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The chemical industry in the developing ESCAP Region

Prepared by
Prof. B.N. Agarwala

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THE CHEMICAL INDUSTRY IN THE DEVELOPING ESCAP REGION

by

Prof. B. N. Agarwala
New Delhi, India

- 1985 -

A B B R E V I A T I O N S

Replita	:	Indonesian Five Year Plan
U.N.C.T.C.	:	United Nations Centre on Trans-National Corporations, New York.
N.C.A.E.R.	:	National Council of Applied Economic Research, New Delhi.
Indian Rupees	:	Exchange rate calculated at US $ 1 = Rs.10.00
Indonesian Rupiah	:	Exchange rate calculated at US $ 1 = 1000 Indonesian Rupiah.
F.A.I. I.F.A.	:	Fertiliser Association of India.
Far East ... ey	:	Chemical Age - 8th June, 1979.
F.A.O.	:	Food and Agriculture Organisation, Rome
O.E.C.D.	:	Organisation for Economic Cooperation and Development.

INTRODUCTION

The purpose and objective of the study is to provide an over-view reviewing past developments of the chemical industry and its present state of growth and future prospects in the developing ESCAP region. The focus of the study is on the growth and developments in its various main branches - organic and non-organic and more particularly the industrial basic organic and inorganic chemicals, fertilizer and pharmaceutical industries. The study seeks to highlight the growth trends observed in the past decade and a half and seeks to offer the projections for the mid-1980s and wherever possible till the end of the 20th century.

It has not been possible to obtain comprehensive data for centrally planned economies of North Korea, Cambodia, Laos, Mongolia and Vietnam as also Afghanistan and Iran. The study has primarily focussed on the developing South and South-East Asian countries of the ESCAP region and China i.e. India, Bangladesh, Pakistan, Sri Lanka, Nepal, Bhutan, the Maldives, Thailand, Malaysia, Singapore, Philippines, Brunei, Hongkong, the Republic of Korea and China.

The methodology adopted has been the study of the various sub-sectors of the chemical industry to provide an overall picture in these countries as also in the region as a whole in a global context. An attempt has been made to analyse the various country, sub-regional and regional development plans and projects having a direct bearing on the evolution and development of the chemical industry, its role in the national economies, local natural and human resources, the prospects and challenges facing the industry, supply-demand situations, and the likely directions of its growth potential in the 1980s and possibly in the 1990s.

An attempt has been made to quantify the available data in regard to production, trade (imports-exports), employment, investment and prices. The role of the chemical

industry towards the realisation of the industrial policy objectives contained in the various country plans, sub-regional and regional groupings have been broadly indicated. The study is largely based on extensive desk research and has been supplemented by field visits by the author to various countries of the developing ESCAP region viz. Bangladesh, Nepal, Thailand, Malaysia, Singapore, Indonesia, Philippines, Hongkong, The Republic of Korea and China.

Discussions were held with the various chemical manufacturers' associations and some of the leading chemical manufacturing enterprises as also the various Ministries, Planning Chambers of Commerce and Industry and the various trade associations dealing with the sub-sectors of the chemical industry.

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CHAPTER - I

Review of past developments and present situation.

The world's chemical industry has had a phenomenal growth during the past three decades, and the turn-over of chemicals reached $ 394 Billion in 1978 as compared with $ 334 Billion in 1977, $ 305 Billion in 1976 and $ 276 Billion in 1974.[1/]

According to a consumption department analyst the chemical industry will witness a gain in the value of shipments for chemicals and allied products to $ 212 Billion for 1981 assuming price hikes of about 10 per cent compared to $ 185 Billion for 1980. In terms of turn-over the chemical industry structure shows a strengthening of organic products in the 1970s. The consumption of agricultural chemicals remains very much the preserve of the developed world with 75 per cent consumption in this area compared with only 25 per cent in the developing countries. The world exports of the chemical industry increased from $ 85.9 Billion in 1977 to $ 102 Billion in 1978. The developing countries of Asia, Africa and South America accounted for the total export of $ 4.6 Billion or 4.45 per cent of the total world exports. The chemical industry in the last two decades has attracted some of the best investors and industrial groups in the developing ESCAP region as it seem to be a healthy and buoyant industry with a great and promising future.

The growth rate of chemical industry had sharply decline in developed countries from 11 per cent in the 1960s and 1970s to 2 per cent or less in the recession years, 1980 to 1982. Chemical industry being inter-locked with every other industrial activity it cannot escape from the

1/ Quoted from an article by S.L. Venkateswaran, appearing in the "Commerce" Bombay, Supplement, on the Chemical industry in its issue of 26.11.83.

vicissitudes of overall economic activity. Generally its growth rate has been ahead of GDP growth by an average multiplier of 1.4 After the severe recessions in 1980-82 the industry has picked up in USA in 1983 and 1984 though not so markedly in West Europe/Japan. Lately Federal Republic of Germany and U.K. have shown signs of modest recovery. 1/ The recent return in profits has projected a growth of 3.5 per cent based on an estimated GDP growth of 2.5 per cent world wide. This is possible only through a massive growth in the presently less developed countries, for the overall 3.5 per cent reflects a rate of 3 per cent in North America, 2 per cent in West Europe, 2.5 per cent in Japan, 3.3 per cent in East Europe and 7 per cent in the developing countries.

As a result of this varied growth of the projected share, the world production in 2000 A.D. will shift sharply from 32 per cent to 24 per cent for North America and in Western Europe and in Japan, but an increase from 12 to 33 per cent in the rest of the world. Even if the overall growth is less than 3.5 per cent the shifts in the share of developing countries and resource rich areas will be inevitable.

The growth of international trade in the chemical industry has been at a much higher rate than that of production and will continue to be so far the next 15 years - but the directions will change. Trade, as a percentage of production is estimated to go up from 18 per cent in 1979 ($ 123 billion) to 27 per cent ($ 369 billion) in mid '80s. The export sectors of major commodity chemicals are likely to be shifted to resource rich countries, namely West Asia, Mexico, Canada, China, Indonesia, Brunei, Malaysia and other gas producers like Thailand, India, Pakistan and Bangladesh. 2/

1/ Quoted from an article by S.L. Venkateswaran in the "Commerce" Bombay Supplement on the Chemical industry in its issue of 26th November, 1983.
2/ Ibid. -do-

There is evidence of some restructuring and redeployment through shifts in ownership and sharing of capacity and operations, take-overs or sell-outs and many changes have taken place in the last 10 years. There is also a parallel movement by the big producers into the developing areas through joint ventures. The enormous quantities of natural and associated gas which is flared in the ESCAP developing countries is an attractive prime feed stock for chemical industries. The lack of expertise and technology has led to joint ventures for many large capacity plants set up in Iran and other Gulf countries. U.S., European and Japanese companies have participated in these ventures and as these projects are largely export oriented such participants have an opportunity for maintaining their international operations.

There has been a shift to move away from commodity chemicals to specialities. The speciality chemical products are also of wide variety. They are lower volume high value products sold on the basis of preference and their usage. Some like agro-chemicals and pharmaceuticals are of fairly large volume while some fine chemicals like industrial enzymes are used only in tonnage quantities being of high value. The movement down stream in specialities affords some opportunity to a few major producers. Water treatment chemicals and specialised grade of chemicals for the electronics and engineering plastics are promising areas of speciality. More effective insecticides with far less toxicity like pyrethroids and newer pharmaceuticals such as "Targamet" used for stomach ulcers treatment have yielded high profits.

The pattern of hydro-carbon feed stocks will continue to be naphtha, gas-oil, LPG, methanol and natural gas. Coal will begin to make its impact as a feed stock material in the 'nineties and other sources like shale oil and tarsands may also grow if the price of crude oil recovers from its present depressed levels in the next decade; though gas-oil

has often been a first choice, butane and, to a lesser extent, propane, for receiving imports or those with indigenous supplies. Developments in this area will largely depend on the price of LPG-conversion from Naptha feed-stock to LPG is expensive, and useful by-products will be lost.

Another prospective feedstock for ethylene production could be methanol which can be transformed into ethylene in two different ways. Methanol may be homologized to ethnol using conventional oxide catalysts or catalysts with iodine promoters that increase the yield. At pressures of 200 to 300 atm, these catalysts and promoters drive the reaction very near to completion, with recycling of aldehydes and esters increasing the achieveable yield to 90 per cent.

It is estimated that there has been a reduction of 8.8 per cent in the need of fuel and power by the chemical industry as a whole in the last decade. Owing to technological shifts there has been an improvement in the efficiency of energy uses to the extent of 23.7 per cent.[1/] The large reduction in power requirements in the caustic/chlorine industry has been achieved through new membraine cells. The energy recovery in the sulphuric acid process has been substantially increased, also the new technology for polyolefins which uses less energy for polymerisation but also needs less power for conversion of fabricated products. Large producers have co-generation plants with power generated from steam required for the processes, and heat recovery from waste heat boilers has been stepped-up. So far biomass is not a significant feed stock except to the extent of fermentation of ethyl alcohol, but it may be a source of

1/ Quoted from an article by S.L. Venkateswaran appearing in the "Commerce" Supplement on the Chemical Industry in its issue of 26th November, 1983.

methanol within the next 15 years. The development and improvement of catalysts is a major area of thrust and the achievements with the zeolites for the conversion of methanol into hydro carbons are significant. Chemical industry's expenditure on the research and development has been maintained despite the squeeze in profits since 1979-80.

The basis of any technological process in the chemical industry are raw materials, energy and equipment. For feedstock the chemical industry relies mainly on the use of both inorganic (ores) and organic (petroleum, gas) mineral raw materials. An important factor for the raw material situation is the geographical distribution of deposits among developed market-economy countries, centrally planned economy countries and developing countries.

The past decade has witnessed considerable emphasis on environmental impact and pollution, more serious are problems arising from wastes. Waste dumps of past years have resulted in leaks and the pollution of water sources by dangerous chemicals like Doixin, Trichloroethylene, Biphenoles. Sulphur-dioxide emissions from boilers and furnaces by the wide spectrum of industry and merely biochemical industry tend to get precipated as "acid-rain" and pollution of lakes and forest areas.

The pharmaceutical producers continue to spend about 10 per cent of turnover - so as to meet the increasing rigours of testing new drugs. The costs of tests and gaining marketing approvals has soared to over $ 1 to $ 10 million on an average - a new generation of anti-biotics, betablockers for heart and blood pressure ailments, new methods for delivery of drugs, new chemicals for cancer treatment - have made their appearance and reached large sale volumes.

The modification of genes for making specific valuable biochemical products to be made by selected micro-organism, has made a beginning - human insuline, growth hormones,

interferons, some diagnostic biochemicals and even a biopolymer.

Chemical industry is expected to remain a high growth industry with growth rates ahead of GDP in the mid-1980s and 1990s. However, the rate of growth will be on a reduced scale compared to the 1960s and 1970s. While the US economy has no doubt shown signs of a rebound in 1983/1984 and is expected to continue to grow in 1985 albeit more slowly the prospects in the second half of the 1980s are not very certain. The economic recovery led by US is yet to fully percolate to the other industrialised countries of Western Europe and Japan and only sustained global recovery in the 1980s will be able to propel and generate dynamic growth in the developing ESCAP region.

Development of the Chemical Industry - 1975-80

Development and place of the Chemical industry in the economy.

Even though the development of the chemical industry in the world as a whole in the second half of the 1970s was greatly affected by the very difficult overall economic situation and by the uncertainities existing in the industrial sectors of the various countries, yet the chemical industry in the world as a whole showed a more favourable quantitative growth curve in 1975-80 than in the period 1970-75. The chemical industry confirmed its traditional capacity to grow more rapidly than industrial output as a whole. The reasons for this are its typical diversification, the difficulty of replacing its products (in practically all industrial sectors) as well as some private consumption sectors and the particularly innovative characteristics of its products. These factors, which

affected all the countries in which the chemical industry occupies a major place seriously influenced the chemical industries of the newly industrialising ESCAP countries particularly The Republic of Korea, India and China.

The progress of the international chemical industry during the period 1975-80 was affected by certain new and very important economic developments. The sharp rises in the 'seventies in the costs of raw materials derived from petroleum, which are extensively used by the chemical industry, as well as of the other factors of production had serious consequences for the sectors profitability by causing a deterioration in the competitiveness of some chemical products. Nevertheless despite its uneven development and the rapid succession of negative economic phases, the chemical industry as a whole showed a more favourable quantitive growth curve than in the period 1970-75 in competitiveness.

With the US recovery the overall situation has begun to gredually improve in 1983 and 1984. The difficulties encountered by the world chemical industry from 1975 onwards caused a decline in its contribution to the formation of value added for manufacturing as a whole. It is estimated that between 1975 and 1978 its share dropped from 11.1 per cent to 10.3 per cent.1/

The fluctuations in the international monetary system and wide exchange rate uncertainities caused a set-back for chemical products. The contraction of "productive base" in a number of countries, where priority was attached to achieving economies through the rationalization of the existing production potential and the reduction of surplus capacity in several sectors of the chemical industry (organic and inorganic chemicals, fertilizers) led to lower growth rates in the chemical industries of several countries.

1/ European Chemical News and Chemical Week.

The period 1975-80 was characterised by an exceptional rise in the cost of raw materials; at the same time, the difficult market situation and the great excess of supplies of chemical products at the international level in relation to demand made it impossible to absorb all the increases in costs through equivalent increases in sales; consequently there was a steady decline in the value added of the chemical industry in relation to turnover, which in some cases created problems as regards the remuneration of the other factors of production and amortization possibilities. The overall situation has improved in 1983-84.

Despite the expected maturing of a number of its sectors, the international chemical industry should continue to develop in the medium term also at rates higher than those for industrial production as a whole.

In the resource rich developing countries priority will be accorded to the development of basic chemical products, fertilizers, pesticides, pharmaceuticals to satisfy their basic needs of agriculture and industry. In the case of the countries with centrally planned economies - China, Vietnam, North Korea, Laos and Cambodia, the chemical industry will continue to develop at a steady rate as envisaged in their respective multi-year plans, even if these are affected by possible unfavourable economic phases. China has embarked on an ambitious modernisation programme.

Side by side with these trends in the development of the chemical industry, in the different geographical areas in the mid-'eighties and 'nineties, the consequences of general economic or monetary difficulties may be compounded by a decline in international trade flows in chemical products, particularly with reference to fertilizers and basic chemical products.

The development and more frequent conclusion of industrial and commercial co-operation agreements between

developed countries and the recently industrialised countries may be expected, particularly in the sphere of traditional chemical products which are being increasingly vacated by developed countries.

In the mid 1980s the chemical industry will have to take into account the problems connected with the compatibility of its development with the requirements of environmental protection, job security and the protection of the health of consumers of chemical products. The recent Bhopal tragedy has underlined the need for environmental protection from pesticides manufacturing units.

With regard to raw materials in the forthcoming decade, the chemical industry will have to tend towards a more rational use of products from the economic stand-point. After the present phase of transition towards the rational use of these products the optimization of production cycles and the implementation of all forms of energy saving, chemical products should regain their traditional competitiveness in comparison with other products.

In the second half of the 1970s, there was a sharp drop of nearly one third in capital investments of the chemical industry in many countries. This was due partly to the completion of the investment programmes based on expectations of high rates of consumption of chemical products, and partly to the need to ensure that profitability conditions were in keeping with the large financial resources made available and rising investment costs with continuing high interest rates in a competitive framework. Between 1975-78, investments in the chemical industry in the various countries, measured in constant United States dollars showed a real growth of approximately 11 per cent.

However, investments in the chemical industry as a percentage of total investments in the manufacturing

industries, fell sharply from 11.7 per cent to 9.7 per cent reflecting a drop in investment.

In recent years a large proportion of investments in the chemical industry instead of going into new plant went to sectors such as monitoring of the environment, the upkeep and modernisation of existing plants or the removal of bottlenecks so as to permit the maximum utilisation of existing capacity with limited investments.

With regard to employment, there has been no significant increase in the chemical sector as it is very largely a highly capital intensive field.

The value of world chemical exports in 1980 rose to $ 147.4 billion as against $ 61.4 billion in 1975 and $ 22.1 billion in 1970. Thus the annual average rate of growth for the period 1975 to 1980 was 19.2 per cent, which shows an appreciable slackening as against the five year period 1970-75 (22.6 per cent).[1/] It should, however, be observed that because of the particularly sharp rise in prices over the past five years, these figures do not affect actual trends in the area.[2/]

Owing to the creation of over capacities in the OECD countries and the subsequent rationalisation programmes in recent years, including plant closure strategies, restructuring and re-deployment of the various sectors of the industry; there have been radical changes in the production

1/ The structure and behaviour of enterprises in the chemical industry and their effects on the trade and development of developing countries. UNCTAD 1979 and IMF International Finance Statistics.

2/ Economic Commission for Europe - Market Trends for Chemical Products 1975-80 and prospects to 1990. Vols. I & II, United Nations, New York, 1982 & 1984.

cost structure particularly in regard to the relation between fixed costs and variable costs.

Over 90 per cent of world production of chemicals is centred in the developed market economy countries, which account for 70 per cent share of world exports. Imports constitute roughly 70 per cent of apparent consumption of chemicals in developing countries. Such imports accounted for almost 30 per cent of world trade in the chemicals in 1975 and if intra-EEC trade is excluded, the share was 35 per cent during the period 1970 to 1975; as per Table below:-

Table-1 [1]

World Production and Share of World Trade.

Share of World Production of Chemicals.		Share of Imports to apparent consumption.		Share of World Trade in Chemicals.	
Developed Countries.	90 per cent.	Developing countries.	70 per cent.	Developed countries	70 per-cent.
				Developing countries. (Exclusive of intra-EEC Trade 35 percent).	30 per-cent.

Many factors have led to the concentration of multi-nationals in the Chemical Sector. They include control over technology and its dissemination, the large capital investments required. Twenty-five enterprises dominate the industry in terms of world production and trade and there has been an accentuation of the larger enterprises taking over the medium chemical enterprises in recent years owing to mergers and take overs.

The chemical industry accounted for almost 9 per cent of world trade for 1974. [2] There were also significant changes in the development of trade in chemical products in

1/ International Financial Statistics, I.M.F.

2/ Ibid.

comparison with trade as a whole. Whereas the period 1970-75 these percentage increases were nearly identical (22.6 per cent and 22.8 per cent), in the past five years the annual rate of growth in the world-wide export of chemical products (19.2 percent) significantly exceeded the development of trade as a whole (18.0 per cent). Almost 10 fold increase in the price of crude since 1974 had a severe impact on the net volume and the profitability of the industry. There has been increasing differenciation in the product mix and a marked trend towards integration.

The industry's output consists mainly of basic and intermediate chemicals which are supplied to other industries for further processing and its health is closely linked to the prosperity of the agro-industrial sector.

The use of chemicals in the manufacturing sector is expanding rapidly, as evidenced by the use of plastics in vehicle manufacture and in the manufacture of building and construction materials.

The development of the chemical industry in developing countries as a whole has been somewhat small in overall volume and range. In its origin it was largely confined to the production of salt (for use in preservation of hides and skins and in foodstuffs) and vegetable dyes (for use in domestic textile industries). Raw materials were exported - natural dyes, cinechona bark, organic fertilizers, phosphate rock, sulphur and oils.

In past two decades several developing countries have gone into the manufacture of basic organic and inorganic chemicals, soaps, detergents, drugs and pharmaceuticals, fertilizers and pesticides. In only a small number particularly India, China, the Republic of Korea has there been significant production of basic drugs/ pharmaceuticals and agro-chemicals and industrial chemicals.

During the 'sixties and 'seventies, more comprehensive manufacturing facilities have been established in some of the more industrially advanced ESCAP countries and further processing of indigenous raw material is being undertaken in some countries of the Asia-Pacific region. With the aid of imported technology several oil and natural gas producing developing countries are currently engaged in establishing chemical plants for the production of basic organic chemicals, methanol and some of their derivatives.

Of eleven industries in the manufacturing sector, the chemical industry - including petroleum, coal, rubber and plastics - is, in terms of value and production, the second most important after metal products and non-electrical machinery. It has also been one of the most dynamic in the manufacturing sector and its annual rate of growth in relation to that of the manufacturing sector as a whole in the period 1964-1976 was 7.3 per cent versus 4.4 per cent in the case of developed market economy countries, 7.2 per cent versus 6.8 per cent in the case of developing countries, and 10.6 per cent versus 9 per cent in the socialist countries of Eastern Europe.

The major proportion of chemical enterprises in developing countries are subsidiaries of enterprises originating in the developed countries. Import dependence applied in respect of most chemicals and allied products, including some of the basic chemicals and their derivatives like drugs, agro-chemicals, dyestuffs, plastics and textiles fibres. In 1974, the Asian developing countries imported significantly large quantities of fertilizers and basic inorganic chemicals; nine Asian countries amounting for $ 720 million of imports. India, Malaysia, the Republic of Korea, Singapore and Sri Lanka imported $ 164 million of synthetic dyestuffs.[1/] India's imports of fertilizers

1/ "Commerce" Bombay Special supplement on Chemical Industry 26 November, 1983 and International Financial Statistics I.M.F.

are estimated at nearly a billion dollars in 1984-85.[1]

Among the developing countries the major exporters were the more industrially advanced developing countries, such as the Republic of Korea and India which exported inorganic and organic chemicals, basic plastic materials, soaps and some pharmaceuticals. Indonesia exported basic chemicals, both organic and inorganic and urea fertiliser.

Foreign investment in the chemical industry has also experienced the highest rate of growth of any industry increasing from $ 14.1 million in 1953 to $ 35.5 million in 1969 and $ 102.3 million in 1975.

United States and European trans-national corporations have also invested more heavily in the chemical industry than in other industries in developing countries. In 1976, such affiliates sold in all developing countries $ 9,792 million of chemical products, which represented 30 per cent of all sales by United States majority-owned affiliates in the manufacturing sector. The percentages were 48 per cent for Asia and the Far-East.[2]

Some of the more industrially advanced among the developing countries have established in recent years domestic manufacturing for the more complex chemicals and in certain cases have established plants for manufacturing a significant proportion of the range of chemicals particularly in the Republic of Korea, China and India. They have also set up indigenous drug and pharmaceutical industries, in some cases based upon active ingredients of domestic origin.

1/ Economic Times supplement on Fertilisers, Bombay, November, 1984.

2/ Trans-national corporations in the pharmaceutical industry of developing countries and trans-national Corporations in the fertiliser industry, 1982. - U.N. Centre on Trans-national corporations, New York, 1983.

During late 'seventies, a number of oil and natural gas producing and other developing ESCAP countries were in the process of extending their domestic chemical industries.

Joint venture arrangements have been entered into between foreign enterprises and local interests (state-owned and or private). Such foreign enterprises supply plant, technology and in some instances marketing management skills and capital. India, Iran, Indonesia, the Republic of Korea, Saudi Arabia, UAE and Qatar have placed contracts for the construction of chemical complexes; the contracts have been placed with chemical engineering enterprises in developed market-economy countries.

On a regional basis the ASEAN countries, in the context of their industrial complementation schemes, are planning a number of projects in the chemical field. These would supply not only domestic and ASEAN markets but in some cases, provide especially for exports. The projects include the expansion of existing facilities or the introduction of new plants to manufacture acetylene black (Philippine/Thailand venture), polyvinyl chloride paste, resins, melamine, methanol, nitric acid, and ammonium nitrate. Plants utilising natural gas are coming up in India, Thailand, Pakistan and Bangladesh.

World pharmaceutical production in volume terms showed a yearly growth of about 10 to 14 per cent between 1975-80. This was a higher growth rate than for the preceding five year period. Pharmaceuticals production will continue to increase for at least the next decade and half, also in volume terms. This will occur because of the growth of the world's population, the higher proportion of elderly people (who tend to use more pharmaceuticals), increasing living standards, the extension of health services

ard of pharmaceutical supply, the discovery of new drugs effective against formerly incurable diseases, the introduction of newer and better drugs with fewer side effects. International trade in pharmaceuticals is also increasing.

The proportion of soap in the total output of detergents continues to decline as a result of higher rates of production of synthetic detergents. It is planned to increase the production of powdered soap compared to previous years' in order to meet the new requirements for synthetic washing preparations.

The development of world pesticides production during 1975-1980 was as under:-

Table - 2

World Pesticide Production [1]

1975	-	U.S. $ 5.5 billion.
1978	-	U.S. $ 8.7 billion.
1980	-	U.S. $ 11.8 billion.

FAO in its recent study "Agriculture towards 2000" has estimated that higher crop yields will provide 60 per cent of additional cropping intensity and these may be achieved by prevention of pre and post harvest losses due to damage by insects, fungus diseases, weeds and storage which are estimated at 30 per cent or more of the potential production.

More and more specific and narrow - spectrum pesticides are available in the world market. More stress needs to be placed on protecting of small farm/village level storage of foodgrains, agro-commodities and seeds; and use of fumigation at the farm level by use of selected

[1] Papers circulated at the International Pesticides Conference held at India International Centre - January-February, 1984.

bio-degradeable pesticides, it should be possible to achieve substantial increase in yields and production. There is considerable scope for pest and granular formulations production which can help raise the production of pulses and oil seeds in the countries of the Indian subcontinent - India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives.

The crops which are most protected by pesticides are cotton and maize; in the near future soyabeans will probably take the third place. International trade in pesticides is also increasing. Pesticides prices are increasing steadily by about 6 per cent a year owing to the increase in price of the chemical intermediates needed for their production. Because of strong competition between pesticide producers and market saturation, the prices of pesticides have moved up at a slower rate than those of other chemical products.1/

Consumption of pesticides in developing ESCAP countries will probably reach an annual increase of 7.8 per cent. The average cost of pesticides will increase from $ 1.57 lb in 1978 to $ 3.12 lb in 1990 because of higher raw material costs and shift to a higher performance.2/

Synthetic organics will probably account for more than 90 per cent of pesticide shipments in 1989-90. The pesticides production of developing Asian/Pacific countries is mainly characterized by formulations. The production of pesticides has recently become very expensive; the costs of development have greatly increased. Substantial production capacities have been set up in India, the Republic of Korea,

1/ Papers circulated at the International Pesticides Conference held at India International Centre - January-February, 1984.

2/ "Commerce" supplement on the Chemical Industry, Bombay - 26th Nov., 1983 - article by Shri K.J. Shroff and Shri S.A. Vashi, entitled Pesticides industry - priorities and prospects.

China and a Pesticide Fertilizer Authority has been set up in the Philippines. Pesticide production in India in 1983-84 was 58,000 tons and is expected to reach 87,000 tons in 1989-90 and 100,000 tons by 2000.

Chemical industry is highly capital intensive and its employment generation potential is modest. Many of the plants in the developing ESCAP region are of medium/small size with some large plants as the investments are very large. The capacity utilisation in some sub-sectors and countries varies from 50-60 to 80 per cent. The share of world production of finished fertilisers and pharmaceuticals production is reflected in Tables 3 and 4.

TABLE - 3

Share of world production of finished fertilizers - 1965-66 and 1984-85 */

	Nitrogen		Phosphate		Potash	
	1965-66	1984-85 (Projected)	1965-66	1984-85 (Projected)	1965-66	1984-85 (Projected)
Market Economies:						
Developed.	68.2	40.8	74.8	48.2	86.1	51.4
Developing.	5.9	19.5	4.1	18.3	0.2	1.7
Centrally Planned Economies:						
Europe & USSR.	21.2	27.8	17.6	26.8	30.8	45.3
Asia.	4.7	11.9	3.5	6.6	8.9	1.5

*/ F.A.O.

TABLE - 4

World Pharmaceutical Production, Consumption and Trade, 1980 ($ U.S. million)

	Production 1980 a/		Consumption 1980 b/		Trade 1980 c/		
	$ Million.	per cent	$ Million.	per cent.	Imports	Exports	Balance
Developed Countries Market Economies:							
North America.	18,600	22.1	14,700	19.6	1,159	2,150	+991
Western Europe.	27,440	33.0	25,350	33.8	6,822	10,620	+3,798
Others**	11,970	14.3	12,454	16.6	1,492	418	-1,074
Centrally Planned Economies:							
Eastern Europe.	15,960	19.1	12,150	16.2			
Total Developed Countries.	73,970	88.5	64,650	86.2	9,473	13,187	+3,714
Developing Countries:							
Africa	470	0.6	1,730	2.3			
Asia*/	4,690	5.6	5,320	7.1			
Latin America.	4,400	5.2	3,300	4.4			
Total Developing Countries:	9,560	11.5	10,350	13.8	4,530	602	-3,928
Total World Market:	83,530	100.0	75,000	100.0	14,003	13,789	

Source: a/ United Nations Industrial Development Organization (1980) Global Study of the Pharmaceutical Industry, (ID/WG.331/6)

b/ UNCHIP No.509, 28 July 1980, using the "market" as proxy for consumption.

c/ United Nations: 1980 Yearbook of International Trade Statistics.

*/ excluding China.

** including Japan, Southern European Countries and Oceania.

Total world fertilizer production in 1981-82 amounted to 120.8 million tonnes nutrients $N + P_2O_5 + K_2O$ an increase of 56.8 million tonnes over 1968-69. The developing market economies accounted for only 5 per cent of world fertilizer production in 1968-69. By 1982-83 their share had more than doubled to 13.5 percent and it is expected to reach more than 20 percent for $N + P_2O_5$ in 1988-89 but will still be negligible for K_2O. This is because of the limited known deposits of potash in the developing market economies; those in Thailand are not expected to be exploited by 1988-89 but may be some time shortly thereafter.[1/]

The changes in the production share by economic class and region are influenced by the availability and cost of raw materials and by changing fertilizer consumption patterns. Besides Thailand, there are more limited deposits of potash in Iran, Jordan (Dead Sea Brine) and Laos. Jordan became a producer of potash in the latter part of 1982. The developing countries have accounted for a fraction of one percent of world production.

The centrally planned economies share of world potash production was 30 per cent in 1968-69, it rose to 47 per cent in 1982-83 but is expected to decline to about 43 percent in 1988-89. Public ownership of potash capacity in 1984 was about 52 per cent compared with 25 per cent fifteen years earlier, and this is expected to rise to about 68 per cent by 1988-89. About 2 per cent was in cooperative ownership in 1988. The potash industry in Jordan is wholly in the public sector.

For phosphate fertilizers the share of the developing market economies was about 6 per cent in 1968-69 and increased to 16 per cent in 1982-83 and is expected to rise to about

1/ F.A.O.

21 per cent in 1988-89. Phosphate rock distribution is limited to the developing ESCAP region. For nitrogen fertilizers the share of the developing market economies increased from 7 to 17 per cent between 1968-69 to 1982-83 and is expectedto reach 25 per cent in 1988-89. In nearly all (the main exception hitherto being India) of the developing and centrally planned economies, ammonia capacities are based on natural gas. In Japan and the Republic of Korea, plants based on expensive feedstocks - naphtha or fuel oil are being either closed or converted to natural gas or liquified petroleum gas.

One third of world ammonia capacity was publicly owned in 1968-69 and by 1979-80 the share of public ownership had risen to 54 per cent and 60 per cent in 1984. It is expected to increaseto about 65 per cent in 1988-89. The cooperative share was 4 per cent in 1984. In the developing market economies around one half of nitrogen industry is in the public sector but the share of government ownership varies by country. In Indonesia the Government ownership is 100 per cent whereas it is around 60 per cent in India.

China:

over The scale of the chemical industry in 2000 should be/4.5 fold that of 1980 base. The general output value of chemical industry in 1980 was 41.1 billion Yuan then the general output value of the chemical industry should be about 185 billion Yuan by the end of the century. Fine chemicals and other downstream chemicals will be the favoured sectors in future and the output ratio 2000/1980 for sulphuric acid is projected at 2.7, 4.0 for soda ash, 2.3 for caustic soda, 2.6 for pesticides and 7.4 for fine chemicals. The average growth rate would not be lower than 7.8 per cent.

Korea:

The basic chemicals industry is expected to develop at a steady pace in the Republic of Korea especially in the organic basic chemicals sector with substantial demand potential reflected in the development trends of the related industries such as fine chemicals, synthetic resins and chemical textiles. However, the prospects for the inorganic basic chemical industry are not bright since the chemical fertiliser industry suffers from excessive production facilities and its basic chemical demand is not expected to increase for some time. The revised fifth five year economic and social development plan 1984-86 of Korea visualises that the growth of chemicals will be actively developed.

India:

In the Indian Seventh Five Year Plan (1985-90) a larger capacity methanol plant of 300 tons per day is proposed as also increased napthalene capacity is to be set up. The approved capacity likely to materialise in next 5 years is expected to be more than sufficient to meet the requirements of caustic soda. Salt washeries are projected as also calcium Carbide Plants, Carbon black units are also proposed as also the expansion of titanium dioxide.

Alcohol will continue to remain an important source for synthesising organic chemicals. There is no immediate scope for increasing phenol aniline acetic acid, acetone, citric acid, sorbistol & cresols production.

Similarly, there is adequate licensed and production capacity in phtenalate plasticizers, acetylene black, formaldehyde and pentaerythritol

Pattern of International Trade:

Potash accounts for the largest share of international trade in fertilizers followed by nitrogen and phosphate. Their respective share in 1982-83 were 14.4 million tonnes

of potash, 12.1 million tonnes nitrogen and phosphate 7.1 million tonnes. Since 1968-69, international trade in each nutrient has essentially doubled. Nitrogen, however, represents the largest share of the developing market economies, they were 5.5 million tonnes N in 1980-81, those for potash 3.7 million tonnes K_2O and phosphate 3.4 million tonnes P_2O_5. Imports of developing countries declined in 1982-83 and were lessthan two years earlier, particularly for nitrogen at 3.9 million tonnes N and 3.2 million tonnes K_2O and 2.3 million tonnes P_2O_5. The centrally planned economies exports have significantly increased for finished fertilizers. Between 1972-73 and 1977-78 and 1981-82 the developing market economies particularly in the developing ESCAP region were a major market especially for urea and ammonia sulphate.

In 1968-69 the developing market economies share of imports was 44 per cent and in 1982-83, however, imports of the developing market economies had risen to nearly 50 per cent of the world total.

The developing markets economies imports, however, have increased in spite of their gains in nitrogen production to meet the increasing demand.

Trade in phosphates involves products in three different stages of processing. These are phosphate rock and intermediate products such as phosphonic acid and mono-ammonium phosphates; the finished fertilisers diammonium phosphate and triple super-phosphate, the ground rock phosphate which can be applied directly to the soil. The trend towards increasing processing facilities of phosphonic acid and phosphatic facilities, is expected to continue with more developing countries becoming producers and exporters. The major share of Morocco's rock phosphate in the ESCAP region went to India and Indonesia as also of Tunisia.

The Republic of Korea accounted for 7 per cent of world trade of ammonium phosphates in 1982-83. China imported large quantities of ammonium phosphate and super-phosphates in 1982-83.

Potash is traded internationally either as straight potassium chloride, (Muriate of potash) potassium sulphate or potassium nitrate or in compound fertilizers. Centrally planned Asia-North Korea, Vietnam, China, Laos, Cambodia and Mangolia obtains its imports from the three exporting regions with the major share from North America, followed by West Europe and then East Europe and USSR.

In China, both import and export of chemical products and raw materials are closely linked to chemical production and construction. Imports of chemicals in China are mainly manufactured goods while exports are mainly raw materials and primary manufactures. The momentum of technical import will be maintained in the next 15 years but the percentage of software will be raised year by year.

The Republic of Korea will continue its stress on larger exports of fine and basic chemicals as also India in the Seventh Five Year Plan (1985-90).

Market conditions:

The large and rapid increase in export prices in 1973-74 was due to a combination of factors. East Europe and the East Asian regions were affected by drought, oil export prices which rose four-fold as also sharp rise in phosphate rock prices. Cereal stocks of USA had been drawn down due to drought. Subsequently, fertilizer consumption began to lag. In 1974-75 fertilizer consumption fell for the first time in post world war II era. Both fertilizer production and consumption again fell in 1981-82 owing to the adverse world economic conditions. The upward trend in prices between 1976-80 was owing to increasing costs of raw material

feed-stocks, labour, inflation and high interest rates. It is estimated that higher investment and raw material costs resulted in total production costs rising from three to five times from 1970 to 1980 and investment costs alone rose two to three times between 1970 to 1982. However, inflationary factors have not very significantly affected investment in production costs since 1982. For nitrogenous fertilizers based on natural gas, investment related costs represent the major cost component. In the case of phosphate fertilizers the cost of raw materials is much more important than investment costs and in some cases the cost of raw materials can be as high as 70 percent of the realisation price. Countries with indigenous supplies have a particular advantage. Costs of producing potash are mainly related to investment and transport.

The calculation of the investment and production costs only indicates realisation prices for different fertilizer products required to attract investment in new capacities in the more favourable sites with good existing infrastructure or advantage in raw material costs.

Increasing world food production is basic to world food security. By the year 2000 agricultural production will need to be increased by 60 per cent to feed the world population with only marginal improvements in the diet of the developing countries and developing ESCAP region will account for over 50 per cent of global populace. In the FAO study "Agriculture: Towards 2000" it is estimated that 72 per cent of the required increase in productions will have to come from the intensification of existing agriculture and 28 per cent from the extension of arable land. Fertilizer use has become more important to crop production in the developing countries of ESCAP since the advent of the high-yielding varieties in mid-sixties. Fertilizers have been responsible for over 50 per cent of the increase in

yields since 1965 and they are expected to account for the same share of the 72 per cent increase in agricultural production upto 2000 A.D. which is to come from higher yields. Fertilizer consumption is expected to increase from around 30 million tonnes in 1980 to over 100 million tonnes $N + P_2O_5 + K_0$ in 2000. The developing ESCAP region will account for the largest share of the estimated increase. Half the fertilizers will be used on cereals, about a sixth on oil crops and lesser amounts on sugar, fibres, fruits, vegetables, pulses and roots. Fertilizer consumption will, have to increase by over 80 per cent in developing ESCAP region by 2000 if the food production is to be doubled. This amounts to a nearly two fold increase in their fertilizer use over the next 15 years.

Very substantial investments are envisaged in the drugs and pharmaceutical sectors to cope up with the anticipated demand requirements in next decade and a half. In the basic chemicals sectors, the expansion will be on a more modest scale.

Forecasts of fertilizer supply and demand:

Forecasts of world and regional fertilizer supply and demand have been made by an FAO/UNIDO/World Bank Working Groups on fertilizers since 1975. Supply forecast takes into account capacity utilisation rates of existing and planned new plants, losses, stock changes and non-fertilizer uses. The demand forecasts takes into consideration the absorption capacity of farmers and countries as influenced by economic and physical factors. The 1988-89 forecasts indicate that there will be a small global deficit for nitrogen after a near balanced situation in 1987-88 and surpluses in two preceding years. The deficit of the developing ESCAP countries become less due to increasing capacity in the ESCAP region growing faster than demand. Developments in centrally planned Asia will be similar.

The outlook for the other nutrients is far more favourable than for nitrogen. In 1988-89 it is expected that there will be a comfortable world phosphate surplus but will remain deficit in developing ESCAP region and centrally planned Asian countries. The world supply position for Potash is also expected to be comfortable. The developing ESCAP region and the centrally planned Asia will be deficit. The nitrogen export market will be increasingly dominated by USSR. Although the developing countries will increase their capacities to produce fertilizer nitrogen and phosphate, there will still be need for imports of the nutrients as well as for Potash. The population in the ESCAP region for 2000 is projected at over 3 billion constituting over 50 per cent of global population and to meet the U.N.I.D.O. target of 25 per cent and W.H.O. target of Health for all a major increases in demand and supply may be anticipated in the chemicals industrial sector.

Investment requirements for new capacity:

An indication of what investment in new supply capacity will be required in the next two years can be obtained by projecting the demand growth rates derived from the demand forecasts. To keep the supply of nitrogenous fertilizers in balance with the projected demand between 1988-89 and 1993-94 and replace worn out plants would require 60 new ammonia plants and associated facilities to manufacture finished fertiliser such as urea. The total cost would be about $ 17 to 18 billion based on 1000 tonnes a day ammonia plant; depending on its down stream and distribution infrastructure to get the fertilizer into farmers hands could cost equally as much.

For phosphatic fertilizers the projections indicate that a total of about 35 new or replacement plants of 1000 tonnes a day P_2O_5 capacity would be needed over a five year period aggregating a total cost of $ 8 to $ 9 billion

excluding the down stream marketing infrastructure and to keep the potash supply in balance with the projected demand would require opening of several new mines and downstream marketing system.

The capacity utilisation varies from 50 to 80 per cent in the various sub-sectors of the industry and also in countries. The size of establishment in many of the developing ESCAP countries is medium/large more particularly in the fertilizer/pesticides/pharmaceutical sector and both large, medium and small in the organic and inorganic sectors. There are also small pharmaceutical producers mostly engaged in formulations.

In regard to the various chemical sub-sectors the seventh five year plan projections in case of India are still being finalised as also the development plan estimates for the Republic of Korea beyond 1984-86, and similarly for China, Indonesia, Pakistan, Sri Lanka, Bangladesh, Thailand and the Philippines.

CHAPTER - II

Basic Problems and Issue -

Strategic and Policy issues related to industrial development, particularly the development of the chemical sector, are to be discussed and analysed in this Chapter with emphasis on the following:

Policy issues related to import substitution, export promotion, forward and backward linkages, vertical and horizontal integration, specialisation, diversification, foreign investment and regional cooperation.

Many of the developing ESCAP countries initiated policies of import substitution for the development of the chemical sector, to save foreign exchange on imports and to create more employment avenues through value added operations. Several of them have made a start with importing the basic raw materials and intermediates and are engaged in formulations, packaging of drugs and pharmaceuticals; in the case of fertilisers many of them have made a start with an accent on granulation. Similarly, in the case of pesticides the basic materials are being imported from the developed countries in many of the developing ESCAP countries. India also went in for massive import substitution drive following the running out of the large sterling balances built up during World War II by 1956 end. Several thousand foreign collaboration agreements were entered into for technology transfer and in some cases for equity participation. Similarly, the Republic of Korea started with import substitution policies in the 'sixties in its first two five year plans and moved over to the export promotion in subsequent plans.

In the case of basic heavy organic chemicals, methanol, phenol, acetone, based on ethyl alcohol and inorganic chemicals, caustic soda, soda ash, some of the

larger countries like India, the Republic of Korea, China, Pakistan, Indonesia and Iran set up indigenous capacities. During 1957 to 'seventies and 'eighties many foreign collaborations were entered into with the leading chemical manufacturers of the developed countries.

The Republic of Korea and lately India and Indonesia havealso embarked upon policies of export promotion having generated surplus production capacities in the various sub-sec)rs of the chemical industries and to earn much needed foreign exchange. The Republic of Korea has been particularly pursuing the policy of export promotion in a very significant manner and hasbeen able to generate large exports of various organic and inorganic chemicals as also drugs and pharmaceuticals. In India, the export of the chemical sector which includes plastics, soaps and detergents has touched 3500 million rupees or $ 350 million dollars in 1983. Indonesia also has been exporting nitrogen fertilisers while it imports other two types of fertilisers. There is now increasing stress on export promotion in the more developed ESCAP countries and both China and India are also moving in this direction.

The Island economies of Singapore and Hongkong are also largely export oriented even though they have only a small chemical sector, owing to their limited domestic market and small population. As these more developed ESCAP countries have developed the skills and have the necessary raw material base and comparatively lower wage costs, they are now venturing forth in the export sector in a more vigorous way. The production base has also grown which allows for export surpluses. This has resulted in the shift from import substitution to export promotion. As the OECD countries labour costs have soared in recent years, there is a perceptible shift towards manufacture of traditional chemicals in the newly industrialising countries and vacation of these areas by the OECD countries who are

increasingly moving up to high value added chemical specialities. The more developed ESCAP countries are diversifying their production base in the light of these global shifts and are increasing their output and product specialisation.

Although the exports of chemical products from India have not reached very high levels owing to dis_economies of scales and the tough international competition, in coming years there are reasonable prospects for resource-rich countries entering the export field in a bigger way. The Republic of Korea has made an impressive start in fine and basic chemicals and Indonesia holds fairly good prospects in the fertiliser export field. China is also emerging as a large potential fine chemicals exporter. Other developing ESCAP countries - Thailand, Malaysia, Philippines, Bangladesh, & Sri Lanka have been following the policies of import substitution with a view to attaining increasing self-sufficiency in the various sub-sectors.

The organic and inorganic sectors of the chemical industry have both forward and backward industrial linkages as it is a catalytic industry feeding many of the other downstream industries like textiles, leather, cement, paper, rubber, paints, printing inks, synthetic and man-made fibres and petrochemicals. Also it has very close linkages through fertilisers and pesticides with the agricultural sector and continues to play a very significant role in many of the developing ESCAP countries. Besides, the chemical industry is very closely linked with the health sector through drugs and pharmaceuticals.

The chemical industry being a highly capital intensive sector as in the more developed developing ESCAP countries like the Republic of Korea, China and India, has led to vertical and horizontal integration as many of the large scale units have sought to assure themselves of regular raw material supplies as also achieving optimal levels of production and economies of scale. But in the smaller developing

ESCAP countries the vertical and horizontal integration has not yet taken place in so significant a measure. However, there are good prospects for such integration taking place with increasing regional and sub-regional trade and economic cooperation as also greater complementation in the regional groupings like ASEAN and SARC. Some of the large multi-nationals from the developed countries are also attempting to move increasingly into chemical specialities and locate their traditional chemical sectors in the developing countries of the ESCAP region. In Malaysia and Thailand, foreign subsidiaries of trans-nationals were producing drugs and pharmaceuticals of the value of $ 18 million and $ 65 million in 1981. 1/

By 1982, the plants in which trans-national corporations have invested capital will represent some 16 per cent for ammonia and 7 per cent for high analysis phosphates of total capacities in developing countries. AMDCO, ICI, Agrichem, Chevron and Standard Oil have set up plants in India. There is a growing trend towards trans-national corporation minority equity participation and in pre-investment studies, plant designs and engineering, plant construction and initial operations. In several cases turn-key construction responsibilities were undertaken using process technologies.

Many of the developing ESCAP countries are making efforts to achieve specialisation in various sub-sectors where they have ready availability of the natural resource inputs. Some of them are specialising in fertilisers and pesticides manufacture based on their large oil and natural gas resources more particularly in Iran, Indonesia, Malaysia, Thailand, Pakistan, Bangladesh and India. Large fertilizer complexes are coming up in these countries based on the natural gas food-stock.

1/U.N. Centre on Trans-National Corps, New York, 1983. Trans-national Corps in the pharmaceutical Industry of Developing countries - a Technical Paper, Page.114.

Countries with large domestic markets like India, the Republic of Korea and China have greatly diversified their chemical industrial base. Of the developing ESCAP countries, India perhaps has the most diversified chemical industry. The Republic of Korea has also achieved a very high degree of diversification as it has a very strong export orientation. Over the years, Indonesia will also be able to diversify its chemical industrial base as it has a large domestic market to cater to and has ambitious Repelita IV programmes and projects that it hopes to complete in the late 'eighties. Pakistan and Bangladesh may also be expected to achieve greater degree of diversification in the coming years with their large domestic populace.1/ If the economic groupings are able to achieve higher rates of complementation in the coming years there could be greater diversification in the ASEAN and the SARC regions.

There has been considerable foreign investment in the chemical sector in the developing ESCAP countries as the industry is very highly capital intensive and also requires sophisticated technology which is largely provided by the multi-national corporations. In India large multi-national corporations have set up drugs and pharmaceuticals plants like Bayer, Hoechst, BASF, Glaxo Laboratories, PFIZER, Monsanto, Warner Hindustan and others. The Imperial Chemical and Explosives of U.K. have set up large fertilizer plants. Many of the large domestic chemical manufacturers in India have had both equity and technical collaboration agreements in the last three decades and the chemical industry accounts for the largest foreign investment in the country of well over a billion dollars. Trans-nationals total sales in India in 1979 amounted to $ 604 million.2/

1/ Trans-National Corporations in the Fertilizer Industry, U.N. Centre on Trans-National Corporation, New York, 1982.

2/ Source U.N.C.T.C., New York.

Cynamid, Boots, E. Merck, May & Baker, Sandoz, Ciba-Gaigy, Parke-Davis, Johnson & Johnson, Roche, Burroughs, Wellcome, Abbott, Laboratories, Smith Kline & French, Bristol-Myers (U.S), Dumex, Glaxo, Warner, Lambert and others have set up joint ventures in Malaysia. PFIZER, Hochest & Bayer, Searle, Rhone-Paulence, have large plants in the Republic of Korea. T.N.C's joint ventures accounted for $ 15 million output of bulk drugs and exports in 1980 and $ 6.8 million of finished drugs exports in the Republic of Korea, Merck-Sharp & Dohme, Dumex, Depitit, Glaxo, Hochest, Warner, Abbett, Zuelig & Scharing have joint ventures in Thailand.1/

In recent years the foreign exchange regulation Act in India has no doubt tended to make some of these multi-national companies to reduce their equity holdings to 40 per cent or so but most of them have managed to keep control of their operations by wide dispersal of the remaining shares holdings. Similarly, substantial foreign investments have taken place in Pakistan, Malaysia, Thailand, Indonesia, the Republic of Korea and Philippines in the chemical sector.

Regional and sub-regional cooperation has made a start and a promising beginning in the ESCAP region and there is increasing consciousness on the part of policy planners, merchants and industrialists to explore greater avenues of economic and technical cooperation. The prolonged recession during 1980-82 in the developed countries has further strengthened the sinews for greater regional cooperation. Much more needs to be done to foster closer links and overcome the attitudinal barriers and the information gaps existing between the various developing ESCAP countries in regard to the capabilities that they have achieved in different sub-sectors in recent years. Serious efforts are already afoot to promote greater sub-regional cooperation in SAARC-India, Pakistan, Bangladesh, Sri Lanka, Nepal,

1/ Source U.N.C.T.C., New York.

Bhutan and Maldives and a number of study projects have been comissioned in the various meetings of the foreign trade Ministers of these countries. A recent meeting at the foreign Secretaries level of these countries at Mahe (Maldives) has made a promising start. Similarly, many complementation programmes are on the envil and progressing in the ASEAN sub-region. There has also been some initiative lately for increased techno-economic cooperation between Iran, Pakistan and Turkey.

b) Technological issues related to types of technologies used, degree of adaptation, technological back-up services, research activities and applied research, design, construction, local manufacturing of equipments etc.

Much of the sophisticated technology has had to be imported in the developing ESCAP countries who have been late starters in the growth and development of the various sub-sectors of the chemical industry. Much of the development has taken place since the fifties and more particularly in the last 25 years. A very large number of technical cooperation arrangements have been negotiated and the multinational corporations have tended to provide the technology required for the various chemical sub-sectors. Twenty-five leading chemical multi-nationals dominate the world market as per chemical and fertiliser industry data.1/

Most of the developing countries have had recourse to technology import and some of them have over the years been learning quickly to import technology increasingly in the unpackaged form.

To start with many of the developing countries had to accept the technology on the terms offered by the developed countries and in recent years the U.N. Centre on trans-National Corporations UNCTAD and other international agencies have been conducting programmes and educating the policy

1/Source: The Economist London, 7 April, 1979 and 8 May, 1976 quoting Chemical Insight.

Planners in the areas of technology transfer with a view to improving their negotiating skills. The technological issues have also been closely inter-linked to royalties and patterns of development in the developed countries.

The type of technology used in most of the developed ESCAP countries is not always the most advanced. Most of the technology imported is around 5 years old by the time it is made available to the developing countries and it takes a minimum of 2 to 3 years before the plants using this technology come into full operation. The technology gap, therefore, is roughly of the order of 5 to 7 years on an average.[1/] Moreover, the most advanced technologies may also require the setting up of very large plants which are highly automated and very capital intensive which are unsuited to developing country needs. Many of the developing ESCAP countries are in need of medium and small scale plants which can cater to their domestic needs and are within their limited capital resources and can help generate employment opportunities. Smaller countries like Malaysia, Sri Lanka, Nepal, Bhutan, Maldives, Papua New Guinea and with small populations require medium/small scale plants as they are anxious to build up domestic capabilities through tariff protection.

It has been observed that in some cases the technology exported to some of the developing countries has become somewhat outdated or obsolete in the more developed and sophisticated countries. Many of the developing countries of the ESCAP region have not developed the necessary research and development base to graft their own technologies owing to financial constraints and lack of technical manpower skills. They have entirely depended on the imported technologies made available to them. In the coming years, countries like The Republic of Korea, China and India which have developed an R&D base and more appropriate type of technology

1/ Source: U.N.C.T.C., New York.

suited to the developing ESCAP countries may be able to share their experiences and expertise with other sister nations.

The degree of adaptation of the technology has been largely conditioned by the R&D base, skilled manpower and infrastructural support which has largely been forthcoming in the Republic of Korea, China and India. Starting from a small number of chemists, chemical engineers, pharmacists, scientists, technologists and managerial personnel in the early 'fifties, India has been able to develop the third largest pool of educated skills in the world and perhaps the largest in the developing ESCAP region. It has in last three decades developed many institutions of excellence for the training of personnel in these fields and some efforts have been made to adapt the technology imported during the mid-50s and '60s to suit the Indian requirements. In recent years some of the national laboratories set up by the Council of Scientific and Industrial Research have also been collaborating with the chemical industry manufacturers in the adaptation of the various technologies and in basic research programmes and projects.

The Republic of Korea has also been able to develop the expertise and skills for the adaptation of the various technologies used in the chemical sub-sectors. This aspect is very significant as the degree of obsolescence in the chemical industry is fairly high and wholesale imports of advanced technologies is not best suited to the genius and requirements of many of the smaller developing ESCAP countries.

To foster greater adaptation for technology transfer, it may be desirable and perhaps necessary to start regional institutions and strengthen the ESCAP transfer of technology centre at Bangalore, as also the Asian and other Institutes of Technology in Bandung, Bangkok, India, the Philippines, the Republic of Korea and China.

The Technological back up services for project design and implementations were initially provided by the multinationals and the manufacturers of chemical plants and equipment from the developed countries but over the years several of the large developing countries like the Republic of Korea and India have been able to develop indigenous technological back up services in tender preparation, pre-investment, feasibility studies, market analysis and selection of contractors, project planning, personnel training, supervising, construction and commissioning. The nature of contractual arrangements for project implementation, transfer of process technology, detailed plant engineering differs in various developing countries. In the smaller developing countries, the technological back up services are still manned largely by expatriate persons. Here also the need for training of the requisite personnel for the back up sales, services and promotion is very much necessary in order to develop the local skills and the appropriate ethos for the maintenance and up-keep of the imported equipment and technology.

The recent ESCAP meetings of the Ministers both at Bangkok and Tokyo have emphasised the theme (technology for development). Both Japan and India have offered to share their technological skills and experience and expertise with the other developing countries of the ESCAP region. The Republic of Korea also can provide strong support and with the pooling of the resources it may be possible to initiate meaningful programmes to strengthen the technological/manufacturing capabilities in the region.

Greater efforts may be necessary in the more developed of the developing countries for further development of design and engineering capabilities in process industries, particularly organic and inorganic chemicals, fertilisers and pesticides and for greater absorption and development of process know-how through increased research and development. In the field of basic research the record of the developing ESCAP countries has so far been rather quite modest.

Even in countries like India only the more enlightened and large chemical manufacturers have set up their indigenous research and development wings and provided them the necessary financial and technical support. The percentage of expenditure devoted to fundamental and applied research has remained small and even in India has been estimated at 80 to 90 million rupees annually.

In the developed industrial countries research activities account for sizeable expenditures spread over several years before the stage of applied research is ushered in. There is need for control of the cost and restrictions on technology transfer arrangements between subsidiaries and parent companies and stipulations that some R&D facilities be established in the most developing countries and their results made available to domestic producers at reasonable cost. In many of the developing countries the pursuit of short-term and immediate gains has inhibited the necessary expenditure outlay on basic and applied research. The consciousness is, however, increasingly dawning on the industry that much more effort and money needs to be devoted to research if the industry has to achieve a higher degree of self-reliance and indigenous capability. The research expenditure in the smaller developing countries is still at modest levels.

Perhaps the pooling of the research experience amongst the countries of the sub-regions and backed up by the Governments, educational and research institutions and industry would help to build up and widen the necessary research base and capability without which the industry will remain dependent on the developed industrial countries, in a large measure. The opportunities for technological cooperation between developing country institutions and enterprises in design engineering and process know-how need to be strengthened and further developed as far as possible to achieve self-reliance in technology and promoting greater techno-economic cooperation.

In the pharmaceutical field it has been observed that sometimes it takes 5 to 10 years for a drug to be researched and developed and it costs millions of dollars before it is commercially exploited.

Such large time consuming research programmes and projects cannot be taken up singly by small developing countries who also suffer from the necessary lack of scientific skills and well-equipped laboratory gaps. These could perhaps be taken up on a sub-regional basis. Very substantial research effort has gone into energy saving technologies for the various chemical sub-sectors more particularly in the last 10 years. The importance of research cannot be over-emphasised if the region has to attain the developmental targets of the third development decade of the United Nations and the Lima target of UNIDO by the turn of the century and the W.H.O. target 'Health for All' by 2000 A.D.

In regard to design, construction and local manufacture of capital equipment etc., only the more developed of the developing countries in the ESCAP region like the Republic of Korea, China and India have made substantial headway.

Little over two decades ago the Fertilizer Corporation of India, Sindri and the Fertiliser and Chemical, Travancore and Engineers India set up planning and development divisions to draw up the designs for the new fertiliser plants to be set up in various States of India. In the last decade several large engineering and consulting firms have come up in India to prepare and draw up the detailed designs, specifications, schedule of quantities for the construction of the plants and a fair measure of indigenous capability has been built up in this regard. A promising start has also been made for the local manufacture of many of the plants and equipment required for the setting up of new chemical plants as also for their expansion and diversification.

Similarly, the Republic of Korea has developed high capabilities in this field and an increasing measure of self-sufficiency has been attained in these areas. China has built up a lot of small and medium sized and mini-fertilizer plants. However, the smaller developing ESCAP countries have not yet made such a significant headway in the design, construction and manufacture of capital equipment needed.

Engineering and consultancy services have also come up to an increasing extent in Philippines, Pakistan and are likely to be forthcoming in Indonesia in the foreseeable future. Considerable amount of experience has been gained in the execution of large construction projects by the Republic of Korea and India in the Gulf countries where considerable expansion and setting up of chemical and petro-chemical plants has been taking place in the past few years.

Thus far the sophisticated designs and capital equipment have been mainly supplied by the developed countries but the experience of the Republic of Korea, Philippines, Pakistan and India could well be put to use for greater techno-economic cooperation in the ESCAP region. The development of strong engineering industrial base both in the Republic of Korea, China and India in the past two decades has the sinews to provide much of the equipment and plant required for the chemical plants of the appropriate size needed by many of the small and medium sized countries.

c) Manpower and Development of skills, education, training:

In the early post-war years i.e. from the mid-forties to early 'fifties when many of the developing ESCAP countries were just recovering from the ravages of war, occupation and colonial domination, the development of skills, education, training for industrial development was at a very early stage. The education pattern in many of the developing ESCAP countries was largely focussed in

the areas of humanities, law and liberal arts. There were very few institutions catering to the development of technical skills and more particularly in the fields of chemical engineering, basic sciences, pharmacy and management. The infrastructural facilities existing for the development of such skills and manpower in the region were extremely limited.

Initially, many promising students from the developing countries were sent abroad for advanced training, research, technical and management education and later various institutions were set up to provide the necessary education, training and skill developing facilities; and scientific laboratories came up in the developing countries.

In India various institutions of technology with foreign collaboration came up in Bombay, Delhi, Madras, Kanpur, Kharagpur and Pilani and during the past twenty-five years a very substantial number of highly qualified personnel have been trained in the various chemical engineering, process design and related fields at Benaras and these Institutes.

In the Republic of Korea also a large number of students were sent to United States for initial training; and in the last 20 years many of these have been trained in their own institutions. Pakistan also has developed its own technical/management institutions and similar institutions have come up in Bandung in Indonesia, the Asian Institute of Technology at Bangkok and other institutions in the Philippines, Malaysia, Iran, Sri Lanka and Bangladesh. Prestigious Management Institutes have also come up in India, Philippines, Singapore, Malaysia and also in Indonesia, Pakistan, Thailand and Bangladesh.

The ESCAP region today is much more favourably placed in terms of educated manpower and in the development of skills, education and training. The smaller developing

countries like Nepal, Bhutan, Maldives, Afghanistan, Papua New Guinea and South Pacific Island countries like Fiji, Solomon Islands need to strengthen and establish the necessary infrastructure for chemical engineering, technical and management education.

Both India and the Republic of Korea are now well placed to share their own technical educational training and management expertise and facilities with other developing countries in the field of human resources development and for the setting up of chemical technology and management institutes to impart education, training and post-experience programmes. As it may not be possible for many of the smaller developing ESCAP countries to set up large centres of excellence in the field of development of skills, education and training it may be advisable to set up such centres on a sub-regional and regional basis. A beginning could perhaps be made in the ASEAN and the SARC regions besides the Republic of Korea and China.

The development of the requisite know how is a <u>sine-qua-non</u> for the efficient operation and maintenance of chemical plants and equipment. Even in India the maintenance of the chemical plants can be considerably improved.

Adequate manpower could be developed within the 80s to fill the gaps in education, training, research and development to meet the requirements of the chemical industry in the mid-eighties and the decade of 'nineties.

d) <u>Infrastructural development, managerial problems, organisational infrastructure, planning, financing and financial institutions, efficiency control</u>.

The infrastructural base in many of the developing countries from mid-forties onwards till recent times has been gradually developing. Over 200,000 villages of over half a million in India have been electrified. The power

generation has increased tenfold and the rate of literacy has increased threefold notwithstanding the doubling of the population in last three and a half decades. In Pakistan Sri Lanka and Bangladesh also significant advances have been made in the infrastructure and the rate of literacy in both Pakistan and Bangladesh has more than doubled, while in Sri Lanka it has reached near universal adult literacy levels. In the South-East Asian countries there have been significant advances in infrastructural growth particularly in the urban and metropolitan areas. In China significant growth is being ushered in with the new modernisations. Even in India, Pakistan, Sri Lanka and Bangladesh, which had a reasonably well developed infrastructure on the morrow of independence infrastructural lags continue to exist in the areas of power generation and transmission, road net-work and supply of adequate drinking water despite advances.

The railway system was in need of rehabilitation after the long years of depression and World War-II in India, Pakistan and Bangladesh. In India in the past thirty years significant advances have been made in strengthening the infrastructure for industrial development although much more remains to be done. Some of the important rail tracks have been doubled. This has helped to increase industrial production five-fold in last 35 years as also a trebling of the food production from 50 to over 150 million tons. A large number of industrial estates have been set up with infrastructural facilities. The ports are being modernised for containerisation, expanded and new ports have come up.

An effort is being made to disperse the various sub-sectors of the chemical industry from the large metropolitan centres to the more backward regions in the up-country and relatively under developed areas but the lack of infrastructure in these areas has been slowing down this process. It is hoped that by the 'eighties end, power and potable water supplies will be made largely available to the entire country-side. By the 'nineties even the remote areas will

be connected by all-weather roads for faster industrial development.

In Indonesia also great advances have been made in the area of infrastructural growth and a massive programme for trans-migration of the populace from Java to the other outer Islands like Sumatra, Kalimantan, Celebas, Irian and Timor is under way. Infrastructural developments in Sumatra have made considerable progress though much more remains to be done in the outer islands. Railway transport in Indonesia has not made much spectacular headway but road transport has made significant advances in Java as also along the coast in Sumatra.

Considerable infrastructural development has also taken place in the Philippines which suffered severely in World War-II. Philippines being a archipelago of a very large number of Islands has logistic transport problems, for its industrial development in the Hinterland. In the metropolitan Manila area there have been significant infrastructural developments.

In Malayasia a fine network of roads has come up linking the country-side and industrial areas have developed around Kuala Lumpur and Penang and new harbours have come up. There have been significant advances in the field of education even though thousands of Malaysian students study abroad in Australia, the U.K., U.S.A. and lately in Japan. Rapid strides have been made in the infrastructural developments in Thailand in roads, communications, ports, power supply and education.

A free trade zone has been developed near Colombo Airport in Sri Lanka with infrastructural facilities for industrial development and imports. In Iran, infrastructural development took place with the development of broad trunk roads through Turkey as well as rail links. Afghanistan has largely remained a land locked country even though considerable road development has taken place.

The Republic of Korea has in the last three decades shown remarkable development of its infrastructure for industrial growth and has achieved universal literacy, expanded health services, vast modern communications network, excellent roads and ports. Singapore and Hongkong have a highly developed infrastructure in ports, metro, education, communication and health services.

Only in the smaller developing countries like Nepal, Bhutan, Papua New Guinea, Maldives and the Island countries of South Pacific infrastructural lags are much more in evidence. Road development has no doubt made considerable progress in Nepal in last 15 years but much more remains to be done in the field of education, power, communications and health services for industrial development. In Bhutan, the country is just opening up. An air-link has recently been established by the Druk Airlines to Calcutta. Road communications are now being expanded. Educational facilities are also being strengthened.

Most of the developing ESCAP countries are faced with managerial problems to ensure the optimal utilisation of their scarce material and financial resources and to fully develop their human and natural resource potential. Till the early '50s the management in most of these economies was organised in the traditional manner of learning on the job and through the process of trial and error and the modern concept of management by objectives, corporate goals and pre-determined target setting, corporate planning, performance budgeting and appraisal, monitoring were not widely practised except by some of the multi-national companies in the region. However, in the past two decades the management movement took deep roots in India, Pakistan, Bangladesh and Philippines and management institutes have also been set up in Indonesia, Singapore, Thailand with prestigious institutional linkages. In recent years the management movement has grown significantly and a large number of professionally trained managers have come up to man both the private and the public sector units. In the private sector, there is

continuing dominance of the family control even though there is a veneer of professional management at the implementation, intermediate and public relations levels. In the fields of policy making, particularly decision on investments, expansion and diversification, appointment of key personnel, pricing and industrial relations, remains with the family members and their relations and friends who continue to exercise the dominant influence.

There is need, therefore, of de-linking of ownership with management and the induction of professionally trained managers to the top levels. There are no doubt exceptions in the case of some of the enlightened groups. Some of the family members of large groups are also being professionally trained in India, the Republic of Korea, Philippines, Pakistan and Singapore.

In the public sector the lack of autonomy, delegation of power, interference by the administrative Ministries and bureaucratic procedures have impeded the managerial ethos and growth of management culture. At the initial levels public sector has attracted better candidates who need to be encouraged for higher positions of responsibility to generate the surpluses and make public enterprises profitable rather than loss making.

There is, however, increasing consciousness to induct modern managerial concepts and practices as the environment and the running of large units has become increasingly complex. The capital output ratio in recent years has almost doubled in India; the large spurt in the savings ratio has thus been largely eroded. The new policies being enunciated in India are seeking to effectively monitor the progress of large projects and cut down cost over-runs and delays. A distinct industrial liberalising environment is emerging. Management courses are now being offered at many universities and institutions and management Associations have become very active in the sub-continent

and the South-East-Asian countries. A beginning has been discernible in China.

In Thailand the management movement has made a modest start with the setting up of an institute couple of years ago. In Indonesia also the management movement has gained momentum with the development of several management institutions. In the Philippines the Asian Institute of Management has been doing commendable work in training managers for many of the developing ESCAP countries. In the Republic of Korea, management has reached high levels at the Korean Development Institute and other Institutions with the rapid development of their steel, automotive, electronics, ship building, garments, leather and rolling stock industries and large general trading companies. A Management Institute also came up in Iran. Sri Lanka is making a start in this field as also Malaysia. Both in Singapore and Hongkong the infrastructural management development has reached a high level.

However, many of the developing ESCAP countries need to strengthen the managerial approach to reach optimal levels of resource mobilisation and fullest utilisation. In the smaller countries like Nepal, Bhutan, Papua New Guinea, the Maldives and the Island economies the management movement is still at an early stage. A good start has been made in Nepal. There is, however, increasing evidence of the induction of technocrats and professional managers in Indonesia, Malaysia and Philippines besides Singapore and Hongkong in decision making in industrial establishments and at policy making levels.

The organisational infrastructure has been considerably developed in India, the Republic of Korea, Pakistan, Singapore, Hongkong and reasonably well in Indonesia, Malaysia, Thailand and Philippines for the manning of the chemical and allied industries. A large number of both private and public sector organisations operating in the various sub-sectors of the chemical industry in India, Pakistan and Bangladesh have been able to evolve over the years the necessary organisational

framework both at the policy making and the implementation levels. In the private sector some of the larger units in the chemical sector are either largely multi-national or controlled by indigenous corporate giants with strong family affiliations.

The companies in the multi-national sector have a well developed organisational infrastructure with detailed systems control, communication systemsnetwork, monitoring and reporting. Some of the large private sector family dominated companies have also been able to develop these systems.

In the public sector the broad policy decisions are made in consultation by the Board of Directors who are nominated by the Government but also in consultation with the administrative Ministry, the Ministry of Finance and the Planning Commission. Efforts are, however, being made to streamline the organisational infrastructure in the public sector by instituting a system of monitoring, systems control and performance appraisal.

In the Republic of Korea the organisational infrastructure has been well developed particularly among the large trading companies like Daewoo, Hyundai, Lucky, Samsung, Gold-Star and the industrial giants. In several of the other developing ESCAP countries the organisational infrastructure has not yet been so finely tuned although concerted efforts are afoot in Malaysia, Indonesia, Thailand and Philippines to strengthen the same as also in Sri Lanka.

Planning:

The chemical industry received high priority in the Indian Second, Third and successive Five Year Plans which were launched from 1956 to 1980 and in the proposed Seventh Five Year Plan (1985-90).

With the onset of the Green Revolution, increasing emphasis was placed on fertilizers and pesticides to attain self-sufficiency in food in India, Pakistan, Bangladesh and Sri Lanka. With the growth in population, the plan strategy in these countries was increasingly linked to the larger investments in this sector leading to higher ratio of outlay in the chemical industry. In mid-1960s private sector was permitted to enter the chemical industry in India.

The fertilizer plants in the public sector in India which had not been performing optimally earlier turned the corner in 1983-84. The private sector fertilizer plants have performed well and shown profitability despite severe power cuts and the high price of raw materials. The capacity utilisation has been around 80 to 85 per cent in private sector and 60 to 65 per cent in public sector owing to old plants. In the cooperative sector around 80 per cent capacity utilisation has been achieved by the Indian farmers and Fertiliser Cooperatives. Public Sector in fertilisers accounts for 55 per cent of installed capacity and together with the cooperative sector the combined share is around 60 to 65 per cent.

The Indian second, third and subsequent plans were instrumental in building up sizeable capacities in industrial and basic chemicals more particularly caustic soda, soda ash and chlorine; the chemical industry base became deepened and diversified. The per capita consumption of drugs and pharmaceu ticals in the urban areas continues to hoaver around $ 2 and in the rural areas where over 72 per cent of the people live, the figure stands at a bare 60 cents per annum.[1]

Recent advances in medicines have helped to eliminate the scourge of tuberculosis, Cholera, Malaria and have helped to reduce infant mortality in India, Pakistan, Bangladesh and Sri Lanka.

1/ J.C.B.A.R. Study on the Indian Pharmaceutical Industry by P.L. Narayana, - 1984, New Delhi.

During the 4th, 5th and 6th Indian Plans stress was laid on developing the public sector units in the field of drugs and pharmaceuticals and more particularly for manufacture of bulk drugs.

In pesticides the public sector unit - Hindustan Insecticides was set up in the mid-fifties and substantial expansion has taken place in the last 3 decades. Both private and public sectors have been complementing each other in the fertiliser, drugs and pharmaceutical fields. In the fertilisers the public sector has greater weightage while the private sector predominates in the drugs, pharmaceuticals, dye-stuff, organic and inorganic chemicals. In the area of dye-stuffs the private sector has had very large foreign collaborations from West Germany, Switzerland, U.K. and U.S.A. Lately, the dye-stuff sector has been badly hit by the prolonged severe recession in the textile industry and the large scale industrial units have also been affected by the excise concessions extended to the small scale dye-stuff units.

Some of the largest economic Units in the Private sector like Nocil have lately shown reduced profitability of barely 1 per cent. Profitability in the chemical industries has come down substantially in the recent years owing to very large imports, some of which have been made at highly discounted prices.

The chemical industry has been faced with a number of challenges in the past five years and planners are now giving thought to overcome the various distortions. In the ESCAP region as a whole the chemical industry has developed considerably. There have been significant approaches to diversify the product-mix of the chemical industry in the last decade and a half in the region.

In the Republic of Korea, the chemical industry has grown phenomenally in the course of the successive Third and Fourth Five Year Plans with emphasis on the indicative planning process with considerable room for flexibility and

enterprise which has characterised the growth of the various sub-sectors despite the lack of industrial raw material resources and almost complete dependence on imported crude. In China the chemical industry has grown very significantly and is poised for great expansion in the next 15 years in the wake of the modernisation programs now in full swing. China is planning to more than quadruple her chemical production from 41.1 billion Yuan in 1980 to 185 billion Yuan in 2000. India's 7th Five Year Plan (1985-90) and the perspective planning for 'nineties also postulates very significant investment increases in the chemical sector with the tapping of the large natural gas reserves.

Replita II and III in Indonesia have considerably helped in laying the secure and firm foundations of the development of the fertiliser and pesticides industries in Indonesia. In the field of basic and industrial chemical, drugs and pharmaceuticals not much spectacular headway has yet been made. But in the Replita IV and possibly V the large natural gas reserves will provide the impetus for the expansion and diversification of the chemical industry.

In Malaysia also the planning process has helped to lay the foundations of the chemical industry and diversification and expansion is envisaged in the mid-'eighties and possibly 'nineties.

In Thailand ambitious plans are to afoot to develop the chemical industry on a wider base with the development of Erawan gas fields.

In Philippines the planning process is somewhat under strain presently owing to the severe foreign exchange position and large foreign debt. But the fertilizer and pesticide industry is expected to grow in coming years as well as sugar and alcohol based chemicals. Both in Pakistan and Bangladesh the successive Plans have sought to lay the basis of the growth and development of the chemical sub-sectors.

In Iran, substantial development of the chemical sector took place and a modest beginning has been made in Sri Lanka. The chemical industry has yet to develop on a large scale in Nepal, Bhutan and Maldives and nearly all fertilisers are being imported. The Planners in several of the developing ESCAP countries have been learning from experience and are now poised to plan more realistically.

Where flexibility has been followed and enterprise favoured the results have been more striking. It is realised that outmoded controls tend to hamstrung dynamic growth. The Planners in the region as a whole are now veering round to encourage more investment and innovation and this holds promise for improving the performance of the sector in coming years.

Finance and Financial Institutions:

The chemical industry being a very highly capital intensive sector requires large financial outlays and investments. In many of the developing ESCAP countries the private sector while making a significant contribution to the growth and development of the chemical industry, has not been able to provide all the necessary financial outlays. Recourse has, therefore, had to be made to provide and supplement the funds for the commissioning, expansion and diversification of the chemical industry from public financial institutions as well as through public sector corporations, World Bank, Industrial Finance Corporation, Industrial Development Banks, Asian Development Bank. The public sector is also making very high investments in the region.

Prior to 1945, financial institutions in most of the developing ESCAP countries were oriented to cater to the short term financial needs of these economies. There were very few financial institutions to provide long term finance for industrial development and such investments came largely

through multi-nationals. In the post-war era, the developing countries sought to redress this imbalance by creating industrial development corporations and other financial institutions to provide both medium and long term finance at reasonable rates of interest to promote industrial growth. These institutions accord priorities to mixed and private sectors.

In India, Pakistan and the Republic of Korea, financial institutions have greatly helped industrial development. Other developing countries of the ESCAP have also moved in this direction - Bangladesh, Malaysia, Thailand, Indonesia and the Philippines. As several of the developing countries have followed the pattern of mixed economy, public sector units have come up with the necessary financial resources for setting up of large chemical plants and multi-nationals have also continued to make substantial investments in the fast developing Asia-Pacific region. The financing of additional capacities to achieve the various targets postulated in various development plant of the developing ESCAP countries entailing massive investments can only come through the resources of the various national financial institutions, international agencies, like World Bank, I.F.C., A.D.B., no doubt supplemented by the ploughing back of profits and depreciation and some investments by multi-nationals.

Efficiency Control:

Efficiency control mechanism have been introduced only sparingly in most of the developing ESCAP countries. The Republic of Korea is in the vanguard of having instituted efficiency control measures and also some of the large scale Indian Units. Many of the public sector units in developing countries are still in the process of instituting efficiency control measures and close monitoring for achieving optimal productivity. In many of the public sector units the planning operation and control mechanism has been highly diffused and requires greater coordination. Steps in this direction are afoot.

e) Other special problems related to this sector:

The present bureaucratic set up of the public sector enterprises involves a close industry linkage with various Ministries, as a result of which the Chief Executives do not enjoy the power and authority to effectively control and institute optimal efficiency measures. Lack of autonomy and frequent changes of the Chief Executives, their limited tenure which is often only 2 years have led to a spate of ad-hocism in the operations. The Fertiliser Corporation of India was bifurcated into five corporations and is expected to be further truncated. The concept of holding companies which was introduced only a decade back in India has also not been given a fuller trial. The concept sought to provide common services on a centralised basis in the functional areas including key appointments, financial control, production targets, procurement of raw materials, while leaving their day to day operations to the general managers of the operating units. Bureaucratic interference by the administrative Ministries and backseat driving has led to the erosion of functional autonomy. As the chemical industry in many of the developing countries has a large public sector base, it is very important that these units are managed in a highly professional and efficient manner to produce optimal results. The new Government in India is taking energetic steps to tone up the working of public enterprises through monitoring and appraisal.

The smaller developing ESCAP countries are dependent on expatriate expertise. Units in developing countries are often faced with problems relating to infrastructure, adequate power, water, transport, raw materials and other supplies. The chemical enterprises have close linkages with the petrochemical sector.

Many of the bureaucrats, particularly, in South-East Asian countries of India, Pakistan, Bangladesh, Sri Lanka, and Nepal do not have any strong grounding in the technical

or in the operational fields. Most of them are generalists with little exposure to modern management systems. There is need for instituting high standards of performance budgeting and performance appraisal in terms of pre-determined targets and also performance audit. The function of performance audit would be to ensure if the right decisions were taken at the right time. The personnel constituting the performance audit board should have the freedom to critically evaluate the decision making of the corporate boards and the Chief Executives.

The Public Sector Boards also need to have a greater representation of non-official directors with experience of Industry, Science and technology and also distinguished academicians more particularly economists, and management experts to advise them on planning, monitoring and execution.

Even in the private sector in many of the developing ESCAP countries the enterpreneurs need to have a long term outlook rather than pursuit of short term gains. There is much greater need for larger outlays on basic and applied research and development than the efforts mounted thus far. Even among the more developed of the developing South-Asian countries like India, Pakistan and Sri Lanka, some of the infrastructural bottle-necks like lack of adequate power, transport and timely supply of raw materials also needs to be overcome. These improvements could lead to faster industrial development more particularly in the chemical sector which is expected to increasingly face very severe international competition in the coming years with the commissioning of large modern chemical plants in the Gulf countries and in other regions with large endowment of natural resources.

The developing ESCAP countries can only hope to realise the full benefits of their investments if these units are organised and run professionally to ensure high excellence of product on an economic cost.

The social compulsions of many of the developing countries of their growing populace and rising expectations of improvement in the standard of living will only be fulfilled if the relentless pursuit of all round industrial efficiency is achieved.

CHAPTER - III

Prospects and potentials for the development of the Sector.

a) Industrial strategy related to the development of the chemical sector at the national, sub-regional and regional levels.

MALAYSIA:

The existing Malaysian Chemical Industry is mainly confined to the manufacture of industrial chemicals from imported chemical intermediates comprising chemical fertilisers, compressed and liquified gases, industrial chemicals, paints and varnishes, lacquers and printing inks, soaps, medical and pharmaceutical products, cosmetic and toilet preparations and miscellaneous chemicals. The ex-factory value of chemicals and chemical products manufactured in 1980 amounted to Malaysian Dollars 640 million.

The total demand for all fertilizers is estimated to be around 1.3 million tons in 1980 - [illegible] of this was supplied from domestic manufacture and the rest being imported. The pesticides industry in Malaysia is characterised by formulating and blending activities. Herbicides constituted the largest portion of the industry. Total value of output was estimated at Malaysian Dollars 104 million. Presently, there is sufficient capacity to meet local demand of pesticides. There is some backward increase in the manufacture of some pesticides like arsenic acid, sodium chlorate and bypyridine from sodium metal and pyridine.

There are 8manufacturers of soap of which two companies produced 85 per cent of the total production of toilet soaps. Only one simple mixing and blending operation unit is engaged in medical and pharmaceutical field and Malaysia imported Malaysian 143.1 million dollars worth of pharmaceutical products in 1982. There are 20 existing companies involved in cosmetic and other toilet preparations. Natural Gas is expected to be the major non-oil energy supply for Malaysia. Gas will supply a power station, a methanol plant and a sponge iron project in Labuan from 1984 and gas will be available in the East Coast in 1984 to supply the Pacca Power Station (Plant) and will also supply the energy needs of the Tranggann sponge iron-cum-billet project from 1985. The second phase of gas development will be installation of a trans-peninsular gas pipeline from Trangganu to the Selang Valley in 1988. This pipeline distribution system will be extended to South Johore (and Singapore) by 1989 and Prai by 1990. The transpeninsular gas grid will enable the conversion of almost all major oil fired thermal plants by 1990 and is expected tomake a significant impact in the transportation sector replacing about 15 per cent of gasolene and diesel volumes in road transportation by 2000. By 1990 gas is projected to contribute 38 per cent of the total primary energy supply. Gas supply is expected to increase to 40 per cent by 2000 A.D. surpassing oil as the single largest energy supply source.

PHILIPPINES:

The policy of import substitution has been adopted since the early 50s and the chemical industry has grown considerably in the last two decades even though the industry is dependent on imported raw materials as domestic processing of inputs involves largely compounding and mixing operations. The major sectors of the industry like drugs and pharmaceuticals, pesticides, fertilizers and cosmetics, plastic packaging, man-made fibres and synthetic rubber products combined, imported a total worth of US $ 169 million in 1982.

The government has embarked on a comprehensive programme of structural adjustments which would benefit mostly the private industry sectorby way of rationalising resource utilisation and gearing up production towards the export markets. The chemical industry sector is being given a choice partly owing to its important dimensions in national development. The government has recently established two major projects - The Phosphate Fertilisers and Coco-Chemical Project. Several chemical products are presently included in the investment priorities plan which includes 50 or more products belonging to the groups of basic industrial chemicals, fertilisers, synthetic resins, synthetic yarn and fibres, drugs and pharmaceuticals, miscellaneous chemical products, plastics and rubber projects. More credit and fiscal incentives arebeing provided by government to stimulate the development of the industry including a temporary ban on import of caustic soda and synthetic resins.

The Government is also actively pursuing the development of industrial estates where industrial by-products can be used as inputs by other chemical firms to maximise benefits. The Five Year Development Plan for 1983-87 also seeks to facilitate the growth of the chemical industry by according high priority, monetary credit and fiscal policies, tariff duties and protection measures, relevant technologies, and export promotion measures for promotion of the industrial cooperation with ASEAN countries. The chemical industry is expected to play a major role in the development of the economy in the mid-1980s and 'nineties.

The Fertilizer and Pesticides Authority was created in May, 1977. The Philippines fertilizer supply originates from domestic production of four fertilizer plants supplemented by imports. Even though the chemical industry has not been fairing well in the Philippines for the past three four years owing to global recession, high energy costs and lately in the wake of political developments, its long-term future, however, appears reasonably promising.

Total fertiliser demand is projected as under :-

Nitrogen fertiliser Demand 1979-2000
(Thousand M.T.N). 1/

	1978-79	1979-80	1984-85	1989-90	1994-95	2000
	215	230	320	445	600	780
of which urea	143	155	240	340	460	600

Representing a total N growth of 6.3 per cent per year over 1980-2000 with urea growing faster; the Fertiliser and Pesticides Authority (FPA) has a key planning and administration role. Refinery off-gas is used as ammonia feedstock. Urea and other products are imported.

Atlas Fertiliser has the second largest fertiliser complex with imported ammonia feeding an ammonium sulphate, sulphuric acid/phosphoric acid/superphosphate/complex fertiliser plant located at Toledo. There is a small naptha based ammonia plant at Iligan City. A new plant is coming up at Leyete. Part of the sulphuric acid requirement is to be supplied from the PASAR Copper (Complex) Smelter. The following table gives the supply, demand and trade projection for ammonia:

Table - 5

Philippines Ammonia Supply, Demand and Trade - 1979-2000. 2/

	1978-79	1979-80	1984-85	1989-90	1994-95	2000
Fertiliser N Production.	46	46	120	170	210	250
Total Demand.	66	70	148	139	240	280
Imports.	35	35	35	35	30	30

1/ Philippines Fertiliser and Pesticides Authority Reports, 1983.

2/ Philippines Fertiliser and Pesticides Authority, 1983.

Indonesia:

The growth of basic chemical industries in the Indonesian archipelago since the early 1970s showed fair promise, and even the pervasive world recession in 1981-83 did not appreciably stunt their development. 16 projects were completed in 1981 at a total cost (investment) of Rs.197,900 million.[1] Two projects were financed by foreign capital at a total investment of Rs.36,000 million. One project was established under the business Regulation Ordinance.

The basic chemical industries have started to earn foreign exchange comprising of agro-chemicals, cellulose, paper, organic and inorganic chemical sectors. Four urea fertiliser plants are under construction and others are being expanded. Pesticides production has also risen significantly with 15 companies engaged in pesticides manufacture. Production of organic chemical products developed favourably with the exception of explosives. Production of synthetic fibres, formalin and thermo-setting materials rose significantly since 1979, as also calcium nitrate and methanol. A methanol project at Bunyu (East Kalimantan Province) is under construction. Increased production was also recorded in organic chemical industries from 1979 to 1982 in the areas of Oxygen, Carbonic acid and sulphuric acid, nitrogen and acetylene, aluminium sulphate, zinc chloride and oleum. A table showing the products and variables is given below:-

TABLE - 6 [2]

Indonesian Chemical Projects:

Products:

Fertilizer Plants under Construction (Four)
Pesticides (15 Co sinopication)
Methanol plant (under construction)
Industrial Sales (under construction)
Sulphuric Acid and Gypsum project (under construction)

Production	Variables
Oxygen	Supply of raw materials
Carbonic Acid.	Natural Gas availability.
Sulphuric Acid.	Water and Transport availability.
Nitrogen.	Capacity utilisation, output and production.
Aluminium.	
Sulphur.	
Zinc.	
Chloride.	
Oleum.	

1/The Exchange rate has been calculated at US $ 1 = 1000 Indonesian Rupiahs.
2/Replita IV.

An industrial salt project at Kupang (East Nusa Tenggar Province) is to be completed in 1986 and a potassium hydroxide plant is in the course of preparation as also a sulphuri acid and gypsum project and also a sulphuric acid and gypsum project are also under construction. The development of basic chemical industrial zones aims at gradually reducing Indonesia's dependence on imports of chemical products. 11 zones are being developed by various government departments and the stress is on import substitution and export promotion.

Fertilizer demand growth rate in 1978 to 1979 were almost 30 per cent in 1979 and almost 15 per cent in 1980. This may well put demand well ahead of presently scheduled production by mid-80s. Indonesia's per hectare consumption is still far below its potential. Total fertilizer nitrogen demand is projected to continue its strong growth representing a total growth of over 6 per cent per year in 1980-2000 period. All fertilizer production in Indonesia is produced by Government owned corporations. The following table represents the estimated nitrogen, fertilizer demand.

TABLE - 7 1/

Indonesia's Nitrogen Fertilizer Demand - 1980-2000.

(in thousand metric tons)

	1978-79	1979-80	1984-85	1989-90	1994-95	2000
	550	710	1060	1340	1630	1940
of which urea	500	660	990	1260	1540	1840

The Pueri Complex in South Sumatra has a urea capacity of 1.52 million m.t. per year (745,000 tons per year N). There were feedstock problems with this complex which are being overcome. Petrokimia at Gresik in East Java has urea, ammonium sulphate and phosphatic fertiliser capacity and by 1984 will add TSP capacity. PT Kujang in West Java has 570,000 tons per year urea capacity 262,000 tons per year N operation.

1/ F.A.O.

Kujang uses natural gas feedstock from Pertiminas on-shore fields and ARCO's off-shore gas. Kujang could run into feedstock problems later as it has to compete for gas use by steel, cement and domestic gas grid. As the latter industries come up in the mid-'eighties and 'nineties, they will utilise considerable quantities of natural gas leaving only the residual for Kujang and alternative sources may well have to be tapped and developed to cater both to the industrial agro-sector needs and the domestic gas users.

The next ammonia-urea plant is under construction at Bontang in East Kalimantan. It will produce 165,000 tons per year of ammonia (135,000 tons per year N) for supply to Petrokimia - gresik and possibly for export to Philippines. The balance of the production will go to a urea plant of 570,000 tons per year (262,000 M.T. per year N). The Kaltim Plant is stated to get started in 1983-84 and could well be the site for the location of the Enfco LNG facility. Additional gas reserves are being discovered within the area for another ammonia project, which is required later. Since 1977, Indonesia has been exporting nitrogen fertilisers in the form of urea and exports in 1977-78 touched 400,000 M.T. (184,000 N).

An additional ammonia/urea project during the end of 1980s and another during early 1990s is anticipated. Urea resin production for the plywood and other wood products is the major consumer among non-fertiliser users. Growth in this area will be modest in mid-1980s. In 1990s the development of the synthetic fibre industry is expected to become a significant user of ammonia for fibre intermediate production The following table gives the ammonia supply, demand projections

TABLE - 8 1/

Indonesia's Ammonia supply, demand projections in 1980-2000

		Demand.	Capacity.	Production	Trade
F.Y.	1980	- 760	1100	760	0
	1985	- 1390	1806	1450	60
	1990	- 1740	1740	1800	60
	1995	- 2000	2359	2000	0
	2000	- 2360	2622	2360	0

1/ F.A.O.

A minor export of anyhdrous ammonia is expected when Kaltim project comes on stream. Surplus is likely to be used up when synthetic fibre production will become a significant user in the 1990s. Neplita IV projections are given in Annexure 'A'.

Singapore:

Singapore has developed into the third largest refining centre and refineries in Singapore have continued to invest substantially to improve efficiency and increase flexibility for processing a wider range of crudes. All hydrocarbons are imported into Singapore. The industry has moved towards increased secondary processing of heavy oil products into lighter and higher value added products. Singapore's total refining capacity in 1981 stood at 1.1 million barrels. Two major refinery projects are coming on stream as well as hydro cracker and catalytic reformer together with an upgrading complex. Being largely an entrepot centre with heavy export orientation, Singapore has developed close trade links with other countries. Till lately much of the Indonesian and Malaysian crudeshave been refined in Singapore. Indonesian refineries have now largely come up. The Malaysian refineries may take some more time before they are able to process all their crude. Singapore's economy is very much dependent on external factors. Some pharmaceutical and industrial chemical units with an export thrust have come up. Use of urea for industrial purposes is significant and industrial urea demand is likely to rise from 5 to 10,000 M.T. by 2000.

The Republic of Korea:

Chemicals:

The chemical industry, which commenced development in the mid-1960s, grew rapidly through the successful implementation of the second, third and fourth five year economic development plans and now plays an important role in the Korean economy. All the crude and hydro-carbons are imported and there is a very pronounced export orientation and close trade links with other countries both in the region and on intra-regional plans.

In 1981, among the major chemical products, production of ethylene increased 1.5 per cent to 374,000 M/t while methanol decreased 20.4 per cent to 169,000 M/T in the absence of domestic natural gas supplies.

In 1981, fertilizer output dropped 13.2 per cent from the previous year to 1,168,000 M/T. Nitrogen fertilizer accounted for 57 per cent at 666,000 M/T, phosphate fertilizer 28 per cent at 324,000M/T and potassium fertilizer 15 per cent at 178,000 M/T.

In 1981, the Republic of Korea was less able to export fertilisers; exports decreased by 39 per cent compared with 1980. The major factor explaining this reduced ability to export is the low competitiveness of the Korean fertilizer products. World market prices of fertilisers fell sharply during 1981 from previous peak levels reached in 1980.

Korea's fertilizer industry, however, has substantially higher production costs. It hasbeen estimated that total average production costs per tonne of urea and compound fertilizer are above US $ 300 and US $ 350 per ton respectively. Such production costs vary according to plant, capacity utilisation, production efficiency etc., but it is clear that under present conditions in world market the Korean fertilizer industry will not even be able to fully recoup its variable costs.

After Japan, the Republic of Korea thus becomes the second country in the Far-East which ismoving towards reducing its fertilizer export industry. Therationalisation plan is to let production capacity be cut to a level commensurate with domestic requirements. It is felt that such a move would not only solve the problem of over capacity, but would also reduce fertilizer production costs by improving the capacity utilisation rates of the remaining plants.

After the rationalisation is completed in the next two/three years, it is expected that the total production capacity in the country will be reduced to 2.17 million metric tonnes from 2.5 million tonnes.

In fifth five year economic and social development plan - 1982-1986, the Government of Republic of Korea has clearly indicated that the deficit in the fertilizer account will have to be eliminated by 1986. The potash sector has also been actively developed in recent years.

Korea has also developed a large pharmaceutical and industrial chemicals - organic and inorganic and pesticide production base. Its production base has become greatly diversified in last 15 years.

The Republic of Korea has one of the strongest domestic pharmaceutical sectors. Of around 300 pharmaceutical firms only 14 are foreign subsidiaries. Foreign investment ratio is limited to 50 per cent or less. Only projects operating in the free trade zone are permitted to have a majority of foreign ownership. The pharmaceutical industry has achieved high growth and the export of pharmaceutical industry has achieved rapid growth and the export of drugs has increased considerably every year. In 1980 the pharmaceutical market maintained a steady 25 per cent growth inproduction. In 1975 Korean production stood at US $ 99 million and by 1977 it went up to US $ 625 million, by 1980 to $ 950 million touching $ 1150 million in 1981. Total foreign investment in health care companies totals $ 34 million by 35 companies, according to the Health Ministry. As a result of economic growth and lower cost products, the Republic of Korea is attractive to a wide range of foreign exporters and the stress is on foreign know-how rather than equity participation. The majority of foreign invested firms are now export-oriented. The table 9 gives the estimated fertilizer nitrogen consumption.

TABLE - 9 1/

(The Republic of Korea)

Korean Fertilizer Nitrogen Consumption - 1979-2000

	1978-79	1979-80	1984-85	1989-90	1994-95	2000
Urea.	289	270	330	375	415	455
Ammonia.	219	207	256	295	329	362
Sulphate.	3	3	4	5	6	8
Total:	511	480	590	675	750	825

Korean industrial nitrogen consumption totalled 106,000 M.T. in 1978-79 with caprolactum, acrylonitrite and urea, plywood, resin being the major users. New caprolactum/acrylonitrite units are anticipated in 1980s. Korean industrial nitrogen consumption is anticipated to rise from 106,000 tonnes in 1979 to 161,000 tonnes in 1984-85 and 251,000 tonnes in 1989-90; rising to 334,000 tonnes in 1994-95 and 344,000 tonnes in 2000. Korean ammonia capacity totalled 822,000 metric tonnes in N basis in 1980 and an additional 247,000 M.T. will come up. Korean urea capacity totalled 1,190,000 M.T. (547,000 M.T.N. in 1980) and capacity is to increase by another 330,000 M.T. (152,000 M.T. as N) in 1981-83-84 with the Yam Nae expansion. 1/

A considerable number of small Scale Units have come up in the Republic of Korea and the ESCAP region.

ASEAN

The ASEAN ammonia-urea project situated at Bintulu Sarawak is expected to be completed in 1985 at a cost of Malaysian Dollars 700 million. The methanol plant in Labuan, Sabah, when ready in 1984 will be the first South-East Asian Project costing Malaysian Dollars 470 million.

1/ Industry in Korea, 1980 and 1984 - The Korean Development Bank and the Korean Economy.

A table showing the estimated ammonia demand and supply for ASEAN countries is given below:

TABLE - 10 1/

Estimated ASEAN Ammonia Supply and Demand
(Thousand metric tons N per year)

Demand	1978-79	1979-80	1984-85	1989-90	1994-95	2000
Thailand.	4	0	0	305	558	558
Malaysia.	42	43	203	295	297	300
Indonesia.	800	760	1390	1740	2000	2360
Philippines.	66	70	148	199	240	280
	912	873	1741	2539	3095	3498
Supply:						
Thailand.	4	0	0	305	610	610
Malaysia.	42	42	203	570	575	585
Indonesia.	800	760	1450	1800	2000	2360
Philippines (Imports).	35	35	35	35	0	0
	881	837	1688	2710	3185	3555

A joint fertiliser ASEAN venture project is scheduled for 1984-85. The planned ASEAN Urea project at Bintulu, Sarawak will consist of a 1000 M.T. per day ammonia plants plus 1500 M.T. Unit per day urea plant. There will be a small surplus of 130 tons per day if both plants are operating at capacity. Natural gas feed to the project will be from the Central Luconia fields off-shore in Bintulu Bay via joint pipeline shared with the LNG Plant. An additional export oriented ammonia project is under consideration for late 1980s with a capacity of 660,000 tonnes annually.

1/ F.A.O.

The last ammonia-urea plant under the development plans is the ASEAN Plant at Aceh, North Sumatra with a rated capacity of 570,000 tons per year urea (262,000 tons per year N). The site at Aceh is also the site of a major LNG facility and a proposed olefins complex. Additional gas finds are in progress of being located and perhaps another ammonia plant could be set up later if needed.

Growth of Indian Chemical Industry:

The Chemical Industry accounts for 20 per cent of the fixed assets in industry, producing more than Rs.6,000 million worth of goods and gives employment to 6 per cent of the industrial labour force. This industry which was the fastest growing segment of the economy in the last two decades slumped to the bottom in 1979-80 and has just been recovering. It achieved a growth rate of 4 per cent in 1983-84.1/

A sound base of Chemical Industry in all its various facets has grown up.

In planning for industry and its location, the economies of scale factor which can lead to lowering of cost due to high volume of production had been overlooked; with the recent five-fold increase in assets limits for larger houses this aspect is being remedied.

The labour force comes from farm sector to the chemical industry and needs to be trained 'on the job'.

Alcohol is an important feedstock for the organic chemicals industry. With liberalisation in the prohibition policy in various States, potable industry is making an increasingly big demand on alcohol.

1/ The Exchange rate is reckoned at Rs.10 = US $ 1.

The total installed capacity in the Caustic Soda industry at the beginning of 1984 stood at 0.935 million tonnes. Another 200,000 tonnes will be added to this in the course of 1984-85. By March, 1985, the total capacity is expected to rise to 1.135 million tonnes as against the targeted capacity of 1.05 million tonnes.

The main user industries have not evidenced any appreciable growth, demand for caustic soda continued to be around 600,000 tonnes right through 1979 till 1983-84.

The soda ash industry, which was pushed to the wall as a result of liberal import policy and tariff structure, has of late been showing signs of recovery in 1984.

The pharmaceutical industry has made stupendous progress. The industry produces as many as 400 bulk drugs and intermediates and the value of production of formulations is currently placed at around Rs.1,500 million. If the WHO objective of HEALTH FOR ALL BY 2000 A.D. is to beachieved, it calls for massive increase in production, both of bulk drugs and formulations.

The drug industry is perhaps one of the most regulated industries and the effect of price control has in fact already started telling upon the faster realisation of its growth potentials. The new drug policy is expected to remedy the situation.

Tables 1, 2, 3 and 4 (Statistical Profiles) given at Annexure 'B' compiled by "Commerce Research Bureau" in its special Supplement on Chemical Industry in its issue of 26th November, 1983 reflect the growth of Chemical Industry and production of its various sub-sectors.

Chemicals have grown at the rate of 8 per cent per annum compared to the manufacturing industry's average of 5.5 per cent and only second to the growth of basic metals

of 8.5 per cent. The major growth areas were synthetic fibres, fertilizers and pesticides, basic chemicals, petro-chemicals and drugs and pharmaceuticals.

A negative growth was registered in 1979-80 over 1978-79, particularly in Organic Chemicals (-13.1 percent) Synthetic Resins and Plastics (-8.5 percent) and Drugs and Pharmaceuticals (-4.7 per cent). The following table gives the production of fertilisers and pesticides.

TABLE-11[1/]

Production of Fertilizer and Pesticides in India

('000 T)

Year	Fertilizers		Pesticides		
	Nitrogenous	Phosphatic.	BHC	DDT	Melathion.
1975*	1470	400	24.3	4.3	1.4
1979*	2270	760	34.2	4.8	2.6
1980**	2164	841	28.4@	4.2	1.0

Significant growth has taken place in the manufacture of sulphuric acid, soda ash and caustic soda as per table below:

TABLE - 12[2/]

Production of Basic Chemicals in India

('000 T)

Year	Sulphuric Acid	Caustic Soda	Soda Ash
1975	1375	442.7	541.4
1979	2199	566.4	543.6
1980	1937	548.0	525.0

1/Source: *Monthly Statistics of Production by Central Statistical Organisation and Production and Capacity Utilisation in 620 Industries - 1970 to 1979 CMIE.
**Fertiliser News, June, 1981 - Page 50.
@Chemical Industry News, April, 1981 - Page 939.

2/Source: Monthly Abstract of Statistics, (CSO).

The growth record has been matched by an equally impressive investment to the tune of Rs.2,500 million per annum. The chemical industry currently is the fourth largest industry, ranking behind Iron and Steel, Engineering and Textiles. Public Sector Investment has been a major factor, playing a dominant role in fertilisers and drugs and pharmaceuticals.

In the manufacturing sector, the chemical industry has made a slightly better use of the fixed capital employed. Labour productivity is substantially better, mainly because of the continuous and automated operation in most process industries.

The growthareas are fertilizers and pesticides, petro-chemicals, synthetic fibres, drugs and pharmaceuticals and dyes and intermediates. Substantial increase in basic chemicals production will be required to support the rest of the chemical industry.

In the case of fertilizers, the Sixth Plan envisaged a target of two million tonnes per annum Nitrogen and 600,000 tonnes per annum P_2O_5; whereas in pesticides it is planned to increase the present capacity by an additional 40 per cent.

Methanol, DMT and detergent alkylate are some of the other growth areas.

A major thrust is anticipated in drugs and pharmaceuticals. Bulk drugs output has been estimated to have increased from Rs.2260 million in 1979-80 to Rs.6650 million in 1984.85.

The Sixth Five Year Plan had visualised an investment in chemical industry of over Rs.3,000 million in the central sector. The major investment has been in fertilizers and petro-chemicals, both of which are highly capital intensive.

A summary of capacity production and requirements (estimated) of selected Inorganic Chemicals and estimated requirements of investment and employment (likely to be

generated) are given in Annexure 'C'.

With adequate supplies of medicinal herbs available in the country and the considerable advances made by the Indian Pharmaceutical Industry, there is considerable scope for increasing exports to other developing ESCAP countries.

The United Nations Development Organization has cited India as a classic example of rapid integration in the pharmaceutical industry producing $ 1,300 M worth of finished dosage form in 1978-80 alongwith 60 per cent of its bulk drug requirements. In the Asian region, according to the UNIDO, whilst India as also Indonesia, Pakistan, the Philippines and the Republic of Korea formulate close to 100 per cent of their domestic requirements, all other countries in the region formulate about 30 to 69 per cent of the national consumption. Pharmaceutical Industry has now reached a phase which signifies a level of operations comparable to the pharmaceutical units in the developed countries in terms of production technology and quality of product. 1/

The bulk drug production has increased from Rs.2,200 M in 1979-80 to Rs.6,650 M and the formulations from Rs.11,500 M to Rs. 24,500 M in 1984-85.

The existing investment in respect of the pharmaceutical industry aggregates to more than Rs.4500 M. This is expected to go up to Rs.7750 M; an additional Rs.2750 M being in the bulk drug sector and Rs.500 M being in the formulations sector.

Production and investment of such size have generated employment opportunities on a large scale. The direct employment provided by the industry is of the order of 1,50,000 (both by organized and small scale sectors). In addition to this, indirect trade, ancillary industry etc.) and in all providing employment for 850,000 people.

1/ Pharmaceutical Industry in India, P.L. Narayana, N.C.A.E.R., New Delhi, 1984.

Most of the Indian companies in the organised sector, including the public sector, and quite a few small scale units, have research and development facilities for product development. It is estimated that the industry currently spends on R & D expenditure of about Rs.80 to 90 million which works out to less than 1.0 per cent of the turn-over. A statement showing additional working capital requirements and additional investment required during 1989-90 for monitored bulk drugs and status position is given in Annexure 'D'.

There are 38 caustic soda plants in operation. 27 using Mercury Cell process, 10 the Diaphrogm Cell process and one chemical process. The sixth plan target, achievements, future capacities likely to materialise, estimated demand and proposed targets are as under:-

TABLE - 13[1/]

Revised Sixth Five Year Plan projections of India

(in thousand tons)

	PERIOD					
	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
1. Revised Sixth Plan Target:						
a) Capacity.	1100					
b) Production.	860					
2. Achievements.						
a) Capacity.	1004					
b) Production.	750					
3. Expected Installed Capacity.		1050	1100	1130	1221	1254
4. Estimated Production.		700	825	848	916	940
5. Expected domestic requirements.	650	680	795	830	865	900
6. Present Targets:						
a) Capacity.	866	986	1060	1106	1153	1200
b) Production.	650	600	975	830	865	900

No gap between demand and production is anticipated.

1/ Report of the Working Group on Chemicals for the 7th Five Year Plan 1985-86 to 1989-90 - Ministry of Chemicals and Fertilisers, New Delhi.

There are 5 Soda Ash plants in operation with total installed capacity of 900,000 tps and 3 plants use the standard solvey process and two use the modified solvey process. No gap is anticipated between production and demand by 1989-90. In Calcium Carbide, carbon black, titanium dicxide and other selected inorganic chemicals no demand/supply gaps are anticipated in view of new licensed capacities.

The study of the sources of growth in total grain production during 1961-62 to 1979-80 (Barring 1981) clearly indicates that the bulk of the increase came through increased yields with the use of fertilisers. The fertiliser consumption and foodgrains production increased during this period by 4.8 and 30 million tonnes respectively. Increase has been of the order of 13 Kg of foodgrains to 1 Kg of nutrient. In the late 1965 a new agricultural strategy wasdevised to take the country along the road to self-sufficiency, and a new fertiliser policy was evolved to facilitate its domestic production and easier availability. Investment in fertiliser production was also opened to the private sector besides liberalising marketing and pricing policies.

The Fifth Plan (1974-75 to 1978-79) laid emphasis on strengthening the infrastructure for fertiliser distribution. These policies boosted fertiliser consumption at a compound rate of growth of 18.7 per cent per annum during the Fifth Plan period.

In the Sixth Five Year Plan ending 31st March, 1985, higher priority has been accorded to bridging the gap between actual and potential farm yields. More than 80 per cent of fertiliser consumption is oncash and irrigated crops like wheat, rice, sugar-cane, cotton, etc.

Indian population is likely to reach one billion by 2000 A.D. To feed this population even at the existing low rate of food intake, the country would have to have at its disposal an additional 100 million tonnes of foodgrains.

The land man ratio in India being as low as 0.24 (1980) per hectare the scope of increased food production lies only through improving the productivity of land. The additional fertiliser consumption from now to the end of the century (15 years) would need to be 10 million tonnes. Average consumption level of chemical fertilisers in India is 37.6 Kg/ha. FAI estimates of Production and consumption of $N_1 P_2 0_5$ and $K_2 0$ from 1984-85 to 1999-2000 is given in Annexure'B

(a) Price subsidy on fertilisers today stands at US Dollars 800 million annually.

(b) There is additionally a further price subsidy of 25 and 33-1/3 per cent to the small and marginal farmers on phosphatic and potassic fertilisers and tribal farmers are offered 50 per cent price subsidy under Integrated Rural Development programme

The two main channels of distribution are the cooperatives and the private trade, each holding nearly 50 per cent of the total trade.

The Indian fertiliser scene has been continually expanding embracing a whole range of fertiliser technology, using a wide spectrum of feedstock and producing a vast array of production. The Fertiliser Industry occupies a pivotal position and in nitrogenous fertilisers India ranks as the 4th largest producer in the world.

After the large finds of associated and natural gas in the Bombay High and South Bassein regions in late seventies, Government took a decision to base the new capacity predominantly on natural gas as the preferred feedstock. Options for raw materials for phosphatic fertiliser are rather limited.

Currently there are 35 nitrogenous and complex fertiliser plants, six by-product ammonium sulphate plants, three triple super-phosphate plants and 40 SSP Plants

(including 10 small scale SSI Units) with an installed capacity of 5.17 million tonnes of N and 1.43 million tonnes of P_2O_5. HEC-Haldia with an installed capacity of 152,000 tonnes N and 75,000 tonnes P_2O_5 is expected to be commissioned shortly. Statement showing capacity and production is given in Annexure 'P'.

Implementation of 8 new nitrogenous plants is planned in addition to five gas based plants under construction. Out of 8 proposed plants, six plants would be based on gas available from West Coast and one is expected to be based on surplus naptha likely to be available in the North-West region and the eighth on coal at Korba. Besides licensing 30 SSP Plants each of 10,600 tons P_2O_5 per annum capacity, 11 phosphatic fertiliser plants are to be built.

Despite build up of large new capacity, continuing deficits will have to be met from imports.

The present investment in Fertiliser Industry is about Rs. 39,250 million (at original cost). Assuming that about 85 per cent of the new ammonia capacity will be based on gas and the end product will be urea, the additional investment for nitrogenous fertilisers alone will be about Rs.60,000 million upto 1990 on current price basis. Similarly, assuming that the new phosphatic fertiliser plants will be based on ammonium phosphate (5 per cent domestically produced) the investment on phosphatic fertiliser plants will be about Rs.10,000 million by 1990. A fertiliser Unit of 1350 tpd ammonia presently costs over Rs.6000 million=US $ 600 million). The total investment by 1989-90 will increase to Rs.120,000 million and the fertiliser Industry is the second biggest industry, next only to steel, in terms of investment.

For nitrogenous fertilisers, feedstock policy has to concentrate on natural gas and coal. Options for raw materials for phosphatic fertilisers i.e. phosphate rock and sulphur are rather limited. Having no deposits of sulphur, the

entire requirement has to be met from imports and joint ventures could be established with other developing countries to ensure the regular supplies of sulphur.

Madras Fertilisers Limited has had the management contract for the ammonia/urea plant of Sri Lanka Fertiliser Manufacturing Co. and Commissioned and managed it for 3 years besides imparting training for Sri Lankan personnel.

Some of the equipments for fertiliser plants in the neighbouring countries like Sri Lanka and Bangladesh have been supplied by Indian firms. Even international giants like Kellogg associated Indian Consultancy Firm - Engineers India as their partner in the case of Sri Lanka nitrogenous fertiliser plant for providing the design engineering and procurement services. India has also gone into a joint venture with another country endowed with phosphatic raw materials.

Nauru on the other hand, in the interest of exploiting its phosphatic reserves has entered into an agreement with India to produce phosphatic fertiliser at Paradeep on the east coast of India. There could be many more such matching possibilities in developing countries.

It has been the policy of the Government to build up parallel, to the growth of the industry technical capability to achieve self-reliance in the field of technology process design, technical know-how and supply of plant and equipment. Rapid expansion in the domestic fertiliser industry in the last 30 years has helped in the setting up of consultancy, design and engineering capacity which has in turn provided the necessary under-pinning for the growth of the fertiliser industry itself. Around the mid-60s public sector engineering organisations like PDIL (the then P&D Divis Division of Sindri Fertilisers) and FEDO entered into know-how agreement with well known process licensors to acquire the then latest developments in both nitrogenous and phosphatic fertilisers.

There are now three premier consultancy organisations. They are (i) Project and Development India Ltd., Sindri, Bihar (PDIL), (ii) FACT Engineering and Design Organisation, Udyogamandal, Kerala (FEDO) and (iii) Engineers India Ltd., New Delhi (EIL).

Indigenous capacity exists for the design of a conventional total recycle urea process. PDIL is involved as a co-contractor with Snamprogetti in design and engineering of a number of urea plants currently under implementation.

Complete design and engineering of large and complex coal/product handling plants and captive power units is now common fare for Indian Consultancy firms and self-sufficiency in respect of all Civil Engineering know-how required for execution of modern fertiliser plants has been achieved.

Indian consultancy organisations have undertaken proposed joint projects with Iran, Kuwait, Bahrain and UAE (Abu Dhabi); techno-economic study for a fertiliser plant in the Philippines on behalf of the Philippines Fertilizer Industry Authority. Studies are on for Fertilizer Marketing and Distribution systems in Burma and Afghanistan. India can now provide and supply upto about 80 per cent of the equipment required for the fertiliser industry from indigenous sources.

Most major manufacturers have extensive training facilities attached to their plants for skilled technicians, operators, engineers etc. These facilities are being used in increasing number by fertiliser companies in neighbouring countries to meet their growing needs.

The fertiliser Association of India is running an exhaustive training programme covering various disciplines. The courses run by the FAI are being regularly attended by participants from the neighbouring countries. The countries

so far taking part in these programmes are Saudi Arabia, Kuwait, Iran, Afghanistan, Pakistan, Sri Lanka, Nepal, Bangladesh, Burma, Thailand, The Republic of Korea, Indonesia, & Philippines. The FAI programmes not only train individuals for their own career development but also trainers for imparting training.

The FAO in its recent study: "Agriculture: Towards 2000" estimates that - Expansion of cropped area will provide just over 25 per cent of additional cropping intensity and higher yields will contribute 60 per cent. Higher yields may be achieved by prevention of pre-harvest losses due to damage by insects, fungal diseases, and weeds which the FAO estimates at 30 per cent or more of the potential production.

In the year 1976-77, nearly 20 per cent of cropped area suffered from pests and diseases but the area treated with pesticides was only 7.2 per cent. In foodgrains alone assuming a conservative loss of 5 per cent on present production of 150 million tonnes, the production/losses that could be sustained/ prevented amounts to about 7.5 million tonnes.

The two outstanding features of (i) rapid response, and (ii) predictability of results in varied crop situations, make chemical pest con-trol a continuing feature of pest control. Although more and more specific and narrow-spectrum pesticides are available in the world market, usage in India is expected to mainly rely on broad-spectrum compounds rather than low-dose narrow spectrum compounds.

The Table below shows the consumption of pesticides in various countries:

TABLE - 14 1/

Pesticide Consumption in various countries.

Country	Consumption
Japan.	10,800
The Republic of Korea.	4,681
West Europe.	2,000
Penninsular Malaysia.	1,908
USA and Canada.	1,500

1/ Paper presented at the International Pesticides Conference, New Delhi.

Country.	Consumption
Philippines.	889
Thailand.	675
Sri Lanka	579
India	450

Considering that only 2.92 million hectares are irrigated out of the 25.7 million hectares under pulses, the scope for dust and granular formulations becomes considerable. It is estimated that proper use of pesticides can raise the production of pulses from present 12 million tonnes to 18 million tonnes.

In the case of oil seeds the area under cultivation is about 18 million hectares but production is only around 10 million tonnes. By use of selected biodegradable pesticides it should be possible to achieve substantial increases in yields and consequently in production.

The major attention of Indian Pesticides Industry has been focussed till date on standing crop protection in the field. With the increase of crop production planned, more stress needs to be placed on protecting small farm/village-level storages of food-grains, agro-commodities and seeds.

Chinese Chemical Industry - Growth and prospects:

At the present time there is a turning point for Chinese industry, including the chemical industry, in their developing history since liberation. An important decision concerning the reform of Chinese economic structure was made by the Chinese Government on October of 1984 (Modernize Agriculture, Industry, Technology and Defence). The new strategic planning of the Chinese chemical industry is just now being formulated.

From 1952 to 1983, the general value of chemical industry output increased at an average rate of 8.97 per cent a year. The amount in 1983 was 49.2 billion Yuan (RMB), equal to about 8 per cent of the general output value of

Chinese Industry. From 1949 to 1983, the accumulative total of profit and tax was 143 billion Yuan. This was three times the grand total of national investment in the same period.

At present, there are more than 5,000 chemical enterprises in China among which about 400 enterprises are most important. Following are the major products and their output in 1983:

TABLE - 15 1/

China's Chemical Production:

Sulphuric Acid.	8.70	million tons.
Soda Ash	1.79	" "
Caustic Soda	2.12	" "
Synthetic ammonia.	16.77	" "
Chemical fertilizers.	13.79	" "
Ethylene.	0.62	" "
Synthetic materials:		
Plastics.	1.12	" "
Fiber monomer.	0.31	" "
Rubber	0.16	" "
Tyres.	12.71	" "

Chemicals for the usage in agriculture, light, textile and pharmaceutical industries and for traffic, transportation and national defence are now essentially provided domestically New capacities for electronic and the building industries are practical and developing and expect a break-through in biochemical engineering in near future. In order to make full use of the skills and the initiative of the coastal chemical industry base, an effort has been made to develop the chemical industries in the vast interior. The output value of the interior increased from 17.3 per cent in 1952 to 50.8 per cent in 1983 in the total output value of the chemical industry. Technical advance in the chemical

1/ The strategy to develop the Chinese Chemical Industry - paper presented at the International Chemical Congress of Pacific Basin Societies by Mr. Zhang Linhan, Deputy Chief Engineer of the Min. of Chemical Industry of Peoples' Republic of China.

industry depends upon imported technology and equipment, such as large-scale petro-chemical and chemical fertiliser plants and own research and development. The use of raw materials and energy consumption in the chemical industry has been reduced year by year, while at the same time the quality and variety of chemical products have been emphasized and improved. Pollution control is of concern and is progressing. There are 2.8 million staff and workers in the chemical industry system, including 230 thousand scientists, engineers and technicians. There are 88 thousand people working in research and engineering departments alone.

By the end of this century, the industrial and agricultural general output value of China should be quadruple of the 1980 based figure. According to the statistical data of the developed countries, the rate of development of the chemical industry should be rather higher than that of the national economy. The scale of chemical industry at the end of this century should be about 4.5 fold that of the 1980 based figure. Since the general output value of chemical industry in 1980 was 41.1 billion Yuan, then the general output value of the chemical industry should be about 185 billion Yuan in the year 2000.

In the preceding 35 years, chemical fertilizer was the sector first to develop. Hereafter, the growth rate of this sector should be reduced appropriately and the money invested in other sectors of higher priority. Within the chemical fertilizer sector, the growth rate of nitrogenous fertilizer should be decreased, but the construction of phosphorus and potassium fertilizer plants will be increased in order to approach a reasonable ratio among the three nutrients. The petro-chemical industry and the supporting accessories should have a higher growth rate in order to provide the basis for synthetic materials and various organic chemicals. Fine chemicals and other down-stream chemical products will be

favoured sectors. Both import and export of chemical products and raw materials tend towards in large quantities; so that the chemical production and construction must be closely linked with foreign trade.

The visualization of the scales of main chemicals in 2000 is possible as follows:-

TABLE - 16[1/]

China's Projected Plan Chemical Estimates:

Chemical Products.	Quantity Million Tons.	Output* Billion Yuan.	Output ratio 2000/1980.
Sulphuric Acid.	18	2.2	2.7
Soda Ash	6.5	1.3	4.0
Caustic Soda.	4.5	1.8	2.3
Syn. Ammonia.	23.3		
Fertilizers.	23.1	21.2	2.1
N_2	15.6	14.0	1.7
P_2O_5	7.5	6.8	4.4
K_2O	0.6	0.4	30.0
Pesticide.	0.55	4.8	2.6
Ethylene.	3.0		
Syn. Materials.			
Plastics.	4.5	9.3	4.3
Fiber Monomer.	1.5	2.1	8.1
Rubber.	1.0	3.9	7.4
Fine Chemicals.	Large and not completely identified.		
Rubber consumption.	1.3	33.0	4.0

Except the output value of 1981 was slightly lower than 1980, but that of 1982 and 1983 increased at the rates of 9.1 per cent and 11.3 per cent than the preceding year respectively.

1/ The Strategy to develop the Chinese Chemical Industry, Paper presented at the International Chemical Congress of Pacific Basin Societies by MR Zhang Linhan, Dy. Chief Engineer of the Min. of Chemical Industry of Peoples' Republic of China.

*Based on 1980 prices.

In order to reach a 4.5 fold of the output value - compared with 1980 base figure - in 2000, the average growth rate should not be lower than 7.8 per cent. As a result of the great improvement in the rural economy, a great upsurge of "peasants investing in industry" appears all over China. Many kinds of foreign capital may be invested in joint ventures, cooperating production, etc. including direct investment; loans between governments, funding through financial markets, and exports credit of OECD, the reasonable use of capital from various channels is quite important. Much of the present equipment is obsolete and technology is out-of-date.

For the new and large scale plant and units it is necessary to undertake renovation. Technology must be kept in pace with the new era. There are a lot of small enterprises which are far from economical and gradually eliminate the out-of-date production units and switch to downstream processing or service type enterprises. All enterprises ought to develop downstream processing if technically possible and economically reasonable. Backward integration is also deemed desirable. It is important to strengthen research on new technology and new products in order to open up our own technical regions. Imports of chemicals mainly are manufactured goods while exports are mainly raw materials and primary manufactures. The structure of import may be changed gradually also. Untill the end of this century, the momentum of technical import will not be down, but the percentage of software shall be raised year by year. Technical import undoubtedly shall improve the level both of chemicals and technics export. The need for establishing the management information system of chemical industry as soon as possible and establishing multi-layer and multi-region consulting-service organs is clearly perceived.

China's agricultural production has increased very significantly in the last couple of years to touch almost 400 million tons. China had been a net importer of food-grains till the early 'eighties and is now emerging as a large exporter of food to Japan, Vietnam and other South-East Asian countries. In the wake of the modernisation and the incentives now open to the farmers to raise their farm production and sell the surplus in the open market after meeting the State targets there has been a sea-change in their attitudes towards increasing productivity. This phenomenal spurt in production is generating a colossal demand for the farm inputs - particularly fertilizers and pesticides and the recent pattern is expected to gain momentum in future years.

The Chinese fertilizer industry now ranks third in the global context and over the next 15 years the plants are slated for vast technological changes. The emphasis is shifting from the myraid of small plants to large sophisticated modern plants to ensure optimal efficiency.

China is engaged in large import of sophisticated chemical technology from the United States, Japan and Western Europe. A very large number of collaboration and buy back arrangements are being entered into with Japan and through Hongkong.

REPUBLIC OF KOREA - BASIC CHEMICALS:

The basic chemicals industry in Korea remained at an embryonic stage until the second half of the 1960s and domestic demand had been confined to the chemical fertilizer and textile industry sectors.

In the latter half of the 1960s various chemical plants, initially projected under the first Five Year Economic Development Plan (1962-66), came into operation. Considerable progress in product diversification as well as in production capacity has been experienced. Large scale production facility expansion

was undertaken in the sulphuric acid, ammonia, and caustic soda sectors. These expansions were chiefly attributable to the development of the chemical fertiliser and synthetic resins industries and other finished chemical industries using basic chemicals as their raw materials.

The completion of the Ulsan Petro-chemical complex in 1972 initiated organic basic chemical production covering the majority of the petro-chemical derivatives. Structural changes in the basic chemical industry were under way with more emphasis being placed on organic products away from the previous importance of inorganic products. Substantial production capacity expansion was also experienced in the inorganic chemical sector. The Government's rationalisation measures to ease the excessive supply problem in the chemical fertilizer industry resulted in the shut-down of Korean Synthetic Chemicals' ammonia plant. The major concerns of the industry are currently centered on potential demand in the intermediate and finished chemical product sectors and on the stable procurement of raw materials.

At the end of 1983 annual sulphuric acid production capacity reached 1,793,000 tons from the 11 manufacturers in the industry.

The only soda ash plant in Korea expanded production capacity several times to reach an annual capacity of 245,000 tons by the end of 1983. The solvay process is used. In 1983, however, the operating level reached 94.1 per cent in response to business recovery. The annual production capacity for chloric acid expanded accordingly to reach 280,800 tons at the end of 1983.

As of the end of 1983 annual ammonia production capacity had fallen to 387,000 tons from Korea's four ammonia plants. Domestically produced ammonia cannot compete with overseas products since naptha is used as a raw material in domestic production, whereas natural gas, a much cheaper raw material

is used in oil-producing countries. Furthermore, the industry is still faced with excessive production facilities.

Production expansion of NITRIC ACID has sharply reduced import dependence from 100 percent in 1974 to a record low of 5.6 percent in 1983.

Production of SULPHURIC ACID has grown to reach a record high of 1,701,661 tonnes in 1980. Production fell in 1981-82 due to the recession but recovered again in 1983 with production amounting to 1,610,089 tons. In 1980 a total of 9,766 tons were imported as the Onsan Copper Refinery temporarily suspended its operations. There were continued imports by the Hanhae chemical Co. in the 1982-83 period as the company, endeavouring to reduce operating costs, reduced its operating rate and made up for the supply shortage with cheaper sulphuric acid imported from Japan.

Domestic demand for soda ash has shown a steady increase with annual growth rate of 16.4 per cent by 1981, amounting to 247,341 tons in 1982. Demand rose again in 1983 to 234,075 tons showing a 17.8 per cent increase over the previous year. The glass products industry is the largest soda ash consumer account-ing for 53.3 per cent of total consumption in 1983.

Soda ash exports began in 1972 and have accounted for about 2 per cent of total demand until 1975 when production facilities were expanded. Export volume increased between 1975-77 mainly to South-East Asian markets. In 1982 as the price of imported soda ash declined sharply in the wake of world-wide recession, domestic consumers preferred imported soda ash and thus imports recorded a total of 12,973 tons. In 1983, imports decreased with a 98.5 per cent self-sufficiency ratio. The import dependence ratio fell from 70.9 per cent in 1979 to 3.5 per cent in 1983. Since 1980 only small quantities of caustic soda have been imported.

As of the end of 1983, production capacity reached 280,800 tons substantially exceeding total demand.

Since 1979 domestic demand of AMMONIA has declined from record high volume of 1,166,552 tons in 1979 to 840,969 tons in 1983. Imports of ammonia began in 1982 mainly to secure low-cost raw materials for themanufacture of fertilizers to be exported. Imported ammonia reached 323,430 tons in 1983, 38.5 per cent of total demand.

At present, the domestic production capacity of Nitric Acid can completely meet domestic demand.

As of 1983, smelting gases accounted for 27.7 per cent of the sulphuric acid raw material and imported sulphur 72.3 per cent. The soda industry depends entirely upon imported salt.

The basic chemicals industry has experienced extensive modernization in its production facilities since the latter half of the 1960s. At the turn of the 1970s a large portion of major products were produced domestically. The two consecutive oil shocks, however, substantially deteriorated the industry's competitiveness and the growth rate declined in the 1980s.

The basic chemicals industry is expected to develop at a steady pace, especially in the organic basic chemicals sector with substantial demand potential reflected in the development trends of the related industries such as fine chemicals, synthetic resins, and chemical textiles. However, the prospects for the inorganic basic chemical industry are not bright since the chemical fertilizer industry, the largest customer of inorganic chemicals, suffers from excessive production facilities and its basic chemical demand is not expected to increase for some time in the medium term.

FINE CHEMICALS:

The fine chemical industry is strategically appropriate for the Republic of Korea which has scarce natural resources but an abundant and highly skilled workforce. With recent

innovations in the exploitation of domestic raw materials and product diversification the industry is expected to grow and become internationally competitive in the near future.

In 1983, 315 firms were engaged in the pharmaceutical industry, by far the largest sector of the fine chemicals industry. Thirty firms accounted for 72 per cent of total production worth 10 billion won, while 208 firms producing goods worth less than 1 billion won were responsible for only 4 per cent of total production. In 1977 the Government promulgated the Korea Good Manufacturing Practice to improve product quality and to enhance international competitiveness through reinforcement of the manufacturing process.

There are 23 pesticide manufacturers in Korea, of which 11 firms produce technical materials for final product preparations. The domestic production capacity amounts to 260,000 tons.

In 1982 fine chemicals accounted for 3.5 per cent of total manufacturing industry production, 4.7 per cent of the manufacturing industry value added and 2.4 per cent of all manufacturing workers. Fine Chemicals accounted for 36.3 per cent of total chemical industry production, 29.8 per cent of total value added and 53.4 per cent of the industry's work force.

The pharmaceuticals industry is one of the leading sectors of the industry. It accounts for 41.9 per cent of total fine chemical production and 55.6 per cent of the industry's value-added. In 1983, pharmaceutical production including cosmetics totalled 1,549,526 million won, 18.7 times that of 1973. Of this pharmaceutical production amounted to 1,249,392 million won. The pharmaceutical industry has experienced rapid growth well above other sectors in the fine chemicals industry and has not been affected by business circumstances.

The introduction of the health care system in 1977 has greatly promoted the use of western medicines and this has expanded the nations health care systems which have become more sophisticated. Pharmaceutical exports amounted to US $ 61 million in 1983 of which medicinal raw materials and herb medicines accounted for 63.8 per cent and 17.4 per cent respectively. While exports showed a sharp annual average growth rate of more than 30 per cent in the 1970s the growth rate slowed down in the 1980s owing to reduced herb medicine exports which had previously accounted for a high proportion of total exports. In 1983 pharmaceutical imports totalled US $ 175 million, 5.4 times that of 1973. Major import items have been medicinal raw materials owing to the poor development of synthesizing technology.

In 1983 domestic manufacturers produced 15,361 content tons of pesticides valued at 153,291 million won. The value of pesticide production has recorded a more rapid growth than actual production itself given the increasing high value added ratio of the product. Of the total pesticide production, insecticide production reached 6,281 tons 40.9 per cent of total production, herbicides 3,936 tons and fungicides 3,690 tons, 25.6 per cent and 24.0 per cent respectively of total pesticide production. Domestic production of finished products almost meets demand and imports have mostly been confined to intermediate materials. In 1983 pesticide exports recorded a 26 times increase over 1973, reaching U.S. $ 11.3 million. Pesticide imports slackened from 1976 and totalled U.S $ 94 million in 1983.

Since the early 1970s and the Government's promotion of the heavy and chemical industry, remarkable progress in the large scale chemical industry has been made providing raw materials for fine chemicals. Inspite of the adequate availability of raw materials systematic linkage of these raw materials to final product output has been impeded due to the lack of technology and production facilities for synthesizing intermediate materials. Since the latter half of the 1970s

efforts to enbance synthesizing technology have been made by national research institutes and private enterprises. Under the Fifth Five Year Plan (1982-86) the Government has been promoting R&D development projects for the fine chemicals industry in line with technology industry development policies. The domestic market for fine chemicals is expected to expand in line with continuous national income increases and the consequent improvement in living standards. Export growth will also be accelerated as a result of technology enhancement and ensuing price competitiveness.

Sri Lanka:

The production of urea in the country began with the commissioning of the first urea plant in November, 1980. The urea factory is managed by a public sector enterprise. The State Fertilizer Manufacturing Corporation (SMFC) which had been plagued by insufficient working capital throughout 1981; this problem has been solved as the Government has provided the necessary working capital at the beginning of 1982.

The State Mining and Mineral Development Corporation (SMMDC), another public sector enterprise is responsible for the production of the Eppawela rock phosphate. In 1981, total production of this Fertilizer reached 14,076 tonnes.

The main reason for the decline in the issue of fertilizers in 1981 was due to an increase in the price of fertilizers, adversely affecting its demand. The table below gives the fertiliser consumption and phosphate production.

TABLE - 17 1/

Sri Lanka's Fertilizer consumption and Phosphate Production:

Fertilizer Consumption.	Phosphate Production.
Consumption in '79 - 137,600 M.Tons.	1981 - 14,076 tons.
Consumption in '80 - 169,000 M.Tons.	

1/ F.A.O.

Drastic reduction in fertilizer prices in September, 1979 brought favourable response from the users of fertilizers. As a result, consumption of fertilizers increased to a total of 169,000 nutrient tons in 1980 against 137,600 in 1979 registering a sizeable increase.

In the field of drugs and pharmaceuticals and pesticides the units are mainly engaged in formulations and packaging. Production of basic organic and inorganic chemicals has made a modest start.

Thailand:

Starting with simple chemical production in the 'sixties, embracing paints, varnishes and lacquers, soaps, inks, pharmaceuticals, plastic processing with simple equipment and relatively low skill requirements, the present stage reached includes the production of a wider range of chemicals and products, man-made fibres, detergents, industrial caustic soda, chlorine, hydro-chloric and sulphuric acids, plastic and synthetic resins, compound fertilizers, certain textile auxiliaries and paper. Chemical intermediates are still largely being imported in Thailand.

Imports of chemical products amounted to B8,857 million baht in 1982 (22.99 baht = 1 dollar) prior to recent devaluation in 1984. Natural gas from the Erawan gas fields will result in a vigorous development of the chemical sector. Proposed petro-chemical and fertilizer complexes in the eastern sea board area will create an integrated and diversified industrial base in inorganic and organic chemicals; and with full capacity utilisation the imports willbe very greatly reduced.

Inorganic chemical industry embracing inorganic acids, alkalis, inorganic oxides and salts, industrial gases and chemical fertilizers, production of sulphuric, nitric and phosphoric acids - an integral part of the fertilizer sector

have developed. Domestic production has been thus far of phosphoric and nitric acids. Sulphuric acid is used in production of aluminium sulphate, acid storage batteries, textile dyeing and printing, steel and metals. Capacity is estimated at 285 metric tons daily or 94,000 tons yearly. In 1981, 39,520 M.T. was produced; in 1980 production was 54,202 M. Tons very largely from imported sulphur.

Hydro-chloric acid is used in [illegible] steel, chemical, pharmaceutical and food processing. Production in 1981 was 84,737 M.T; caustic soda is manufactured by electro-lysis of common salt solutions. Production capacity in 1981 was 360 tons daily and production in 1981 was 67,654 M.Tons.

There is no production of Soda Ash yet and consumption was 58,078 M.T. in 1982.

Ammonium Sulphate:

In 1981 production was 40,916 tons sodium silicate, production in 1981 was 20,158 M.T. and daily capacity is 168 M.T; small quantity of oxides are produced and industrial gases are produced from air by liquefaction, liquid oxygen, liquid nitrogen and liquid argon. Part of the chlorine produced is transformed to hydro-chloric acid, in the proposed gas based petro-chemical complex; large quantities of chloride monomer (VCM), Carbondioxide will be produced as a by-product about 877,000 tons yearly. Acetylene production was 372.4 tons in 1981. Considerable quantities of certain inorganic chemicals are imported as domestic units have not operated at fully rated installed capacities. 6,052 tons of sulphuric acid were imported; besides 27,300 tons of hydrochloric acid, 11,150 tons of solid caustic soda and 1,380 tons of caustic soda in solution, 581 tons of zinc oxide and 175 tons of sodium silicate in 1982.

A soda ash project with a capacity of 400,000 M.T. has been proposed to meet domestic demand needs of [illegible] region.

Fertilizer Sector:

Agricultural growth from 1960 to 1981 averaged 5 per cent with 10 Kg of nutrients usage. Nitrogen phosphorous and potassium fertilizers are in use and nearly all are being imported either as finished products or intermediates. A state enterprise has been producing limited quantities of ammonia sulphate, urea liquid ammonia in Lampang Piorina, but it shut down in 1979. The imports of nitrogenous phosphates and potash fertilizers between 1979 and 1982 were 157,000 of nitrogenous fertilizers in 1979-80, 132.5 thousand (potassium) phosphorous and 32,000 tons of potassium sulphuric acid, 321,500 tons. In 1980-81 total imports were 317,000 tons and in 1981-82 were 324 thousand tons. In 1981, total fertilizer imports were 874,545 tons and in 1982 it was 909,000 M.T. at a cost of 3619.4 million baht in 1981. A joint sector fertilizer plant is mooted at Rayong. The estimated direct investment cost of the complex is $ 563 million dollars - based on the gas separation plant slated for 1985. Potash will be imported and construction of the complex is to start in 1985.

Fertilizer use is among the lowest in the region since mid-1970s. Nitrogen fertilizer consumption in 1979-80 was 46,000 tons in 1970; 90,000 tons in 1975; 136,000 tons in 1976; 181,000 tons in 1977; 164,000 tons in 1978; 185,000 tons in 1979 and 180,000 tons in 1980. Half of nitrogen is used in paddy and sugarcane is also a large user - about 20 per cent; rubber 3 per cent and others 21 per cent. The table below gives the projected fertiliser N consumption over two decades:

TABLE - 18 1/

Projected fertilizer N consumption, Thailand 1980-2000:

	1979-80	1984-85	1989-90	1994-95	2000
Total N.	180	260	380	500	600
of which Urea.	20	50	220	320	420

1/ F.A.O.

Urea use has thus far been artificially low. Major current N source is ammonia sulphate. Metro group is the largest fertilizer importer. Association of Traders (Thai Fertilizers Importers and Traders Association) - Public Sector is represented by Marketing body for farmers. There is a small government-owned nitrogen complex at Mae Moh Off-shore gas based plant which is expected to come up in 1980s. The complex may come up in mid-1980s. Natural Gas reserves are adequate. Industrial nitrogen is expected to grow modestly. A major soda ash facility is expected in late 1980s, with 58,000 million tons per year N being supplied by the new ammonia plant. Agronomically the ammonia chloride could be used. All the ammonia chloride produced in Soda Ash plant can be fully used within the Thai Fertilizer market provided that a soda ash process is selected which limits the ammonia chloride output to 200,000 million tons annually. Start up of a major ammonium/urea complex in mid-1980s and during 1990s of a second complex is anticipated. The table below gives the ammonia and nitrogen supply, demand & trade projections.

TABLE - 19[1/]

Thailand's Ammonia and Nitrogen Supply, Demand and Trade - 1979-2000:

	1978-79	1979-80	1984-85	1989-90	1994-95	2000
Consumption Fertilizer N.	183	188	270	393	517	620
UN Production.	4	0	0	243	486	486
Ammonia for Fertilizer.	4	0	0	247	500	500
Ammonium Chloride recycles from Soda Ash.	0	0	0	58	58	58

1/F.A.O.

Table below gives the consumption of fertiliser nutrients in ESCAP countries.

TABLE - 20 1/

Table of consumption of Fertilizer Nutrients per hectare 1980-81 in 1000 grams in ESCAP Countries

Bangladesh	29.8	N	N	13.3	P_2O_5	03.2	K_2 46.3
Burma.	6.7	N		3.0		0.3	10.0
India.	20.8			6.5		3.7	30.3
Indonesia.	44.4			14.2		4.5	63.0
Malaysia.	32.3			27.6		45.2	105.1
Nepal.	6.9			2.4		0.5	9.7
Philippines.	22.7			5.4		5.6	33.7
Republic of Korea.	203.6			88.8		83.3	375.7
Singapore.	225.0			62.5		262.5	55.0
Thailand.	8.6			12.9		21.4	16.3
Sri Lanka.	42.7			75.7		2.0	77.0
China.	122.1			27.7		5.9	155.3

In mid-70s, natural gas was discovered and estimates are of 20 million cu. ft. gas reserves; a pipeline was constructed and first gas began to flow in September, 1981 and second gas field is expected to go on stream in 1985. When all supplies come on stream by 1990 natural gas production is likely to reach 900 MMSCFD. It may eventually meet a fifth of the country's total energy needs. By 1986, Thailand will need to import less than half of the energy requirements and by 1987, largely refined products will be imported. Targeted natural gas utilisation will displace crude oil imports. The following table gives the estimated gas resources and production

TABLE - 21 2/

Thailand's Gas Reserves:

Estimated Natural Gas Reserves	:	20 billion cu. ft.
Anticipated natural gas production in 1990.	:	900 MMSCFD

Synthetic Fibres:

Rayon Polyester and nylon fabrics are produced based on the imports of caprolactum, PTA, DMT and E.G. Capacity utilisation between 1979 to 1981 was over 95 per cent but in 1982

1/ F.A.O.

2/ Papers presented at the International Energy Conference, New Delhi.

it fell to 78.46 per cent. Total imports of synthetic fibres were 15,530 tons in1980; 1956 M.T. in 1981 and 27956 tons in 1982. Thai man-made fibre imports dropped in 1982. 5345 tons of acrylic fibres were imported in 1982 showing a quadrupling of the demand from 1979.

Synthetic Detergents:

Synthetic detergents have made great inroads and production in 1974 was 40,900 tons; 50,639 tons in 1975; 54,966 tons in 1976; 59,251 tons in 1977; 61,160 tons in 1978; 73,210 tons in 1979; 84,618 tons in 1980; 82,726 tons in 1981; 84,284 tons in 1982 and about 94,000 tons in 1983 (estimated).

All detergent constituents are imported and local production is mainly in compounding. When the aromatic complex comes up the constituents may be domestically produced.

Pharmaceuticals:

There are 187 producers of pharmaceutical products and two are government owned - 21 are affiliates of MNC's and mainly engaged in formulations. Other firms are medium and small sized engaged in simple formulations and re-packing; only one firm producing active ingredients in Thailand which started in 1982 and is engaged mainly in producing antibiotics (4 tons yearly) capsules and injections. 90 per cent of raw materials are imported from MNC's. Consumption of drugs has increased from 3,037 million baht in 1971 to 19,327 million baht in 1982 at an average growth rate of 18.7 per cent. In the 'seventies local production increased by 23.6 per cent, from 150 million to 15,387 million baht. Local industry supplies 73 per cent of demand and sophisticated drugs are mainly imported. Capacity utilisation is 30 to 50 per cent. The Thai Government pharmaceutical Organisation is a major drug supplier and produces 400 pharmaceutical products; export of pharmaceuticals are 200 million baht. Domestic industry still lacks the transfer of manufacture technology

in this sector. The table below gives the drug consumption and production.

TABLE - 22 1/

Thailand's Drug Consumption and Production

Year	Drug Consumption. (million baht.	Drug Production. (million baht)
1971	3,037	150
1982	19,927	15,387

(Exchange rate: - US $ 1 = 22.9 baht.)

The countries of the ESCAP region proved much more resilient than most in coping with the difficulties brought about by the recession. Inspite of their perceptibly better economic performance, the developing ESCAP countries suffered a considerable slow-down in growth, especially in 1982. Although the FRG U.S. and Japanese economy in 1983-84 showed considerable signs of improvement, the immediate and medium-term prospects were yet not too reassuring.

First, regarding the strength and durability of the current resurgence of economic activity in developed countries and secondly whether such a recovery by itself would be able to land momentum to sustained development in developing countries, which had been held back since the onset of the current recession in developed countries. The world economy seemed to be moving into a new phase in which the structural characteristics of the developed and developing world had changed considerably and the old mechanisms of adjustment did not operate with the effectiveness and automaticity of the past. Although, there are some grounds for optimism regarding growth rates during 1985-86 especially in the United States, Japan and South-East Asian economies, world growth will remain low compared with those in the 1960s and early 1970s. OECD forecast is for moderate growth.

The World Bank Central Scenario[1/] assumes that GDP growth in industrial countries will average about 3.8 per cent upto 1980 and 3.5 per cent thereafter; given technical progress, per capita output is expected to grow at 2.8 per cent between 1985 and 1995, while the inflation rate is estimated at 6.4 per cent/year in the industrial countries for the period 1982-1995. In its low scenario the World Bank assumes a per-capita output growth of 1.8 per cent per annum in industrial countries. Recovery under this scenario is assumed to be slower. The developing countries are shown to perform poorly with an annual growth rate of 4.2 per cent over the decade. Developing countries will grow at a slow rate of about 3.7 per cent. South-East Asian economies and socialist countries of Asia might be expected to grow at a higher rate than this average. Both China and India have performed well in the recent years and the modernisation programmes in China and the liberalising trends of recent late in India offer ground for optimism in the near term.

ESCAP

By 2000, total nitrogen fertilizer demand for the ASEAN region is projected to increase from 1.1 million M.T. in 1978-79 to 3.6 million M.T. in 2000 at an average 6 per cent growth. The ASEAN region will increase domestic supply of nitrogen fertilizer derivatives from 0.86 million M.T. in 1979 to over 3.2 million metric tons N in 2000 - an average annual increase of 6.6 per cent. This assumes the addition of ASEAN projects at Bintulu and Aceh; Kaltim in Indonesia and another urea project in Indonesia in 1990 and two more by 2000; two major projects in Thailand in late 1980s and 1990s; and in this period the region will remain a net importer of fertilizer nitrogen.

With very few exceptions, the most important of which being China and India, developing ESCAP countries experienced a definite and significant slow-down in their growth rates in 1982. The incipient recovery in the United States, Japan, FRG

1/ World Bank Annual Reports, 1983 and 1984.

and other developed countries since early 1983 has begun to have sufficient effect on some developing ESCAP countries to arrest and reverse the unfavourable trends of 1981 and 1982. In some countries, such as Burma, Malaysia, and Singapore, high growth rates have been maintained by relying on more efficient use of domestic resources.

Burma and Iran have followed more inward-oriented policies than most other countries in the sub-region. The growth performance of India, Pakistan and Sri Lanka during 1983-84 is likely to be above average in South-East Asia and except for Sri Lanka, higher than in 1982. The growth rate of GDP in real terms declined everywhere in the sub-region, compared with 1981. They were the lowest in more than a decade for most of these economies. Most East and South-East Asian countries and areas - including Hongkong, Malaysia, the Republic of Korea, Singapore and Thailand - are likely to achieve improved economic performance and growth in 1983-84. Economic performance in Indonesia in 1983-84 has not been so heartening and Philippines has been passing through a difficult time.

The growth experience of the five centrally planned economies of the ESCAP region, Afghanistan, China, the Lao People's Democratic Republic, Mongolia and Vietnam has been somewhat different from that of the rest of the developing ESCAP countries. While growth has slowed down in some of them, notably in Afghanistan and the Lao People's Democratic Republic, the performance of the Chinese economy has been impressive during the past few years, both in the domestic and external fields, mainly because of a series of reform measures undertaken to improve the efficiency of the economy and to increase production, trade and per capita incomes, especially in rural areas. In 1982-83, the economy of China achieved one of the highest growth rates in the ESCAP region. The high rate of growth achieved in 1982-83 by China is in contrast both to the 3 per cent growth achieved in 1981 and to 4 per cent target set for 1982. Even in 1984 the buoyancy

was maintained in the Chinese economy with the foodgrain production touching 400 million tons and the exports reaching US $ 25 billion.

The Republic of Korea, Indonesia and Malaysia are likely to develop attractive domestic fuel-related uses. Philippines usages will grow slowly. Main chemical application of relevance is formeldehyde production particularly in countries where wood processing is well developed and a growing industry e.g. Indonesia, Thailand, Malaysia, Philippines. Some developing countries will also have a market as a Solvent and as a feedstock for acetic acid and DMT

Methanol:

Natural gas is expected to remain the dominant feedstock for methanol throughout the 'eighties, with many developing ESCAP countries endowed with large gas resources likely to have a competitive edge in methanol production. China, Pakistan, Thailand, Brunei, Philippines, Indonesia, Malaysia, India and Bangladesh have large natural gas reserves. One of the most important factors determining the feasibility of methanol production will be the economic value (opportunity) cost of the particular gas resource available or to bemade available for such production. The economic value of gas will be related to the value of fuel oil where it can readily substitute for current or future fuel oil use and will be between zero and U.S. $ 2.5 per MMB tu in situations where fuel oil substitution and similar uses are precluded and where only ammonia or LNG constitute alternative gas uses. The table 23 gives the Asian demand estimates for methanol.

TABLE - 23 1/

Asian Methanol Demand Estimates:

	Methanol (1980)	Demand Estimates (2000)
Thailand.	13,000 M.T.	40,000 M.T.
Malaysia.	14,000 M.T.	45,000 M.T.
Indonesia.	19,000 M.T. (1979)	370,000 M.T.
Philippines.	15,000 M.T. (1979)	38,000 M.T.
Singapore.	20,000 M.T.	40,000 M.T.
India.	110,000 M.T.	450,000 M.T.
Pakistan.	50,000 M.T.	220,000 M.T.
Republic of Korea.	100,000 M.T.	520,000 M.T.

IN ASEAN REGION:

Thailand:

Demand in 1980 was 13,000 M.Tons. Formaldehyde based adhesives for woodproducts accounts for 80 per cent of demand and balance in solvent uses. Demand is expected to rise to 40,000 M.T. in 2000 on forecast growth in forest products. Thailand does not have available refinery or chemical stream rich in isobutylenes. Methanol demand for MTBE would be 90 to 120,000 M.T. assuming a rise of 7 per cent annually in MTBE blend in gasoline. A 370,000 metric ton per year natural gas-based methanol plant is assumed in late 1980s with most production being exported.

Malaysia:

Demand has grown from 2 to 14,000 M.T. during 1970 to 1980. Forecast demand is keyed to Malaysian forest products industry and corresponding demand for formaldehyde resins is expected to rise to 20,000 tons in 1985; 26,000 tons

1/ Emerging Energy and Chemical Applications of Methanol: Opportunities for Developing countries, World Bank, April, 1982.

in 1990 and 45,000 by 2000 at an average annual growth rate of 5 to 5.4 per cent. Plywood production increased three-fold in 1970s.

Sarawak and Sabah have vast forest resources but developing slowly owning to infrastructure limitations. Presently demand is met by imports through Singapore. It is planned to build a 1200 tons per day methanol plant.

Indonesia:

The demand is expected to rise from 19,000 M.T. in 1979 to 50,000 M.T. in 1985; 93,000 M.T. in 1990 and 370,000 M.T. in 2000 at an average annual growth of 15 per cent in view of the rapidly growing forest products industry. The P.T. Pamol-to-Resin production capacity was 18,000 M.T. in 1979 and expected to rise to 27,000 M.T. and P.T. Aroki from 24,000 M.T to 33,000 M.T. There are no plans for major addition to gas turbines till 1990.

The present production of by-product methanol could continue at 10,000 M.T. per year and new fibre plants could later in 1980s add 1 to 3000 M.T. About half is trans-shipped in Singapore and exported to Japan.

Philippines:

The demand during 1979-2000 is expected to increase for formaldehyde from 15,000 tons in 1980 to 22,000 M.T. in 1985; 26,000 M.T. in 1990 and 38,000 M.T. in 2000 and solvent and mix will rise from 3 to 4000 in 1985; 5000 in 1990 and 8000 in 2000 at an average annual growth rate of 4.2 per cent. There is a 20,000 tons methanol plant based on partial oxidation of Naptha since 1973 but not operational. 8 to 10,000 tons of methanol is produced as a by-product from a polyest plant based on imported dimethyl terephthalate. Philippine will continue to be a net methanol importer in the forseeable future.

Singapore:

Total methanol demand was 20,000 tons in 1979 and will likely grow to 40,000 tons by 2000. Total ASEAN Methanol demand is likely to grow about 9 per cent from 87,000 tons in 1979 to 540,000 tons by 2000. Indonesia will be growing fastest in this sector because of its large forest resources. Major future sources are likely to be Thailand, Indonesia and Malaysia. Pertimiva has an ambitions plan for a 300,000 M.T. per year plant based on low cost gas on Bunyu Island.

India, Pakistan and the Republic of Korea:

Demand for methanol in India is estimated at 110,000 M.T. in 1980 and likely to grow to 150,000 tons in 1985 to 215,000 M.T. in 1990 and 415,000 M.T. in 2000. In Pakistan it was 50,000 M.T. in 1979 and 55,000 tons in 1980 and likely to rise to 75,000 tons in 1985; 100,000 tons in 1990 and 220,000 tons in 2000. In the Republic of Korea it was estimated at 88,000 M.T. in 1979 and 100,000 M.T. in 1980 and is likely to rise to 225,000 tons in 1985; 335,000 M.T. in 1990 and 520,000 M.T. in 2000.

The overall growth should be at seven per cent per year through 2000. The formaldehyde production in India is presently 94,000 M.Tons per year; in small and regional plants they require 42,000 M.T. of methanol. The production of methanol in high-level methanol/gasoline blends and in straight alcohol engines may be worth studying alongwith other alternatives in the large natural gas rich developing countries with a significant gasoline consumption and a car industry like in the Republic of Korea and India.

It is worth compering ethanol and methanol as potential fuels since both options may co-exist as in Thailand. In many developing countries demand for petroleum distillates is heavily slanted towards diesel and Kerosene with fuel oil particularly gasoline being in balanced or surplus supply.

Use of methanol may be desirable as a substitute for diesel and kerosene in gas-rich but oil poor countries like India, Bangladesh and Thailand. Main justification for methanol production in developing countries will have to rest on export potentials with the prospects for the development of local chemical and fuel uses playing a crucial role. There could be significant room for increased methanol trade and exports beyond 1985. The feasibility of setting up largely export-oriented projects in developing countries needs to be studied. India and Thailand should give considerable consideration to methanol/MTB tu production from natural gas for export, and explore long term export contracts. A research and study programme should also be set up for developing domestic chemical and fuel applications for methanol and as a house-hold fuel where firewoods deplation is a problem. There is need for preliminary gas-utilisation studies to evaluate the relative merits of gas use for power generation against that of methanol, ammonia and ammonia/urea and LNG production.

b) <u>How the sectoral strategy for the chemical industry is related to the national industrial strategy and what degree of priority it holds</u>:

The chemical industry has occupied a high degree of priority since the 60s and more particularly in the decade of 1970s and early 'eighties. In the mid-80s and 90s it is expected to play a very significant role in the overall national development plan priorities on a national, sub-regional and regional basis.

Many of the developing ESCAP countries seek to vigorously pursue the policy of import substitution and export promotion both with a view to reach a high degree of self-sufficiency in the various sub-sectors of the chemical industry as also to generate the necessary foreign exchange as the domestic market is often not large enough to reach economies of scale

and optimal demand-supply situation. The medium term projections of the demand of the major sub-sectors of the chemical industry and main products and groups of products together with long-term projectionsupto the end of the century are for steady growth though somewhat lower than the levels attained in the seventies.

The projected ammonia capacity and the market for drugs upto 2000 A.D. are reflected in the table below:

TABLE - 24 1/

Projected million tons capacity

Regional Distribution of Ammonia Capacity:

	1974-75	1979-80	1984-85
Developing Asia market economies.	6.4	11.5	17.5
Centrally planned economies of Asia (Principally China).	5.1	8.9	9.1

Estimated markets for Drugs - 1980-2000:

(Value - $ 000 million)

	1980	1990	2000
Asia.	17.10	38.46	74.95
India	3,515 in 2000 A.D.		
Iran.	2,660 in 2000 A.D.		
Indonesia.	2,435 in 2000 A.D.		
Philippines.	1,640 in 2000 A.D. 2/		

1/ National Fertilizer Development Centre, TVA, Jan. 1980.

2/ Opportunities for pharmaceuticals in the Developing World in next 20 years - Information Research Ltd., cited in SCRIP No.509; 28th July, 1980.

The ranges of capital costs at 1980 prices are US $ 300 to $ 400 million for an integrated ammona/urea complex, $ 169 to 363 million for phosphate rock, $ 218 - 291 million for phosphoric acid. Estimates for additional investment in the drugs and pharmaceutical sector in India are estimated at $ 7.5 billion by 2000 A.D.

The investment plans of many developing ESCAP countries are presently under finalisation. World trade in 1980-82 has not risen[1/] and trade projections for the next decade and a half would at best be entirely tentative. The industry being very highly capital intensive, the impact on employment generation would be modest.

The ESCAP region is rich in natural and human resources. The Asia-Pacific region is expected to maintain reasonably high sustained rate of industrial/economic growth in the mid-'eighties and 'nineties though the rates achieved in the 'seventies may not be equalled in the next 5 to 15 years. Basic industrial chemical production is expected to maintain a steady upward trend in the six ASEAN countries. The growth in the seven South ASIAN countries will be somewhat slower, and may be expected to recover later in Iran and expand in the Republic of Korea in the mid-'eighties and possibly 'nineties. The chemical industry being a catalytic segment has a significant bearing on the national industrial strategy of the various ESCAP countries. Its rate of growth has been around 50 per cent higher than the industry growth rate as a whole and ithas both backward and forward linkages with agriculture, industry and public health. In many of the developing ESCAP countries, the pressure of population growth has been quite significant in the 70s and early 'eighties and in the South-Asian region is likely to remain at fairly high levels even in the mid-'eighties and 'nineties.

1/ I.M.F. and G.A.T.T. World Trade rose by 2 per cent in 1983 and likely by 9 percent in 1984.

In the South-East Asian region the population growth may show a modest decline; By the end of this century the developing countries will have over 72 per cent of world's population and the ESCAP region accounts for more than half of the global population.[1] By 2000 A.D. the global population is expected to reach around 6 1/2 billion and this necessitates doubling of the agricultural produce in many of the most populous countries of the ESCAP region - China, India, Indonesia and Bangladesh, to meet the minimum nutritional standards. To feed this growing population a massive spurt in fertilizer and pesticides usage will become inescapable. The growth of fertilizer and pesticides industry is, therefore, of paramount concern to the developing ESCAP countries during the mid-eighties and 'nineties.

India, Jordan, the Republic of Korea, Nauru and Vietnam are major phosphate rock producers accounting for 3 per cent of global production. China accounts for 1.1 per cent of global potash production.

With the growing consciousness to improve public health the pharmaceutical industry will need to grow at a high rate in the mid-'eighties and 'nineties involving major investments in the production, formulations, packaging and distribution of not only the bulk drugs but also formulations besides extensive growth of research and development. In India, the Republic of Korea, Iran and Indonesia the pharmaceutical industry is estimated to grow around 7.5 per cent in the next 15 years.

A deficit of 1.39 to 1.93 million tons of nitrogen fertilisers is estimated, while that for centrally planned economies of Asia at 1 to 1.4 million tons nitrogen. Also a deficit of 1.5 million tons is estimated in phosphate fertilisers as also a deficit of 1.4 million tons in Potash.[2]

1/ Reports of U.N. Fund for Population, New York.

2/ Trans-national corps in the Fertiliser Industry, UNCTC, New York, 1982.

As the ESCAP region is well endowed with rich natural and human resources the agro-industrial development is likely to remain at high levels during mid-80s and '90s even though the rate of overall growth may be somewhat more modest than experienced from mid-'60s through the '70s. To cater to this agro-industrial spurt the organic and inorganic sector will also grow sigeably in the next 15 years. The Asia-Pacific region has been identified as one of the most promisting global region for industrial and agro-economic growth in the mid-'eighties and 'nineties. There are increasing signs of greater sub-regional and regional cooperation in the future, both in ASEAN and a very promising start has been made at the recent Male Conference of the SARC countries.

The developmental goals of the chemical sector in the Indian economy are to achieve a high degree of self-sufficiency during the Seventh Plan (1985-1990) in the fertilizer, pesticides, drugs and pharmaceuticals, industrial and basic chemicals sector and to generate exportable surpluses particularly for supplying the other developing countries in the ESCAP/African and West Asian Regions. The discovery of large deposits of natural gas in the Western region has provided the basis for the setting up of very large fertiliser plants based on natural gas and it is expected that during the mid-'80s complete self-sufficiency in the area of fertiliser production will have been achieved and possibly export surpluses may also begun to be generated. Similarly the outlook for self-sufficiency in pesticides has become quite promising. However, in the drugs and pharmaceuticals sector the progress in the last 5 years has been dis-appointingly small owing to lack of sigeable fresh investments resulting from the price control mechanism that has been instituted in recent years. The drug control policy is expected to be suitably revised and recent relaxation in industrial licensing are indicative of a more pragmatic policy.

In the basic and industrial chemical sector also the growth in the last 4 to 5 years has been very modest. 1979-80 was the peak year and only in 1983-84 the production has started picking up again and in 1984-85 it has shown signs of recovery.

Similarly, the development plans of China, Pakistan, Sri Lanka, Bangladesh, Thailand, Indonesia, Malaysia, Philippines and the Republic of Korea, have assigned a place of very high priority for the growth of the chemical industry in the mid-'eighties and 'nineties and more particularly in the fertilisers, pesticides, drugs and pharmaceuticals, basic industrial organic and inorganic sectors. In China the Chemical industry is expected to more than quadruple its output in next 15 years. A break-through in bio-chemical engineering is expected. The industry has also being developed and located in the vast interior as it had thus far been mainly concentrated in the coastal region. The construction of phosphorus and potassium fertilizer plants will be increased and fine chemicals and other down-stream chemical products will be favoured sectors. The chemical production and construction will be closely linked with foreign trade. In the Republic of Korea the accent will be on higher technology, bio-chemical engineering, fine chemicals and export oriented chemicals production and construction. The agro-industrial sector being heavily inter-linked with chemicals occupies a key place in the national industrial strategy of the sub-region and the region as a whole.

c) <u>The development goals of this sector by individual countries and what are the inter-governmental goals if any. Discuss trends observed with regard to demand and investment, integration, complementarity.</u>

The development goals of the indivual countries at sub-regional and regional levels aim at attaining a high degree of self-sufficiency in the areas of organic chemicals,

acetone, phenol, methanol, acetic acid, acetic-anhydride, melatica-anhydride, nitro-benzene, sorbitol, resoroinol, bete-naphtol, bon-acid and inorganic chemicals - caustic soda, soda ash, liquid chlorine, calcium-carbide, potassium chloride carbon black, red-phosphorous, acetylene black and titanium oxide, fertilizers, ammonia, nitrogen and potassium, pesticides, herbicides and weedicides, drugs and pharmaceuticals, dyestuffs, soaps and detergents, paints, man-made fibres and basic chemicals. The other basic objective of the developmental plans of individual countries is to achieve export capabilities and generate exportable surpluses to generate foreign exchange to meet their import requirements of plant and machinery and sophisticated chemical items from the developed countries.

In the ESCAP region - India, China and the Republic of Korea have developed a large chemical industrial base in the field of organic and inorganic chemicals, industrial and basic chemicals, petro-chemicals, fertilizers and pesticides, drugs and pharmaceuticals, soap and detergents, paints and man-made fibres.

The chemical base has been considerably deepened and diversified in India and China over the past two decades, and in the Republic of Korea since the launching of the second five year Plan. In Indonesia, Malaysia, Thailand, the Chemical industry occupies a central place in the development plans as also in the Pacific region.

The contribution of Asian Developing Market Economies is presently low in the world export of pharmeceuticals. Besides, due to its inability to keep pace with the rates of expansion, commensurate with the world exports, its contribution registered a marginal fall as per the

table below:

TABLE - 25 1/

Pharmaceutical Imports on Regional/Global basis:

Region-wise Imports	(percent on global basis)			
Regions.	1976	1977	1978	1979
Asian Developing Market Economies.	14.0	16.1	14.4	15.0

Developing Market Economies of Asia continue to import increasing quantities of medicines for meeting their consumption needs.

The trade deficit of Asian Developing Market Economies rose by 84 per cent during the above period.

Exports from India increased at an annual rate of 10.7 per cent per annum during 1973-74 to 1980-81 while world exports rose at a faster rate of over 18 per cent per annum.

The Republic of Korea also seems set to considerably reduce its dependence on imported crude by development and diversification of its coal and hydro-resources. Despite the deepest post-war recession in the 1980-82 period, the Korean chemical industry has been able to weather the storm and has been attempting to make necessary adjustments in 1983-84.

Indonesia with its large petroleum and gas base is well placed to develop its fertilizer and pesticides sector and four major fertilizer plants are being set up. Even though

1/ TNC's in the Pharmaceutical Industry of Developing Countries, UNCTC, New York, 1983.

Indonesia has had to cut down its crude production in keeping with the reduced OPEC schedules, the long-term industrial outlook remains reasonably satisfactory. During 1982-83 and 1983-84 the Indonesian economy has largely adjusted itself and its foreign exchange reserves have been slowly rising and a measure of confidence has been restored with the launching of Replita IV from 1st April, 1984. The industrial chemical sector may be expected to grow at a more moderate rate than experienced in the seventies over the next 5 to 15 years. The strategy is not merely to develop sufficient indigenous capacity, to meet the domestic requirements in the key areas of fertilisers/pesticides but also to develop export potential to cater to nearby markets in the Philippines and elsewhere. In the drugs and pharmaceutical sector the present stage of concentrating on formulations/packaging will gradually be moved to the manufacture of fine chemicals and further downstream processing.

For Group I and II basic chemical industry i.e. to process renewable and non-renewable natural resources, the development policy is based on conservation principles, the rationalisation of utilisation and priorities for the fulfilment of domestic needs, whereas the surplus for export is limited.

In the operation period many Indonesian workers have been able to learn to control the operation of several basic chemical industries having sophisticated equipment.

Agro-chemical industry which comprises fertiliser industry and pesticides increased in volume/production quantity by as many as 26 per cent in Replita III which ended on 31.3.1984.

Organic chemical industry which comprises several downstream petro-chemical industries such as resin, synthetic fibre, urea formaldehyde, explosive materials etc. increased in volume/production quantity by 43 per cent.

Inorganic chemical industry, which includes among others, cement, glass, caustic soda, soda ash and industrial gases. Its volume and production quantity increased by 24 per cent.

Agro-Chemical Industry

Urea fertiliser industry:

The installed National capacity at the moment amounts to 2,190,000 tons in 1984-85 and will be improved to 4,470,000 tons in 1989.

Phosphates:

TSP/DAPONPK fertiliser industry:

The installed National capacity at the moment amounts to 460,000 tons/year and will be improved in 1984-85 to 1,000,000 tons/yearly

Fertilizer Industry (Ammonium sulphate):

The installed National capacity at the moment amounts to 150,000 tons/year and will be improved in 1984-85 to be 400,000 tons/yearly

The following by-products will be produced:-

(i) Ammonia amounting to 360,000 tons/year, a part of which will be utilised for the development of ammonia as raw material, Caprolactum, soda ash etc. and the remaining will be exported.

(ii) Gypsum amounting to 440,000 tons/year which will be utilised as retarder for the entire cement industry.

(iii) Aluminiur flouride amounting to 11.000 tons/year which will be utilised as flux for melting aluminium at Asahan Project.

Pesticide Industry:

The development of the production/capacity of pesticides industry is not a problem, because the installed national capacity at the moment is + 50,000 tons/year whereas the need just reached + 25,000 tons/year. The real problem, however, pertains to the import of ingredients as the production is mainly formulation based.

Inorganic Chemical Industry:

Also the development of other inorganic chemical sector such as :-

- caustic soda
- soda ash
- sulphur acid
- Chloride acid
- phosphate acid
- glass sheet
- industrial gas
- gypsum etc.

is in hand for Replita IV.

The first fertiliser factor, "PUSRI" I, was built in Palembang, South Sumatra in 1963 and has, thereafter, been expanded with new factories, namely PUSRI-II in 1974; PUSRI-III in 1976 and PUSRI-IV in 1978. Other new factories besides the PUSRI plants have been set up, such as those of PT. Petro Kimia Gresik (ZA) in Surabaya, East Java in 1972, PT. Pupuk Kujang in Cikampet, West Java in 1978, PT. Petro Kimia Gresik (TSP-II).

There are other four new urea fertiliser factories, the construction of which is in the final stages. These are the urea fertiliser factories of PT. ASEAN, Aceh Fertiliser (PT AAF), the fertiliser plant of PT. Iskandar Muda in Lhok Seumewe, Aceh, and the two plants of PT. Pupik East Kalimantan I and II in Bontang, East Kalimantan.

Indonesia is still importing fertilisers at present, specially those types that are not yet produced domestically. When all fertilizer plants have come into production, in 1985-86, Indonesia will have no need to import urea fertiliser

any longer, but will even be able to export it, particularly to the closest neighbouring countries.

The fertiliser produced in Indonesia today is Urea, TSP/DSP and ammonia sulphate whilst such other types as Muriate of Potash (MoP), Keisorite and Rock Phosphate, are not produced. At the end of 1982, the production capacity for these three types of fertilisers was 2,190,000 tons of urea a year, 400,000 tons of TSP a year and 150,000 tons of ammonium sulphate.

The growth of Indonesia's production of fertiliser from 1978 to the end of 1982, by type, has been: urea 9.87 per cent a year, rising from 1,437,000 tons in 1978 to 2,060,000 in 1982; for aluminium sulphate fertiliser in the same period the increase has averaged 11.64 per cent a year, rising from 129,000 tons in 1978 to 196,000 tons in 1982; for TSP and DSP fertilisers which went into production only in 1979, there has been an average increase of 56.40 per cent a year with a rise from 117,000 tons in 1979 to 540,000 tons in 1982.

Production realised has reached 94 per cent of urea capacity, 135 per cent of TSP/DSP capacity and 130 per cent of ammonia sulphate production capacity.

The plant producing TSP now has an added production capacity of 500,000 tons a year, which was officially inaugurated on 30th July, 1983. Expansion of the ammonia sulphate plant for an added capacity of 250,000 tons is expected to be finished by the end of 1983.

The level of use of fertiliser in Indonesia currently is still relatively low, it reached an average of only 125 Kilograms per hectare.

The largest use of chemical fertilisers in Indonesia presently is in the agricultural sector of food crops, and for horticultural and estate crops.

Since 1977, Indonesia has been exporting fertilisers, particularly of the urea type, to such neighbouring countries of destination as the Philippines, Thailand, Malaysia, India, Pakistan, Sri Lanka, New-Zealand and Australia.

In 1977, the volume of surplus of urea fertiliser from Indonesia reached 400,196 tons, after which imports fell constantly to reach 45,032 tons in 1982. In the next one or two years, four new fertiliser factories will come into production, the volume of Indonesia's surplus of fertilizer is likely to be increased again as from 1985.

As from 1985, Indonesia will be able to have a surplus of 557,000 tons of urea, increased to 1,158,000 tons in 1986 and to 1,148,000 tons in 1987, for the TSP/DAP/NPK types of fertilisers.

Indonesia has sufficient supplies of the raw materials for fertiliser (liquified natural gas).

Indonesia is importing relatively large quantities, mainly of non-urea fertilisers. In 1978-1980 the import volume of urea was relatively small, reaching only 10,000 tons. But it rose in 1981 to 302,084 tons, falling again in 1982 to 120,801 tons.

The level of increase in the consumption of fertilizer by Indonesia in the last 10 years has reached 20 times the amount.

The greater part of these imports of non-urea fertilizers came from the United States of America, Japan, Britain and Morocco.

The highest value of imported fertiliser occurred in 1981, when it reached US $ 264.1 million or 1.99 per cent of the total value of Indonesia's imports that year, which were worth US $ 13272.1 million. It is estimated that the value will also be quite large for 1982, in view of the fact

that in the first half year the value had already reached US $ 50,9 million which is 0.60 per cent of the value of Indonesia's total imports in this period, which are worth US $ 8339.2 million.

Malaysia has very large natural resources and with its oil and gas reserves is poised for a steady growth of its chemical sector in the medium-term (1985-90) and long-term (1999-2000). Natural gas reserves are estimated at 22,500 billion cu.ft. However, the small population (15 million) of Malaysia somewhat limits the size of its production capabilities which would necessarily have to be focussed on meeting the gaps in the ASEAN and ESCAP region. The Malaysian authorities have launched a comprehensive health programme and the development plan prescribes the expansion of the public sector as the main source of supply to public health institutions. Research and testing facilities are also being established. The Malaysian economy has just completed a mid-term review of its current five-year development plans. The chemical industry occupies a critical role in the growth and development of the Malaysian economy.

Malaysia is aiming at achieving higher self-sufficiency in the manufacture of drugs and pharmaceuticals and down-stream processing with the completion of the refineries. It is also seeking to establish the fertilizer capabilities.

Thailand has identified large natural gas fields in Erawan and the development goal seeks to considerably augment its fertiliser production capability both in the medium and long-term as it has so far been very largely dependent on imports. The Thai Ministry of Public Health adopted a National Drug Policy as part of its fifth five year Development Plan beginning October, 1981. Most purchases are from the state owned GPO factory. The main objective of the new policy is to make available to the whole populace the most effective and safe pharmaceutical products at

reasonable cost. Organic and inorganic sectors are being developed in the private sector. Besides the projected goal of self-sufficiency through gas-based fertiliser plants, Thailand is developing its methanol potential and will develop the pesticides sector later.

Burma with its oil fields and new gas finds expects to achieve modest development production goals in the chemical sector. With the introduction of high yielding varieties of rice, Burma is engaged in augmenting its fertiliser and pesticides production development goals and is building up the necessary capacities of recent late. Even though the economy of Burma had remained largely inward looking, it has in recent years begun to gradually open up and the development of the fertilizer industry occupies an important place in the country's development plans.

Singapore has developed into a major refining centre with the third largest capacity and has been branching out into various chemical industries mostly catering to the export markets as the domestic market is very limited excepting for methanol. Singapore's stress has been on entrepot trade, fine chemicals and downstream processing.

Hongkong is developing into a large centre for chemical and pharmaceutical industries more particularly man-made fibres, basic chemicals, soaps and detergents. Hongkong also is largely catering to export markets. With the recent agreement for the transfer of Hongkong to China in 1997 and the two systems the chemical industry is poised for expansion and development to cater to the technology needs of China in its modernisation programme.

The Philippines is engaged in building up a larger fertiliser/pesticide complex. The Philippines chemical industry has been passing through a difficult phase owing to global recession and the current political situation.

The long-term outlook remains for a modest growth and will continue to be largely alcohol based.

The Governmente created the Fertiliser Industry Authority in 1973. This was later expanded to the present Fertilizer and Pesticides Authority (FPA) in 1978.

Fertiliser supply in the Philippines comes from two sources, namely local production and imports. Before the turn of the 70s domestic demand was readily met by local production from four fertiliser plants; from 1970-1975, local production experienced steady growth with an average rate of 4.79 per cent per annum and accounted for 46 per cent of the total supply. After 1978, local production volumes decreased and this down-trend was attributed to the higher cost of production with the escalation of costs of imported raw materials, labour and other variable costs.

While local production was on a down-trend during the later part of the '70s imports readily met the growing fertiliser demand, imports increased almost three-fold. Imports accounted for 86 per cent of the total supply in 1982.

The preceding decade (1972-1982) experienced a general uptrend in fertilizer consumption averaging 6.6 per cent per annum.

In May, 1975, however, fertilizer demand suffered a major set back with a 21.7 per cent drop largely attributed to the increase in domestic prices. Beginning 1976, fertilizer demand increased by an average of 7.53 per cent per year, reaching a peak of 848,000 M.T. in 1979. However, in 1980 and 1981, demand again suffered slight decrease of 3.42 per cent and 4.17 per cent respectively which were likely caused by price increase of 12 per cent and 10 per cent effected on August 24, 1980 and July, 1981, respectively.

The following table gives the fertiliser consumption in 1982.

TABLE - 26 1/

Fertiliser Consumption - 1982:

Urea	-	40 per cent.
Ammosul	-	13 per cent.
Complete fertiliser.	-	19 per cent.
DAP	-	2 per cent.
Potassic fertiliser.	-	75 per cent.

In 1982- Urea (40-0-0) accounted for 40.45 per cent of fertiliser consumption; Ammosul - 13.30 per cent, complete fertiliser - 19 per cent; 16-2-0 - 14.17 per cent DAP - 2.13 per cent and potassic fertilizer - 75 per cent. Aggregate demand increased by 7.7 per cent in 1982 over the previous year.

As an archipelago of 7,100 islands, the Philippines geography poses a critical problem in transporting fertiliser to various parts of the country.

The pesticide industry in the Philippines is entirely in the hands of the private sector. It is built around 20 companies under the trade organisation - Agricultural Pesticide Institute of the Philippines (APIP). APIP is responsible for 95 per cent of the industry sales. Almost all the major international producers are represented.

The pesticide supply depends heavily on imports of technical materials, and to a certain extent, on imports of finished products. For the past three years, there has been a shift in imports from finished products to technical materials In 1981, 47 per cent of total imports represented finished products while 53 per cent were technical materials. 50-60 per cent of the technical materials imported are used for insecticide formulations while all fungicides, except for

1/ F.A.O.

chlorothelonil, are imported as finished products.

The strategy is to achieve greater self-reliance in the fertiliser/pesticides sector and alcohol based basic chemical sector. As the economy has been passing through a very difficult phase for the past three/four years of the severe recession, drought and political developments, the development plans are in a state of flux. Over a longer term the strategy is also to develop the pharmaceutical base with rising population from the present stage of formulations/packaging.

Nepal, Bhutan and Maldives:

There are no significant chemical producing units in Nepal, Bhutan and the Maldives presently. The requirements are being met largely from imports. Nepal is planning to set up chemical plants in the future. In the first three years of the sixth five year plan of Nepal, the achievement of fertilizer consumption was 22,292 M.T. and 29,551 M.T. corresponding to 71 per cent, 64 and 69 per cent of the planned target. Kathmandu valley has the highest fertilizer consumption at 290 Kg/ha in gross whereas the hills have only 13 Kg/ha of the same. It is estimated that the requirement of fertilizer by the year 2000 would reach to around 240,000 M.T. in nutrients for the three major crops - paddy, maize and wheat. Nepal is planning to develop indigenous capacity in the fertiliser and basic chemicals sector.

In Pakistan the chemical industry is growing with the Sui Gas deposits and the oil deposits in Attock. Both organic and inorganic chemical units together with fertilizers, drugs and pharmaceuticals, soaps and detergents, basic chemicals have come up largely with foreign collaboration. Pakistan used nearly one million tonnes of fertilisers annually and the the development goals are to achieve increasing self-sufficiency in this and other related basic chemical sectors. In the period 1983-88, under the Sixth five year plan, the strategy is to move from self-sufficiency to one where exports can be

expanded on a competitive basis with a gradual curtailment of subsidies. In 1982-83 the national consumption reached 1,243,630 tons; 53 per cent were locally produced and almost all the phospherous and potash fertilisers were imported. Presently there is a surplus of urea. Fertilizer consumption is expected to increase from 1.24 million tons in 1982-83 to 1.83 million tons in 1987-88 representing an annual compound growth rate of 8 per cent and an average use of 87 Kg per hectare by 1987-88. The estimates of fertiliser imports are given in the table below:

TABLE - 27[1/]

Pakistan Estimated fertiliser imports (1000 tons)

Year / Nutrient	1984-85	1986-86	1986-87	1987-88
N	60	121	172	233
P_2O_5	253	297	331	386
K_2O	55	69	85	107
Total:	368	487	586	727

Bangladesh has discovered substantial gas reserves which are being gradually exploited and developed. The existing fertilizer units are expected to be expanded and diversified as per the development goals. A start has also been made in regard to the production of basic chemicals, medicines, soaps and detergents and pesticides. Bangladesh's population is expected to touch 130 million by 2000 A.D. and there is a paramount need for increasing food production through larger applications of fertilisers/pesticides. Also the demand for pharmaceuticals will continue to grow besides the industrial chemicals required for the jute, paper and pulp, textile and other industries.

Bangladesh Chemical Industries Corporation is a public sector corporation fully owned by the Government of Bangladesh

1/ Pakistan Economic Survey.

was established from 1st July, 1976. The data below reflects the product range and annual installed capacity:

BCIC Enterprises at a glance:

Name	Location	Product	Annual Installed Capacity.
Urea Fertiliser Factory Ltd.	Ghorasal, Dhaka.	Urea	340,000 Tons.
Natural Gas Fertilizer Factory Ltd.	Fenchuganj, Sylhet.	Urea Ammonium Sulphate.	106,000 Tons. 12,000 Tons
Triple Super Phosphate Complex.	North Patenga, Chittagong.	TSP	152,000 Tons.
Chittagong Chemical Complex.	Barabkund, Chittagong	DDT, Caustic Chlorine.	2,000 Tons (DDT)
		Hydrochloric Acid.	4,5000 "(Caustic
Kohinoor Chemical Company Limited.	Tejgaon, Dhacca.	Soap (Two shift)	14,000 Tons
Zia Fertilizer Company Ltd.	Ashuganj, Comilla.	Urea	500,000 Tons

Name of joint Venture	Equity hold by BCIC.	Name of joint Venture.	Equity hold by BCIC
Bangladesh Pharmaceutical Industries.	40 percent	Bulk Management (Bangladesh) Ltd.	30 per cent.
Squibb of Bangladesh Limited.	40 "	Dhacca Match Industries Co.Ltd.	30 "
Ciba Geigy (Bangladesh) Limited.	40 "	Tavin Bangladesh Limited.	20 "

BCIC is currently implementing to set up the potash urea Fertilizer Factory with an annual production capacity of 100,000 tons urea at Ghorasal involving an investment of TK. 174,720 million with Chinese assistance.

Bangladesh's fertilizer import averaged 229 thousand product tons in 1973-74 to 1977-78 and 466 thousand product tons during 1977-78 to 1982-83. It is expected to average 350 to 380 thousand tons annually over the next five years. Over the past decade and a half, fertilizer consumption grew on an average of 11 per cent annually compounded from 108 thousand nutrient metric tons in 1968-69 to 461 thousand tons in 1982-83. Bangladesh farmers apply 1/3rd of fertilizer nutrient applied per acre in Malaysia and China and half that of Sri Lanka and Indonesia and application is concentrated on the rice crop.

A List of major development projects now envisaged to be taken up in this perspective is given below with capacity and estimated investment:

(In million) U.S. $ 1 = 25 Taka) at constant prices.

Name of the Project	Product	Capacity	Total investment (Taka)
Soda Ash Plant.	Soda Ash	60,000 M.T.	1300.00
TSP Plant, Khulna	TSP	300,000 M.T.	1200.00
Antibiotics Project.	Penicillin Steptromycin Tetricyclin.	300 M.T.	1000.00
Sulphuric Acid/ Cement Methenol.	Methanol.	300,000 M.T.	2000.00
Karnaphuli Fertiliser Company.	Urea.	529,000 M.T.	10000.00
Ammonium Bi-Carbonate Project.	Ammonium Bi-Carbonate.	1,200 M.T.	07.00
Caustic Chlorine Project.	Caustic Chlorine.	3,000 M.T.	70.00
Ammonium Sulphate Project.	Ammonium Sulphate.	10,000 M.T.	500.00
Mini Fertiliser Plant.	Urea	100,000 M.T.	2000.00

1982-83 was the most successful year for Bangladesh Chemical Industries Corporation in terms of productivity,

profitability and over-all performance. The production was TK. 490,950 million as against TK 430,650 million of 1982-83 representing an increase of 14 per cent.

Highest ever production was achieved in Urea by UFIG, Ammonium Sulphate by ECFF.

There was a break-through in export especially in Urea. 72,000 tons of Urea was exported during the year.

Consumption of natural gas per ton of fertilizer was also reduced. The highest profit was, however, achieved from export of Urea which was exported at an average price of TK 2700/- per ton as against local sale price of TK 2600/- per ton (US $ 1 = 25 Taka).

Sri Lanka

In Sri Lanka the chemical industry is in a formative stage and with the completion of the ambitious Mahaveli project, Sri Lanka's food production will be considerably augmented necessitating larger usage of fertilisers and pesticides. The development goals of Sri Lanka's economy are also geared to attain self-sufficiency in fertilisers and pesticides manufacture as also for the establishment of organic and inorganic chemicals and medicinal plants.

The structure of Manufacturing value added at constant (1975) and current prices and of manufacturing employment in selected years (percentages is at Annexure 1/. As per Far East Survey Project values for a total of 107 plants in selected ESCAP countries is at Annexure 2/.

1/Asian Industry in figures - UNIDO - June, 1983.

2/Survey of Chemical Age - June, 1979. Project Values for a total of 107 plants in selected ESCAP countries.

ESCAP - POLICY ISSUES:

During the 'eighties the inter-governmental goals in the developing ESCAP countries have shown signs of greater cohesion and complementation. The six ASEAN countries have been coming closer with regard to the grouping's goals in the industrial and trade sector. Similarly, a promising beginning has been attempted in the Seventh South Asian Developing Countries (SARC) comprising India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and the Maldives. These groupings seek to extend increased complementarity in the industrial-cum-trade fields to achieve a higher degree of economic self-reliance in these sectors as also in the field of agriculture, science and technology. The trends observed with regard to demand and investment, integration, complementarity are hopeful of increasing economic and technical cooperation amongst the developing countries of the ESCAP region. A beginning has been made in regard to increased technical and economic cooperation among developing countries in this sector and programmes of cooperation are being evolved and formulated. These programmes could play an important part in future in achieving closer industrial and technological linkages between developing countries.

The economies of both China and India have shown signs of withstanding the global recession reasonably well.1/ The growth rate in China in recent years has been fairly high and Indian economy has also shown signs of resilience and lately of liberalisation. Both in regard to demand and investment, China and India have shown signs of a steady growth. The economies of Indonesia and Malaysia have shown signs of structural adjustment in the wake of the oil glut and the collapse of the commodity prices in the global recession and both demand and investment are showing signs of a pick up in these economies which are expected to perform reasonably well during the mid-1980s and likely through the 'nineties. In Thailand, both demand and investment have remained fairly high even in

1/World Bank Report, 1983.

the 'eighties and the Thai economy is expected to maintain its steady growth over the coming years. Both Singapore and Hongkong are maintaining steady growth rates even though on a somewhat more modest level than witnessed in the 'seventies. The Korean economy has shown a strong re-bound and has made the necessary structural adjustments. In Pakistan and Bangladesh demand and investment levels are expected to show a modest growth and the Sri Lankan economy may also be expected to recover its momentum once the communal situation settles down and stabilises.

Both India, the Republic of Korea and China having developed a deep and diversified base in the chemical sector can provide the necessary technical expertise to sister developing countries of the ESCAP region in setting up chemical plants. Their experience would also be more relevant to the needs of other developing economies of the region who could usefully profit from their successes and avoid failures. There is need for pooling of resources - both human and material to realise the sub-regional and regional goals of increasing self-reliance and greater trade exchanges. The areas of complementarity need to be more clearly researched and focussed and there is need for overcoming the attitudinal barriers through a regular interface and exchange of experts, academics, leaders of trade and industry to foster closer linkages on a regular basis. Research and development efforts could also be dovetailed asthe smaller island and land-locked countries of the region are not particularly well placed to undertake these tasks individually with their limited resources.

d) <u>Medium-term projection of demand on the major sub-sectors of the chemical industry by countries, region and main products and groups of products (upto 1990), long-term projection upto the year 2000 whenever possible.</u>

The medium term projection (1985-90) of demand of the major sub-sectors of the chemical industry - industrial and basic organic and inorganic chemicals, fertilizers, pesticides

drugs and pharmaceuticals are for a steady and sustained growth of around 5 to 6 per cent in India.[1] The organic and inorganic chemical projection is for lower growth of 5 per cent in the Seventh Plan (1985-90) while the fertilizer, pesticides, drugs and pharmaceutical sector will grow more rapidly at 6 to 7 per cent. In the Republic of Korea, Indonesia, Thailand, Malaysia, and Pakistan the demand projections for the medium term would be on a fairly modest scale of around 6 to 7 per cent per annum.[2] The Philippines economy is still to make necessary structural adjustments resulting from its $ 25 billion foreign debt and acute balance of payments position. The Bangladesh economy had been severely affected in 1983-84 by the drought and rising population. In Sri Lanka the events of 1983 and recent developments have perceptibly slowed down demand and investments which can only be expected to assume its normal growth after the situation has established. In China, the medium and long-term projection is of 7.8 per cent over next 15 years. The following Table gives the projections - medium term.

TABLE - 28

Indian Chemical Industry (estimated - 1985-90)

Organic and Inorganic	5 per cent per annum
Fertiliser/Pesticides.	6 per cent per annum
Drugs/Pharmaceuticals.	6 per cent per annum
Republic of Korea, Indonesia, Thailand, Malaysia, Pakistan, (all sectors).	6 to 7 per cent.
China (all sectors).	7.8 per cent per annum.
Philippines (all sectors).	3 to 4 per cent.
Bangladesh (all sectors).	4 per cent.
Sri Lanka (all sectors).	4 per cent.

Variables: Investment, Production, Output, Capacity utilisation, Imports, Exports, Ownership, Sizes of establishment.

1/ Seventh Five Year Plan projections based on the report of the Working Group of Chemicals 1985-86 to 1989-90 - Ministry of Chemicals and Fertilisers.

2/ Extract from Budget Statement prepared in the Indonesian Peoples Deliberative Assembly on 1st year of Replita IV constituting implementation of guidelines of state policy; and projections contained in the Far-East Survey of the Chemical Age - 18 June, 1979 and World Bank Reports.

In the ESCAP region as a whole the medium term projections of demand is estimated at around 6 to 7 per cent per annum for the various chemical sub-sectors. The South-East Asian sub-region is estimated to show a higher demand growth rate than the South-Asian regions while the Republic of Korea and China is estimated to show a steady upward rate of around 7½ per cent to 8 per cent.[1/] The modernisation programme under way in Chinese economy is estimated to keep the demand and investment levels in the medium term at a fairly steady rate of around 7.8 per cent; more especially in the context of Chinese recent efforts to upgrade its technological base with the infusion of Japanese and American know-how in the agro-industrial sector.[2/] The projections for Iran and Afghanistan and the centrally planned economies of Laos, Cambodia, Vietnam and Mongolia are somewhat more uncertain in the present fluid situation. But once the war situation settles down, the demand and investment projections in Iran will no doubt show a marked upturn.

The main sectors which are expected to maintain a very steady rate of growth in the medium term would be the fertilizers, pesticides, the drugs and pharmaceuticals followed by the industrial basic organic and inorganic chemicals. Many of the developing ESCAP countries being largely agrarian will of necessity have to raise enough food for the growing populations, drugs and medicines for health care and raw materials for industrial processing.

As the ESCAP region is richly endowed with natural and human resources, industrial demand may be expected in the medium term to be maintained at a steady though somewhat at more modest levels of growth than witnessed in the 1970s. The long term projections upto the end of the century for the

1/ World Bank Reports, 1984; F.A.O., U.N.O. and Far East Survey, Chemical Age, 8 June, 1979.

2/ Far East Survey of Chemical Age - 8th June, 1979.

developing ESCAP region are indeed quite promising. The Asia-Pacific region is estimated to be in the vanguard of growth prospects in the next 15 years. The chemical industry will naturally develop in a significant manner in the resource rich ESCAP region in the mid-'80s and '90s and more particularly with the possibilities of greater technological transformation and linkages envisaged in coming years from developed countries like Japan, U.S.A. and West Europe; and large export capabilities are likely to be developed particularly in the basic chemical sectors as the developed market economies increasingly shift to chemical specialities.

The estimated sub-regional growth rate for the ASEAN grouping is 7 to 8 per cent in 1985-90 and also the perspective for the 'nineties are bright in view of the very large natural resources base of natural gas in Indonesia, Thailand (oil/ and Crude Oil/gas deposits in Malaysia and Brunei. In the Philippines it will largely be alcohol based.

In the SAARC sub-region comprising India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and the Maldives the estimated projections are for a more modest growth of around 5 per cent.1/

In China, the estimated growth rate is 7.8 per cent over next 15 years and for the Republic of Korea around 6 to 7 per cent in the medium and long-term.

e) Projections of the Implications of the sector on Employment, investment, Trade and Regional Corporation.

The manufacturing sector in the developing countries has revealed a much wider range of wage levels. In developing countries the dispersion of wage levels actually increased, suggesting the development of a more heterogenous relationship. The share of Industry of the developing countries rose

1/ Based on the SAARC Council for Economic Corporation's deliberations held in New Delhi, Dhacca and Male (Maldives).

from 8.1 per cent in 1983 to 11.0 per cent in 1982. There was a gradual rise from the mid-1960s until 1975; in later years, relative gains occured more erratically. In 1982 the developed countries accounted for 80 per cent of world MVA. There was only a modest rise in the share of the developing countries. The developing countries did play an important role during the 1973-1975 recession, however, and managed to sustain their levels of demand and industrial activity.1/

Despite the fact that the developing countries have achieved only limited improvement in their share of world MVA, their manufacturing growth rates have been high. The developing countries' MVA growth rate has exceeded the corresponding average for the developed market economies. The MVA growth rate of the developing countries, indeed exceeded that of the "rest of the world" by 1.7 per cent in 1963-1973 and 2.4 per cent in 1972-1980.2/

In India the percentage of value added in 1974-80 at constant prices increased from 2.28 to 5.97 for industrial chemicals and from 6.38 to 6.94 for other chemicals. In Indonesia it increased from 5.13 to 8.15 for industrial chemicals and in Iran from 0.35 to 2.93 for industrial chemicals and 1.34 to 4.06 for other chemicals. In Pakistan it rose from 3.83 to 7.04 for industrial chemicals and from 4.11 to 5.24 for other chemicals. In the Republic or Korea it rose from 3.29 to 5.62 for industrial chemicals and from 4.22 to 5.95 for other chemicals and in Thailand from 2.07 for other chemicals to 3.44. In Bangladesh it rose from 1.52 to 1.75 for industrial chemicals and from 10.49 to 14.30 for other chemicals and in the Philippines from 2.31 to 2.99 for industrial chemicals and 5.21 to 6.76 for other chemicals.

Much of the manufacturing activities carried out by the developing countries in the period is attributable to a small number of semi-industrialised members of that economic grouping.

1/ Asian Industry in Figures UNIDO - June, 1983, Annexure.3

2/ Ibid.

Countries which enjoyed the most rapid growth during the 1963-1980 period were Brazil, Iran (Islamic Republic), Mexico and the Republic of Korea.

The share of South and East Asia, relative to other regions, has increased. The growth rates in the low income countries are on average, significantly less than those recorded for intermediate and upper middle income groups. It is mainly countries in the intermediate ($ 600 - $ 1.320) and upper-middle ($ 1.320 - $ 2.415) income range that provide the impetus for the growth of the manufacturing sector in the developing countries. In the least developed countries growth in industrial production has slowed noticeably in recent years amounting to only 3.0 per cent per annum in 1973-1980. The process of industrialisation has yet to begin in these countries in any significant measure.

During 1974-80 in terms of employment there was a small increase in Bangladesh from 1.14 to 1.33 for industrial chemicals; in India from 1.69 to 2.57 for industrial chemicals and from 2.41 to 4.02 for other chemicals. There were small changes in employment in Indonesia for industrial chemicals while for other chemicals employment rose from 3.89 to 4.41 per cent; in Pakistan it rose from 1.49 to 2.25 per cent for industrial chemicals while for other chemicals it jumped from 2.56 to 8.01 and in Thailand from 0.46 to 1.34 for industrial chemicals. There was in fact a decline in employment in Republic of Korea and Sri Lanka.[1/]

Alterations in the structure of domestic demand as per capita income grows will have an impact on rates of industrial expansion. Over a long course of development the manufacturing sector expands most rapidly at intermediate levels of per capita income. World demand for manufactures is decisive for growth in developing countries which have adopted an outward looking industrialisation strategy. Demand projection for

1/ Asian Industry in Figures UNIDO - June, 1983.

the developing ESCAP region for the chemical sector in mid 'eighties is around 7.0 per cent based on the assumption of 5 per cent annual GDP growth and using 1.4 as multiplier for chemical industry.

The third U.N. International Development Strategy (1981-90) targets imply a GDP growth rate of 7 per cent for the developing countries as a whole over the present decade. The largest relative increase would take place in South-East Asia. The progress of many of the developing countries would largely be offset by population increase, leaving the gap in per capita levels of output between developed and developing countries essentially unchanged. The developed market economies, nevertheless, are expected to continue to be the major buyers of manufactured exports from the developing countries.

The projected investment for Bangladesh, China, India and Pakistan has been estimated during 1980-89 at $ 6.8 billion over 324 plants.[1/] The projected investment for Caustic Soda, Chlorine, Soda Ash, Calcium Carbide, Carbon black and Titanium Oxide in India in 1985-90 is estimated at $ 600 million and the employment generation at 6900 as per the report of the working group on chemicals for the Seventh Five Year Plan.

The share of the rapidly growing chemicals and plastic products (ISIC 35) group has also increased, and it has emerged as the second largest of the major groups with dynamic links. Chemicals also made important gains which accounted for more than 5 per cent of MVA in 1979. Of the major industrial groups, chemicals ISIC 35) recorded no drop in employment in that period even though employment in related sectors dropped in the severe recession years. The market mechanism alone cannot order efficient resources allocation.

1/ Far-East Survey - A Chemical age Survey - 8 June, 1979.

TRADE:

Trade among the developing countries has considerably increased and accounted for only 35-40 per cent of that group's exports of manufactures. Trade and economic cooperation among the developing countries assumed greater importance in the 1970s and early 1980s. 31 per cent was shipped to other developing countries in 1978, compared to 24 per cent in 1970. The corresponding figures for imports also show a slightly upward trend, from 14 to 15 per cent. In South and East Asia, the relative share of labour intensive mature products was large but decreasing, while the shares of capital intensive mature products and new labour intensive products were on the rise.

International trade in chemicals has grown roughly in line with international trade in general. In 1973, it represented 7.3 per cent of the value of trade. In 1980, it accounted for 7.7 per cent. In the intervening years, trade in chemicals fluctuated between 7.2 and 8.0 per cent of world trade. During the period 1973-80, it averaged 10.3 per cent of the developed market economies exports, 5.0 per cent of the centrally planned economies exports and 3.0 per cent of the non-oil exporting developing countries exports.

Over the same period, the developed market economies accounted for a virtually stable 86 per cent of all chemical exports; the centrally planned economies accounted for just over 6 per cent and the non-oil exporting developing countries for around 5 per cent. In the developed market economies, chemicals was consistently the fastest-growing branch of industry from the late 1950s to the late 1960s and early 'seventies. The more research-intensive chemical products, such as pharmaceuticals, also benefitted, as the growth in real income fuelled greater health expenditures, the demand for new and more drugs escalated.

There is considerable potential for sub-regional and regional co-operation for expansion of trade and to promote technical exchanges. Considerable technical know-how, skills,

design and manufacturing capabilities have been developed in past two decades which can be fruitfully transmitted to the least developed, land locked, island and most seriously affected economies of the region by the more developed ESCAP developing countries. The sharing and pooling of experience would be useful to set up smaller plants based on relevant and intermediate technologies which are more suited to the investment capacities and are more labour intensive.

CHAPTER - IV

(a) The relation to and implication of the main findings on development goals and objectives

The chemical industry has had a phenominal growth in the past three decades and the turn-over of chemicals reached $ 276 billion in 1973 and $ 450 billion in 1982. In the ESCAP region, chemical industry has also experienced a very rapid growth rate over the past 25 and more particularly in last 15 years. India, the Republic of Korea and China have developed a large and diversified chemical base in organic and inorganic chemicals, fertilizers and pesticides, drugs and pharmaceuticals. The past 10 years have witnessed significant technological changes in the wake of the oil crisis and energy saving measures have helped reduce consumption sizeably. There has been a parallel movement by large producers into developing resource rich areas through joint ventures and industrial commercial ccoperation arrangements and also a growing shift from commodity chemicals to chemical specialties. The 25 large TNC's who dominate the chemical industry are increasingly moving to high value added specialties. There is a growing potential for Methanol, as a perspective feed-stock based on natural gas of which large deposits have been identified in the Gulf countries, Thailand, Indonesia, India, Pakistan and Bangladesh.

There has been a continuing emphasis on research and development despite the squeeze in profits during the severe recession years of 1980-82. In the past 10 years there has been an increasing emphasis on environmental protection, pollution, protection of health of consumers and sizdable investments have gone into anti-pollution measures.

The chemical industry remains a highly capital intensive area with modest employment potential. The price outlook in the mid-'eighties is for relatively more stable prices in view of restrained global inflation. Large investment programmes in the various sub-sectors more particularly fertilizers, pesticides, drugs and pharmaceuticals are envisaged in the developing ESCAP countries. Investments in the organic and inorganic sectors are expected to show a relatively more modest pattern in the near term but may increase in longer term with the vacation of the traditional sectors by the developed countries.

The TNCs continue to be in the vanguard of technology transfer and as a source of capital investments although substantial technical capabilities in designing, processing constructing have been generated in the more developed countries - India, the Republic of Korea and China. The public sector has continued to remain a leading investor in the fertilizer sector and also in basic drugs in India, Indonesia, Iran and Bangladesh and in the centrally planned economies.

The developing ESCAP countries started off with import substitution strategies in the 'sixties with a view to saving foreign exchange on imports and generation of greater employment opportunities and building of the industrial chemical base. Having built-up the infra-structure and production capabilities, they have been increasingly moving into the export promotion areas in the 'seventies and 'eighties. The Republic

of Korea is in the vanguard of the export effort and India, China and Indonesia are also increasingly moving in this direction. In the past couple of decades there have been significant strides in the sphere of man-power development, training and technical education more particularly in the developed ESCAP countries - India, the Republic of Korea, China, Indonesia, Philippines, Pakistan, Malaysia and Thailand. The management movement has taken roots and the planning process is tending to be more realistic and pragmatic and there is a distinct trend towards modernisation and liberalisation in China and India.

The chemical industry has played a catalytic role in the national and regional economy and has been assigned a high priority in the developmental plans of the region. Its growth rate has been 1.4 in relation to the industrial sector as a whole and it has maintained its lead as a pace-setter being closely linked to the other downstream industries, agriculture and public health.

The projections and perspectives for the chemical industry's growth remains buoyant for the foreseeable future as many of the developing countries will need to significantly increase their food production to meet the growing population needs as also to cater to the basic health requirements for drugs and pharmaceuticals and to deepen and diversify the industrial production base.

The share of the developing countries under certain circumstances may go up to 17 to 25 per cent of world production of drugs and pharmaceuticals by 2000 A.D. Projections of consumption postulate that developing countries may account for 22 to 27 per cent and even 34 per cent of global consumption by 2000 A.D.

The Asia-Pacific region is expected to show a high rate of sustained growth in the mid-'eighties and 'nineties and is rated as the fastest growth region of the world. The

Republic of Korea, China, the ASEAN countries are expected to be in the vanguard of continuing high growth rate while the countries of the SARC - India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives are expected to maintain a relatively more modest growth particularly in organic and inorganic chemicals than witnessed in 'sixties and 'seventies over the next 5 years. India is expected to maintain a better rate in the fertilisers/pesticides, drugs and pharmaceuticals sector.

The development goals and objectives of many of the countries in the ESCAP region are to attain greater indigenous capabilities and increasing self-reliance. The smaller countries will nodoubt require the techno-economic cooperation of the more developed countries and greater complementation possibilities exist as the OECD countries move away from the commodities sectors to the chemical specialities.

Substantial capital investment will have to come largely from plough-back of profits and depreciation, investment allowances, national savings directed into the public sector, funds made available from the financial institutions on term lending basis and investments by Multi-nationals.

(b) The observed demand for the various products of the sub-sectors is very closely related to the price trends. Government subsidies on fertilizers/pesticides have had to be stepped up for increased off-take by farmers. Korean exports of fertilizers have dropped significantly in the 'eighties owing to the high price of Naptha and crude. The chemical industry remains subject to cyclical fluctuations. There has been a high degree of substitution in the area of fibres-cotton, Jute, and natural rubber in the last 20 years as also steel which is being substituted by Plastics in automative and construction fields.

As the population in the developing ESCAP countries and particularly in the Indian sub-continent and Indonesia is likely to keep growing in the mid-'eighties and 'nineties

before reaching a plateau in the 21st century, massive increase in fertilizer, pesticides, drugs and pharmaceuticals production is inescapable. Several of the ESCAP countries fortunately have large gas reserves for the development of this sector.

There has been relatively greater stability in the observed demand of drugs and pharmaceuticals although the rate of increase in India came down in the last five years. In the case of basic and industrial chemicals the prolonged industrial recession has tended to reduce the demand for caustic soda, soda ash, chlorine and various other organic and inorganic chemicals and the demand is lately starting to pick up again in the developing countries.

Some of the developed countries have been exporting various chemicals at highly discounted prices on account of a significant shift in their demand in their effort to keep their production lines moving even at covering barely their variable costs. The chemical industry has reached a fair measure of maturity in the Republic of Korea, China and India but in many of the other developing ESCAP countries like Indonesia, Malaysia, Philippines, Bangladesh, Sri Lanka, Iran, & Afghanistan it has not yet attained high levels of maturity but may be expected to do so in the mid-'eighties and 'nineties.

In regard to basic and industrial organic and inorganic chemicals the price elasticity factor is of considerable significance as these products are used in downstream processing and the economic health and production value of the related industries has considerable bearing on their offtake.

In many of the developing countries, agricultural production is also subjected to the vagaries of nature and droughts, floods and other national disasters, which have an impact on the fertilizer and pesticides usage.

There is comparatively less cyclical fluctuation in the areas of drugs and pharmaceuticals, more particularly in the context of the growing population and health care needs of the populations in the region.

As the chemical industry is very highly research oriented, the stress on substitutes, even within the chemical sector is fairly high. With the energy crisis of the past 10 years these trends towards substitution and complementation have become increasingly discernible in related sectors.

(c) Opportunities for future development arising from local demand/supply imbalance, export potentials:

It is anticipated that the ESCAP region will have nearly three fourths of the global population estimated to reach well over 6-1/2 billion by 2000 A.D; this would require almost the doubling of the present food production levels. If the large masses of people in India, Indonesia, Pakistan, Bangladesh, Nepal, Bhutan, Maldives are to reach the nutritional levels recommended by W.H.O. it may even be necessary to treble the food production. This implies that both the fertilizers and pesticides sectors have considerable inbuilt growth potential. India alone will have to increase its food production from 151 million tons (1984) to 250 million tons by 2000 A.D. and treble its drugs and pharmaceutical production. Similarly, Bangladesh, Indonesia, Pakistan will have to step up their food production by 60 per cent even to maintain existing levels of consumption.

The drugs and pharmaceutical sector in the region has a very large potential for growth and development in the coming years. Besides meeting the local demand, the region's chemical industry has considerable export potential. The labour costs in many of the developing countries are considerably lower, and with the spread of techno-managerial education development of human skills and training, the productivity gap is gradually narrowing and in the next few years, will be reduced even further. The ready availability of natural

resources at economic cost coupled with human skills will afford an edge to the countries of the region to export. The technological gap may be reduced over coming years with research and development and collaboration.

(d) Recommendations of course of action to be taken including policy options and regional cooperation:

There is an urgent need for making an indepth study of the complementation possibilities in the less developed countries in various sub-sectors and identifying areas of mutual cooperation to achieve the national goals and objectives as also the sub-regional and regional growth targets as envisioned in the third U.N. Development Decade, UNIDO and WHO projections.

Among the policy options it would be necessary to streamline the working of the chemical industry units on an optimal efficiency basis through induction of appropriate and modern technology and modern management systems, practices, planning, monitoring, performance budgeting, appraisal and performance audit. This would require the training of highly skilled techno-managerial personnel more particularly among the smaller of the developing countries as many of the large units requiring very heavy investment and long gestation periods, particularly in the field of fertilizer and pesticides are likely to be set up in the public sector.

As the chemical industry is a very highly research and development oriented industry, considerable stress would have to be laid on R & D to ensure innovation, technological upgradation and avoidance of obsolescence. The private sector units also in the developing ESCAP region would have to take a long term view and earmark considerable financial outlays on research, training - both basic and applied rather than the pursuit of short-term gains.

To foster regional cooperation, it would be appropriate if existing centres for engineering design and technology transfer are strengthened and further opened up in the region to enable sharing of capabilities for setting up chemical plants and equipment in other sister developing countries. In the far Eastern and ASEAN region much more can be achieved by way of sub-regional cooperation as the countries are endowed with rich industrial and human resources and many more chemical projects can be set up. Similarly, the seven South-Asian countries have a combined market of nearly one billion people and although technical and economic cooperation can be expected to grow in a more gradual way, the potential for such cooperation is indeed immense as identified by the SARC Council for Cooperation at its recent Conference in Mahe. Many of the erstwhile reservations are being overcome and there is a distinct awareness to foster closer lineages than has been experienced in last three decades. There is a growing realization of the need for closer techno-economic cooperation, exchanges and interface which augurs well for the future.

Many of the smaller developing countries like Nepal, Bhutan, Maldives, Afghanistan can benefit from the reservoir of skills and expertise together with the plant and equipment manufacturing capacities for designing, setting up and commissioning of chemical units from India, Republic of Korea and possibly Indonesia in the fertilizer sector and from India/Republic of Korea in the drugs, pharmaceutical, organic and inorganic chemical sectors to mutual advantage.