapidly; on the one hand because of an expected increase in the region's production and, on the other hand, because the domestic market for this commodity will be quite slow to develop.

The region's main importing countries are Ceylon, Hong Kong, Singapore and Australia, as table 5 illustrates.

From an average of only 305,000 m^3 per annum in the period 1950-1952, consumption in Asia rose quickly to an average of 1.46 million m^3 per annum during 1959-1961, an increase of almost 400 per cent. Asia's share in the world consumption grew in the same period from 4 per cent to more than 9 per cent.

In the following years, consumption continued to increase rapidly and, by 1963, with a share of 11 per cent, the region became the third largest consumer after North America and Europe — a position that was maintained till 1966.

Table 5. IMPORTS OF PLYWOOD, BY COUNTRY

(Thousand cubic metres)

Country	1963		1964		1965		1966	
	Q	%	Q	%	Q	%	Q	%
Ceylon	37	34	40	28	35	24	48	27
Hong Kong	19	17	27	19	32	22	38	21
Singapore	—	—	12	9	10	7	12	7
Australia	12	11	14	10	21	14	24	14
Others	42	38	47	34	45	33	57	31
Total Asia and Pacific area	110	100	140	100	143	100	179	100

Consumption

Table 6. APPARENT CONSUMPTION OF PLYWOOD

(Thousand cubic metres)

	1950-1952	1953-1955	1956-1958	1959-1961	1963	1966
Asia	305[a]	570[a]	908[a]	1,461[a]	2,280	3,629
Europe	..	..	..	..	3,498	3,705
USSR	..	..	..	..	1,446	1,635
North America	..	..	..	..	12,425	15,409
World total	6,802	9,378	12,019	15,596	19,649	24,378

[a] Average of three years.

Despite its spectacular development in plywood consumption, Asia's *per capita* figure still ranks very low; it is only a small fraction of North America's and is far below the world average. Consumption of plywood — and for that matter, consumption of forest products in general — is highly concentrated in the developed countries. In addition, the far higher population of the developing countries inevitably results in an extremely low *per capita* consumption figure. In Asia and the Pacific area, in 1965, it was almost one-hundredth of that of North America and about one-tenth of the world average. Discouraging though these figures were, they had in fact very much improved over the past ten years.

Table 7. CONSUMPTION OF PLYWOOD: PER 1,000 CAPITA

(Cubic metres)

Region or country	1955	1960	1965
Asia-Pacific	0.2	0.4	0.7
North America	34.0	48.0	69.0
Europe	4.9	6.5	8.3
USSR	5.2	5.9	6.8
Latin America	1.1	1.4	2.1
Africa	0.3	0.4	0.7
World average	3.8	5.1	7.1

Net trade

Table 8. THE REGION'S TRADE BALANCE IN PLYWOOD

(Q = quantity in thousand cubic metres
V = value in thousand US dollars)

Year	Exports		Imports		Balance	
	Q	V	Q	V	Q	V
1950	..	..	..	..	−3	
1960	520	76,000	85	10,000	+435	66,000
1963	855	112,000	97	12,000	+758	100,000
1966	1,284	173,000	150	20,000	+1,134	153,000

It is owing to the increased contributions by Japan, the Republic of Korea, the Philippines and China (Taiwan) that the net trade in plywood has grown so favourably for the region as a whole. In terms of value, an increase of about 130 per cent was achieved in the six-year period 1960-1966. Plywood having thus demonstrated its importance as a foreign-currency earner for the region, the countries endowed with abundant forest resources may be encouraged to foster its manufacture. However, for practical reasons, an adequate domestic market for plywood should be ensured before steps are taken to utilize the processing potentialities.

Much has been said and written about the size and location of plywood mills. The average output per mill in Finland and Canada is 16,500 m^3 and 20,500 m^3 per annum, respectively,[1] and in the United States almost 50,000 m^3 per annum. On the other hand, in Japan, where annually more than 300,000 m^3 of plywood is shipped to international markets, the average sized mill has a capacity of less than 6,000 m^3.

The mill need not necessarily be located near the raw material resources. Japan, despite an insufficient domestic supply of veneer logs, has a highly developed plywood industry based mainly on imported raw material from neighbouring countries.

Table 9 indicates the capital investments required for establishing plywood mills of different types and sizes:

Thus the investment required in case (A) is about US$19,000 per daily cubic metre. It is about US$27,500 for a similar plant (C) that has 25 per cent less capacity. The table also reveals that an investment of US$23,400 per daily cubic metre is needed for plants producing thinner plywoods.

[1] *Source: Plywood and other Wood-based Panels,* FAO, 1966.

Table 9. INVESTMENT REQUIREMENTS FOR PLYWOOD MILLS

Item	A	B	C
Production capacity panels/day	6,500	12,000	4,000
or m^3/day	77	54	47
Working hours/day	8	8	8
Size of the plywood (ft)	8 × 4	6 × 3	8 × 4
Thickness of the plywood (mm)	4	2.7	4
Investment (US dollars)			
1. Veneer and plywood equipment	1,130,000	1,000,000	1,043,250
2. Dust-collector system	32,000	24,000	27,780
3. Boiler	210,000	144,000	138,900
4. Trucks	7,500	7,500	10,570
5. Rack-roller and spare parts	9,500	9,500	—
6. Other equipment and water-supply equipment	85,000	80,000	—
7. City-water piping			11,110
8. Steam piping			13,900
9. Others			46,400
Total	1,474,000[a]	1,265,000[a]	1,291,910[b]

[a] FOB Japan, not included are:
land, buildings, foundation and installation work, piping and electric wirings, etc.

[b] FOB Japan, except items 7-9; not included are:
land, buildings, foundation and installation work, electric wiring.

The cost of wood represents the largest percentage of total manufacturing costs in the plywood industry. An attempt is made in table 10 to calculate the production cost of plywood in a typical Japanese mill having a capacity of 12,000 sheets of 6 ft × 3 ft × 2.7 mm/day.

Table 10. MANUFACTURING COST OF PLYWOOD IN A JAPANESE MILL

(daily capacity: 12,000 sheets of 6 ft × 3 ft × 2.7 mm)[a]

Item	Cost per sheet (US cents)	%
Wood	26.70	56.2
Glue	3.99	8.4
Labour	1.63	3.4
Electricity	0.65	1.4
Office and factory supplies	1.75	3.7
Repair and maintenance	0.30	0.6
General administration	5.06	10.7
Depreciation, interest, tax	7.40	15.6
Total manufacturing cost per sheet	47.48	100.0

[b] Waste wood is used as fuel for the boiler.

The calculation in table 11 relates to a Japanese-made plywood mill, located in a southeast Asian country.

Table 11. MANUFACTURING COST OF PLYWOOD IN SOUTHEAST ASIA, BASED ON LOCALLY AVAILABLE RAW MATERIALS

(daily capacity: 4,000 sheets of 8 ft × 4 ft × 4 mm)

Item	Cost per sheet (US cents)	%
Wood	53.0	37.0
Subsidiary materials	11.5	8.1
Labour	13.3	9.3
Electricity	9.3	6.5
Steam	5.5	3.9
Other utilities	0.6	0.4
Repair and maintenance	6.5	4.6
Overhead	18.6	13.0
Depreciation, interest	24.5	17.2
Total manufacturing cost per day	142.8	100.0

Comparing this table with table 10, it is conspicuous that the share of wood has dropped considerably from 56 to 37 per cent. It is true that wood is relatively cheaper in southeast Asian countries than in Japan, but it still constitutes the most important factor in the cost structure.

In the case of the southeast Asian mill, the unit production cost amounts to US$1.43 per sheet. Based on a unit sale price of US$1.67 per sheet, gross sales will be US$6,680 per day, indicating a daily net profit of US$968. Thus the net profit ratio for this mill is 14.4 per cent and the capital-profit ratio is 16.86 per cent.

The amortization period, defined as $\frac{\text{capital investment}}{\text{Profit + Depreciation}}$, amounts to 4 years.

Vast tropical rain forest areas are located in countries of the region where large-scale development of the plywood industry and of other forest-based industries has not yet taken place. Consumption of industrial wood is low and these countries are more actively engaged in exporting logs as such.

On the other hand, Japan, for example, which has a highly developed plywood industry, is largely dependent on the continuous supply of raw materials from the log-surplus countries. This country's overseas purchase of peeler logs has accounted in recent years for 80-85 per cent of its raw material input, comprising mostly lauan species from the Philippines and Sabah.

A similar situation is found in the Republic of Korea where, to meet the plywood industry's ever-increasing demand for hardwood logs, log imports from the Philippines and Sabah are continuing and the possibility is being explored of tapping Indonesia's vast forest resources.

China (Taiwan) is another country which depends heavily on imports. Imports of logs increased from 565,000 m^3 in 1964 to 692,000 m^3 in 1966 and attained almost 900,000 m^3 in the following year.

Singapore, even though it has no forests of its own, has a flourishing plywood industry, based mainly on imported logs from West Malaysia. In the period 1964-1966 this source provided about 95 per cent of the country's total requirements.

India, with its seventy-four plywood factories using a large variety of locally available wood species, has become almost self-sufficient in this domain. However, an inadequate supply of peeler logs may present certain difficulties for the expansion of plywood production facilities.

Despite imports of veneer logs, the performance of the plywood industry in Pakistan has been rather poor in recent years, mainly because of a lack of raw materials.

The Philippines, the region's largest log exporter, has recently cut its supplies to foreign markets as the result of its newly adopted policy of increasing the local processing of this raw material.

Sabah and Sarawak account for most of Malaysia's log exports. Log production for export purposes is likely to continue or even increase, despite a brisk development in the country's plywood industry.

A third country bestowed with abundant forest resources is Indonesia, where 24 million ha of productive forests is reported to exist. Not only has consumption of industrial wood in this country been extremely low but exports of logs have been practically non-existent. However the picture is expected to change somewhat in the near future, once foreign capital has been granted permission to exploit the rich forest resources.

The direction of trade of hardwood logs from surplus to deficient countries, is shown in the table 12.

The requirements for veneer and plywood logs are rather rigid; various qualifications have to be fulfilled, such as size, form, appearance and peeling characteristic. All these factors, in fact, reflect the raw material's technical suitability. However, availability of the raw materials in sufficient quantity and on a continuing basis is of equal importance.

FAO has reported that about 75 per cent of all plywood log supplies comprised only a very limited number of wood species, i.e. those that had long ago been introduced into an accepted by the international market. A striking example is that of Japan, where 80-85 per cent of the plywood industry's raw material requirements are met by Philippine lauan hardwoods. In the United States, Canada, the Soviet Union and many European countries, birch, fir and beech are the most widely used wood species.

Asia's natural forests comprise hundreds of wood species. In view of the tendency of peeler logs to become more and more scarce — and consequently more expensive — and in order to derive greater benefits from forest resources, ways and means could be found to pave the way for a greater utilization of the wood species at present being rejected, as a possible source among others of raw material for plywood manufacture.

Research and development in the field of raw material for plywood manufacture have *inter alia* resulted in the expansion of the raw material base for this industry. For most tropical peeler logs, the required diameter is around 70 cm; however, developments in manufacturing techniques and equipment have made it economic to use relatively smaller logs.

Veneer lathes have recently been equipped with retractable spindles and chucks, and each spindle is provided with two or three chucks of differenet diameters. The type of chuck to be used with the spindles is selected on the basis of the size of the log to be peeled.

At the beginning of the peeling, the log is held by the large-diameter spindle chucks. When the log is peeled down to a predetermined diameter, these chucks are automatically retracted and the smaller sized chucks take their place and hold the block while the peeling process goes on uninterruptedly.

Thus the system of differently sized chucks ensures a higher yield from the logs, as it permits peeling to a smaller-core diameter. At the same time, it makes possible a smooth and speedy peeling of smaller-diameter peeler logs.

Another aspect that may merit consideration for further research is utilization of the so-called "secondary wood species". This problem is being faced by countries practising selective cutting of only the best trees and commercially acceptable wood species. Mention has been made earlier of the very few wood species

Table 12. TRADE FLOW OF HARDWOOD LOGS — MAJOR COUNTRIES ONLY

(Thousand cubic metres)

To \ From	Philippines		West Malaysia		Sabah		Sarawak		Indonesia	
	1964	1966	1964	1966	1964	1966	1964	1966	1964	1966
Japan	5,284	6,716	64	91	2,267	3,501	426	1,233	110	178
Republic of Korea	161	527	—	—	167	478	19	84	—	—
China (Taiwan)	474	440	36	157	45	60	—	—	—	—
East Asia total	5,919	7,683	100	248	2,476	4,039	445	1,317	110	178
World total	6,140	7,850	889	1,402	3,384	4,856	866	1,933	78[a]	217

[a] 1962

that are acceptable to the plywood industry. However, tropical forests may contain numerous other species suitable for plywood production — including many of high strength and durability, two often determining factors in the selection of a construction material in the developing countries. Thus, if such species could be successfully made into plywood and were found suitable for local consumption, it would greatly encourage the development of this and other forest-based industries in the developing countries of the region.

Development of a plywood industry need not necessarily mean the establishment of a fully integrated complex with production of lumber, hardboard, pulp and paper, and other forest-based products. As a start, simple veneer plants can be installed that will produce green or dry veneer which can then be shipped as such to plywood plants for further processing.

PROCESS OF VENEER AND PLYWOOD MANUFACTURE

A brief outline of the process of veneer and plywood manufacture is given below:

Preparation of veneer logs

The logs stored in the log-yard, log pond or nearby stream are transferred to the factory yard where they are cut by chain saws to the appropriate length for feeding to the veneer-lathe.

Particularly when high-density logs are used, pretreatment in the form of steaming is most desirable. This process will soften the wood, thus facilitating its peeling, and will also remove some of its resinous substance.

Veneer manufacturing

To-day, most veneer is produced by rotary-cutting of the log on a veneer-lathe, where it is peeled into an endless sheet. The veneer is then reeled. Many plants are also equipped with a tray-deck system.

For the production of decorative plywood, the log is fed to a veneer-slicer that slices sheets of veneer across the grain of the wood.

Rolls of veneer are transferred from the reeling machine to the unreeling unit, where they are unrolled and cut by the veneer clipper into the required dimensions. Where the tray-deck system is used, the veneer can be fed directly to the veneer clipper.

Veneer sheets must be dried adequately before they are glued together. This can be done either in a roller type veneer-dryer or in a continuous type veneer-dryer.

The roller veneer-dryer has a heat-insulated chamber provided with a hot-air circulation system and a multiple set of feeding rollers. This type of dryer is best suited to thick veneers.

The continuous veneer-dryer, which usually employs wire-mesh belts instead of rollers, is suitable for drying a continuous sheet of unclipped veneer directly from the unreeling unit. The dried veneer emerging from the dryer is cut to the right size by the dry-veneer clipper.

In the veneer manufacturing part of the plywood mill there is an important unit known as the veneer preparation unit. Here, narrow strips of veneer are joined together to make up a full-size veneer sheet, thus reducing veneer waste to a minimum. The first step is carried out by the veneer jointer that cuts very straight edges. The veneer taping machine is then used to join the veneer, edge to edge, by applying a tape between the pieces.

The veneer splicer joins the edges of veneer with glue instead of tape, whilst the veneer edge-gluer is used for the continuous glue-coating and splicing of the veneer edges, with the veneer moving in a direction crosswise to the grain of the wood.

Plywood manufacturing

A glue mixer is used to mix the glue, in liquid or in powder form, with the proper amount of water, filler and other ingredients. The glue is then spread evenly on the core veneer sheets, with the aid of glue-spreading rollers and doctor rollers.

After a certain assembly time, the stacked and glued veneer sheets are transferred to the cold press and pre-pressed. This process reduces the time required in the hot press.

After prepressing, the plywood is put under pressure and under high temperature in the hot press, which is usually provided with an automatic loader and unloader in order to obtain maximum efficiency.

Finishing

When it emerges from the hot press, the plywood is given a conditioning period in order to restore the moisture content in the face plies. It is later conveyed to the double sizer, which cuts the plywood into the right dimensions with the aid of edge and edge-trimming saws.

The finishing touch is provided by belt sanders and drum sanders that remove tapes and smoothen out the plywood faces.

Grading and inspection

The plywood panels are then transferred on to a conveyor for inspection and selection prior to packing and shipping.

A simplified flow-diagram and data on various yields in plywood manufacture are given in charts 1 and 2, respectively.

Chart 1: Simplified flow-sheet of plywood manufacture

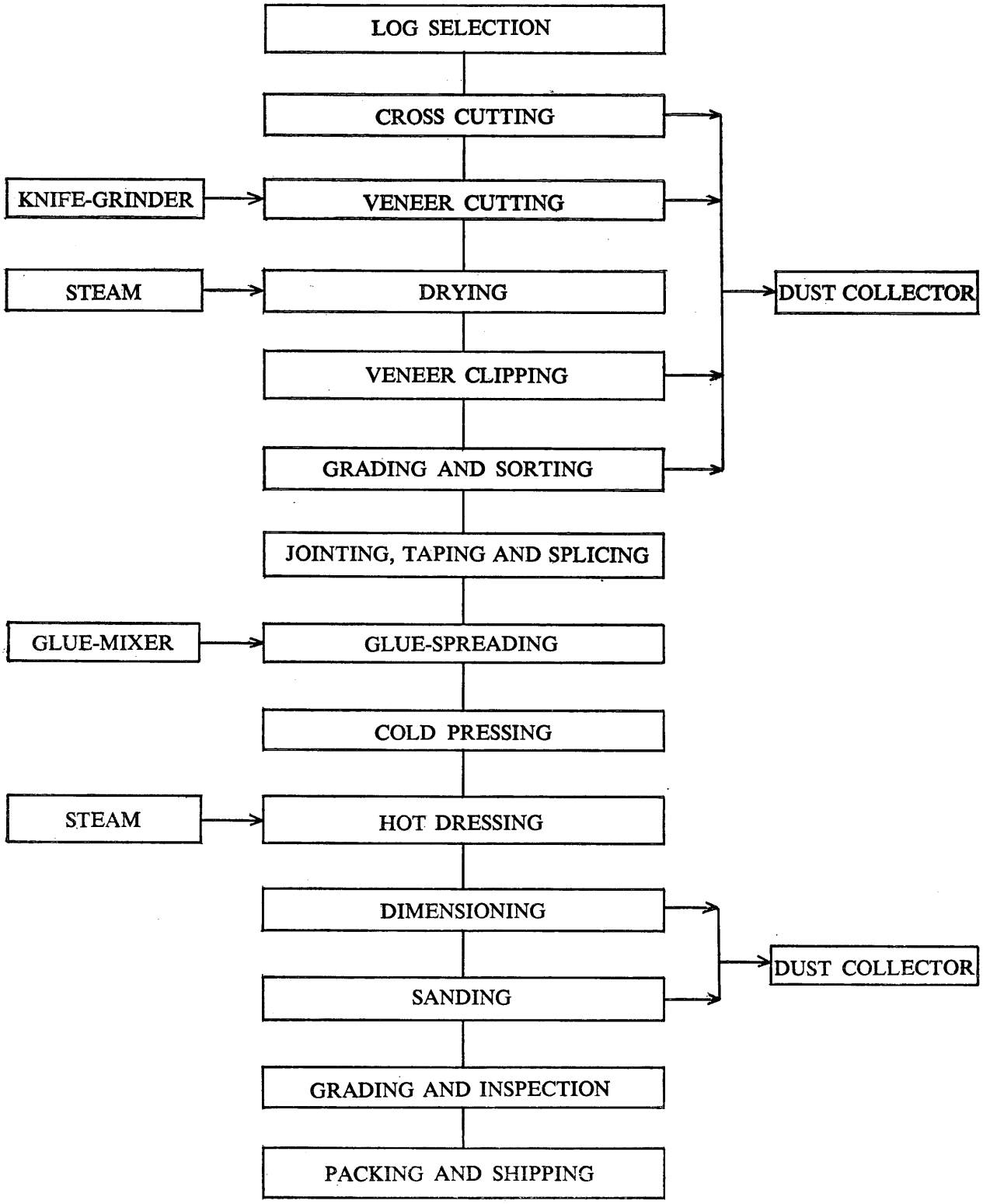
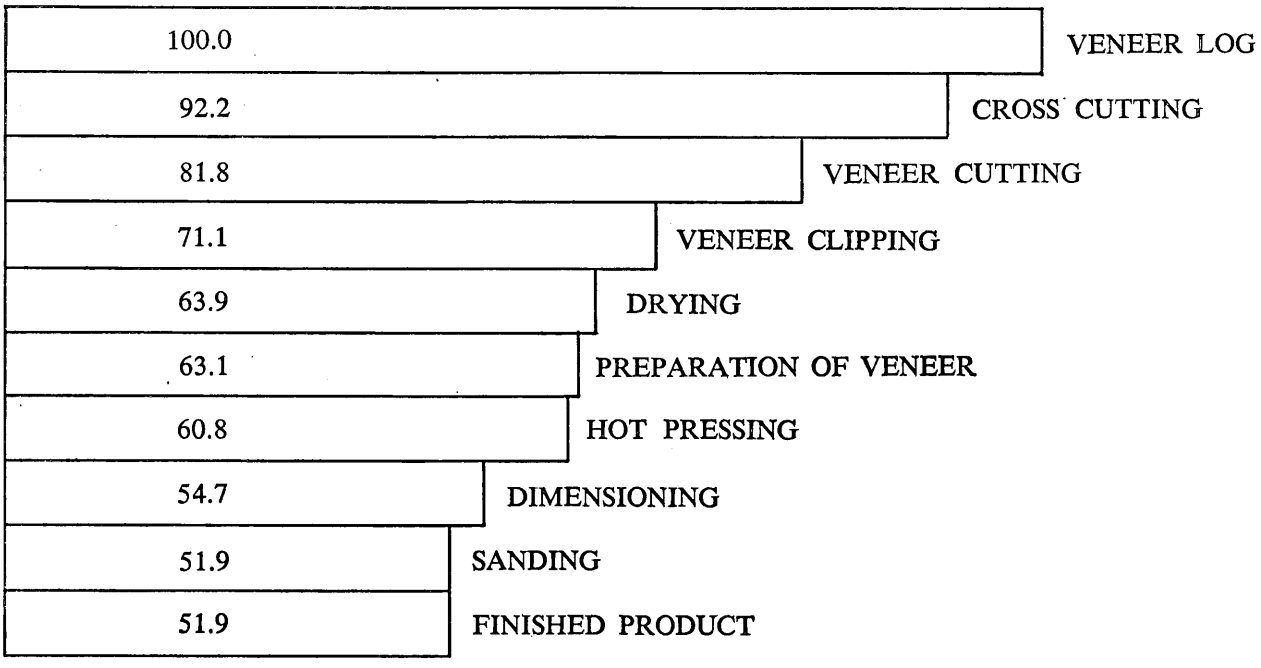


Chart 2: Yields in plywood manufacture

(Percentages)



Source: Hirai and Horioka: "Plywood", 1967.

The utilization of secondary wood species for the manufacture of veneer and plywood may merit consideration for research. This would assist appropriate steps to be taken to encourage the countries concerned to have such species analysed for the purpose, and other member countries with research facilities could be invited to provide technical assistance in this matter.

The application of technological developments, such as devices that enable peeling of veneer logs to a smaller-core diameter and utilization of smaller diameter logs, could be widely promoted. The efficiency and productivity of existing veneer and plywood mills in the region's developing countries, where a diminishing use of installed capacity is not an uncommon phenomenon, could also be greatly improved.

RESEARCH NEEDS FOR THE MANUFACTURE OF PROTEIN CONCENTRATES FROM OILSEEDS IN THE ECAFE REGION[1]

Introduction

Malnutrition resulting from an inadequate supply of protein has serious consequences; particularly on the health and well-being of children, as it retards growth, mental development and makes them susceptible to infections and fatal diseases. One of the most effective ways of combating protein deficiency in Asia is to tap the resources of oilseeds, principally cottonseed, groundnut and soybean, which are also the region's cheapest source of production of protein concentrates.

The technology of producing such concentrates has been developed in advanced countries where it has been kept secret by the industry; it is thus available to the developing countries only on a commercial basis. The United Nations agencies FAO, WHO and the United Nations Children's Fund (UNICEF) set up a Protein Advisory Group (PAG) which has been examining the problem of protein deficiency in its broad perspective. It has produced several useful documents on the utilization of oilseeds for the manufacture of protein concentrates, apart from its general and diversified work on augmenting the availability of protein to the vulnerable sections of the peoples in the developing countries of the world. Some developing countries also claim to know how to manufacture protein concentrates from oilseeds, such as edible flours from groundnuts and cottonseed. The main problem being a lack of consumer acceptance, there is an urgent need to carry out research work in this field as a matter of regional importance. The Advisory Committee on the Application of Science and Technology to Development has also emphasized that protein concentrates from oilseeds could become one of the main sources of protein for people in the developing countries.

Need for protein

It is self-evident that, in the countries of Asia, the general nutritional level is appallingly low. Table 1 shows them to have a calorie deficiency of 7 per cent, whereas in the developed countries consumption is 20 per cent higher than required. It has been estimated that the protein intake of one-third of the population in the developing countries is inadequate, and the gap between nutritional requirements and actual consumption is widening rapidly. Remedial measure must be found, not only to improve the present inadequate supply but also in preparation for the even more acute situation that will arise as the population increases.

Technology

In the developed countries, where a high-quality oilseed product can be produced at low cost, the major difficulties lie on the consumption side. Millions of tons of good quality protein are presently available in oilseed cake, but unless the product is made available in a palatable and desirable form, it will not be purchased. Particularly urgent effort must therefore be directed towards the development, promotion and marketing of protein foods which will be welcomed by the consumer.

[1] This paper has been prepared by Mr. H. G. R. Reddy, Regional Adviser on Oils and Fats.

Table 1. LEVELS OF CONSUMPTION AND REQUIREMENTS OF CALORIES IN 1962 AND PROJECTIONS FOR 1975 AND 1985

	1962 Calorie (per capita, per day) Consumption	Requirement	*1962* Consumption as percentage of requirement	*1975* Implications of the projected food demand in terms of calories as percentage of requirement			*1985*		
				L	*H*	*LB*	*LA*	*HB*	*HA*
Asia and Far East	2,080	2,230	93	110	105	104	105	117	117
South Asia	2,040	2,240	91	99	105	104	105	116	117
India	2,030	2,240	91	98	104	104	105	116	117
Pakistan	2,100	2,250	93	101	108	106	107	117	118
East and southeast Asia	2,160	2,200	98	101	106	103	104	117	117
Japan	2,250	2,360	95	105	109	110	111	119	120

Source: FAO, *Agricultural commodities — projections for 1975 and 1985,* publication [CCP 67/3 (1966)], vol. 1, p. 23.

Key: *L* = Low GDP distribution.
H = High GDP assumption.
LB = Combination of low GDP assumption with high population assumption.
LA = Combination of low GDP assumption with low population assumption.
HB = Combination of high GDP assumption with high population assumption.
HA = Combination of high GDP assumption with low population assumption.

The total availability of the three principal oilseeds in the ECAFE region is indicated in table 2. According to the report of the Advisory Committee on the Application of Science and Technology (E/4343), 50 per cent of the oilcake's proteins would be available for direct human nutrition. Modern technology has suggested ways in which its constituents could be adapted to satisfy human requirements. In a number of instances, nutritional and technological research and commercial production have clearly demonstrated how certain oilseed residues, notably cottonseed, groundnut and soybean, may be converted into materials of high nutritional value that are free from harmful substances, so that they fully meet the standards for human foodstuffs. At present, oilcake is mainly used for animal feeding, by which procedure 4 tons of vegetable protein yield approximately one ton of animal protein. Most of the animal protein production from oilseed residues is now carried out in the developed countries; thus not only is a large amount of potentially valuable human food uneconomically converted into a small amount of animal product for human consumption, but it is at the same time removed from the developing countries, where much of the world's oilseeds are produced, to developed countries to provide more of the animal products with which they are already abundantly supplied. The attention of the Governments of the ECAFE region should be drawn to the potential of these important resources.

The vast amounts of oilseed proteins available in the developing countries could be incorporated into simple, nutritious, low-cost mixtures with cereals or used in more sophisticated food products at higher cost. Indeed, no other single source of unconventional protein could contribute so greatly and promptly towards closing the protein gap. The soybean, in addition to being a raw material for oil production, is widely used in some developing countries for human feeding without undergoing industrial processing. Extending milk supplies through the use of peanut or soy protein isolates is now feasible. Moreover, additional techniques are being developed for texturing bland isolated vegetable proteins by spinning and extrusion to yield products which, when properly flavoured and coloured, closely simulate such commonly used foods as bacon, chicken, meat, beef and sea-food. Basic and applied research directed towards utilization of oilseed protein has to be carried out in institutes of food science, food technology and applied nutrition. This step would also lead to further opportunities for industrial development.

Table 2. OIL SEED PRODUCTION IN SELECTED COUNTRIES OF THE ECAFE REGION

(Thousand long tons)

Country	Groundnut (shelled)	Cottonseed	Soybean
Burma	370	40	—
China (Taiwan)	114	—	57
India	6,078	1,730	—
Indonesia	400	—	394
Iran	—	213	—
Japan	129	—	236
Korea, Republic of	—	—	160
Pakistan	30	749	—
Thailand	118	38	39
Total	7,239	2,770	886

Source: *Vegetable Oils and Oilseeds* — A review published for the Commonwealth Economic Committee by Her Majesty's Stationery Office, London.

Biological value of oilseed proteins

In a number of instances, the biological value of oilseed protein concentrates is limited by deficiencies in certain of their essential amino acids; for instance, groundnut protein appears to be of limited value because of its low content of sulphur-containing substances, namely amino acids, lysine and threonine. Admixture of this valuable commodity with other protein less deficient in amino acids could greatly improve its quality and so increase its effectiveness in meeting requirements. This could be done either by mixing the protein concentrate with another suitable protein concentrate or by adding synthetically produced essential amino acids at the point of manufacture before distribution to the public. Alternatively, nutrition education could be used to teach the public how to mix, in the kitchen, the protein resources available so as to ensure the consumption of a protein mixture of the highest nutritional value. Educating the general public to the necessary level could, however, present very considerable problems.

It is estimated that approximately 8 million metric tons of fermented or cooked soybean products is consumed annually in the region and that another 3 million metric tons of peanuts, coco-nuts and other oilseeds is eaten in the world as a whole. Despite the vast quantities of oilseeds produced in the region, this source of protein has not been made available for human consumption. The meal, after extraction of oil from the seed, contains 40-50 per cent of good-quality protein which particularly if combined with cereal grains, is suitable for human consumption. After accounting for the oil — and, in the case of cottonseed, for other by-products also — this meal is the world's cheapest sources of protein and likely to remain so: it costs US cents 8-12/lb, compared with US cents 22-27 for non-fat dry milk and US$1-2 for most other proteins of animal origin. Although available in large quantities in most developing areas, these nutritions and low-cost protein materials are now largely exported, fed to ruminants or wasted as inefficient fertilizers.

In developing processes for providing suitable protein concentrates from such resources, consideration should be given to retention of the oil component to a degree technologically and economically feasible from the point of view of product stability. There are various simple, relatively low-cost oilseed protein food mixtures on the market and infant foods containing processed full fat soya flour have been successfully tested in China (Taiwan). Additional processing research, particularly on cottonseed, should be pursued, as well as market studies and product development. The use of suitable oilseed protein concentrates in infant foods, infant milks and in toned milk products seems to be a particularly appropriate area for research and development; firstly, because products of this type are most needed by the young child; and, secondly, because the successful production and sale of such products in Hong Kong and Indonesia indicate that they may be acceptable and also economical to manufacture in developing countries.

The use of oilseed protein concentrates in weaning-foods and milk-like products appears to be especially important, but admixture with staple cereal products would be a valuable method of increasing consumption by the family and so by the vulnerable population groups. For instance, its addition to the flour or cereal meal used for one or other of the many types of bread, chappati or biscuit could be an effective outlet for oilseed protein concentrates. The additive must, of course, survive the quality and economy tests of the open market. Governments could stipulate appropriate fortification of staple cereals but, for this to be effective, they must also have the will and the ability to enforce their legislation. If incorporation could be made at the flour-milling or grain-milling units, then government legislation for the countries' requirements could be readily enforced at a small number of centralized mills; whereas if the staple grains were milled in a large number of village mills or in the house, enrichment legislation, although nutritionally desirable, would be difficult or impossible to enforce unless the consumer actively desired and could afford the supplementation.

Protein from fish-protein concentrate or singe cells would probably be at least double the minimum cost of that from oilseeds. It is particularly important, however, to recognize that the most promising and palatable new protein foods will remain laboratory curiosities unless they are successfully produced and marketed.

Textured food from oilseed protein concentrate

The potential of protein isolates produced from oilseed meals and the failure of a protein-hungry world to utilize that potential constitute a challenge to the food industry and the food technologist to prepare a palatable form of protein. A number of experimental foods prepared from spun-soya protein simulate the texture, appearance, and flavour of a variety of meat products. Materials of this type are currently sold in the United States. More recently, cheaper methods of manufacture have been proposed.

Particular attention should be paid to the development and use of low capital cost processing equipment and to trials of products made with it in areas where oilseeds are produced. It is essential that the products should meet the necessary standards of safety and quality.

Fermentation processes also offer the possibility of producing highly acceptable foods from oilseed proteins. In many instances, the oilseed itself may conveniently be used and should be tested in a number of areas; in some parts of the world, notably China (Taiwan), Japan and southeast Asia, products of this type are found to be highly attractive by large sections of the population.

In India recently, with the assistance of UNICEF, interest has been stimulated in taking up the manufacture of edible cottonseed flour in some of the cottonseed crushing plants. More than ten years ago, UNICEF supplied two plants for producing edible groundnut flour. One of the national research laboratories, namely the Regional Research Laboratory, Hydsabad, is already equipped with a pilot plant with a half-ton per day capacity for the manufacture of edible flour from cottonseed. It is reported that there are plans to increase the installed capacity to 5 tons per day by the adoption of the solvent extraction process. The Central Food Technological Research Institute in Mysore is also reported to be engaged in developing know-how for the production of protein concentrates from oilseeds. While the picture regarding indigenous know-how in the other developing countries is not clear, it may be of interest to note the following standards which are being considered for edible groundnut and cottonseed flours in India:

(a) **Edible cottonseed flour**

The edible flour shall be obtained by extraction of oil by means of a solvent from oilcake, immediately following the single pressing of good quality edible oilseeds, which have been pre-cleaned and are free from infected or otherwise damaged materials and extraneous matter. It shall have been subjected to such heat and steam treatment under controlled and regulated conditions as may be necessary to ensure removal of solvent without adversely affecting the quality of the protein in the edible flour, and ground to appropriate size as may be desired. It shall conform to the specifications indicated below:

Tentative specification for edible cottonseed, screwpressed and solvent extracted

S. No.	*Characteristic*	*Screwpressed*	*Solvent Extracted*
1.	Moisture per cent by wt, max	9	9
2.	Crude Protein (N×6.25) on dry basis, per cent by wt, min	48	48
3.	Available Lysine g per 100 g of crude protein, min	3.6	3.6
	Protein solubility per cent by wt, min	70	70
4.	Acid insoluble on dry basis per cent by wt, max	0.1	0.1
5.	Fat, on dry basis, per cent by wt, max	6.0	1.0
6.	Acid value of extracted fat, max ..	6.0	6.0
7.	Crude fibre on dry basis per cent by wt, max	5.0	5.0
8.	Residual solvent ppm, max	—	170
9.	Free gossypol, per cent, max	0.065	0.065
10.	Total gossypol, per cent, max	1.10	1.10
11.	Total bacterial count per g, max ..	50,000	50,000
12.	Coliform bacteria per g, max	10	10
13.	Salmonella bacteria	Completely free	
14.	Insect and rodent contamination ..	Essentially free	
15.	Sodium propionate additive per cent by wt, max	0.3	0.3

(b) **Edible groundnut flour**

The edible groundnut flour shall be obtained by extraction of oil by means of a solvent from oilcake, immediately following the single pressing of good quality of edible oilseeds which have been pre-cleaned and are free from infected or otherwise damaged material and extraneous matter. It shall have been subjected to such heat and steam treatment under controlled and regulated conditions as may be necessary to ensure the removal of solvent without adversely affecting the quality of the protein in the edible flour, and ground to the desired size; it shall conform to the following specifications:

1.	Moisture, per cent, max	8.0
2.	Total ash, per cent, max on dry basis	5.0
3.	Ash insoluble in dilute Hcl, per cent, max, on dry basis	0.35
4.	Ether extract, per cent, max	1.5
5.	Total protein, per cent, min (NY6.25)	47.0
6.	Crude fibre, per cent, max	5.0

Part III

INDUSTRIAL GROWTH PROSPECTS AND POLICIES FOR THE SECOND DEVELOPMENT DECADE[1]

1. Introduction

The Committee for Development Planning[2] estimates that it is possible " . . . for the developing countries as a whole to achieve an annual rate of 6 to 7 per cent in total gross product and of 3.5 to 4.5 per cent *per capita* during the next decade". Increase in agricultural output is expected to be 4 per cent per year. The Committee observes that "industry will have to serve as the sheet anchor of the modernization process, with an increase in the manufacturing output of developing countries to 8-9 per cent during the decade".[3]

In order to assess the growth prospects of the manufacturing sector among the ECAFE developing countries during the second United Nations Development Decade, it is necessary to examine the past trends of growth — the percentage growth rates as well as the changing structure of industry.

During its twentieth and twenty-first sessions, held in 1968 to 1969 respectively, the Committee reviewed the progress achieved in the manufacturing sector as well as problems pertaining to the strategy of growth through an examination of historical statistical data on the growth and changes in structure of manufacturing industry.

An examination of historical statistical material in the form of percentage growth rates, industrial origin of GNP, indexes of productivity, etc., however, does not by itself provide the clues to a real understanding of the factors which generate economic progress. In social science, a statistic must be examined in relation to other related statistics essentially in the context of the social forces that generate economic growth.

If, therefore, industry is to "serve as the sheet anchor of the modernization process", it is also necessary to go beyond statistics in order to determine the real factors which are the motive force of social and economic changes.

In manufacturing industry, an effort towards conscious development planning among the developing countries of the region commenced in the early 1950s[4] and, between 1953 and 1958, the rate of growth for these countries as a whole reached an average of 11.6 per cent. Between 1960 and 1968 it increased slightly to 11.8 per cent.

During the period 1960-1968, the industrial base of the developing countries was expanded and, although countries were still preoccupied with objectives of import substitution, the producer goods industries and chemical industries demanded increasing attention.

The process of development, however, was marked by the increasing disparity between a few countries and the rest of the region. Countries in East Asia, in particular, forged ahead because they were able to take advantage of several favourable circumstances. With a few exceptions, growth rates among the other countries were tardy and several of these countries were straining every nerve to avoid the grip of the scissor movement of declining export incomes and increasing requirements of imports.

Although, in general, the average growth rates continued to be favourable for the region as a whole, the majority of the countries had to spend much time and energy on administrative problems associated with debt-servicing which demanded increasing attention each year.

Thus, debt-servicing became a major issue during the latter years of the last decade and it will become an even greater problem in the 1970s.[5] One of the primary constraints of the 1970s will, therefore, be resource management, particularly foreign resources.

This paper will focus mainly on the prospects of growth in the manufacturing field during the 1970s. In such an exercise, statistical data for a reasonable preceding period, as well as projections made by country planners for the future, are essential. It is also important to search for the real social and economic factors, the motive forces that have been responsible for the rates and directions of growth. The objective is to examine the past, draw conclusions therefrom and underscore factors which will be of importance during the second development decade.

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[1] Document E/CN.11/I&NR/L.91 prepared by the ECAFE secretariat for the twenty-second sessions of the Committee on Industry and Natural Resources, 1970.

[2] United Nations, *Report of the Fourth and Fifth Sessions* — March/May 1969, *ECOSOC Official Records: Forty-Seventh Session*, 1969.

[3] *op. cit.*, page 7.

[4] See "Twenty Years of Industrial Development in the ECAFE region" (E/CN.11/I&NR/L.75).

[5] See *Partners in Development* (Pall Mall Press, 1969).

The average growth rate of 8 to 9 per cent envisaged for manufacturing industries in developing countries is an indicative figure. In the case of ECAFE developing countries, the average itself has very little significance because of the wide disparities in growth rates between the different countries of the region. The 11.8 per cent average rate during 1960-1968 is, in such circumstances, no indication of an interpretable trend.

In reviewing past trends of growth as well as policies now being adopted by the member countries, it is possible to estimate the trends of industrial growth for the period 1970-1980. Countries which have had a high growth rate during the last decade are not expected to maintain the same rate during the first half of the period 1970-1980. It will also be observed that the potential for increasing the rate of growth among other countries is great and that, with the adoption of certain measures outlined, the over-all average growth rate for the region as a whole could still be maintained at the increasing levels which the region has experienced during the past.

The problems that need continuous and careful attention generally fall outside the purview of industrialists alone: they are, in fact, problems common to the economy as a whole and relevant to over-all economic growth itself. These are:

(a) Capital — both domestic and foreign;

(b) Agriculture development to support and improve over-all economic growth through balanced sectoral development;

(c) Development of infrastructure — education, transport and electricity;

(d) Development of sound administration which includes policies for security and political stability within the region;

(e) Adoption of external economic policies suitable for regional co-operation.

If the average growth rate during the 1970s is to be maintained at a satisfactory level, countries in Middle and West Asia must increase their growth rates to compensate for the expected decline in the growth rates of the developing countries in East Asia. This aspect will be dealt with in the second part of the paper.

Whether this can be done, and the prerequisites for achieving it, should be considered carefully. The factors which have restrained industrial growth and remedial measures for improving growth rates will require priority consideration. One important aspect of this paper will be the relevance of sharing experiences. In the process of industrialization there are a multiplicity of factors which influence growth rates and the development process. These factors are common to all countries, differing only in their degree of impact according to the circumstances peculiar to each country. The solutions to most problems are, in most instances, practically identical.

2. Industrial growth rates 1960-1969[6]

In dealing with growth rates, three aspects will be taken into account: (i) percentage growth rates of manufacturing industries in selected ECAFE countries, (ii) index of industrial production, and (iii) changes in the structure of manufacturing industry.

During the period 1960 to 1968 (see table 1)[7] average growth rates varied between 5.5 per cent in India and 18 per cent in the Republic of Korea. Average growth rates of over 10 per cent were achieved by five countries, namely the Republic of Korea, China (Taiwan), Pakistan, Iran and Singapore. The latter countries[8] also maintained a fair degree of consistency in contrast to the rest of the developing countries where growth rates were both low and subject to wide variations.

The first conclusion to be drawn from table 1 is the disparity between the developing countries with more dynamic manufacturing sectors and those with stagnant manufacturing sectors. As this is a basic problem, a more detailed examination of it will be undertaken in the latter part of this paper.

Tables 2 and 3, (index of industrial production of developing countries and changes in the structure of manufacturing industry), show growth trends of different groups of industries.

These tables show a qualitative change in the manufacturing sector, the decline in the importance of light industry in terms of total value added and the increasing importance of heavy industry. There was also a marked shift in the pattern of employment.[9]

[6] Collection data for ECAFE developing countries as a whole are for the period 1960-1968. Data for 1969 and later years are on an individual basis, having been obtained by direct contact with industrial planning authorities.

[7] All tables are in the annex.

[8] With the exception of Iran and Singapore for which comparable data are not available.

[9] For more details see "Twenty Years of Industrial Development in the ECAFE Region" (E/CN.11/I&NR/L.75), pp. 17-24, "Review of Industrial Growth Rates with Specific Reference to Development Problems of ECAFE Developing Countries" (E/CN.11/I&NR/L.81), pp. 14-18, and "Strategy for Industrial Development Among ECAFE Developing Countries" (E/CN.11/I&NR/L.69), pp. 9-14. These papers were presented to the twentieth and twenty-first sessions of the Committee on Industry and Natural Resources in 1968 and 1969.

This change in the structure of manufacturing industry is the second conclusion to be drawn from tables 2 and 3, but changes in the structure must be qualified by the disparities in growth rates between countries and its applicability, therefore, is limited to those developing countries which have more dynamic manufacturing sectors.

Statistical data in respect of production of individual commodities also indicate that output increased rapidly in almost all important spheres of production. Production of several items, such as textiles, cement, fertilizer, steel and engineering goods, was still concentrated in a very few countries in the mid-1960s.[10] Table 4 shows that, with the exception of the output of cotton textiles which was adversely affected by the serious recession in India, the output of all other commodities improved between 1960 and 1967.[11] In fact, during this period, almost all developing countries of the region increased the production capacities of many of their important industries. This was particularly noticeable in the iron and steel and fertilizer industries.[12]

Among the developing ECAFE countries, during 1960-1968, a growth rate of over 15 per cent was achieved by two countries — the Republic of Korea (18.0 per cent) and China (Taiwan) (16.6 per cent); a rate of between 10 per cent and 15 per cent was achieved by four countries — Pakistan (11.1 per cent), Iran (11.1 per cent), Singapore (14.5 per cent) (1966-1968), Thailand (13.3 per cent)(1962-1967) and a rate of between 5 per cent and 10 per cent was achieved by the Philippines (6.4 per cent), India (5.5 per cent), Ceylon (5.1 per cent) (1960-1966)[13] and Malaysia (9.5 per cent) (1960-1966). Data are not available in respect of Indonesia, Cambodia, Laos, Nepal and Western Samoa.

(a) Countries with a high rate of industrial growth

Consistently high rates of industrial growth have been recorded in the Republic of Korea and China (Taiwan).

In the Republic of Korea, industrial growth rates between 1965 and 1970 were as follows:

	1965	*1966*	*1967*	*1968*	*1969*	*1970*
					(estimated)	
Manufacturing growth rate	12.1	15.2	22.5	25.9	23.9	19.8
Economic growth	7.4	13.4	8.9	13.3	15.0	11.0

High growth rates have been maintained since 1962, the first year of the first five-year plan, and during the plan period the average growth rate was between 20 and 24 per cent.

The main characteristics of the Republic of Korea's industrial structure can be summarized as follows:[14]

(i) Percentage contribution by manufacturing industry to GNP increased from 15.1 in 1960 to 26.8 in 1969 — agricultural contribution declining from 41.4 to 28.1 during the same year.

(ii) Percentage contribution of heavy industry to total industrial output, based on value added, increased from 24.6 in 1962 to 35.9 in 1969, and it is estimated that by 1970 it will be 38.4. The share of light industry declined from 75.4 to 64.1 during the same period,[15] and is expected to be 61.6 in 1970.

(iii) In 1967, small industry, i.e. industries employing less than 200 persons, accounted for 98.2 per cent in terms of number of establishments, 58.8 per cent in terms of employment and 39.3 in terms of value of output.[16]

(iv) There has been a healthy diversification of the manufacturing base, particularly noticeable since 1966 with the rapid growth of the transport, machine and equipment, electrical machine, chemical, clay and glass and metal industries. Despite this, over 30 per cent of value added is accounted for by the textiles, food, beverages and tobacco groups of industries.

[10] See section 11 of document E/CN.11/I&NRL.75, *op. cit.*, for details.

[11] Production figures for 1968 and the first half of 1969 are not available in full. In the course of the discussion available data will be used independently. The disadvantage of over-all figures where production capacities and potentials vary so widely, as in Asia, is obvious, e.g. a 2 per cent drop in production of steel in India (assuming production of 6,000,000 tons) could wipe out a 100 per cent increase in output in Malaysia (assuming 120,00 ton production).

[12] See document E/CN.11/I&NR/L.81, *op. cit.*, pp. 15 and 16 and, for details, *Asian Industrial Development News*, No. 4 and 5, 1969 — Directory of Iron and Steel and Fertilizers.

[13] Ceylon's 1966 growth rate was less than one per cent but it was 12.2 per cent in 1967 and 46.6 per cent in 1968. (Report of the Central Bank of Ceylon 1968, page 57, and table II b 2, page 59).

[14] See Ministry of Commerce and Industry, *Annual Statistics of Major Commerce and Industries 1969; Over-all Recources Budget for 1970* (draft) 2nd version; *Industrial Structure and Production in Korea, 1969.*

[15] Calculations are based on 1965 constant prices. Paper and paper goods are included among the light industry group, clay products which have been grouped together with glass products are included among the heavy industry group. In this connexion, see also definition of industrial sectors adopted by the United Nations Statistical Office, where non-metallic mineral products as well as paper products are included in the heavy industry group: "Twenty Years of Industrial Development in the ECAFE Region", *op. cit.*, page 19.

[16] Annual Statistical, *op. cit.*, page 21.

(v) Exports of manufactures increased from 18.2 per cent of total exports in 1960, (total US$-32.4 million), to 81.5 per cent in 1969 (estimate) out of an estimated total of US$700 million. In terms of actual exports in 1968, about 60 per cent of a total of US$500 million consisted of clothing (US$-96.3 million), plywood and veneer (US$67.8 million), wigs (US$30.5 million), raw silk (US$21.0 million) and cotton fabrics (US$-15.5 million).

In China (Taiwan), the average growth rate in manufacturing industry between 1960 and 1968 was 16.6 per cent.

	1965	*1966*	*1967*	*1968*
Growth rate in industry[17]	18.9	16.0	16.8	21.4

Over-all economic growth rate[18] . . .

First four-year plan	7.4%
Second four-year plan	6.6%
Third four-year plan	10.4%
Fourth four-year plan	9.7%
Average for 1952-1968	8.8%

Estimates of manufacturing growth rates made in connexion with the fifth five-year plan indicate an average of 18 per cent for the period 1960 to 1969.

The main characteristics of China (Taiwan)'s industrial structure can be summarized as follows:

(i) Percentage contribution by manufacturing industry to GNP increased from 16.7 in 1960 to 21.19 (estimate) in 1968, the agricultural contribution declining from 32.5 to 23.2 during the same period.

(ii) Percentage contribution of heavy industry to total industrial output, based on gross value added at factor cost, changed from 45 in 1960 to 55 in 1966 and that of light industry from 55 to 44 during the same period.[19]

(iii) Small industries[20] account for 97 per cent of enterprises. Employment in manufacturing enterprises with less than 100 persons accounts for 42.7 per cent and, in terms of annual sales revenue, for 25.1 per cent. The very large enterprises with 500 persons and over account for only 0.5 per cent in terms of number of enterprises, but 62.7 per cent of total assets, 34.8 per cent of employment and 54 per cent of annual sales revenue.

(iv) The rapid growth of the manufacturing sector has been accompanied by a healthy diversification of the industrial sector as well as a strengthening of the basic industrial sector. The growth rate of chemical, machinery and, particularly, communication equipment industries was very rapid in 1967 and 1968. The light industries still account for almost 40 per cent in term of production value.[21]

(v) Exports of industrial products increased from 34 per cent of total exports in 1960 to 57 per cent in 1968. In 1960, total exports were US$174 million (11.2 per cent of GNP) and, in 1968, US$843 million (20.9 per cent of GNP).[22]

(b) Countries with a moderate rate of industrial growth

During the period 1960-1968, Pakistan, Iran, Singapore and Thailand recorded rates of growth in manufacture ranging from 11.1 per cent to 14.5 per cent. (Tables 5, 6 and 7).

Pakistan's growth rate was maintained at an evenly high pace from 1960 to 1965 but the trend slackened after 1965 because of a decline in foreign aid and investment and unsettled political conditions. In fact, production in the major sectors, particularly in textiles and cement, recorded a considerable drop.[23] A conscious effort to change the structure of industry from one heavily dependent upon light consumer-goods industries towards one with a supporting heavy-industries sector was clearly evident in the third five-year plan (1965-1970) which included the expansion of iron and steel plant capacities and the setting-up of plants

[17] See *Economic Progress in the Republic of China*, 1969.

[18] See *National Income of the Republic of China*, 1968.

[19] "Industrialization in the Republic of China", April 1969. Comparable data cannot be worked out for 1967 and 1968 as the basis of calculation is not known. However, the industrial production index available as of August 1969 shows that, on the basis of percentage change, the growing importance of heavy industry vis-à-vis light industry has continued. For example, the changes in electrical machinery, appliances and supplies, rubber products and machinery were +128.6%, +58.9% and +26.4%, respectively, whereas food, textiles, timber and wood products recorded changes of +2.4%, +27.9% and +11.5%, respectively.

[20] According to the latest census (1966) a small industry is defined as one employing 10-49 persons. In China (Taiwan), the very small-size industries are those employing less than 19 persons, medium-size 50-99 persons, large-size 100-499 persons and very large, over 500 persons. Large-size industries account for only 2.3 per cent of total enterprises.

[21] *Taiwan Economic Statistics*, August 1969, pp. 112-113.

[22] See *Industrialization in the Republic of China*, April 1969.

[23] See *Pakistan Economic Survey 1966-1967*.

for the manufacture of machinery and machine tools.[24] The most significant developments have been in the chemical fertilizer field where plants now under construction will more than triple the existing capacity.[25]

Iran's manufacturing sector is dominated by mineral oil production. The manufacturing and mining sectors grew at an average rate of 11 per cent between 1959 and 1966 and their share in GNP increased from 9.4 per cent to 12.9 per cent. The agricultural share in GNP declined from about 30 per cent to 25 per cent during the same period.[26] Food and textile industries (including carpets) contributed over 40 per cent initially. During the latter years of the third plan, the Government concentrated on the development of the capital goods and intermediate industries.[27] The fourth plan (1968-1972) places still greater emphasis upon the development of the heavy industries sector.

Thailand's manufacturing industries grew at an average rate of about 13.3 per cent during 1962-1967. In 1960 they provided 11.58 per cent of GDP, increasing to 14.47 per cent in 1967. The percentage contribution of agriculture declined from 38.21 to 29.58 during the same period. Food, beverages and tobacco manufacturing accounted for over 50 per cent of the value of industrial output. From 1964 to 1967 the output of petroleum products, cement and tin metal increased rapidly.[28]

(c) Countries with a comparatively low rate of industrial growth

The Philippines, India, Ceylon and Malaysia recorded average annual industrial growth rates of between 5 and 10 per cent during the period 1960-1968 (Tables 8-11). Authoritative data are not available in respect of Burma, Cambodia, Indonesia, Laos, Nepal and Western Samoa.

India's position is unique in this group. That country possesses immense wealth in men and material and, since 1956, its manufacturing base has expanded considerably with the rapid development of heavy industry. The expansion of heavy industry has taken place in the context of an existing light manufacturing sector which has been built up since the beginning of this century.

To reflect development in India in terms of growth rates would be misleading, particularly in the form of relative evaluations, because productive capacities vary so greatly between countries.[29] However, the low growth rate of 5.5 per cent for the period 1960-1968 was largely due to the serious industrial recession in 1966 and 1967. Between 1960 and 1965, the index of industrial production increased at an annual rate fo 10.2 per cent,[30] but in 1965 and 1967 it fell to 0.1 per cent and 0.5 per cent respectively. During the period 1960-1968, the structure of industry changed so rapidly that, by 1966, the intermediate goods and machinery industries contributed 43.2 per cent and 21.9 per cent respectively, as against 33.9 per cent from the consumer goods industries on value added basis.[31]

The index of manufacturing industries (base 1963) increased from 77 to 114 between 1960 and 1967, the highest increases being recorded by the petroleum, metal products, machinery and electrical machinery industries. Development efforts since 1960 have been mainly concentrated in the large-scale industries sector. As in the other ECAFE developing countries, small industries, which contributed 60 per cent of the total industrial production in 1950/1951 and 52 per cent in 1968,[32] are still of considerable importance.

Malaysia's manufacturing sector recorded a growth rate of 9.5 per cent during the period 1960-1966. Although the manufacturing sector, together with the allied service sectors,[33] construction and electricity, grew at a faster rate than GDP there were no significant structural changes in the economy. Light consumer-goods industries dominated the industrial scene. After 1965, increasing attention was paid to the development of heavy industries, e.g. iron and steel and assembly of automobiles. Between 1960 and 1967 there was hardly any change in the pattern of output of the major industries. Production of cement alone increased from 287,000 t/y to 898,000 t/y during this period.[34]

In the Philippines, the manufacturing sector's contribution to net domestic product between 1962 and 1969 was follows:[35]

[24] The most significant of these being the WPIDC machine tool factory in West Pakistan and the heavy machinery complex near Taxila for producing cement and sugar plants, low-pressure package-type boilers, travelling cranes, railway materials, road-building machinery, medium-pressure vessels and steel structures.

[25] Installed capacity of all fertilizer plants at present is 630,000 tons per year; plants under construction will provide for an additional capacity of 1,409,000 tons per year. See *Asian Industrial Development News*, No. 5 — December 1969.

[26] *Industrial Development of Iran*, Ministry of Economy, August 1967.

[27] See United Nations, *Asian Industrial Development News*, Nos. 3 and 4, 1969. The more important heavy industries include a steel mill at Isfahan, an engineering plant and tractor factory at Tabriz, a machine plant at Arak, an aluminium plant at Ahwac, a fertilizer plant at Shapur and petrochemical plant at Abadan. See also Government of Iran, *Fourth National Development Plan 1968-1972*, pp. 120-122.

[28] United Nations, *Statistical Yearbook for Asia and the Far East 1968*.

[29] This is particularly noticeable in the capacities being built in the iron and steel and fertilizer industries of the heavy industries sector.

[30] See "Sectoral Projections" (EGPT/WP/3 Add.1), page 5, and *Asian Industrial Development News*, No. 4, 1969, pp. 7-9.

[31] See "Review of Industrial Growth Rates with Specific Reference to Development Problems of ECAFE Developing Countries", *op. cit.*

[32] See Nanjappa, K. L., *Small Industries Assistance Programme in India*, October 1969, page 41. Official estimates have been based on uncertain methods of calculation so that total output from this sector may be grossly underestimated — see Bettelheim, "India Independent", *Monthly Review Press* (New York, 1968), p. 254.

[33] See "Sectoral Projections", *op. cit.*, page 4.

[34] *Statistical Yearbook for Asia and the Far East, 1968, op. cit.*

[35] Data obtained from the Directorate, National Economic Council, in September 1969.

(Millions Pesos at FY 1967)

	1962	1963	1964	1965	1966	1967	1968	1969
Agriculture	5471	5805	5927	6040	6424	6847	7358	7932
Rate of growth		6.1	2.1	1.9	6.4	6.6	7.5	7.8
Per cent of GNP	29.2	29.0	28.3	27.7	27.8	27.9	28.2	28.6
Manufacture	2888	3086	3226	3270	3409	3623	3810	4016
Rate of growth		6.9	4.5	1.4	4.3	6.3	5.2	5.4
Per cent of GNP	15.4	15.4	15.4	1.50	14.8	14.8	14.6	14.5

Industrial development, although interrupted in the mid-1960s, grew at a rapid rate during the last decade and its share in national income, in relation to agriculture, increased from 12.4 per cent in 1950 to 17.5 in 1968.[36] Between 1960 and 1967, light industry, mainly dominated by sugar production, increased at an annual average rate of 7.7 per cent, and heavy industry, mainly cement, increased at an annual average rate 11.8 per cent. The relative shares of the two groups of industries did not change substantially and, as of 1967, 61.2 per cent in terms of total volume of output was still contributed by light industry. Until the latter part of the decade, emphasis was placed on the development of agriculture and industry was left to grow on its own. This resulted in the development of a wide range of industries in all sectors with various problems which are now causing concern to the planners.[37]

In Ceylon, concerted efforts towards building up an industrial sector were taken after 1961. It involved the reorganization of an existing light industries sector whose main objective had been import substitution and the building-up and strengthening of the public sector which directed its attention mainly towards the heavy industries sector. In 1960, the manufacturing industries contributed 5.2 per cent to GDP at factor cost, increasing to 7.7 per cent in 1967.[38] In 1964, the heavy industries sector contributed 15.8 per cent in terms of value of output as against the light industries' 84.2 per cent. By 1968 the relative proportions were 26.9 per cent and 73.1 per cent.

Although the average growth rate of the manufacturing sector was 5.1 per cent during the period 1960-1966, (incidentally one of the lowest growth rates in the region), there was an increase of 18.2 per cent in value added at current prices in 1968. At constant prices this amounted to an 11.4 per cent increase over 1967 production. There have been substantial increases in the output of the electrical machinery, rubber goods (including tyres and tubes), cement and ceramics, fabricated metal products and hardware in the heavy industry sector and textiles, garments and confectionery in the light industry sector. During the latter part of the decade, the heavy industries (iron and steel, hardware, engineering industries and cement) expansion schemes in which investment commenced in the earlier years, went into operation and, at the same time, investment in the more important fertilizer and petroleum-refining industries was well under way.

In Indonesia, with the exception of a very few items such as cigarettes and tin, there has been a noticeable downward trend in the output of some of the principal industrial products.[39] Sugar production declined from 678,000 tons in 1960 to 614,000 tons in 1966, cotton yarn from 8,000 tons to 4,200 between 1960 and 1964, output of all petroleum products declined (with the exception of distillate fuel oil), cement production declined from 387,000 tons in 1960 to 339,000 tons in 1966 and tin metal production declined from 1.97 thousand tons to 1.5 thousand tons between 1960 and 1966.

According to recent estimates,[40] the manufacturing sector contribution to GNP in 1967 was 12 per cent and not only has there been a decline in total production in most areas, but operational levels in terms of real capacity have been 20 to 40 per cent. Small industries contribute about 80 per cent of the total industrial output[41] and nearly 10 million people are engaged in small-scale and handicraft industries, concentrated mainly in food, tobacco and textile production.

[36] See "Country Projections" (EGPT/WP/8), p. 5.

[37] This problem was strongly emphasized at a discussion with the Director and staff of the Operations Planning and Statistics Division of the Presidential Economic Staff in September 1969. Similar views are also implicit in a report, "The Development and Status of the Basic Chemical Industry", Mariano P. Ramiro and Efigenia F. Basco, Manila, January 1969, which states that lack of specific government direction in the development of the economy created several problems for the chemical industry".

[38] Construction and processing of the major agricultural crops (tea, rubber and coconut) are not included.

[39] *Statistical Yearbook, Asia and the Far East, 1968, op. cit.*, p. 116.

[40] Estimates of IBRD Mission (1968) and data given in the Indonesian plan. The figures were all confirmed during discussions with experts from UNIDO working with the Ministry of Industries.

[41] Director-General of Light and Handicraft Industry in September 1969.

3. Industrial growth prospects: 1970-1980

Several factors favour a higher rate of growth and a consolidation of the industrial structure in the ECAFE developing countries during the 1970s. The more important are: (a) the size and variety of the region's natural resources; (b) the high potential economic surplus in many of the countries in relation to national income; (c) the large labour force with a tradition of craftsmanship; (d) availability managerial and technical personnel, many at present unemployed; (e) experience in planning — the lessons of successes and failures of the 1960s; (f) existing and potential domestic as well as regional markets which are easily accessible; (g) transport facilities and the increasing degree of urbanization; (h) rapidly developing agriculture sectors; (i) prospects of peace and relative stability in the region.

Econometric projections of growth rates on a more detailed basis have been made by the ECAFE secretariat.[42] The purpose of this paper, however, is to evaluate past trends and determine the procedures, policies and a programme of action best suited to accelerate the pace of development of manufacturing industries.

The average growth rate in manufacturing industry has been 11.8 per cent during the past decade; but only four countries recorded average rates above 11.8 per cent.

The estimated growth rates for several developing countries are given below:

[42] For details, see case studies, "Projection of Sectoral Outputs and Employment for several ECAFE countries", prepared by the ECAFE secretariat for the seventh meeting of the Group of Experts on Programming Techniques, October/November 1969, Bangkok. Also see report of Committee for Development Planning, *op. cit.*, pp. 3-5, as well as *Feasible Growth and Trade Gap Projections in the ECAFE Region: Developing Programming Techniques*, Series No. 7, 1968, pp. 5-13.

Industrial growth rate — Projection 1970-1980

		1970–1975	*1975–1980*
China (Taiwan)	Estimate in country plan	9.2	—
	Estimate in ECAFE[a]	8.3	7.8
India	Estimate in ECAFE[a]	5.5	6.3
Iran	Estimate in country plan	15.0	—
	Estimate in ECAFE[a]	8.6	8.5
Korea, Rep. of	Estimate in country plan	15.0	—
	Estimate in ECAFE[a]	11.5	11.3
Malaysia	Estimate in ECAFE[a]	7.3	7.0
Philippines	Estimate in country plan	7–8	11–12
Thailand	Estimate in ECAFE[a]	11.3	11.6

Note: [a] Economic projections (*op. cit*) for developing countries. Where growth rates for manufacturing industries have not been estimated, calculations have beenn made on the basis of projected commodities output growth for the period 1970-1980.

During 1970-1980, in terms of real potential, the average growth rate in manufacturing industry should fluctuate between 12 and 15 per cent per annum and in several countries may even exceed 15 per cent. Industrial growth rates for the plan periods in China (Taiwan) (1969-72) and the Republic of Korea (1972-76) will be 9.2 per cent and 15 per cent, as against 16.6 per cent and 18 per cent, respectively, during the 1960s. The growth rates in the two countries are expected to be lower than those recorded during the 1960s, but the actual trends are likely to be higher, the average for both countries being in the region of 15 per cent. Planners in both countries have estimated a structural change in investment pattern but structural changes are already in process. The boom conditions caused by war are expected to subside and the rapid expansion generated by war will certainly be reduced, but there are other variables associated with peaceful development and regional co-operation which are bound to exert beneficial effects.

During the Second Development Decade, the manufacturing growth rates should be much higher in Ceylon, India, Iran, Pakistan, Philippines and Thailand. Although the projected growth rates are lower than might be expected for a 12 to 15 per cent average for the whole region, several factors favour higher growth rates in these countries. The same reasoning applies

to development possibilities in Indonesia. In Ceylon, India and Pakistan, in particular, trends of agricultural development have had a very salutary influence on industrial production in many ways. Unless developments in agriculture are retarded, due to unforeseen circumstances, industrial growth rates should benefit greatly from these trends. Apart from India and Pakistan, the other countries in this group will, during the first part of the decade, have opportunities for concentrating on the building of their light industries and consumer-goods industrial sectors which, if given special attention, have a higher growth potential than has been estimated.

The reasons for arriving at the above conclusions should now be examined in greater detail.

During the past decade, both China (Taiwan) and the Republic of Korea have diversified their economies and built up stable industrial structures, their principal objective being import substitution. The process of import substitution through concentration on light consumer-goods industries has simultaneously engendered an increasing reliance on the import of capital and intermediate goods. China (Taiwan), for example, increased its imports of textile machinery from NT$223.5 million in 1961 to NT$1,278 million in 1968[43] and its machinery and parts imports increased from NT$659.6 million to NT$1,311.2 million during the same period. There were similar increases in intermediate goods; for example, imports of ungalvanized sheets increased from NT$29.7 million in 1961 to NT$241.9 million in 1968. In the Republic of Korea, machinery and transport equipment imports increased from US$40.1 million in 1960 to US$533.0 million in 1968.[44] Textile machinery imports increased from US$5.4 million to US$36.2 million and iron and steel ingots from US$8 million to US$17.5 million during the same period. The most important reason for the increasing imports of essential industrial facilities was the rapid expansion of industrial exports. In other words, the process of industrialization in these countries was able to generate its own momentum through the building up of an export-oriented light consumer-goods sector which played the role of the heavy industries sector. This did not mean that the heavy industry sector was completely neglected: as from about 1963/1964, the manufacture of basic metals, metal products and machinery in both countries gathered momentum.[45] The main force behind the growth process, however, was the export-oriented light consumer-goods industries sector.

The anticipated decline in the rate of growth of manufacturing industries of both China (Taiwan) and the Republic of Korea is due solely to the planned structural changes anticipated in the 1970s. In China (Taiwan), investment will be concentrated in the more sophisticated capital goods manufacturing sector and priority will be given to the electronics, petrochemical and iron and steel industries. These industries require more capital and higher technical skills and have a longer period of incubation. Similarly, in the Republic of Korea, priority during the next plan will be given to the development of the iron and steel, machinery and petrochemical industries.[46]

The prospects and problems of India, Pakistan and Indonesia should be considered separately from those of Thailand, Malaysia, Iran, Philippines, Ceylon and Singapore.[47] Both India and Pakistan will concentrate on further development of their heavy industries during the 1970s.[48] Indonesia has emphasized the importance of agriculture and, according to its plan, will invest more in that sector than in industry. In the industrial sector, it will be concerned with problems of reorganization.

Taking the long-term view, the speed, pattern and development potential of the western and southern Asian region will be decisively influenced by changes in these three major countries of the region.

As regards industrial resources,[49] India is one of the richest countries in the world. Its iron ore resources are estimated at 21 thousand million tons (a quarter of the world's deposits) but so far only 6.8 thousand million tons have been located. Its deposits of manganese are the third largest in the world (estimated at 112 million tons). There are also deposits

[43] Imports for the first five months of 1969 were NT$792 million. (*Taiwan Economic Statistics, op. cit.*, p. 142).

[44] Imports for the first six months of 1969 were US$273.6 million. (*Major Economic Indicators 1957-1969*, Seoul, 1969).

[45] See *Major Economic Indicators* (Korea), *op. cit.* and *Taiwan Economic Statistics, op. cit.* Also see, "Korea's machinery Industry", *Korea Trade and Investment*, September 1969, published by the Korea Trade Promotion Corporation, Seoul.

[46] In the chemical field, the main emphasis will be on the development of the phosphatic and potassium fertilizer capacities. Imports of these fertilizers now average 160,000 t/y. In iron and steel there are only three or four small-scale plants and production is negligible. The plan will provide for over US$160 million investment in iron, steel and machinery manufacturing. The planners have selected thirty-two items of machinery, imports or which in 1968 accounted for US$500 million and, by 1976, it is expected that at least 50 per cent of these will be substituted by local manufacture. Investment in petrochemicals will be approximately US$200 million. (Information provided by Directorates of Heavy and Light Industries of the Ministry of Commerce and Industry, September 1969).

[47] Both Singapore and Hong Kong are fast developing and, though their problems differ in degree, future prospects of growth will be closely determined by trends within the area.

[48] See India, *Fourth Five-Year Plan* and Pakistan, *Third Five-Year Plan*.

[49] Bettelheim, *India Independent, op. cit.*, chapter III.

of chromium, gold, bauxite, ilmenite and several non-ferrous metals of importance for atomic industries, as well as an estimated 60,000 million tons of economically workable coal. The existence of these vast resources can give India "a leading position in world industry, in particular the steel and engineering industries and the chemical industries based on coal."[50]

Over-all industrial production in India increased considerably (about 140 per cent)[51] during the three five-year plans, but was far below the estimates in the plans. Progress has been particularly rapid in the iron and steel industry, the fertilizer industry and the engineering and machinery industries, but is still far below India's potential.[52] During the recent recession (1966/1967), the engineering industries in particular suffered considerable production losses but they have in most instances recovered and, as from the latter part of 1968, output in the depressed industries increased to normal production levels. Despite favourable trends, however, most industries continue to operate below rated capacities.

In terms of the draft plan, production in 1973/74 is expected to be as follows:

[50] *Ibid.*, page 47.

[51] Estimates from data contained in draft of Fourth Five-Year Plan.

[52] "The increase in industrial output (1960 as base) stood at 8.2 per cent in 1961/62, 9.6 per cent in 1962/63, 9.2 per cent in 1963/64 and 8.3 per cent in 1964/65. Thereafter there was a sharp deterioration in the range of growth of output. It fell to 4.3 per cent in 1965/66, 1.7 per cent in 1966/67 and 0.3 per cent in 1967/68". (Government of India, *Draft Fourth Plan*, March 1969).

India — Production targets 1973/74[a]

Industry	*1960/61 Production*	*1965/66 Production*	*1968/69 (estimated)*		*1973/74 (targets)*	
			Capacity	*Production*	*Capacity*	*Production*
Iron and steel						
Steel targets (million tons)	3.47	6.5	9.0	6.5	12.0	10.8
Finished steel (million tons)	2.39	4.5	6.9	4.6	9.0	8.1
Pig iron for sale (million tons)	1.1	1.2	1.2	1.2	4.2	3.8
Aluminium (thousand tons)	18.2	67.0	117	120	230	220
Manufacturing						
(1) Metallurgical and heavy machinery (thousand tons)	..	11	85	20	115	75
(2) Coal and mining machinery (thousand tons)	..	5.1	50	10.5	50	20
(3) Fertilizer and chemical (thousand tons)	..	..	..	..	25	20
(4) Chemical machinery (million rupees)	..	..	..	..	300	275
(5) Dumpers and scrapers (units)	..	..	..	..	575	500
(6) Crawler tractors and wheeled tractors (units)	..	..	..	..	1,500	1,200
(7) Tractors (thousands)	negligible	6.3	20	14	68	50
Fertilizer (N) (thousand tons)						
Nitrogen	101	232	1,024	550	3,700	3,000
Phosphatic (P_2O_5)	53	123	421	220	1,800	1,500
Coal: excluding lignite (million tons)	55.67	67.73	90	69.5	..	93.5
Crude oil (million tons)	0.41	3.02	6.15	5.85	..	9.7
Refining capacity: crude throughout (million tons)	6.09	9.75	17.5	16.13	28–29	26

[a] Compiled from data in draft fourth five-year plan.

The highest growth rates are expected, and planned for, in the heavy industry sector. Cement, paper and newsprint industries are also expected to increase output during this period. The industrial sector, as a whole, is expected to grow at an annual rate of 8 to 10 per cent during the fourth plan period.

In Pakistan, as in India, industrial growth was subject to considerable strains during the latter part of the 1960s. Nevertheless, the basis for rapid expansion of a diversified industrial sector has been laid and, in the 1970s, growth rates, particularly in the heavy industries sector, will be rapid. One of the major factors in the growth process has been the high expansion rate of the export of manufactures.

On the basis of data available, the high growth rate of fertilizer production will make the chemical sector the leading sector during the first years of the 1970s. Emphasis has already been shifted to the heavy manufacturing sector[53] and growth rates of the intermediate and capital goods sector should be faster than that of the light consumer-goods industries during the 1970s.

The importance of Indonesian industrial development and prospects during the 1970s is due to (a) the size of the Indonesian market; (b) its industrial potential, being second only to India in proven and estimated natural resources: petroleum, tin, copper, bauxite and several other minerals as well as forest resources; and (c) immediate prospects for substantial increases in output.[54]

The 1969-1974 plan which was introduced in April 1969 has given priority to agricultural development. The total investment in industry in estimated at Rp250,660 million (approximately US$270 million), of which 45.65 per cent has been earmarked for fertilizer, cement and chemicals, 16.59 per cent for textiles, 16.78 per cent for pulp, paper and printing, 9.97 per cent for light industry and handicrafts, 9.53 per cent for the metal industry, machinery and transport equipment, and 1.49 per cent for pharmaceuticals. If these rates of investment are realized, output in terms of value of fertilizer, cement and chemicals is expected to rise by over 175 per cent, of textiles 100 per cent and the total output by nearly 100 per cent, which means an average growth rate in output of approximately 15 per cent per year.[55]

In the Philippines, the proposed five-year plan[56] places emphasis on industrial development and the growth rate of manufacturing industry is expected to be between 7 and 8 per cent during 1970-1974. The rate is also expected to rise during the latter part of the decade, reaching an average 11 to 12 per cent per year for the decade ending 1979[57] The growth rate in GNP is estimated to be between 6 and 7 per cent during the 1970s. The percentage share of manufacturing in GNP is estimated to increase from 14.5 per cent in 1970 to 14.9 per cent in 1974, showing a decline from an average of 15.4 per cent between 1962 and 1965. The agricultural sector is expected to increase its share from 28.7 per cent in 1970 to 29.4 per cent in 1974.

The total investment, as shown in the draft plan (1970-1974), is ₱39,480 million (approximately US$-900 million) of which ₱6,355 million (approximately 15 per cent) has been earmarked for industry. The entire sum is shown as investment by the private sector.[58]

Growth is expected to be highest in the metal, wood, cotton textiles, engineering and chemical sectors.

Details of development prospects for the other countries are not available but trends in recent years indicate prospects for higher capacity at an increased rate of growth in all of them. The trends of growth in these countries during the past decade have been discussed in the early part of this paper.

4. Major Development problems and policies, 1970-1980

In order to achieve the higher rates of industrial growth, five important aspects should be given priority consideration.

(a) Capital — there is a shortage of both domestic and foreign capital, particularly among the countries in Western Asia. Their growth rates have in the last decade been lagging. There are two facets to the problem of capital: (a) the management and utilization of domestic capital and determination of the potential of domestic capital and (b) the management and selection of foreign capital inflow. These aspects will be discussed below.

(b) The development of agriculture, particularly with a view to establishing appropriate balanced relationships between industry and agriculture.

[53] See *Pakistan Economic Survey, 1966-67* and Pakistan, *Third Five-Year Plan.*

[54] This will be discussed in greater detail below. The planners as well as the directors-general of various sectors with whom discussions were held prior to the preparation of this paper often drew attention to the existence of the unutilized industrial assets.

[55] The problems involved in prospective growth rates and their implications will be dealt with subsequently.

[56] The draft proposals were finalized in 1969 and the plan itself is to be operative from 1970-1974.

[57] Data provided by the National Economic Council in September 1969.

[58] Government and private share in sectoral investment (N.E.C. draft plan 1970-1974).

(c) Development of infrastructure, particularly in providing the required technical training for the increased demand in respect of skills and many other services in manufacturing industry; supply of transport facilities (harbours, rail and road facilities) at economic rates for movement of industrial goods and materials; electricity, in particular, regular supplies at economical rates for inputs and outputs of heavy and chemical industries.

(d) Re-orientation of administrative machinery in order to cope with the novel demands in the administration of industrial economies. This would mean not only making personnel able to administer commercial enterprises available but also changing the attitudes of civil administrations to cope with the requirements of industrial needs.

(e) The adoption of external economic policies suitable for regional co-operation, particularly in trade and commercial relationships and monetary policies, and conducive to greater mobility of capital and regional economic relations.

These constitute some of the major aspects which do not fall within the purview of manufacturing industries alone but are common to the entire process of economic development. In industry itself, consideration should be given to two important aspects, namely:

(a) Utilization of existing capacities and, in particular, development of small industries through introduction of appropriate technology, and

(b) Adoption of planning and programming techniques, at both enterprise and sectoral levels.

Many of these problems are common to all countries of the region. Naturally, problems anticipated during the 1970s differ from country to country and it would be advantageous to examine them in greater detail.

In China (Taiwan), the major problems anticipated are: (i) shortage of projects adequately profitable for private sector investment; (ii) shortage of land for factories; (iii) inadequate transport facilities; and (iv) shortage of manpower.[59] In the Republic of Korea, they are: (i) heavy export dependence upon manufactured fibre materials, mainly textile, which constituted 55 per cent of the total exports of light industry; (ii) shortage of capital; (iii) shortage of technical know-how and technical personnel.[60]

Among the other member countries, particularly India, Pakistan, Indonesia, Philippines and Ceylon, shortage of capital, especially foreign exchange, appears to be the most serious problem. Thailand and Malaysia, on the other hand, do possess a greater potential for development, if capital alone is considered to be the main generating force of industrial activity.

There are indeed several other adverse factors, such as weak agricultural structures, shortages of managerial and technical know-how, shortage of skilled labour, lack of institutional facilities, inadequacy of incentives and low levels of domestic savings and capital formation which have become the concern of academic theoreticians as well as policy-makers. These factors will continue to influence the pace of industrialization at all levels of development and in order to resolve such problems, it is necessary not only to provide the capital that is required but also to plan ahead in order to avoid serious bottlenecks.

First, it would be appropriate to discuss in brief the problems outlined above in respect of China (Taiwan) and the Republic of Korea and then make a brief comparative assessment of the whole region in order to suggest a procedure for priorities in dealing with the situation.

In China (Taiwan), the problems envisaged are more symptomatic of the maturing of the economy and a shift of emphasis in restructuring the industrial base. From a policy point of view, the Government is most concerned that it is unable to divert domestic capital into industrial enterprises, particularly the capital which is accumulating in the rural agricultural sector. Here, there are two aspects which appear to indicate a way out: (1) the predominance of small-scale industries which account for 97 per cent of the enterprises that produce only 25.1 per cent of sales revenue and (2) the prevailing low wage levels in industry and agriculture.[61] With the shortage of labour, wage levels are expected to rise at a faster rate in the 1970s and this is bound to stimulate domestic consumption, in particular of the light consumer-goods industries, and will naturally call for a process of rationalization of the small industries sector.[62] In the Republic of Korea, the process of export diversification is already taking place in a small way but the efforts now being made to promote trade in manufactures are bound to reduce the importance of the textile and fibre products group of industries.[63]

[59] Sectoral Planning Division, September 1969.

[60] Discussion with Directors of Light and Heavy Industries, September 1969.

[61] Wages of factory workers rose from NT$41.60 per day in 1962 to NT$57.68 in 1967. *Taiwan Economic Statistics, op. cit.*, page 190.

[62] An example of such growth is the development of the NANYA Plastic Corporation of Kaoshiung: in 1957 its total capital was US$100,000 and now it is US$9,750,000.

[63] Already both China (Taiwan) and the Republic of Korea are taking advantage of the rising cost of simple products in Japan and are increasingly displacing the latter in the United States market (*Asian Industrial Development News*, No. 4, 1969).

An important problem for both countries is that of the anticipated shortage of technically trained skilled labour. In China (Taiwan), the Manpower Development Committee has undertaken an evaluation of the problem and estimates of requirements upto 1972 have now been completed.[64] In the Republic of Korea, a Manpower Development Working Group has been set up but, according to the over-all resources budget 1970, the shortage in the 1970s is expected to be covered by the introduction of foreign skills.

The major problems that deserves immediate attention among other countries may be classified as endogenous and the most important of these is agricultural resuscitation. The importance of agriculture for industrial prosperity cannot be overstated. In India, Pakistan and Ceylon, as well as in the Philippines and the Republic of Korea, this relationship has been only too well established.

Both in terms of employment and contribution to GNP the agricultural sector is the most important in the non-industrialized developing countries, but it is generally the weakest from the point of view of productivity and there are many reasons for this. The most important are outmoded systems of land tenure which give rise to low agricultural income, heavy rural indebtedness and the prevailing low levels of living of the rural population.[65] In this regard, the successes achieved by China (Taiwan) provide an example which might be successfully emulated. Economic power is often highly concentrated in both rural and urban areas in developing countries and "where such concentration of power is an impediment to increasing productivity of land and achieving other objectives of development, such as fuller employment and greater equality of incomes, land reforms should be undertaken. These should not merely be tantamount to scratching the surface but should bring true benefits to the actual tillers of the soil and at the same time contribute towards improving the productivity of the land".[66] Agricultural reform will not merely help to enlarge the markets for industrial goods and provide much needed inputs but will also provide a source of much needed capital because surpluses from this sector can be directed to industry.[67]

Such reforms which expand domestic markets will certainly also stimulate demand to more than absorb the existing unutilized capacities. There are of course several reasons for non-utilization of existing industrial capacities: for example, shortfall in demand, non-availability of inputs for capacity production and existence of monopolies. All these aspects have in one way or another created serious over-capitalization in terms of output in the industrial sector.[68] Apart from this, there is the large amount of productive forces that could be mobilized in terms of men and materials and the surpluses which today circulate in speculative activities.

In India and Pakistan, apart from the recessionary trends in recent years which caused production to reach extremely low levels, normal production trends have been well below average standards. In 1968/69, production in the Indian engineering industries ranged between 20 and 30 per cent of capacity, in fertilizers 50 per cent of capacity and, by 1973/74, the former group is expected to increase production up to only 40 per cent of capacity and the latter up to 70 to 80 per cent.[69] In Indonesia, utilization of capacity ranges between 20 and 40 per cent and, in addition to low levels of capacity utilization, plant sizes are uneconomic.[70] In the Philippines, a survey of the chemical industries in 1967[71] showed that the industry operated at an average of 50 per cent per year. The aluminium sulphate, ammonia, sulphuric acid and ammonium sulphate plants operated at 11 per cent, 26 per cent, 35 per cent and 45 per cent respectively. In the Republic of Korea, a survey undertaken by the Chamber of Commerce and Industry showed that capacity utilization was 67.2 per cent for all industry[72] and that light industries, particularly leather and food industries, were operating at or below 50 per cent of capacity.

Finally, there is the question of capital which has to be examined in two ways, (1) the availability of foreign capital through aid and investment and (2) management of available capital both foreign and domestic. It has been estimated[73] that, on the basis of 6 to 7 per cent over-all growth of the GNP, the

[64] See *Manpower Development in the Republic of China*, July 1965, and *Projection on Manpower Supply and Demand for Taiwan, 1966-1971*, November 1967.

[65] For more details on prevailing systems see United Nations, *Report of the World Land Reform Conference, 1966* (New York, 1968).

[66] *Report of the Committee for Development Planning, op. cit.*, page 8.

[67] History has demonstrated that the countries which developed industry in the 18th and 19th centuries initially used such surpluses successfully. The more recent experience of the "Centrally Planned Economies" should also be taken into account.

[68] The extent of unutilized capacities is discussed in the Committee reports on "Twenty Years of Industrialization and Progress and Problems" — twentieth and twenty-first sessions, 1968 and 1969.

[69] India, *Fourth Five-Year Plan, op. cit.*, pp. 261-262.

[70] Existing paper plants in North Sumatra, West Java and East Java have capacities of 3 to 3.6 thousand t/y per unit only.

[71] "The Development and Status of the Basic Chemical Industry", *op. cit.*

[72] Sample survey covered 1,000 large manufacturing firms.

[73] *Feasible Growth and Trade Gap Projections in the ECAFE Region, op. cit.*, pp. 14-15.

trade gap in the developing ECAFE countries will be in the region of US$4,000-7,000 million by 1975. These are the over-all requirements and undoubtedly a greater proportion will be required for industrial development.

There have been and will continue to be many divergent views on the problems of foreign private capital investment as well as on the problems of capital aid as it is constituted at present. Some hold the view that private investment is the key to development strategy while others consider it a neo-colonialist stronghold. Data available on private foreign investment for all developing countries indicate that, between 1956 and 1964, investments fluctuated between US$1 and US$1.5 billion but that " . . . the inflow of capital on both private and government account to less developed countries is matched by an almost equal, if not greater, outflow from less developed countries to developed countries on investment income account.[74] A recent survey undertaken by the Department of Economic Research, Central Bank of the Philippines, shows that outward investment remittances increased from US$64.58 million in 1966 to US$352.04 in 1968. Whereas total United States investment in the Philippines was estimated[75] at US$500 million, outward investment remittances between 1962 and 1968 amounted to US$2,216.85 million, representing an average capital flight of US$316.69 million a year. Foreign private capital investment also engenders other problems, such as the tendency to over-import technology, particularly capital intensive technology, and to invest in products of peripheral importance with, in many cases, a high import content. At the same time, it should be borne in mind that all foreign investment does not come in the form of foreign currency. In many cases, foreign firms operate with domestic capital which includes profits from existing foreign investments.[76]

In such circumstances, it seems reasonable to expect that foreign aid should, in the future, play a greater role in economic development. The Pearson report[77] points out, however, that the target of foreign aid, as indicated in the objectives of the United Nations First Development Decade, fell far short of expectations. During the early 1960s, the net flow of resources amounted to 0.89 per cent of the combined GNPs, but by 1968 it had fallen to 0.77 per cent and, furthermore, nearly 50 per cent of this consisted of investment and commercial credit, the balance (equal to 0.39 per cent) consisting largely of loans, in particular "tied" loans and surplus food. The report also shows that, in consequence of the nature of such aid, developing countries are now paying US$4,000 million per year in the form of debt services (apart from dividends on investments). Average debt service payments rose by 17 per cent per year during the 1960s, and it is estimated that by 1977 there will be a large net flow of money from the developing to the developed countries.

In India, the fourth five-year plan anticipates increasing trade deficits and consequently more loans and aid. At the end of June 1968, India's total loan obligations were estimated at Rs5,600 crores which is about a quarter of the country's national income and four to five times the annual export earnings. In 1967, the annual debt-servicing liabilities accounted for 28 per cent of the merchandise exports.[78] In Indonesia, it is estimated that, as from July 1970, total debt servicing will amount to US$240 million per year.

The Pearson report also points out that the developing countries have now reached an annual average rate of gross investment amounting to 17.8 per cent of GNP and that 85 per cent of this has come from domestic savings. This clearly demonstrates the unquestionable importance of domestic savings and the need to adopt policies to increase savings to generate economic growth. It will therefore be necessary to concentrate on:

(a) Maximization of capacity utilization — in India, Pakistan, Ceylon, the Republic of Korea and Indonesia. The problem is particularly acute in Indonesia where industrial production could be more than doubled by the use of existing capacities. For example, the small industry sector, which contributes a substantial proportion of present industrial output, is said to be capable of doubling its output in one year from the present US$300 million to US$600 million by an investment of US$8.3 million:[79] not to take advantage of such an astounding capital output ratio would be tantamount to missing a great opportunity in the present circumstances. Detailed surveys of capacity utilization and measures to maximize use of capacity should therefore be undertaken in selected countries.

[74] See a series of studies prepared by the University of Sussex, Institute of Development Studies, in particular M. J. Desai, "Cost and Returns of Overseas Investment from the Point of View of the Host Country", January 1969.

[75] *Economic Monitor*, Manila, 15 September 1969.

[76] Schreiber S., *American Challenge* (London, Hamish Hamilton, 1968).

[77] *Partners in Development, op. cit.*

[78] Agrawal R. G., "Import Substitution", in *Social Action: A Quarterly Review of Social Trends*, July/September 1969.

[79] Summary of information sheets from the Directorate-General of Light and Handicraft Industry, September 1969.

(b) Improvement of techniques of planning, not merely by the introduction of more sophisticated techniques of planning (which should follow in the wake of the growing maturity of developing economies), but also by the provision for real participation at the productive levels. The latter involves both improvement of planning machinery and greater communication between planners and people at all levels.

(c) Development of small industries which at present account for a substantial share in output and employment of industrial labour by improvements in technology and provision of better facilities.

(d) Improvement of domestic savings by land reforms and proper management of economic resources.

(e) Improvement of foreign trade in manufactures and semi-manufactures, particularly of those countries which are heavily dependent at present on the exports of primary commodities.

(f) Introduction of regional industrial planning to enlarge markets as well as to accommodate technological requirement of scales of production.

(g) Introduction of manpower planning in order to avoid bottlenecks through shortages of the supply of skilled and semi-skilled workers when such workers are required.

(h) Introduction of administrative reforms to cope with problems of economic development.

The measures outlined above will result in a great increase in production through a minimum of investment. They call, in the first instance, for appropriate administrative measures and the adoption of correct economic policies. Experience during the last two decades has shown, unfortunately, that some civil administrations are so centralized and bureaucratized that they are not fully aware of the real demands of national problems. Unless the administrations are willing to recognize the obstacles to economic development and are capable of removing them, achievement will be gravely handicapped.

Annex

STATISTICAL DATA

Table 1. GROWTH RATE OF MANUFACTURING IN SELECTED ECAFE COUNTRIES[a]

	1953-1958	*1958-1963*	*1953-1963*	*1958-1967*	*1960-1968*
Burma	2.8	5.5	4.2	—	—
Ceylon	2.6	6.7	4.6	5.4 (1958-1966)	5.1 (1960-1966)
China (Taiwan)	9.0	13.1	11.0	14.1	16.6
India	6.2	8.3	7.3	5.8	5.5
Iran	—	—	—	—	11.1
Korea, Republic of	16.1	10.1	12.7	11.7	18.0
Pakistan	17.3	15.2	15.7	—	11.1
Philippines	11.1	6.0	8.6	5.4	6.4
Singapore	—	—	—	—	14.5 (1966-1968)
Viet-Nam, Republic of	—	—	—	—	9.7 (1962-1963)

[a] 1953-1963 base 1958, 1958-1967 base 1964, 1960-1968 base 1964.

Sources: National Tables in the Growth of World Industry;
United Nations, *Statistical Yearbook, 1968*;
United Nations, *Monthly Bulletin of Statistics*, September 1969.

Note: Data in tables 1-4 have been compiled from latest United Nations sources, references to which are given therein. Data in tables 5-11 have been compiled from national sources which are too extensive to be quoted. Main sources, however, have been the yearbooks of national statistics and reports of central banks.

Table 2. DEVELOPING ECAFE COUNTRIES:[a] INDEX NUMBER OF INDUSTRIAL PRODUCTION

(1963 = 100)

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Mining and manufacturing, electricity and gas	82	87	94	100	110	120	125	132	142
Mining	80	85	94	100	106	117	124	143	155
Coal	77	82	91	100	97	105	107	109	109
Metal	90	96	98	100	100	109	112	117	123
Crude petroleum and natural	79	85	94	100	111	123	134	164	184
Manufacturing	83	88	94	100	110	120	124	129	138
Food, beverages, tobacco	92	96	96	100	105	113	126	125	132
Textiles	92	95	99	100	114	117	115	118	124
Clothing footwear and made-up articles	76	85	94	100	111	138	153	167	...
Wood products	77	77	85	100	104	158	146	159	...
Paper and paper products	74	80	86	100	107	113	123	128	142
Chemical, petroleum and coal products	84	87	93	100	110	114	119	132	148
Non-metallic mineral products	75	82	92	100	107	116	121	131	142
Basic metal	61	70	84	100	103	106	111	108	116
Metal products	62	73	88	100	119	134	135	136	150
Light manufacturing	89	93	97	100	109	119	124	128	135
Heavy manufacturing	71	79	89	100	112	121	124	130	144
Electricity and gas	66	76	87	100	114	130	143	161	187

Source: United Nations, *Monthly Bulletin of Statistics,* September 1969.

Note: [a] Afghanistan, Brunei, Burma, Ceylon, China (Taiwan), Hong Kong, India, Indonesia, Iran, Republic of Korea, Malaysia, Pakistan, Philippines, Thailand and Republic of Viet-Nam.

Table 3. DEVELOPING ECAFE COUNTRIES: BROAD CHANGES IN THE STRUCTURE OF MANUFACTURING INDUSTRY, 1960-1968

(percentage)

Industry group	Contribution to total manufacturing value added		Growth rate	
	1960	1968	1960-1961	1960-1968
Light industry	67.7	61.4	7.0	5.4
Food products	26.5	22.8	(6.5)	(4.6)
Textiles	22.1	18.4	(5.3)	(3.5)
Others	19.1	20.2	(8.5)	(7.4)
Heavy industry	32.2	38.6	11.1	9.2
Chemicals and petroleum products	10.3	11.4	(10.7)	(7.3)
Basic metals	4.4	4.4	(9.5)	(8.3)
Metal products	10.3	14.9	(12.9)	(11.7)
Others	7.3	7.9	(8.9)	(7.6)
All manufacturing	100.0	100.0	8.6	6.6

Source: United Nations, *Monthly Bulletin of Statistics,* data derived from the index of manufacturing production for Asia, excluding Japan (1963 = 100).

Table 4. DEVELOPING ECAFE COUNTRIES: OUTPUT OF SELECTED COMMODITIES

	1950	1955	1960	1961	1962	1963	1964	1965	1966	1967
Textiles (thousand million metres)	3.5	5.5	6.2	6.5	6.4	6.5	6.9	6.8	...	...
Cement (million tons) . . .	3.7	7.3	13.7	15.1	16.5	17.0	19.4	22.6	24.3	25.5
Nitrogenous fertilizer (thousand metric tons) . .	18.0 (1950/51)	108.1 (1955/56)	197.8 (1960/61)	284.8 (1961/62)	385.3 (1962/63)	482.1 (1963/64)	595.7 (1964/65)	619.3 (1965/66)	735.0 (1966/67)	923.4 (1967/68)
Paper (newsprint) (thousand metric tons) . .	5.3	14.9	83.5	94.4	104.5	83.1	120.0	127.5	140.9	...
Paper (other) (thousand metric tons) . .	34.4	99.0	146.6	167.6	192.7	207.1	226.0	284.0	278.3	...
Paper (printing and writing) (thousand metric tons) . .	80.0	173.5	317.2	393.6	442.4	464.4	547.7	571.0	584.7	...
Crude steel (million metric tons)	1.8	1.8	3.5	4.3	5.5	6.4	6.4	6.9	7.2	7.1

Sources: United Nations, *Statistical Yearbook, 1968;*
FAO, *Yearbook of Forest Products, 1968.*

Table 5.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Pakistan									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	9.4	10.0	10.6	11.0	11.0	11.1	10.6	10.8	—
(2) Percentage contribution of — light industry . .	45.7	42.6	42.6	43.9	42.0	40.1	45.0	42.4	—
— heavy industry . .	54.3	57.4	57.4	56.1	58.0	59.9	55.0	57.6	—
(3) Annual growth rate of — light industry . .	6.8								
— heavy industry . .	8.7								
(4) Annual growth rate of exports of manufactures .	16.4								

Table 6.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Iran									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	24.8	25.6	26.7	29.1	28.1	28.6	30.0	31.7	—
(2) Percentage contribution of — light industry . .	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	—
— heavy industry . .	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	—
(3) Annual growth rate of — light industry . .	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	—
— heavy industry . .	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	—
(4) Annual growth rate of exports of manufactures .	(n.a.)	(n.a.)	(n.a.)			16.4			

Table 7.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Thailand									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	10.5	11.1	11.4	11.4	11.8	12.4	12.0	13.1	—
(2) Percentage contribution of — light industry	20.5	15.8	14.6	12.2	14.6	21.5	16.5	12.8	—
— heavy industry	79.5	84.2	85.4	87.8	85.4	78.5	83.5	87.2	—
(3) Annual growth rate of — light industry	8.9								
— heavy industry	18.1								
(4) Annual growth rate of exports of manufactures	41.0								

Table 8.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Ceylon									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	5.2	5.3	5.5	5.6	5.8	6.4	6.9	7.7	(n.a.)
(2) Percentage contribution of — light industry	(n.a.)	(n.a.)	(n.a.)	(n.a.)	84.2	85.2	84.9	78.5	73.1
— heavy industry	(n.a.)	(n.a.)	(n.a.)	(n.a.)	15.8	14.8	15.1	21.5	26.9
(3) Annual growth rate of — light industry	(n.a.)	(n.a.)	(n.a.)	(n.a.)	22.5				
— heavy industry	(n.a.)	(n.a.)	(n.a.)	(n.a.)	45.0				
(4) Annual growth rate of exports of manufactures	4.2								

Table 9.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
India									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	13.7	14.2	14.6	14.8	14.0	14.5	13.9	—	—
(2) Percentage contribution of — light industry	28.7	26.6	28.0	22.8	26.3	26.3	24.1	21.2	—
— heavy industry	71.3	73.4	72.0	77.2	73.7	73.7	75.9	78.8	—
(3) Annual growth rate of — light industry	2.6								
— heavy industry	6.8								
(4) Annual growth rate of exports of manufactures	4.3								

Table 10.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Malaysia, West									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	8.7	8.1	8.3	9.1	9.8	10.2	10.9	(n.a.)	(n.a.)
(2) Percentage contribution of — light industry	49.8	46.2	45.3	43.5	42.9	46.4	(n.a.)	(n.a.)	(n.a.)
— heavy industry	50.2	53.8	54.7	56.5	57.1	53.6	(n.a.)	(n.a.)	(n.a.)
(3) Annual growth rate of — light industry	14.8								(n.a.)
— heavy industry	18.0								(n.a.)
(4) Annual growth rate of exports of manufactures	7.5								

Table 11.

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Philippines									
(1) Percentage contribution of manufacturing industry to GDP at factor cost	18.6	18.9	19.1	19.8	19.0	17.9	17.6	17.5	(n.a.)
(2) Percentage contribution of — light industry	67.3	78.7	73.8	73.2	69.4	63.2	62.1	61.2	(n.a.)
— heavy industry	32.7	21.3	26.2	26.8	30.6	36.8	37.9	38.8	(n.a.)
(3) Annual growth rate of — light industry	7.7								(n.a.)
— heavy industry	11.9								(n.a.)
(4) Annual growth rate of exports of manufactures	15.7								

UNIDO AND THE FERTILIZER INDUSTRY IN THE DEVELOPING COUNTRIES[1]

The United Nations Industrial Development Organization (UNIDO) was set up on 1 January 1967 by the United Nations General Assembly as an autonomous body within the United Nations to promote and accelerate the industrialization of the developing countries, and to co-ordinate the activities of the United Nations system in this field. UNIDO was conceived to fill a gap in the United Nations system as, until then, there had been no separate United Nations body or specialized agency wholly devoted to industrial development. The new agency was given the primary responsibility in the field of industrialization and assigned the central role in co-ordinating the activities of the United Nations family of organizations in the industrial field.

In the exercise of its mandate, UNIDO, which has its headquarters at Vienna, Austria, undertakes field and supporting activities to assist the developing countries to solve a wide range of industrial problems. Its activities range from providing assistance in the formulation of industrial development programmes and economic feasibility studies to the establishment, operation and management of industrial enterprises. Training of technical personnel, research studies, surveys, seminars, as well as promotion of domestic investment and external financing also fall within the sphere of UNIDO activities.

UNIDO and the fertilizer industry

One of the fields to which UNIDO attaches particular importance is the development of the fertilizer industry in the developing countries. For most of these countries the fertilizer industry provides a unique link between agricultural development and industrial growth. Greater use of fertilizers offers the best prospect for more intensive agriculture and for higher yields; and the fertilizer industry often presents a nucleus for a broadly-based development of heavy chemical industry. Moreover, by building up the domestic fertilizer industry, developing countries, which at present rely on imported fertilizer to meet almost all their domestic requirements, will be able to save valuable foreign exchange.

Recommendations of the Athens Symposium

The first International Symposium on Industrial Development, organized by UNIDO at Athens, Greece, in December 1967, analysed the question of the fertilizer industry in the developing countries in great detail. It was felt at the Symposium that the serious imbalance in regard to the production, availability and consumption of fertilizers between the developing and the industrialized countries had to be corrected as a matter of urgency, possibly through the establishment of fertilizer industries in developing countries with the assistance and backing of the developed countries and international organizations. The Symposium made several recommendations on this subject, calling on international organizations, particularly UNIDO and the Food and Agriculture Organization of the United Nations (FAO), to assist the developing countries in the establishment of a fertilizer industry through research, feasibility studies and expert advice on planning and pilot projects. UNIDO's programme, including field and supporting activities, is guided by the Symposium's recommendations.

Wide range of activities

UNIDO's field and supporting activities in the field of fertilizers cover a very wide spectrum. In addition to helping the developing countries in solving technical and managerial problems of existing fertilizer plants,

[1] This article was prepared for the News by UNIDO's Public Information Service.

UNIDO carries out exploratory and feasibility studies for the establishment of new fertilizer plants. Occasionally, UNIDO undertakes to set up a demonstration fertilizer pilot plant in a country which has no fertilizer industry.

UNIDO's aid is offered on a short-term, medium-term and long-term basis to the developing countries. While the short-term assistance (often in response to an urgent need) is provided under the Special Industrial Services (SIS), a programme jointly administered by UNIDO and the United Nations Development Programme (UNDP), medium-term assistance is given under the Technical Assistance component of the UNDP and the United Nations Regular Programme of Technical Assistance. Long-term projects, such as pilot plants and pre-investment and feasibility studies, are financed from the Special Fund component of the UNDP.

Short-term and medium-term projects

Under the SIS, the Technical Assistance component of the UNDP and the Regular Programme of Technical Assistance, UNIDO experts have undertaken fact-finding and exploratory missions of short and medium-term duration to various developing countries to advise them on the development of their fertilizer industries and to assist them in production, improvement and maintenance in the petrochemical and fertilizer industries. For example, a UNIDO expert was sent to Bolivia to undertake a fertilizer project feasibility study, while a fact-finding mission went to the Congo (Kinshasa) to investigate the possibility of UNDP/UNIDO assistance in fertilizer production. UNIDO experts have been to Rwanda to initiate a project for the extraction of methane dissolved in the waters of Lake Kivu for fertilizer production. In Togo, UNIDO experts have discussed with the Government the proposed demonstration plant for the production of phosphate fertilizers.

UNIDO experts have also visited:—

- — Indonesia, to advise the Government on existing fertilizer projects
- — Jordan, to prepare a fertilizer industry feasibility study
- — Guinea, to study the production of organic fertilizers
- — Madagascar, to investigate the market for nitrogen fertilizers
- — Sudan, to prepare ammonia and urea fertilizer plant specifications
- — Syria, to analyse tenders for a fertilizer project and
- — Uganda, to study investment and marketing arrangements of the fertilizer industry.

Long-term assistance: Special Fund projects

UNIDO's long-term assistance to the developing countries in the fertilizer industry comprises execution of UNDP/Special Fund projects assigned to it by the UNDP Governing Council. At present, UNIDO is executing three Special Fund projects relating to fertilizers, and was assigned one more by the Governing Council of the UNDP at its June session this year. Two of the three projects under execution are country projects, one each in Algeria and Pakistan, and the third is a regional project for the Maghreb countries. The new project assigned to UNIDO for execution concerns the development of a fertilizer industry in Togo.

In Algeria, UNIDO has completed the first phase of a Special Fund project aimed at assisting the Government to carry out feasibility studies for local use of petroleum derivatives and natural gas, as well as for the export of natural gas. Under this project, export markets for natural gas were surveyed, and a study of the petrochemical and fertilizer industry was completed. Forecasts were made for long-range export markets, price tendencies and Algerian production costs, and specifications of the plants to be built were determined. As a result of the first phase studies, a second phase Special Fund project has been initiated to assist the Government in the most efficient use of the natural hydrocarbon resources.

Under the second Special Fund project, UNIDO is assisting the Government of Pakistan to develop its fertilizer and petrochemical industries and to promote the use of fertilizers and petrochemical end-products. UNIDO experts have carried out an analysis of existing production facilities and formulated detailed specifications for contracting market surveys in Pakistan. Arrangements for the delivery of experimental fertilizers have been made with FAO which, under a subcontract, is looking after the promotion and use of the fertilizer aspects of the project. Also included in the operational plans of this project is a market survey to determine present and potential demand for petrochemical intermediates in Pakistan. This survey is expected to provide a basis for UNIDO's recommendations concerning the establishment of production facilities in the field of fertilizer and petrochemical industries in Pakistan.

The regional project for the Maghreb countries — Libya, Tunisia, Algeria and Morocco — aims at assisting these countries to co-ordinate their industrial development on a regional basis. This five-year UNIDO/Special Fund project calls for the establishment of a Centre of Industrial Studies for the Maghreb at Tripoli, Libya. The Centre will undertake regional studies in various fields of industry, including fertilizers and petrochemicals. The purpose of this project is to obtain the maximum utilization of capital investment

and resources for economic development, and to harmonize and streamline commercial and trade policies of the four Maghreb countries.

Pilot plant in Togo

The recently-approved UNDP/SF project at Lome, Togo, calls for assistance to the Government in launching an intensive fertilizer use campaign and in establishing a fertilizer demonstration plant with an annual capacity of 14,000 tons, for the manufacture of single superphosphate. As the executing agency, UNIDO, in addition to setting up the demonstration plant and promoting fertilizer use, will assist the Government of Togo to set up a marketing and credit network for the sale of fertilizers. At present, the use of fertilizers in Togo is extremely limited and depends on imports. This three-year project is expected to contribute towards increasing the farm output in Togo, as well as saving the country's scarce foreign exchange resources.

Projects under consideration

At present, UNIDO is considering several projects for the establishment of pilot and demonstration plants, including one for making compound fertilizers (Ghana), one for the manufacture of fertilizers and industrial explosives (the Americas), one for the direct application of ammonia to the soil (Brazil), one to transfer technology regarding ammonization of superphosphate and one to utilize computers in designing fertilizer plants (both India), and one for the manufacture of compound fertilizers using Kivu lake gas (the Congo (Kinshasa) and Rwanda).

Supporting activities: surveys, symposia and publications

In order to facilitate the field operations, a variety of supporting activities, such as seminars, symposia, expert group meetings, surveys and studies, preparation and publication of documents, are carried out by UNIDO in the field of fertilizers. All these supporting activities aim at the transfer and adaptation of modern production technology in the fertilizer industry to the developing countries. For example, an expert group meeting, held at Vienna in 1968, brought together experts from the fertilizer deficit countries and consultants from the fertilizer surplus countries. This group discussed a wide variety of subjects relating to the fertilizer industry, including the availability of capital for purchase of plant and know-how, supply problem of raw materials, inadequate infrastructure, lack of trained personnel, marketing inadequacies, lack of regional co-operation and inadequate project planning and execution in the developing countries. A meeting for the promotion of fertilizers and pesticides is planned to be held at Tangier for the Economic Commission for Africa (ECA) region and one in Tehran for the Economic Commission for Asia and the Far East (ECAFE) region. It is proposed to hold the Second Interregional Seminar on Fertilizer Production in 1971. In co-operation with the regional economic commissions, UNIDO is also preparing a region-by-region directory of fertilizer production facilities. In co-operation with ECA, a regional directory of fertilizer production facilities in Africa has been completed, and it is planned to complete a similar directory for the Asian region, in co-operation with ECAFE, by the end of the year. A similar survey for Latin America is proposed to be carried out in collaboration with the Economic Commission for Latin American (ECLA) in 1970.

At the request of UNIDO, regional economic commissions and the United Nations Economic and Social Office in Beirut also undertake studies on production, consumption and trade in petrochemicals and fertilizers. One such study, "Critical Study of Different Nitro-phosphate Processes" was recently completed. ECLA has been asked to prepare a study on "Supply and Demand Position of Fertilizers in the Latin American Region". Some of the more useful surveys and studies are published by UNIDO in the form of monographs, from time to time.

Some of these publications are:—

- — Chemical fertilizer projects: their creation, evaluation and establishment.
- — Guide to building an ammonia fertilizer complex
- — Fertilizer Manual
- — Fertilizer technology production and use (Kiev Seminar Papers)
- — Fertilizer Production in six selected countries with good natural gas resources (Report of the Meeting of the Ad Hoc Expert Group).

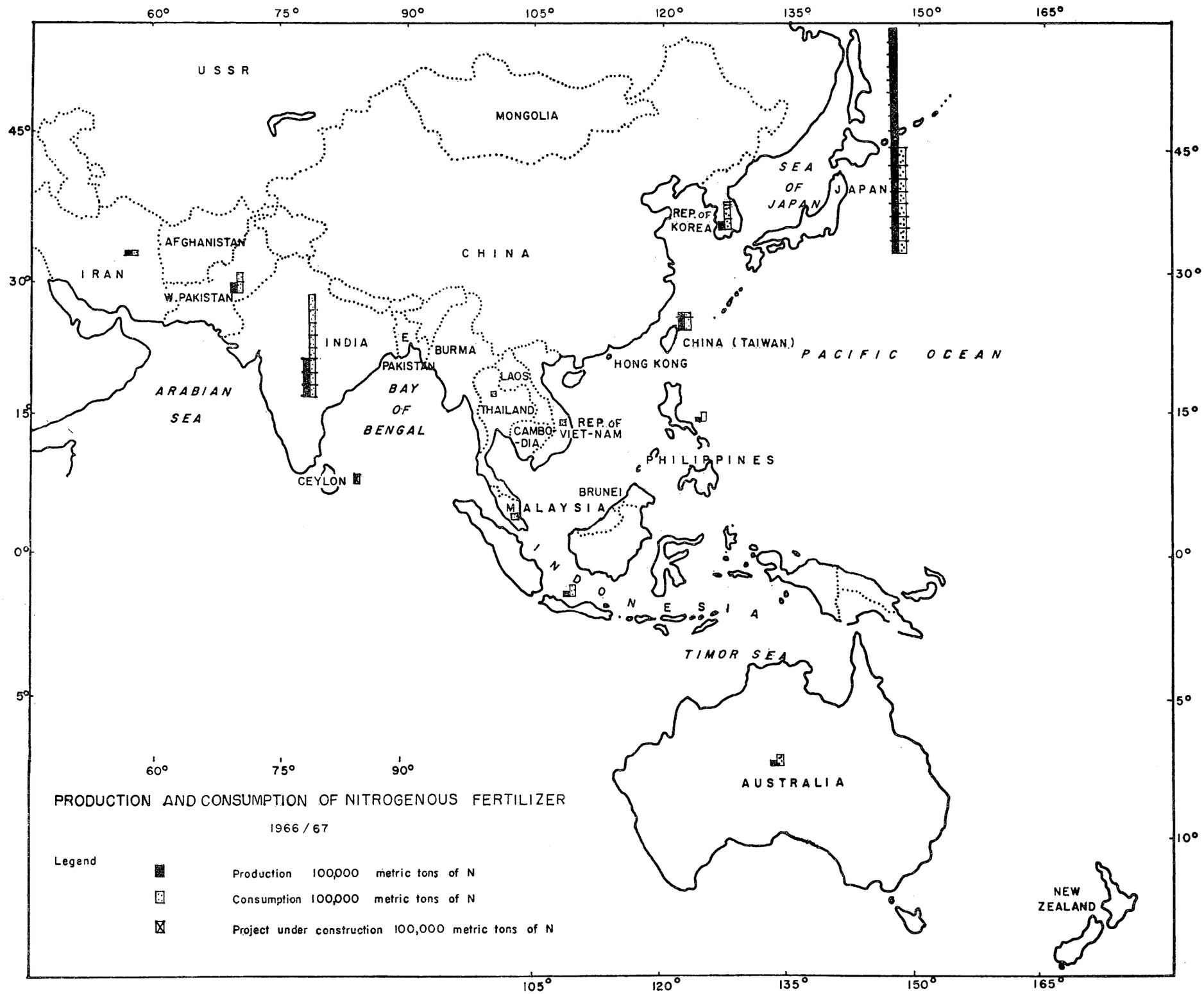
Future plans

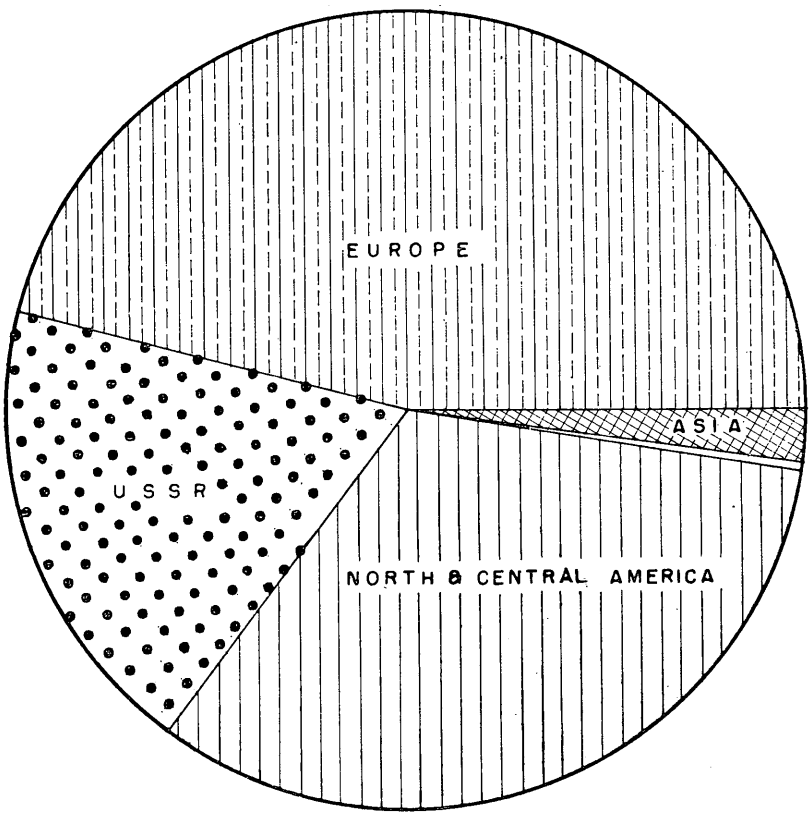
Many developing countries are giving high priority to the creation of industries which aid agricultural development, such as fertilizers and pesticides. It is expected that UNIDO will be increasingly called upon by the developing countries to assist them in this field. In planning its future activities in the field of fertilizer industry, UNIDO bears in mind the demand for fertilizers in the developing countries in relation to their agricultural requirements. It is also proposed to assist the developing countries to use to the full the existing capacities of the fertilizer industry and to promote regional co-operation in production and marketing. With respect to the financing of fertilizer plants and projects, UNIDO intends to encourage international financing for these projects on a soft-loan basis and to encourage the developing countries to create a suitable domestic climate to attract international investment in the fertilizer industry.

Part IV

FERTILIZER DIRECTORY

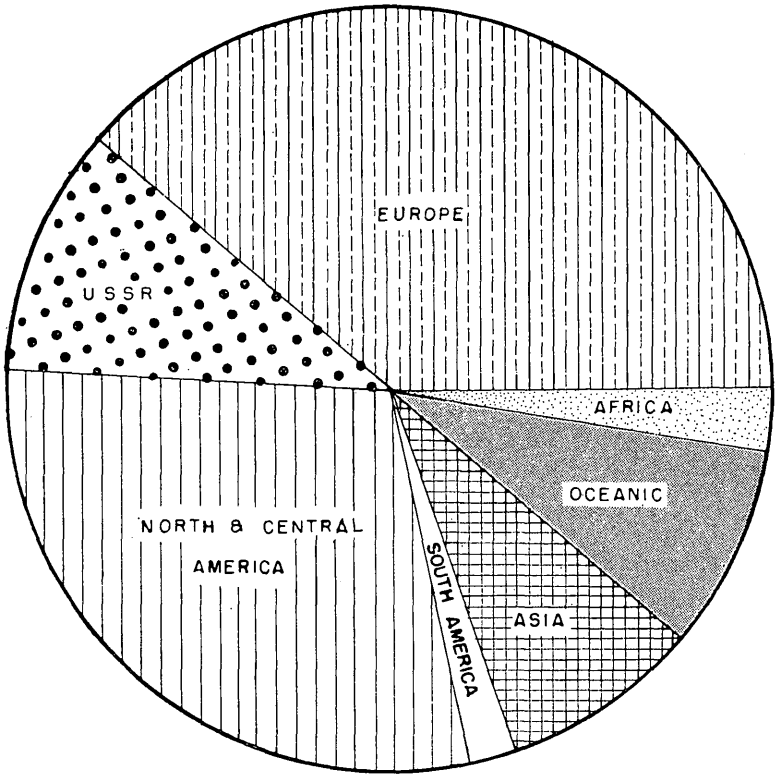
1. Map, graphs and diagrams on the production and consumption of fertilizer, 1966/67.
   (a) ECAFE region
      (i) production and consumption of nitrogenous fertilizer
      (ii) Production and consumption of phosphatic fertilizer
      (iii) consumption of potash fertilizer
   (b) World
      (i) consumption of nitrogenous fertilizer
      (ii) consumption of phosphatic fertilizer
      (iii) consumption of potash fertilizer
      (iv) production of potash fertilizer
2. List of fertilizer plants in Australia, Ceylon, India, Japan, the Republic of Korea, New Zealand, Pakistan, the Philippines, Thailand and the Republic of Viet-Nam.


60°
75°
90°
105°
120°
135°
150°
165°
45°
30°
15°
0°
5°
10°
U S S R
MONGOLIA
SEA OF JAPAN
JAPAN
REP. OF KOREA
AFGHANISTAN
IRAN
W. PAKISTAN
CHINA
INDIA
BURMA
PAKISTAN
BAY OF BENGAL
ARABIAN SEA
CHINA (TAIWAN)
PACIFIC OCEAN
HONG KONG
LAOS
THAILAND
CAMBO-DIA
REP. OF VIET-NAM
PHILIPPINES
CEYLON
BRUNEI
MALAYSIA
INDONESIA
TIMOR SEA
AUSTRALIA
NEW ZEALAND
PRODUCTION AND CONSUMPTION OF NITROGENOUS FERTILIZER
1966 / 67
Legend
Production 100,000 metric tons of N
Consumption 100,000 metric tons of N
Project under construction 100,000 metric tons of N



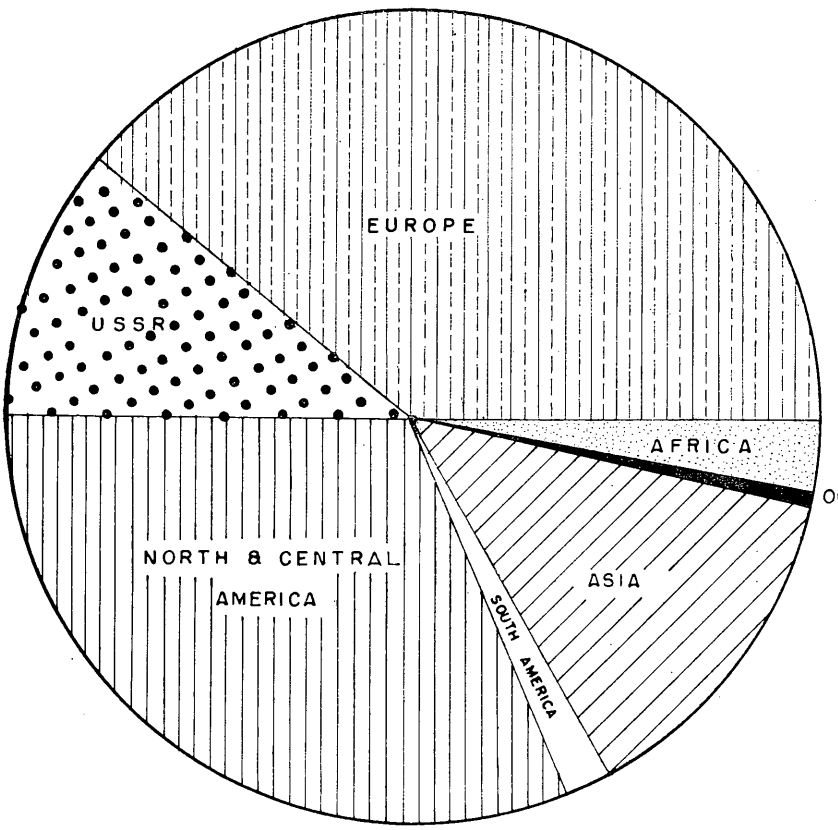
PRODUCTION OF POTASH FERTILIZER 1966/67

WORLD	=	100.0 %
AMERICA NORTH & CENTRE	=	33.4 %
AMERICA SOUTH	=	0.2 %
ASIA	=	2.1 %
EUROPE	=	46.0 %
USSR	=	18.4 %



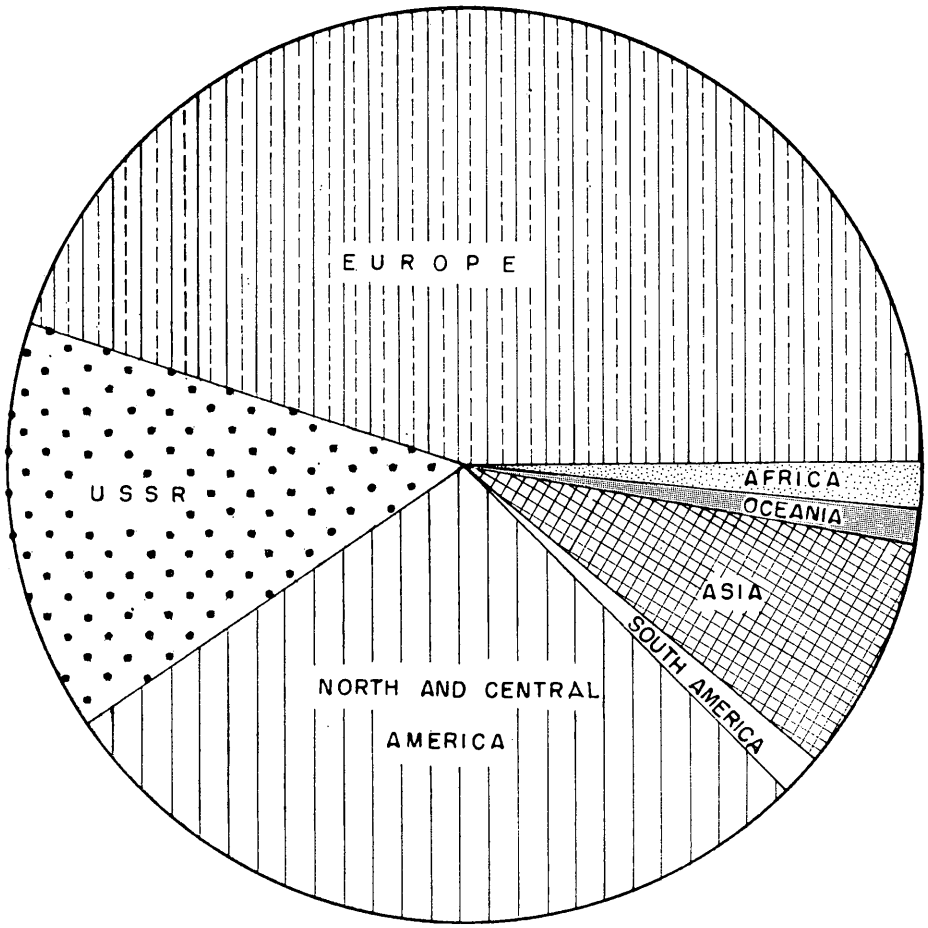
CONSUMPTION OF PHOSPHATE FERTILIZER 1966/67

WORLD	=	100.0	%
AMERICA. NORTH & CENTRE	=	29.3	%
AMERICA SOUTH	=	1.9	%
ASIA	=	8.6	%
EUROPE	=	38.6	%
ASIA	=	8.6	%
OCEANIC	=	8.3	%
U S S R	=	10.7	%
AFRICA	=	2.6	%



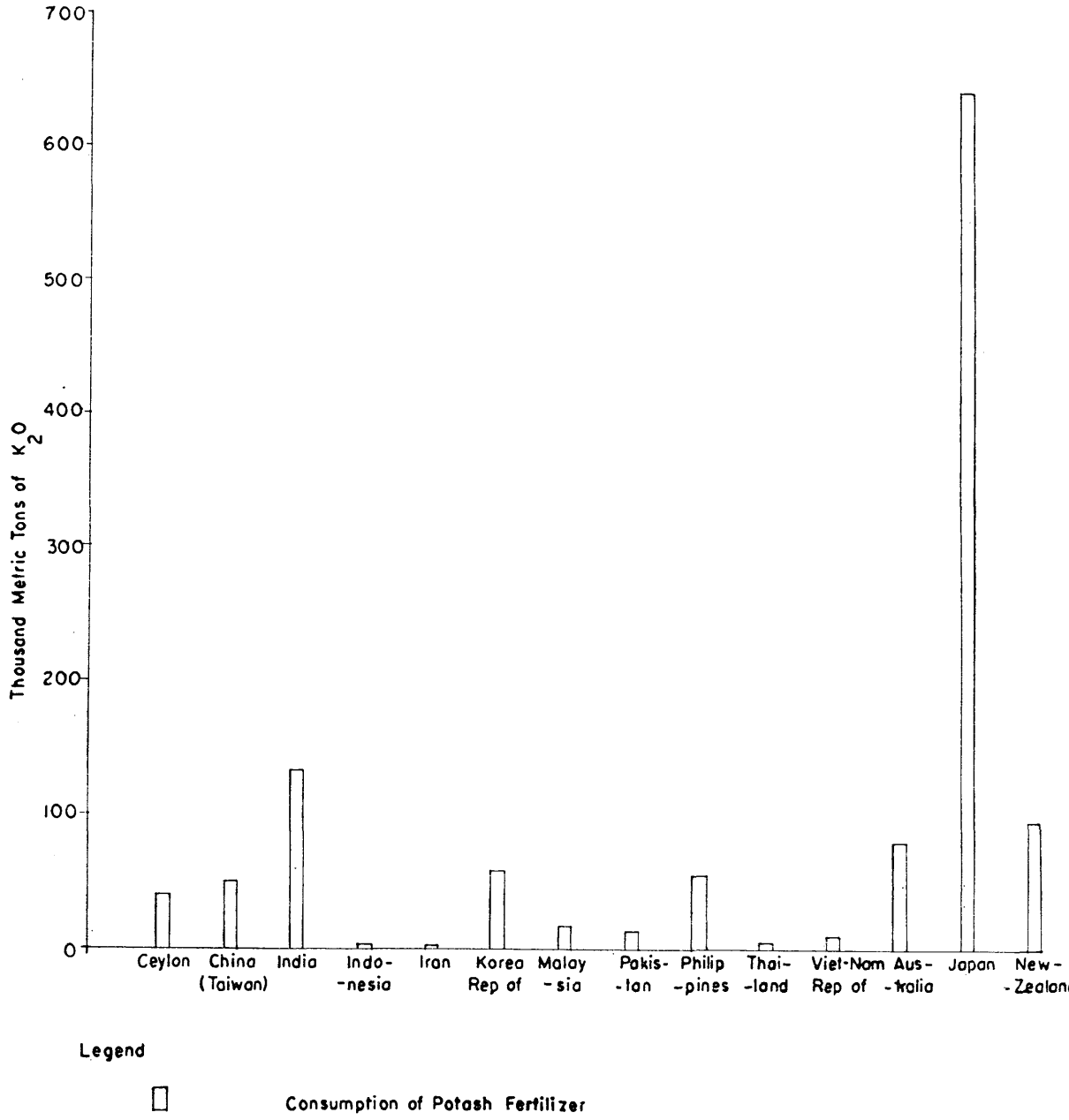
CONSUMPTION OF NITROGENOUS FERTILIZER 1966 / 67

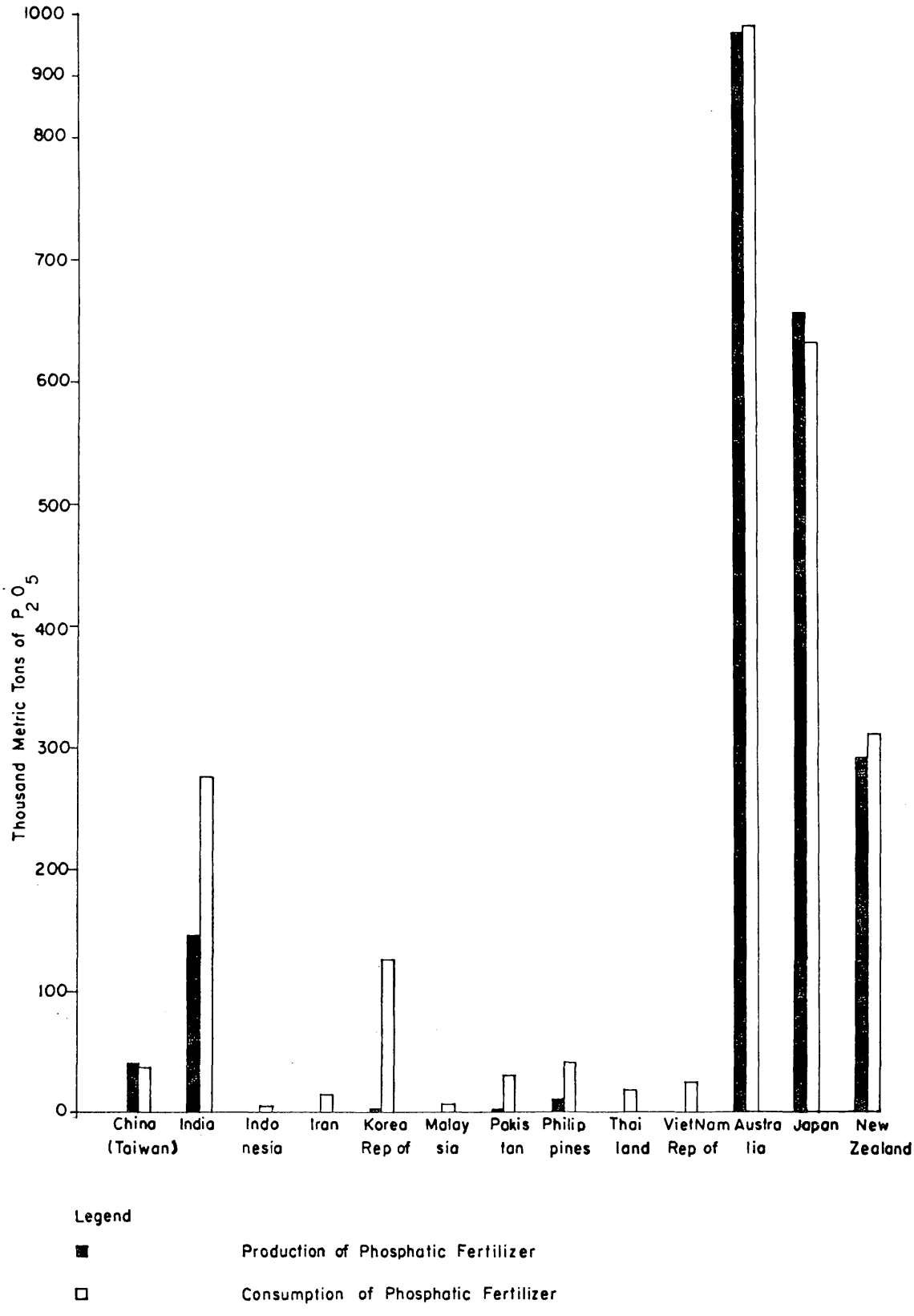
WORLD	:	100.0 %
AMERICA, NORTH & CENTRE	:	31.9 %
AMERICA, SOUTH	:	1.7 %
ASIA	:	14.1 %
EUROPE	:	35.5 %
OCEANIA	:	0.5 %
AFRICA	:	2.9 %

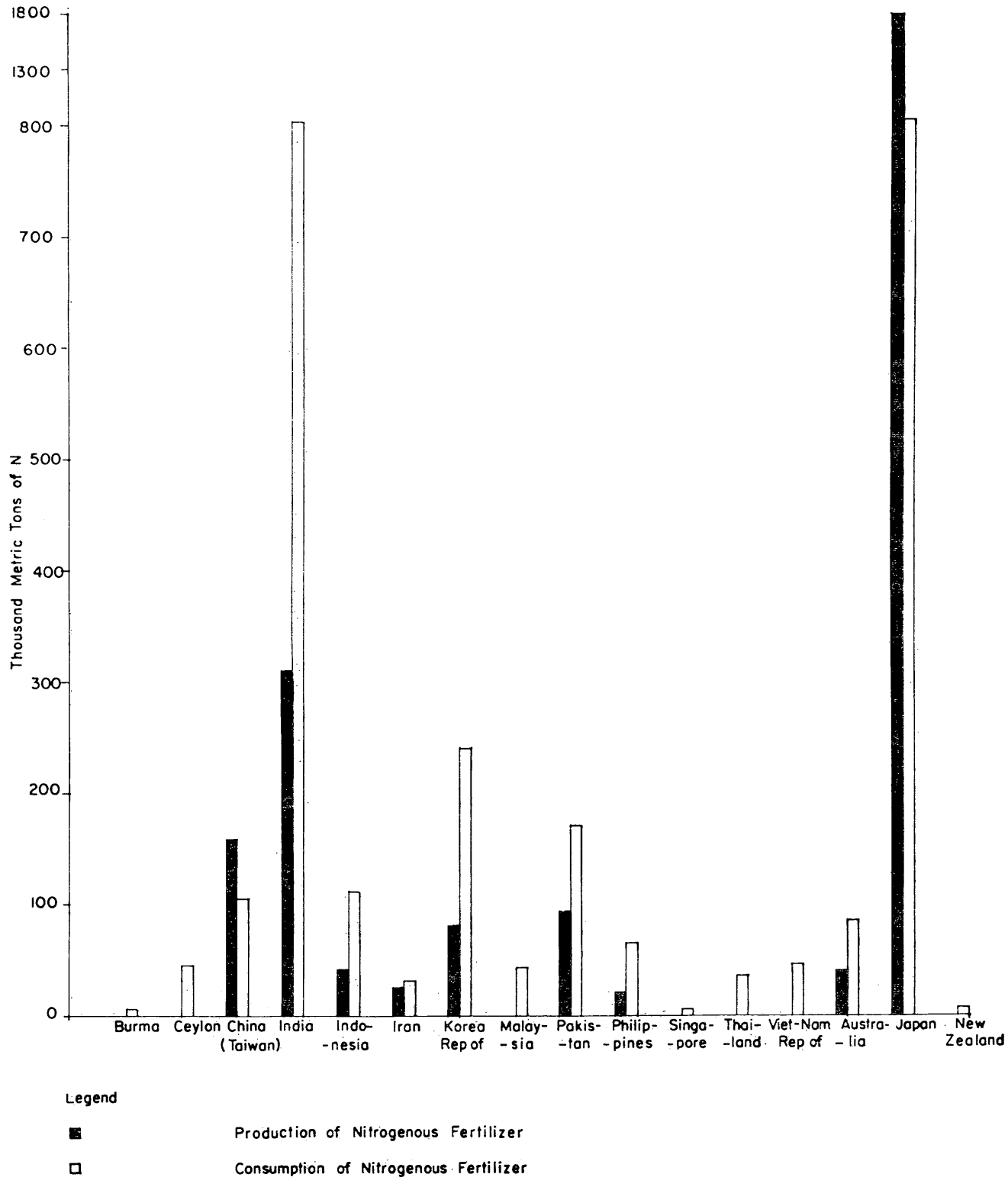


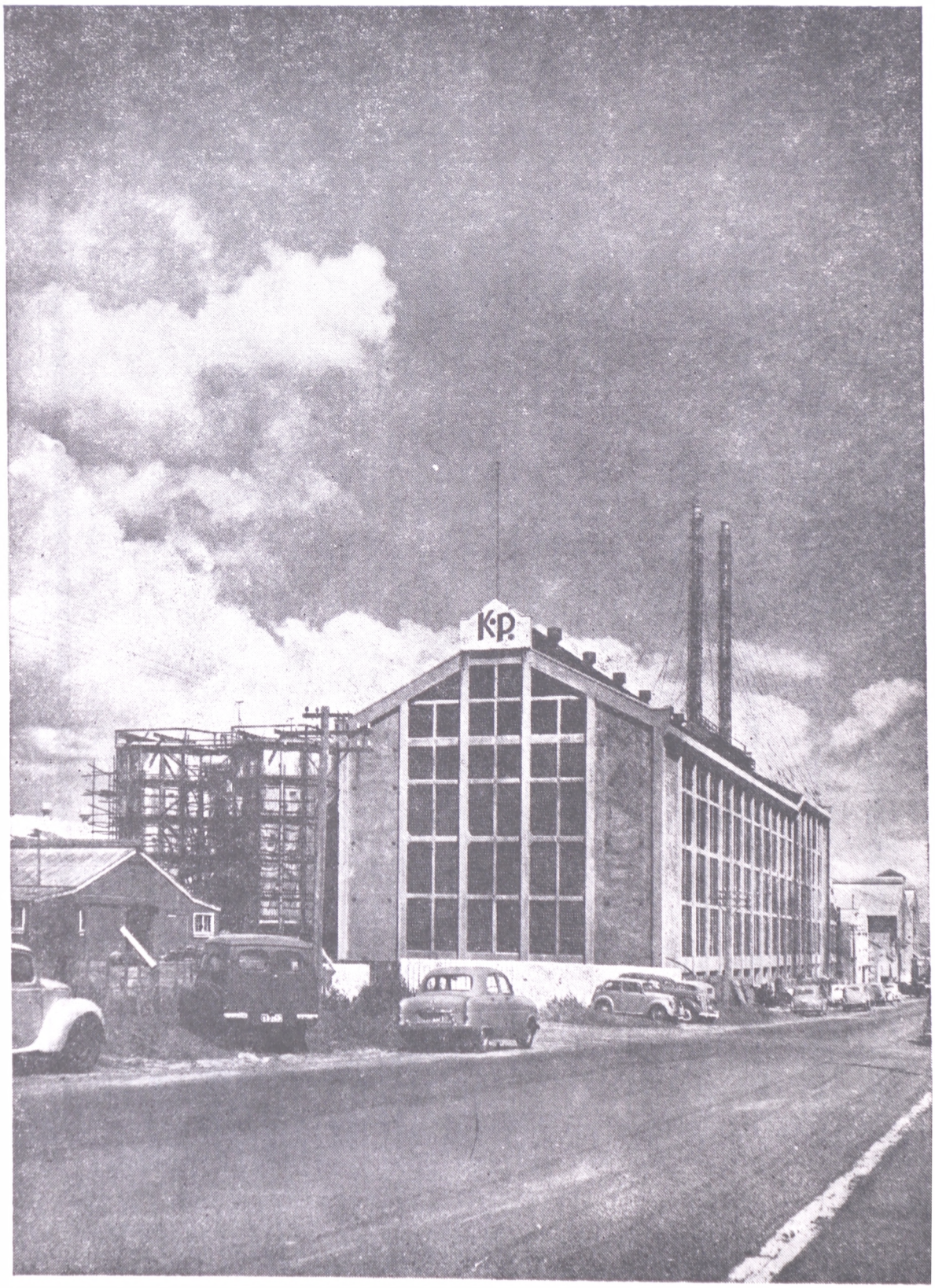
CONSUMPTION OF POTASH FERTILIZER, 1966 / 67

WORLD	=	100.0	%
AMERICA, NORTH & CENTER	=	27.9	%
AMERICA, SOUTH	=	1.4	%
ASIA	=	8.2	%
EUROPE	=	44.9	%
OCEANIA	=	1.4	%
USSR	=	14.7	%
AFRICA	=	1.5	%

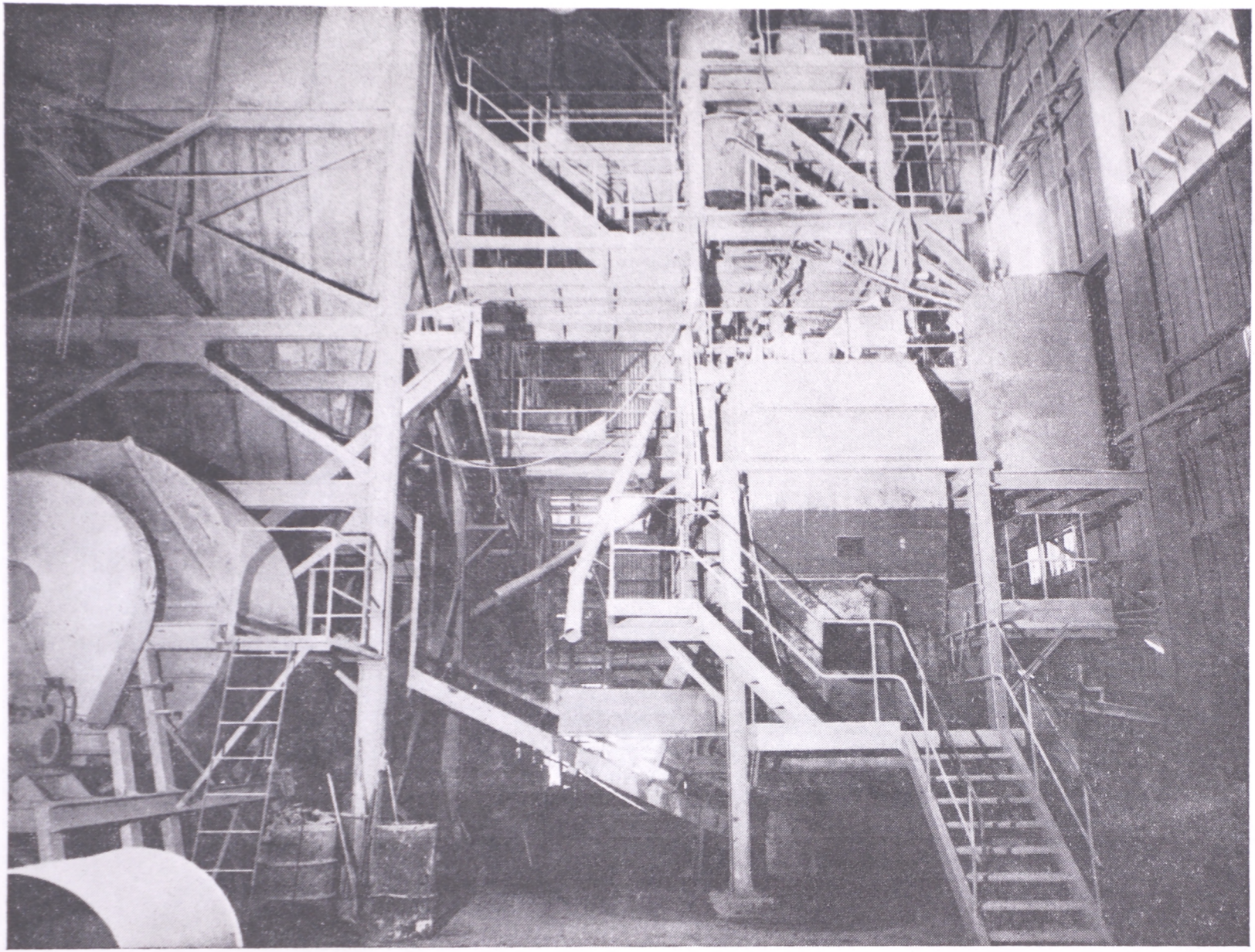

700
600
500
400
300
200
100
0
Thousand Metric Tons of K_2O
Ceylon
China (Taiwan)
India
Indo-nesia
Iran
Korea Rep of
Malay-sia
Pakis-tan
Philip-pines
Thai-land
Viet-Nam Rep of
Aus-tralia
Japan
New-Zealand
Legend
Consumption of Potash Fertilizer


1000
900
800
700
600
500
400
300
200
100
0
Thousand Metric Tons of P_2O_5
China (Taiwan)
India
Indonesia
Iran
Korea Rep of
Malaysia
Pakistan
Philippines
Thailand
VietNam Rep of
Australia
Japan
New Zealand
Legend
Production of Phosphatic Fertilizer
Consumption of Phosphatic Fertilizer

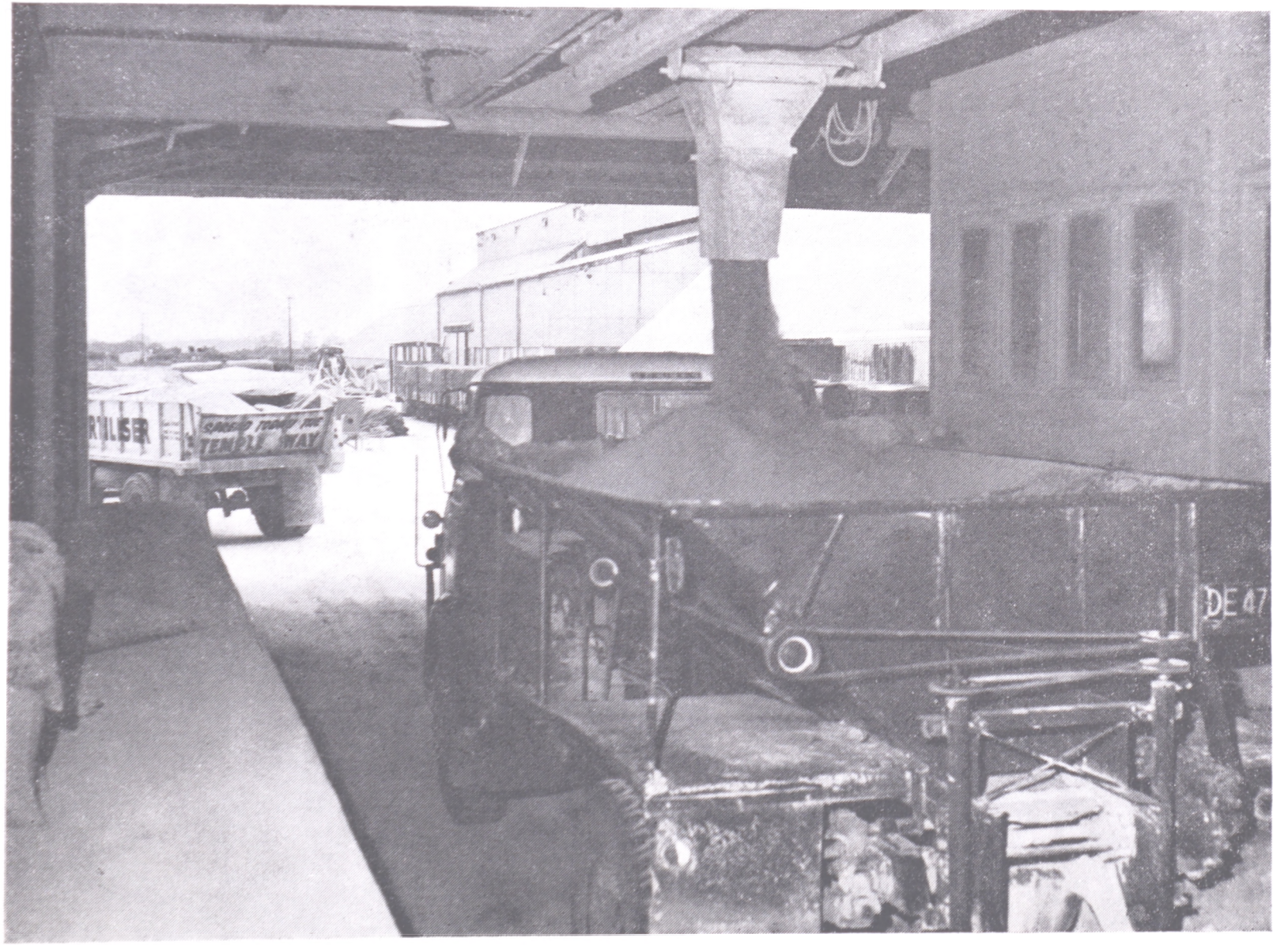

1800
1300
800
700
600
500
400
300
200
100
0
Thousand Metric Tons of N
Burma
Ceylon
China (Taiwan)
India
Indo-nesia
Iran
Korea Rep of
Malay-sia
Pakis-tan
Philip-pines
Singa-pore
Thai-land
Viet-Nam Rep of
Austra-lia
Japan
New Zealand
Legend
Production of Nitrogenous Fertilizer
Consumption of Nitrogenous Fertilizer



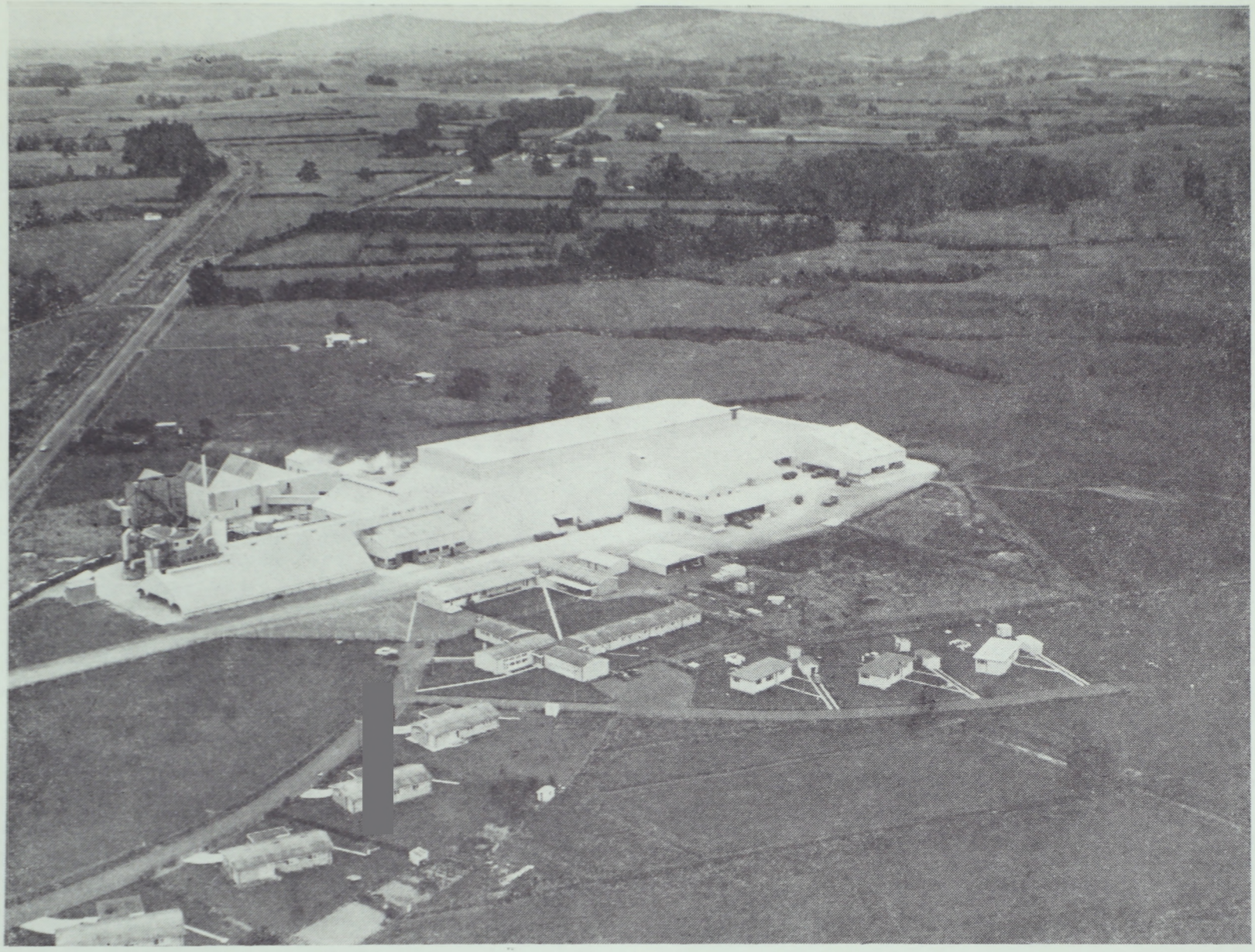
Kempthorne Prosser's fertilizer plant, Otahuhu, New Zealand.



On bottom platform cleaning centre housing at Broadfield continuous superphosphate plant, Southland Co-op. Phosphate Co. Ltd., New Zealand.



Kiwi Fertilizer Works, Morrinsville, New Zealand.



New fertilizer works near Morrinsville, New Zealand.

AUSTRALIA

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*	*Production or output*	*Direct employment*	*Remarks*
Total Australia			Superphosphates and ammonium phosphate (P_2O_5)		In 1966/67 production of superphosphates and ammonium phosphate in terms of P_2O_5 was 4.6 million tons. Production of ammonium sulphate in 1966/67 was 105,600 tons.		Sulphuric acid, the principal raw material, is locally available. Rock phosphate is imported from Nauru, other Pacific Islands and Christmas Island in the Indian Ocean, but increased demand for single and concentrated superphosphates has necessitated imported supplies being augmented with phosphate rock from Florida, Togo and other areas. The search for suitable phosphate rock in Australia has recently been intensified, and the extent and quality of the deposits already found is being assessed.
EZ Industries Ltd.	Risdon, Tasmania.		Ammonium sulphate.	Ammonium sulphate=62,000 t/y			
ICIANZ Ltd.	Newcastle, N.S.W.		Ammonium sulphate.				
New plants:—							
1) ACF & Shirleys Fertilizers Ltd.	Gladstone and Townsville, Queensland.		Superphosphate.				In addition to these proposed plants investigations are being made for possible location of additional fertilizer plants in Westernport Bay, Victoria; Gladestone, Queensland; Gladestone and Townsville, Queensland; and at Newcastle, N.S.W.; by Cresco Fertilizers Ltd., Esso Standard Oil (Aust.) Ltd. and B.P. (Aust.) Ltd.; Mount Morgan-Grace Pty Ltd.; A.C.F. and Shirleys Fertilizers Ltd. and Continental Oil Co.: of Australia Ltd. respectively.
2) Austral—Pacific Fertilizers Ltd.	Gibson Island, Brisbane, Queensland.		Ammonia, urea, ammonium phosphate ammonium sulphate and complex NPK.				
3) BHP Co., Ltd.	Whyalla, S.A.		Ammonium sulphate.				
4) Cresco Fertilizers Ltd.	Portland, Victoria, Bayswater, W.A.		Superphosphate and mixed NPK.				
5) CSBP & Farmers Ltd.	Kwinana, W.A.		Superphosphates, ammonium nitrate, ammonium phosphate, and complex NPK ammonia, ammonium nitrate.				
6) Eastern Nitrogen Ltd.	Walsh Island, Newcastle, N.S.W.		Ammonia, ammonium nitrate.				
7) Greenleaf Fertilizers Ltd.	Walsh Island, Newcastle, N.S.W.		Superphosphates, ammonium phosphate and complex NPK.				
8) Kwinana Nitrogen Co., Pty Ltd.	Kwinana, W.A.		Ammonia and ammonium nitrate.				

Source: Government of Australia, Department of Trade and Industry, Office of Secondary Industry, 1968.

CEYLON

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*	*Production or output*	*Direct employment*	*Remarks*
State Fertilizer Manufacturing Corporation	Sapugaskanda, Colombo.	1968	Ammonium sulphate and urea.	Urea = 280,000 t/y Ammonium Sulphate=66,000 t/y			Tenders closed for plant and machinery.

Source: Ministry of Industries and Fisheries, Government of Ceylon, 1969.

INDIA

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*	*Production or output*	*Direct employment*	*Remarks*
Public Sector Projects							
Sindri Fertilizer Factory	Sindri (Bihar)	1951	Ammonium sulphate, double salt urea.	117,000 t/y			An expansion scheme has recently been approved. The expansion will add 156,000 tons of P_2O_5 to the over-all capacity.
Nangal Fertilizer Factory	Nangal (Punjab)	1961	Calcium, ammonium nitrate.	80,000 t/y			
Trombay Fertilizer Factory	Trombay (Mahrashtra)	1965	Urea nitrate and phosphate.	90,000 t/y 45,000 P_2O_5 t/y			Proposal for expansion is under consideration.
Gorakhpur Fertilizer Factory	Gorakhpur (U.P.)	1968	Urea.	80,000 t/y			
Namrup Fertilizer Factory	Namrup (Assam)		Ammonium sulphate, urea.	151,800 t/y			Under construction.
Barauni Fertilizer Project	Barauni (Bihar)		Urea.	152,000 t/y			Under construction.
Durgapur (FCI)	Durgapur (West Bengal)		Urea.	152,000 t/y			Under construction.
FACT (Alwaye)	Udyogmandal, Alwaye (Kerala)	1947	Ammonium sulphate, ammonium phosphate, superphosphate.	70,000 t/y			
Cochin	Cochin (Kerala)		Urea.	Urea = 152,000 t/y			Under construction.
Private Sector Projects							
Coromandel Fertilizer Ltd.	Visakhapatnam.	1967	Urea, ammonium phosphate.	80,000 t/y			Under construction.
E.I.D. Parry	Ennore.	1962	Ammonium phosphate and sulphate.	8,000 t/y			
Gujarat State Fertilizer Co., Ltd.	Bajwa, Baroda.	1967	Urea, diammonium phosphate.	96,000 t/y			Expansion for additional capacity of 120,000 tons of N. is under implementation.

Source: Government of India, 1969.

Name	Location	Year of establishment	Product mix	Production capacity	Production or output	Direct employment	Remarks
Amagasaki Coke Industries Limited (joint venture of Mitsubishi Chemical Industries Limited, Kolu Steel Ltd. and Osaka Gas Company).	Amagasaki City, Hyogo Pref.	1956	Ammonium sulphate.				
Asahi Chemical Industry Co., Ltd. (Asahikasei Kogyo Kabushiki Kaisha).	Kita-ku, Osaka.	1931	Compound chemical fertilizer (potash nitrophosphate).				
Asahi Glass Co., Ltd.	Chiyoda-ku, Tokyo.	1907	Ammonium chloride, magnesium hydroxide, compound fertilizer.				
Azuma Kako Co., Ltd.	Chuo-ku, Tokyo.	1917	Fertilizers: "Aquma" (commercial compost and farmyard manure), minor elements fertilizers (containing manganese, magnesium, boron, silica, etc.).				
Central Glass Co., Ltd.	Chiyoda-ku, Tokyo.	1936	Compound fertilizer.				
Chisso Corporation	Chiyoda-ku, Tokyo.	1950	Ammonium sulphate, ammonium phosphate, ammonium phosphate potash.				
Hikari Kako K.K. (subsidiary of Hikari Kogyo Co., Ltd.)	Ohmiya City, Saitama Pref.	1950	Potassium phosphate, ammonium phosphate.				
Hikari Kogyo Co., Ltd. (subsidiary of Ajinomoto Co., Inc. and Showa Denko K.K.)	Chuo-ku, Tokyo.	1947	Mixed fertilizer, compound fertilizer.				
Hokutan Chemical Industry Co., Ltd. (subsidiary of Hokkaido Colliery & Steamship Co., Ltd.)	Toda City, Saitama Pref.	1965	Soil conditioning fertilizer.				
Hosoi Chemical Industry Co., Ltd.	Chuo-ku, Tokyo.	1905	Ammonium sulphate.				
Ishihara Sangyo Kaisha, Ltd.	Nishi-ku, Osaka.	1920	Calcium superphosphate, ammonium sulphate, compound fertilizers.				
Japan Gas-Chemical Company, Inc.	Chiyoda-ku, Tokyo.	1951	Urea, technical urea, ammonium sulphate, PCP-urea, high analysis compound fertilizer.				
Japan Union Fertilizer Co., Ltd. (joint venture of Asahi Glass Co., Ltd., Tokuyama Soda Co., Ltd. and Toyo Soda Mfg. Co., Ltd.	Chuo-ku, Tokyo.	1963	Single type fertilizer: ammonium chloride, magnesium hydroxide. Compound fertilizer: NPK compound fertilizer, NP compound fertilizer, NK compound fertilizer, NPKMgO compound fertilizer, gypsum.				

JAPAN (Cont'd)

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*	*Production or output*	*Direct employment*	*Remarks*
Katakura Chikkarin Co., Ltd.	Chiyoda-ku, Tokyo.	1920	Compound fertilizers, all kinds of mixed fertilizers, ammonium sulphate recovered.				
Kawaguchi Chemical Industry Co., Ltd.	Chiyoda-ku, Tokyo,	1937	Fertilizers.				
Kawatetsu Chemical Industry Co., Ltd. (joint venture of Kawasaki Steel Corporation and C. Itoh & Co., Ltd. Group companies)	Chiba City, Chiba Pref.	1959	Ammonium sulphate.				
Konoshima Chemical Co., Ltd.	Kita-ku, Osaka.	1946	Superphosphate, compound fertilizer, mixed fertilizer.				
Kyowa Chemicals Co., Ltd. (wholly owned subsidiary of Kyowa Hakko Kogyo Co., Ltd.)	Chiyoda-du, Tokyo.	1961	Urea, ammonium sulphate.				
Kyowa Gas Chemical Industry Co., Ltd.	Chuo-ku, Tokyo.	1958	Ammonium sulphate recovered.				
Mitsubishi Chemical Industries Limited	Chuo-ku, Tokyo.	1934	Ammonium sulphate, urea, calcium superphosphate, ammonium nitrate, compound fertilizers.				
Mitsui Chemical Industry Co., Ltd.	Chuo-ku, Tokyo.	1941	Ammonium sulphate.				
Mizusawa Industrial Chemicals, Ltd. (subsidiary of Takeda Chemical Industries, Ltd.)	Higashi-ku, Osaka.	1937	Ammonium sulphate.				
Niigata Rynsan Co., Ltd.	Niigata City, Niigata Pref.	1896	Calcium superphosphate, fused phosphate fertilizers, high compound fertilizers.				
Nippon Chemical Industrial Co., Ltd. (The Nippon Chemical Industries Co., Ltd.)	Koto-ku, Tokyo.	1893	Fertilizers.				
Nippon Denko Co., Ltd.	Chuo-ku, Tokyo.	1935	Calcium silicate fertilizer.				
Nissan Chemical Industries, Ltd.	Chuo-ku, Tokyo.	1887	Ammonium sulphate, urea, high grade compound fertilizer.				
Nitto Chemical Industry Co., Ltd.	Chiyoda-ku, Tokyo.	1937	Ammonium sulphate, urea, calcium superphosphate, high grade compound fertilizer.				
Nitto Ryuso Co., Ltd.	Chuo-ku, Tokyo.	1918	Calcium superphosphate, compound fertilizers.				

JAPAN (Cont'd)

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*	*Production or output*	*Direct employment*	*Remarks*
Onoda Chemical Industry Co., Ltd. (wholly-owned subsidiary of Onoda Cement Co., Ltd.)	Chiyoda-ku, Tokyo.	1955	Multi-phosphate compound fertilizers.				
Osaka Gas Company, Ltd.	Higashi-ku, Osaka.	1897	Ammonium sulphate.				
Rasa Industries, Ltd.	Chuo-ku, Tokyo.	1913	Chemical fertilizer: calcium superphosphate.				
Seitetsu Kagaku Co., Ltd. (joint venture of Sumitomo Chemical Co., Ltd. and Fuji Iron & Steel Co., Ltd.)	Higashi-ku, Osaka.	1944	Chemical fertilizer: ammonium sulphate, urea.				
Shin-Etsu Chemical Industry Co., Ltd.	Chiyoda-ku, Tokyo.	1926	Chemical fertilizers.				
Showa Denko K.K.	Minato-ku, Tokyo.	1930	Chemical fertilizers.				
Sumitomo Chemical Co., Ltd.	Higashi-ku, Osaka.	1913	Ammonium sulphate, ammonium nitrate, urea, calcium superphosphate, compound fertilizers.				
Toagosei Chemical Industry Co., Ltd.	Minato-ku, Tokyo.	1942	Ammonium sulphate, compound fertilizer.				
Tekkosha Co., Ltd.	Chuo-ku, Tokyo.	1924	Fused magnesium phosphate fertilizer, silica lime.				
Tohoku Hiryo K.K.	Chuo-ku, Tokyo.	1938	High analysis compound fertilizers, ammonium sulphate, urea.				
Tokuyama Soda Co., Ltd.	Tokuyama City, Yamaguchi Pref.	1918	Ammonium chloride fertilizer.				
Toyo Gas Chemical Industry, Ltd. (joint venture of Toyo Koatsu Industries, Inc. and Teikoku Oil Co., Ltd.)	Chuo-ku, Tokyo.	1956	Urea, ammonium sulphate.				
Toyo Koatsu Industries, Inc.	Chuo-ku, Tokyo.	1933	Urea, PCP urea, ammonium sulphate, high analysis compound fertilizer, other chemical fertilizers.				
Ube Industries, Ltd.	Ube City, Yamaguchi Pref. and Chiyoda-ku, Tokyo.	1942	Chemical fertilizers.				
Yawata Chemical Industry Co., Ltd. (wholly-owned subsidiary of Yawata Iron & Steel Co., Ltd.)	Chuo-ku, Tokyo.	1956	Ammonium sulphate.				

Production of fertilizers

(unit: 1,000 N tons)

Product	*Fertilizer year*	*Output*	*Exports*
Ammonium sulphate	1967	544.6	280.4
	1968	525.1	343.4
Urea	1967	958.7	671.5
	1968	953.1	777.4
Ammonium chloride	1967	155.6	80.6
	1968	175.6	122.5
High analysis fertilizers	1967	291.2	18.9
	1968	314.2	31.5
Others	1967	11.8	—
	1968	12.8	—
Total	1967	1,961.9	1,051.4
	1968	1,980.7	1,274.8

Source: Japan Ammonium Sulphate Industry Association (extracted from *Japan Industries 1968*).

Outline of large-scale programmes by various companies

Name of company	*Equipment scale (daily output in tons)*	*Date of completion*	*Site*
Mitsubishi Chemical	1,000	1969 Aug.	Kurosaki
Toyo Koatsu, Toa Gosei	1,000	1969 Sept.	Osaka
Tohoku Hiryo, Nippon Suiso	900	1969 Dec.	Onahama
Asahi Chemical, Chisso	800	1969 Year-end	Mizushima
Showa Denko, Nissan Chemical	1,000	1970 Mar.	Keiyo area
Ube Industries	1,000	1970 Mar.	Ube
Seitetsu Chemical, Sumitomo Chemical	1,000	1970 Mar.	Undecided
Nitto Chemical, Mitsubishi Petrochemical	1,000	1970 June	Kashima
Toyo Koatsu, Toyo Gas, Murotetsu Chemical	750	1972 June	Undecided
Japan Gas-Chemical	600	1972 Apr.	Niigata
Total	9,050		

Sources: *Japan Chemical Directory*, 1968;
Eastern World, January/February 1969.

REPUBLIC OF KOREA

Name	Location	Year of establishment	Product mix	Production capacity	Production or output	Direct employment	Remarks
Chung-Ju Fertilizer Corporation	Seoul.		Urea.	Urea = 115,500 t/y			
Honam Fertilizer Co., Ltd.	Seoul.		Urea.	Urea = 85,000 t/y			
Hong-Nam Chemical Ltd.	Seoul.		Urea, compound fertilizer.	Urea = 84,100 t/y Compound fertilizer (22-22-11) = 92,300 t/y (14-37-12) = 73,000 t/y (18-18-18) = 15,300 t/y			
Chinhac Chemical Co., Ltd.	Seoul.		Urea, compound fertilizer.	Urea = 84,100 m. t/y Compound fertilizer (22-22-11) = 92,300 t/y (14-37-12) = 73,000 t/y (18-18-18) = 15,300 t/y			
Korea Fertilizer Corporation	Seoul.		Urea.	Urea = 330,000 t/y			
Samchok Industrial Co., Ltd.	Seoul.		Calcium cynomide.	Calcium cynomide = 21,000 t/y			
Kyonggi Chemical Co.	Kyonggi-do.		Fused phosphate.	Fused phosphate = 50,000 t/y			
Poong Nong Fertilizer Co.	Chung Nam-do.		Fused phosphate.	Fused phosphate = 108,000 t/y			

Source: Ministry of Commerce and Industry, Republic of Korea, 1969.

NEW ZEALAND

Name	Location	Year of establishment	Product mix	Production capacity	Production or output	Direct employment	Remarks
N.Z. Farmers' Fertilizer Co., Ltd.							
Te Papapa works	Auckland.	1917	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures, metal sulphates.	H_2SO_4 = 114,000 t/y		351	
Challenge works	Auckland.	1927	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures, metal sulphates.	total fertilizers = 360,000 t/y			Expansion programme has been completed and new contact acid plants have been installed.
New Plymouth works	Plymouth.	1926	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 = 81,000 t/y total fertilizers = 270,000 t/y		137	Expansion programme has been completed and new contact acid plants have been installed.
Northland Fertilizer	Whangarei.	1964	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 = 48,000 t/y total fertilizers = 165,000 t/y		64	Expansion programme has been completed and new contact acid plants have been installed.
Kiwi Fertilizer	Morrinsville.	1958	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 = 48,000 t/y total fertilizers = 165,000 t/y		68	

NEW ZEALAND (Con'td)

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*		*Production or output*	*Direct employment*	*Remarks*
Kempthorne Prosser & Co.								
Wanganui works	Wanganui.	1926	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 total fertilizers	= 52,000 t/y = 172,000 t/y		113	
Hornby works	Hornby (Christchurch)	1922	The same as Wanganui works.	H_2SO_4 total fertilizers	= 84,000 t/y = 270,000 t/y		90	Expansion programme has been completed and new contact acid plants have been installed, plant designed for conversion to newly developed inter-absorption system which would result in 40% increase in capacity.
Dominion Fertilizer Co., Ltd.								
Dunedin works	Revensbourne.	1931	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 total fertilizers	= 75,000 t/y = 180,000 t/y		103	Expansion programme has been completed and new contact acid plants have been installed.
Seadown works	Timaru.	1967	Superphosphate and phosphatic. fertilizer mixtures.	total fertilizers	= 70,000 t/y		50	
Bay of Plenty Co-Operation Fertilizer Co., Ltd.								
Mt. Maunganui works	Mt. Maunganui.	1958	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 total fertilizers	= 85,000 t/y = 300,000 t/y		120	Expansion programme has been completed and new contact acid plants have been installed.
East Coast Farmers' Fertilizer Co., Ltd.								
Napier works	Awatoto.	1954	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 total fertilizers	= 146,000 t/y = 440,000 t/y		188	Expansion programme has been completed and new contact acid plants have been installed. A new plant is to be set up at Gisborne in three stages.
Southland Co-Operation Phosphate Co., Ltd.								
Invercargill works	Awarua.	1959	Sulphuric acid, superphosphate and phosphatic fertilizer mixtures.	H_2SO_4 total fertilizers	= 77,000 t/y = 300,000 t/y		93	Expansion programme has been completed and new contact acid plants have been installed.
				Grand total	= 2,692,000 t/y			

Source: Government of New Zealand, 1968.

PAKISTAN

Name	*Location*	*Year of establishment*	*Product mix*	*Production capacity*	*Production or output*	*Direct employment*	*Remarks*
Installed							
1) Esso Fertilizer Co. Ltd.	West Pakistan		Urea.	Urea = 173,000 t/y			
2) Pakistan American Fertilizer Factory	Daudkhel, West Pakistan.		...	... = 9,000 t/y			
3) Natural Gas Factory	Multan, West Pakistan.		Ammonium nitrate. Urea.	Ammonium nitrate = 132,000 t/y Urea = 75,700 t/y			
4) Lyallpur Chemical and Fertilizer Ltd.	Jaranwals, West Pakistan.		Superphosphates.	Superphosphate = 54,000 t/y			
5) Natural Gas Fertilizer Factory Ltd.	Fenchuganj, East Pakistan.		Urea.	Urea = 106,000 t/y			
Under Installation							
1) M/S Heavy Chemicals Ltd.	Khulna, East Pakistan.		...	... = 120,000 t/y			
2) Dawood Hercules Chemical Ltd.	Karachi, West Pakistan.		Urea.	Urea = 340,000 t/y			
3) Hycsons Commercial and Industrial Corp. Ltd.	Karachi, West Pakistan.		Urea.	Urea = 340,000 t/y			
4) Jaffer Brothers Ltd.	Karachi, West Pakistan.		Triple superphosphate.	Triple superphosphate = 105,000 t/y			
5) Urea Fertilizer Factory	Ghorasal, East Pakistan.		Urea.	Urea = 340,000 t/y			
6) T.S.P. Plant No. I	Chittagong, East Pakistan.		Triple superphosphate.	Triple superphosphate = 32,000 t/y			
7) T.S.P. Plant No. II	East Pakistan.		Triple superphosphate.	Triple superphosphate = 120,000 t/y			
8) Ammonium Sulphate plant	Fenchuganj, Sylhet, East Pakistan.		Ammonium sulphate.	Ammonium sulphate = 12,000 t/y			

Source: Government of Pakistan, President's Secretariat, Economic Affairs Division.

PHILIPPINES

Name	Location	Year of establishment	Product mix	Production capacity	Production or output	Direct employment	Remarks
Atlas Fertilizer Corporation	Toledo City, Cebu.	1958	Ammonium sulphate. Complex fertilizer. Superphosphate.	Ammonium sulphate = 90,000 t/y Complex fertilizer = 96,400 t/y Superphosphate = 27,200 t/y			
Chemical Industries of the Philippines Inc.	Taguig, Rizal. Malabon, Rizal.	1953	Ammonium sulphate. Complex fertilizer. Superphosphate.	Ammonium sulphate = 54,000 t/y Complex fertilizer = 12,000 t/y Superphosphate = 15,000 t/y			
Esso Standard Fertilizer & Agricultural Chemical Co., Inc. (Phils.) (ESSFAC)	Limay, Batann.	1966	Urea. Complex fertilizer. Mixed fertilizer.	Ammonium sulphate = 67,000 t/y Complex fertilizer = 165,000 t/y Superphosphate = 165,000 t/y			
Maria Cristina Fertilizer Corporation	Iligan City.	1953	Ammonium sulphate. Aqua ammonia.	Ammonium sulphate = 59,400 t/y Complex fertilizer = 64,349 t/y			

Source: National Economic Council, Philippines, 1969.

THAILAND

Name	Location	Year of establishment	Product mix	Production capacity	Production or output	Direct employment	Remarks
The Bureau of Bangkok Municipal Fertilizer	Phyathai, Bangkok.	1962	Organic fertilizer and mixed organic fertilizer.	3,000,000 t/y		75	Total capital stands at US$ 125,000. The plant manufactures organic fertilizer which is a soil conditioner.
Chemical Fertilizer Co., Ltd.	Meamoh, Lampang.	1967	Ammonium sulphate. Urea.	Ammonium sulphate = 60,000 t/y Urea = 30,000 t/y		690	Total capital stands at US$ 20,000,000.

Source: Government of Thailand, Ministry of Industry, 1968.

REPUBLIC OF VIET-NAM

Name	Location	Year of establishment	Product mix	Production capacity	Production or output	Direct employment	Remarks
An-Hoà Nông So'n Complex Project			Urea. Ammonium sulphate.	Urea = 133 t/y Ammonium sulphate = 152 t/y			

Source: *Industrial Development and Investment Opportunities in Viet-Nam*, 1969.

SELECTED SHORT-TERM INDUSTRIAL INDICATORS

1. Index Number of Industrial Production

2. Production of Textiles, Paper, Chemicals, Cement and Crude Steel

3. Index Number of Employment in Manufacturing

1. Index Number of Industrial Production

1963 = 100

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Australia													
Manufacturing	(1967)	86	124	123	119	120	117	118	120	126	126	129	110
	(1968)	88	127	130	124	125	122	126	128	134	137	140	118
	(1969)	98	138	139	132	130	132	...	...	...	...	...	...
China (Taiwan)													
Mining	(1967)	154	87	131	130	131	122	122	121	123	129	124	150
	(1968)	135	88	126	115	127	119	114	107	113	116	131	139
	(1969)	151	92	116	128	129	117	116	109	96	...	...	...
Manufacturing	(1967)	213	177	210	188	191	190	195	193	199	196	208	249
	(1968)	237	216	243	237	234	234	249	247	241	251	262	299
	(1969)	300	252	295	285	282	281	293	296	279	...	...	...
India													
Mining	(1967)	110	108	117	115	119	110	108	102	103	99	100	99
	(1968)	119	119	117	122	121	114	112	109	110	113	109	117
	(1969)	120	116	117	122	123	...	...	...	...	...	...	...
Manufacturing	(1967)	120	110	119	108	113	115	112	115	119	112	112	120
	(1968)	120	124	122	112	114	119	125	123	120	120	125	131
	(1969)	133	125	133	126	124	...	...	...	...	...	...	...
Iran													
Mining	(1967)	...	...	...	———	163	———	———	183	———	———	181	———
	(1968)	———	180	———	———	185	———	———	202	———	———	213	———
	(1969)	———	220	———	———	223	———	...	...	...	...	...	...
Manufacturing	(1967)	...	...	...	———	142	———	———	176	———	———	175	———
	(1968)	———	135	———	———	165	———	———	193	———	———	201	———
	(1969)	———	158	———	———	179	———	...	...	...	...	...	...
Japan													
Mining	(1967)	101	102	114	102	103	105	103	98	103	102	105	108
	(1968)	100	104	112	103	101	102	109	100	103	108	108	107
	(1969)	102	104	112	103	104	101	106	95	103	...	...	...
Manufacturing	(1967)	143	151	167	155	157	164	164	161	173	173	176	184
	(1968)	168	180	194	185	188	193	195	188	201	205	210	214
	(1969)	195	209	224	218	218	226	229	219	238	...	...	...

Index Number of Industrial Production

1963 = 100

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Korea, Republic of													
Mining	(1967)	130	121	142	141	146	136	143	139	135	152	128	134
	(1968)	108	108	119	119	122	115	106	110	112	112	113	115
	(1969)	108	92	109	106	108	107	108	106	107	...	...	...
Manufacturing	(1967)	157	152	168	173	188	186	191	203	200	220	211	210
	(1968)	222	224	259	267	279	287	291	289	296	275	296	301
	(1969)	300	280	313	322	341	340	335	336	342	...	...	...
New Zealand													
Manufacturing	(1967)	——	127	——	——	128	——	——	127	——	——	125	——
	(1968)	——	125	——	——	126	——	——	126	——	——	127	——
	(1969)	——	128	——	——	131	——	...	...	...	...	...	...
Pakistan													
Mining	(1967)	——	117	——	——	117	——	...	...	...	...	...	...
	(1968)	...	...	...	...	...	...	...	...	...	...	...	...
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...
Manufacturing	(1967)	——	153	——	——	146	——	...	...	...	...	...	...
	(1968)	...	...	...	...	...	...	...	...	...	...	...	...
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...
Philippines													
Mining	(1967)	——	129	——	——	141	——	——	128	——	——	124	——
	(1968)	——	131	——	——	148	——	——	160	——	——	162	——
	(1969)	——	154	——	——	167	——	...	...	...	...	...	...
Manufacturing	(1967)	——	124	——	——	129	——	——	122	——	——	127	——
	(1968)	——	128	——	——	141	——	——	139	——	——	142	——
	(1969)	——	143	——	——	——	——	...	...	...	...	...	...
Viet-Nam, Republic of													
Manufacturing	(1967)	——	158	——	——	176	——	——	173	——	——	162	——
	(1968)	——	125	——	——	154	——	——	171	——	——	151	——
	(1969)	——	186	——	——	——	——	——	——	——	——	——	——

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

2. Production of Textiles, Paper, Chemicals, Cement and Crude Steel

1963 = 100

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Cotton yarn (thousand metric tons)													
Australia	(1967)	0.96	2.40	2.41	2.29	2.81	2.67	2.25	2.68	2.65	2.55	2.44	1.91
	(1968)	1.10	2.25	2.44	2.14	2.63	2.42	2.49	2.53	2.51	2.57	2.50	1.76
	(1969)	1.32	2.07	2.35	2.45	2.52	2.60	2.62	2.62	...	...	...	...
China (Taiwan)	(1967)	6.00	4.56	6.47	5.88	5.96	6.14	5.74	5.71	5.59	5.97	6.26	5.86
	(1968)	5.86	5.28	5.14	5.82	5.68	5.26	6.35	5.76	6.03	5.98	5.69	6.64
	(1969)	6.67	4.78	6.78	6.80	6.92	6.20	6.43	6.39	5.96	...	...	...
Hong Kong	(1967)	———	10.71	———	———	11.37	———	———	11.38	———	———	12.30	———
	(1968)	———	11.73	———	———	12.40	———	———	12.35	———	———	12.70	———
	(1969)	———	11.64	———	———	11.95	———	...	...	...	...	...	...
India	(1967)	71.4	64.4	72.2	70.6	77.0	75.4	77.1	77.0	81.0	78.3	74.5	77.3
	(1968)	80.0	78.7	79.2	78.8	79.4	79.3	84.6	81.8	80.5	75.9	80.7	81.9
	(1969)	81.6	74.5	79.1	79.1	76.8	78.9	...	...	...	...	...	...
Japan	(1967)	38.5	43.8	41.5	44.0	42.4	44.2	44.2	41.4	44.1	44.0	46.3	44.5
	(1968)	42.0	47.2	45.5	47.9	44.7	46.3	46.5	41.9	48.0	46.6	47.0	47.5
	(1969)	40.6	45.7	42.3	45.7	41.5	46.0	44.4	40.3	46.4	...	...	...
Korea, Republic of	(1967)	5.06	4.75	5.79	6.28	5.75	6.28	6.71	6.70	6.20	7.14	7.06	7.08
	(1968)	6.00	6.20	5.90	5.66	6.39	6.11	6.20	6.46	6.69	7.00	7.65	7.60
	(1969)	6.98	5.75	5.41	6.54	7.34	7.36	7.71	...	6.27	...	...	...
Pakistan	(1967)	19.1	18.4	18.8	20.0	21.8	21.2	20.9	21.5	21.6	22.6	21.9	22.9
	(1968)	21.5	21.5	21.0	19.3	19.4	22.3	22.6	23.5	23.4	24.2	23.8	23.0
	(1969)	22.9	23.5	22.2	24.1	23.9	22.8	24.0	24.0	24.8	24.3	...	...
Philippines	(1967)	2.28	2.33	2.00	1.98	1.75	1.52	1.37	1.11	2.33	2.85	2.87	2.33
	(1968)	1.86	2.20	2.44	2.29	1.59	1.76	1.59	1.44	1.44	1.53	1.50	2.11
	(1969)	1.96	3.19	3.36	2.34	3.00	3.57	3.38	3.27	3.08	...	...	...
Viet-Nam, Republic of	(1967)	0.63	0.40	0.67	0.60	0.57	0.58	0.50	0.62	0.61	0.74	0.65	0.84
	(1968)	0.39	0.01	0.33	0.34	0.29	0.36	0.40	0.57	0.52	0.58	0.58	0.64
	(1969)	0.74	0.41	0.69	0.61	0.52	0.57	0.61	0.71	...	...	...	...
Woven cotton fabrics (million square metres)													
Australia	(1967)	2.12	4.69	5.12	4.90	5.75	5.40	4.98	5.68	5.84	5.39	5.32	4.26
	(1968)	2.33	4.85	5.37	4.64	5.61	5.10	5.31	5.89	5.11	5.25	5.29	3.81
	(1969)	2.58	4.46	5.08	4.40	5.11	4.84	4.57	4.83	5.07	...	...	...
China (Taiwan)[a]	(1967)	24.6	20.5	30.6	26.8	31.8	27.5	31.1	27.2	30.7	30.4	29.8	29.8
	(1968)	30.5	23.6	37.6	31.1	29.6	29.9	33.1	33.3	29.6	31.9	35.0	38.8
	(1969)	33.1	33.3	29.6	31.9	35.0	38.8	33.0	35.1	33.3	...	...	...
India[a]	(1967)	324	291	326	318	350	348	354	350	373	369	341	353
	(1968)	374	361	365	366	369	359	382	370	367	334	357	360
	(1969)	360	324	348	355	344	352	...	...	...	...	...	...

[a] Million metres.

Woven cotton fabrics (Cont'd)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Japan	(1967)	230	246	241	245	239	235	232	222	232	231	237	234
	(1968)	219	230	227	234	228	233	233	218	231	227	232	231
	(1969)	220	240	234	240	232	238	233	218	233	...	...	...
Korea, Republic of	(1967)	20.1	19.0	24.9	25.6	28.1	27.0	26.7	25.9	25.8	23.6	27.8	27.2
	(1968)	23.7	26.1	24.2	19.6	20.0	19.7	20.9	20.4	20.3	19.6	21.5	22.4
	(1969)	29.0	22.7	24.1	21.4	22.0	...	...	...	19.5	...	...	...
Pakistan[a]	(1967)	53.8	53.6	57.5	59.8	64.6	58.9	58.8	57.7	59.7	60.9	59.4	60.1
	(1968)	57.6	60.5	57.2	62.8	63.1	62.2	57.0	56.6	61.8	58.7	62.1	60.3
	(1969)	57.8	59.4	49.6	58.4	59.9	62.6	...	...	...	...	...	...
Philippines[a]	(1967)	11.5	12.2	13.0	14.7	14.4	14.0	13.9	13.8	16.7	15.8	13.6	12.8
	(1968)	17.1	15.5	17.3	16.1	15.3	14.7	14.3	16.6	17.1	17.3	16.7	16.2
	(1969)	15.2	16.5	17.0	19.8	17.2	16.8	16.8	18.1	17.2	...	...	...
Viet-Nam, Republic of[a]	(1967)	3.94	2.25	4.37	3.50	3.66	3.70	3.66	3.84	3.63	3.61	3.45	3.47
	(1968)	1.81	—	1.59	2.04	1.16	1.56	2.49	3.08	3.40	3.79	3.72	3.86
	(1969)	4.31	2.32	3.15	4.12	4.19	4.37	4.30	4.90	...	...	...	...

Rayon and acetate filament and fibres

(thousand metric tons)

China (Taiwan)	(1967)	0.64	0.57	0.56	0.64	0.61	0.62	0.61	0.57	0.59	0.70	0.62	0.72
	(1968)	0.61	0.51	0.81	0.45	0.70	0.66	0.54	0.67	0.60	0.61	0.71	0.72
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...
India	(1967)	7.27	6.35	6.99	7.15	7.64	7.77	8.08	7.89	7.89	8.20	5.95	6.38
	(1968)	8.40	7.99	8.55	7.97	7.84	7.75	8.15	8.22	8.12	8.36	8.48	9.20
	(1969)	8.62	7.53	7.99	7.44	7.62	7.83	...	...	...	...	...	...
Japan	(1967)	44.1	42.7	44.3	44.5	44.0	44.3	44.1	44.6	43.3	42.8	42.1	42.6
	(1968)	43.1	41.6	42.3	42.3	42.7	42.3	42.2	42.9	42.2	42.6	42.3	42.6
	(1969)	43.0	41.1	42.6	42.6	43.6	43.0	43.4	43.6	42.7	...	...	...

Woven rayon and acetate fabrics

(million square metres)

Australia	(1967)	1.21	2.52	2.59	2.56	2.75	3.19	2.71	2.93	2.93	2.66	2.60	2.06
	(1968)	1.22	2.39	2.85	2.36	3.09	2.92	2.63	2.94	2.97	2.78	2.76	2.02
	(1969)	1.43	2.31	2.56	2.30	2.56	2.94	2.48	2.74	...	...	...	...
China (Taiwan)[a]	(1967)	3.33	2.83	4.09	3.57	3.74	3.36	3.80	4.00	3.60	3.82	4.49	5.13
	(1968)	4.95	5.19	6.16	4.89	5.89	5.50	4.55	3.66	5.41	5.02	5.72	6.18
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...
India[a]	(1967)	76.8	70.8	71.0	66.9	72.4	68.8	68.2	71.9	68.1	77.7	80.8	82.0
	(1968)	84.8	92.6	76.2	79.6	80.2	70.1	85.3	78.4	81.4	97.2	95.1	84.6
	(1969)	88.5	78.8	83.2	83.2	...	...	...	...	...	...	...	...
Japan	(1967)	127	130	130	135	137	140	140	134	140	139	138	138
	(1968)	127	131	132	137	136	137	140	134	136	136	136	134
	(1969)	126	133	133	141	138	143	143	137	139	...	...	...
Korea, Republic of	(1967)	5.62	5.63	5.76	5.96	5.97	5.98	5.54	5.99	5.99	5.93	5.83	5.81
	(1968)	6.20	5.69	5.70	5.90	6.12	6.15	4.64	4.21	4.42	3.72	4.40	3.70
	(1969)	3.18	2.34	3.58	3.92	3.90	3.98	3.84	...	3.64	...	...	...
Pakistan	(1967)	3.06	3.45	3.55	3.23	3.15	2.90	3.76	4.32	5.02	3.61	4.44	5.33
	(1968)	3.96	4.19	4.26	4.10	4.07	4.01	8.68*	8.09*	6.15*	7.51*	7.40*	4.61*
	(1969)	4.74	4.96	4.96	5.60	7.54	7.05	7.31	7.23	7.24	...	...	...

[a] Million metres.

Newsprint
(thousand metric tons)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Australia	(1967)	8.18	7.99	8.67	8.45	8.76	8.08	8.19	8.14	8.19	8.45	7.93	6.20
	(1968)	6.87	7.79	8.36	8.11	8.09	7.82	7.79	8.31	8.14	8.53	7.65	5.96
	(1969)	10.66	11.54	13.94	13.62	14.96	14.81	15.13	14.84	14.92	...	...	...
India	(1967)	...	...	...	...	...	...	2.87	2.92	2.76	2.64	2.48	2.70
	(1968)	2.65	2.46	2.72	2.40	2.64	2.59	2.48	2.56	2.56	2.38	2.63	2.73
	(1969)	2.58	2.29	2.71	2.52	2.70	...	...	...	...	...	...	...
Japan	(1967)	97.5	95.9	110.4	108.8	112.7	114.7	117.0	108.8	111.7	112.5	112.3	117.8
	(1968)	110.0	114.1	125.4	121.4	119.2	119.2	127.3	122.9	124.6	128.9	127.8	129.3
	(1969)	123.8	120.6	134.2	132.8	131.8	131.4	135.7	139.6	140.3	...	...	...
Korea, Republic of	(1967)	4.93	4.40	5.09	4.94	4.96	4.71	5.00	4.93	4.93	5.12	4.47	4.11
	(1968)	3.97	3.40	4.69	4.97	4.97	4.79	5.13	5.17	5.16	6.32	6.40	7.10
	(1969)	6.76	6.23	7.30	7.00	7.45	...	...	...	...	...	...	...
New Zealand	(1967)	———	15.46	———	———	15.40	———	———	17.52	———	———	19.17	———
	(1968)	———	14.13	———	———	16.23	———	———	17.22	———	———	17.50	———
	(1969)	———	16.62	———	———	16.57	———	...	...	...	...	...	...
Pakistan	(1967)	3.56	3.61	2.91	2.18	3.67	3.40	3.76	3.59	2.84	3.30	3.15	3.52
	(1968)	2.57	3.47	3.71	2.64	3.43	3.25	3.40	3.27	2.61	3.64	3.43	3.70
	(1969)	3.27	3.50	3.09	3.41	3.29	3.32	3.35	3.56	3.38	...	...	...

Sulphuric acid
(thousand metric tons)

Australia	(1967)	189	166	197	180	174	153	139	158	176	163	156	164
	(1968)	166	167	158	173	166	128	121	152	176	169	142	167
	(1969)	158	169	180	170	150	126	107	140	...	...	...	...
China (Taiwan)	(1967)	17.1	13.9	15.6	14.9	14.1	15.2	14.1	13.9	15.4	18.0	19.0	18.9
	(1968)	16.6	15.2	14.4	14.3	14.2	13.9	17.7	19.7	16.4	21.9	20.9	27.4
	(1969)	19.1	11.4	25.6	21.5	14.8	15.2	20.2	18.2	25.5	...	...	...
India	(1967)	58.7	56.4	64.1	51.4	58.7	48.3	77.4	76.6	76.0	74.0	75.0	87.8
	(1968)	79.8	77.0	76.0	75.5	71.4	78.7	87.7	73.8	90.3	78.2	87.3	108.4
	(1969)	95.0	93.0	95.0	95.0	95.0	...	...	...	...	...	...	...
Japan	(1967)	523	480	530	513	517	487	516	535	514	549	544	468
	(1968)	574	537	558	537	532	535	539	528	545	562	551	591
	(1969)	587	535	590	534	542	546	557	543	546	...	...	...
Korea, Republic of	(1967)	2.05	2.04	1.99	1.75	2.15	2.30	2.41	2.15	2.29	2.71	2.45	2.46
	(1968)	2.93	2.08	2.25	3.13	3.37	2.71	3.13	3.35	3.27	2.54	2.76	2.97
	(1969)	2.93	2.61	2.10	2.38	3.18	3.25	3.01	...	2.76	...	...	...
Pakistan	(1967)	1.94	1.06	1.78	2.01	2.30	1.99	1.87	2.43	1.87	1.99	1.94	2.32
	(1968)	2.18	2.16	1.82	1.82	3.83	3.04	3.25	2.45	2.25	2.35	2.37	2.62
	(1969)	1.46	1.13	2.28	3.08	3.07	2.87	2.87	3.59	3.23	2.24	...	...
Philippines	(1967)	2.53	4.50	7.32	7.41	5.88	6.82	6.09	5.58	5.54	6.63	6.29	6.95
	(1968)	2.12	10.60	12.92	15.81	16.74	14.43	19.05	13.0	20.4	24.3	22.3	10.1
	(1969)	9.4	12.4	16.6	20.0	17.8	16.7	12.5	12.9	10.0	...	...	...

Caustic soda
(thousand metric tons)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Australia	(1967)	9.10	7.34	6.74	7.18	9.26	8.58	9.63	8.32	8.33	8.72	7.84	8.25
	(1968)	9.12	7.41	6.72	8.80	8.10	8.63	9.74	8.88	9.60	8.81	8.69	9.59
	(1969)	8.57	8.43	10.26	8.74	8.75	10.18	9.09	8.98	...	...	...	...
China (Taiwan)	(1967)	7.94	7.06	7.79	7.52	7.61	7.72	7.50	6.99	6.51	6.82	8.11	9.01
	(1968)	8.45	8.43	11.65	11.13	11.83	8.95	7.22	7.52	7.96	6.94	6.90	8.53
	(1969)	9.44	7.70	9.07	8.93	8.07	9.04	9.31	9.12	7.71	...	...	...
India	(1967)	19.4	18.2	20.4	17.2	20.0	20.2	20.1	22.0	22.8	22.4	22.5	23.0
	(1968)	24.6	24.3	25.3	20.6	24.6	23.9	25.7	27.1	27.1	26.6	27.7	30.0
	(1969)	30.7	25.4	24.8	25.6	27.9	...	...	...	...	...	...	...
Japan	(1967)	130	123	138	132	136	136	136	140	140	144	144	150
	(1968)	151	149	160	155	162	162	161	160	159	167	164	168
	(1969)	179	168	179	179	186	183	180	184	189	...	...	...
Korea, Republic of	(1967)	1.53	1.27	1.30	1.33	1.46	1.21	1.09	1.72	2.96	3.27	2.26	3.02
	(1968)	2.89	2.23	2.38	3.08	2.98	3.31	2.74	2.70	2.60	3.04	3.42	3.25
	(1969)	2.92	2.54	2.76	2.83	2.56	2.42	2.42	...	2.65	...	...	...
Pakistan	(1967)	1.58	1.32	1.19	1.77	1.82	1.67	1.60	1.76	1.36	1.93	2.00	2.25
	(1968)	2.29	1.79	2.17	2.24	2.20	1.77	1.92	1.83	1.86	2.02	2.28	2.12
	(1969)	2.02	2.02	1.54	2.42	2.04	2.10	2.42	2.52	2.31	...	...	...
Philippines	(1967)	0.88	0.91	0.72	0.59	0.41	0.96	0.72	0.85	0.71	0.72	0.52	0.50
	(1968)	0.60	0.84	0.92	0.83	0.86	0.81	0.80	0.82	0.78	0.81	1.15	1.05
	(1969)	1.21	1.20	0.52	0.63	0.78	0.70	0.82	0.72	0.79	...	...	...

Plastics and Resins
(thousand metric tons)

Australia	(1967)	9.93	11.08	12.77	12.67	13.77	13.12	14.47	14.98	13.92	13.79	14.19	13.71
	(1968)	12.82	13.60	14.18	15.07	15.30	14.38	16.02	16.56	15.29	15.16	15.82	17.41
	(1969)	14.90	15.89	18.55	11.14	15.73	17.66	18.53	19.57	...	...	...	...
China (Taiwan)	(1967)	5.59	5.04	5.35	6.04	6.06	5.65	5.52	4.56	4.40	4.40	4.82	5.92
	(1968)	5.16	6.02	7.87	7.54	7.98	7.37	7.84	8.05	8.43	6.20	7.03	8.00
	(1969)	9.96	7.97	8.95	9.17	7.47	9.32	6.16	5.23	4.61	...	...	...
India	(1967)	3.20	3.06	3.64	2.61	2.94	3.04	3.58	3.86	3.81	3.17	2.92	3.54
	(1968)	4.30	5.13	4.72	2.96	4.13	4.15	39.3	4.72	3.60	3.92	4.32	4.48
	(1969)	4.84	5.03	4.05	4.99	5.45	...	...	...	...	...	...	...
Japan	(1967)	296	288	313	317	329	328	178	179	179	191	191	204
	(1968)	205	193	205	207	213	216	218	216	222	221	219	234
	(1969)	243	231	241	248	258	256	263	268	267	...	...	...
Philippines	(1967)	1.54	0.76	0.69	1.25	1.31	1.28	1.71	1.68	1.44	1.59	2.34	2.56
	(1968)	1.66	1.89	1.81	1.54	2.22	1.94	1.69	1.54	1.45	1.03	1.15	1.78
	(1969)	2.54	2.00	1.75	3.90	4.82	2.05	2.74	2.64	2.04	...	...	...

Cement

(thousand metric tons)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Australia	(1967)	225	294	312	314	359	218	342	346	338	360	329	281
	(1968)	243	317	334	300	353	320	347	350	351	372	354	290
	(1969)	257	325	365	321	371	340	391	407	392	...	...	...
Burma	(1967)	13.21	14.05	12.21	12.11	9.39	11.32	13.45	10.84	5.40	8.81	8.91	12.50
	(1968)	14.7	14.2	18.1	18.2	15.0	8.1	11.7	17.2	13.4	14.1	12.7	19.2
	(1969)	15.5	13.2	15.7	11.0	20.5	15.9	...	...	...	...	...	...
Ceylon	(1967)	6.40	8.12	11.74	11.85	13.69	13.81	18.10					
	(1968)	...	...	...	...	...	...	18.26	18.58	19.35	19.04	17.14	19.93
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...
China (Taiwan)	(1967)	287	267	290	276	289	273	270	247	292	314	321	361
	(1968)	346	286	346	316	360	274	337	302	324	338	365	401
	(1969)	366	331	346	356	353	335	346	327	279	...	...	...
Hong Kong	(1967)	19.3	1.3	14.7	24.8	1.8	1.7	21.3	16.4	28.2	30.6	29.6	25.4
	(1968)	25.8	33.3	34.5	33.6	38.6	33.0	30.4	25.5	32.4	21.5	23.5	32.7
	(1969)	36.3	18.7	26.4	30.0	24.6	32.6	30.3	42.8	27.9	...	...	...
India	(1967)	1,006	807	995	930	1,003	953	946	925	827	962	961	964
	(1968)	1,001	969	1,015	999	974	945	892	919	953	1,054	1,033	1,157
	(1969)	1,089	1,039	1,169	1,127	1,176	1,086	1,049	1,089	1,076	...	...	...
Japan	(1967)	2,937	3,232	3,745	3,216	3,362	3,476	3,601	3,707	3,666	3,979	3,789	4,091
	(1968)	3,225	3,618	4,329	3,839	3,779	3,700	3,925	3,966	4,118	4,295	4,209	4,674
	(1969)	3,570	3,798	4,460	4,067	4,134	3,956	4,232	4,313	4,542	...	...	...
Korea, Republic of	(1967)	128	161	214	231	265	197	233	208	203	281	185	135
	(1968)	130	146	205	332	364	347	356	303	343	401	333	312
	(1969)	210	196	352	413	477	503	...	...	512	...	...	...
Malaysia	(1967)	75.2	50.5	74.8	70.2	72.6	73.6	...	...	...	90.4	80.2	85.6
	(1968)	77.7	72.4	71.4	83.4	82.7	84.9	84.7	73.1	74.5	79.4	80.6	72.6
	(1969)	86.6	61.1	77.7	81.7	64.7	72.7	89.6	85.7	100.0	...	...	...
New Zealand	(1967)	48.7	69.5	73.7	74.3	81.9	64.8	67.5	67.6	67.9	70.6	68.2	51.7
	(1968)	50.5	70.1	67.2	57.6	69.9	60.5	66.2	64.4	66.4	66.6	68.3	55.1
	(1969)	55.9	67.1	75.3	65.1	72.3	64.8	71.3	6.3	67.8	72.3	...	...
Pakistan	(1967)	175	138	156	193	194	186	152	147	168	184	170	175
	(1968)	167	179	181	182	201	193	184	189	185	228	238	196
	(1969)	207	192	224	239	213	206	216	229	243	244	...	...
Philippines	(1967)	122.5	116.6	103.4	150.6	151.9	144.2	161.8	138.1	149.8	147.9	110.7	172.5
	(1968)	207.0	157.9	159.3	150.1	189.3	207.0	233	216	184	210	217	206
	(1969)	143	167	185	195	204	213	191	212	178	...	...	...
Thailand	(1967)	119.2	107.7	167.5	149.0	148.0	135.8	157.2	158.5	149.2	119.1	155.2	170.0
	(1968)	146.4	161.1	182.1	198.6	186.5	185.8	175.3	180.8	185.5	182.8	157.1	204.1
	(1969)	182.8	207.4	201.8	210.6	...	...	...	...	...	...	...	...

Crude steel
(thousand metric tons)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Australia	(1967)	516	463	531	469	562	539	515	521	532	533	478	539
	(1968)	530	524	565	586	551	523	488	529	530	557	547	575
	(1969)	581	595	618	635	542	578	581	580	559	...	...	...
China (Taiwan)	(1967)	33.8	31.1	37.7	37.5	39.3	39.6	37.3	35.2	38.6	37.7	37.1	38.3
	(1968)	43.0	43.4	46.0	18.6*	19.0*	17.3*	21.8*	23.0*	21.7*	23.0*	23.7*	21.9*
	(1969)	19.6	18.1	21.8	22.3	19.8	19.6	18.8*	19.3*	18.3*	...	...	...
India	(1967)	585	526	586	531	529	494	537	539	492	533	518	570
	(1968)	561	519	561	513	506	494	534	530	516	533	568	610
	(1969)	613	520	566	530	543	...	...	...	...	...	...	...
Japan	(1967)	4,839	4,582	5,140	4,943	5,212	5,256	5,316	5,300	5,461	5,473	5,215	5,415
	(1968)	5,411	5,233	5,540	5,356	5,517	5,456	5,611	5,595	5,664	6,005	5,656	5,847
	(1969)	6,053	5,773	6,453	6,505	6,779	6,717	6,843	6,970	7,157	...	...	...
Korea, Republic of	(1967)	20.5	19.5	30.5	25.9	25.8	26.8	26.0	29.9	25.0	34.2	25.1	31.0
	(1968)	21.0	18.0	27.4	30.3	28.7	29.5	33.0	33.1	36.4	35.6	34.8	37.1
	(1969)	33.2	32.6	33.8	35.3	33.4	32.8	38.3	33.5	...	...	...	...

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

3. Index Number of Employment in Manufacturing
1963 = 100

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Australia	(1967)	110	111	111	111	111	111	111	111	111	112	112	112
	(1968)	112	113	114	113	113	113	114	114	114	114	115	114
	(1969)	115	116	117	...	...	...	...	...	...	...	...	...
Japan	(1967)	108	108	112	109	112	113	114	113	113	115	116	113
	(1968)	114	115	115	118	117	117	113	112	112	111	110	111
	(1969)	112	112	116	117	116	112	112	114	116	...	...	...
Korea, Republic of	(1967)	...	...	159	...	...	158	...	...	188	...	...	197
	(1968)	...	...	187	...	...	191	...	...	204	...	...	242
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...
New Zealand	(1967)	116	118	118	117	116	114	112	111	110	109	112	114
	(1968)	113	114	113	112	112	111	110	109	109	109	112	117
	(1969)	116	118	118	117	...	...	...	...	...	...	...	...
Philippines	(1967)	106	106	107	106	102	102	104	-03	103	104	105	108
	(1968)	108	108	108	108	107	106	106	106	106	108	110	110
	(1969)	...	...	...	...	...	...	...	...	...	...	...	...

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

THE DEVELOPMENT ENQUIRY SERVICE

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