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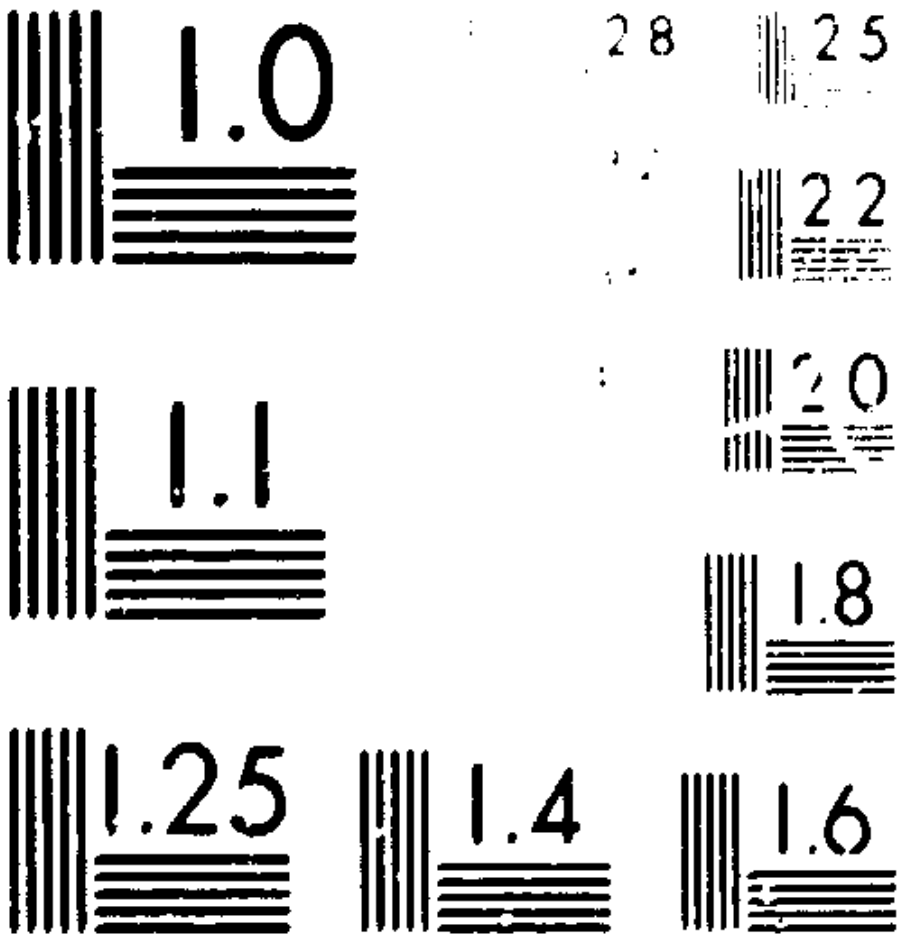
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consultant: Stuart Sinclair
for the Industrial Development Survey

11788 (1982)

Introduction

This section of the survey examines the recent trends, present problems, future prospects and patterns of adjustment exhibited by the world petrochemicals industry. In view of the comprehensive overview contained in the last issue of the survey, this section is arranged so as to highlight the linkages between this and other branches of industry in various countries, and also to draw attention to the ways in which interest groups of various sorts influence the evolution of the industry. In view of the substantial involvement of state-owned agencies in this industry, particular attention will be paid to these.

The first part gives a brief introduction to the scope of the industry and its importance within the industrial sector overall. Its growth during the early post-war period is discussed, along with the characteristics of the firms involved and their integration with other industrial activities. The second part deals with the 1970s period, during which a marked faltering in the trend rate of growth experienced by the industry was observed. The chief reasons behind this change of trend are adduced, and the main consequences, for both prospective and existing participants in the industry, are examined. Continuing the above discussion, the last part of this section deals with the main problems currently facing the industry and its constituent firms, and the ways in which policy-making can influence them. Among these problems are the excess capacity in many petrochemical products which emerged during the 1970s and the tendency to extreme price competition among producers. New sources of supply, notably from oil-producing countries, are examined and their likely impact on the existing firms' prospects are discussed.

Two important characteristics of the petrochemicals industry are its high degree of contact with other industries, and the intensely international nature of the firms involved in it. The petrochemicals industry itself is based on the processing of crude oil and certain natural gases, and this basic fact means that it has increasingly been tied to energy companies anxious to integrate their operations vertically. Because of the economics of these industries, large minimum efficient scales of production are needed, and this gives rise to a great deal of international trade in the various products created. By the same token, the recent weakening of the bonds tying together different parts of the vertically integrated firms, has meant that new forms of operation are being devised. Firms hitherto known for their refining and refined products distribution systems are increasingly making oil and gas exploration their forte, to take one example. In sum, the changes presently underway will increase the international linkages which have always been a hallmark of the cluster of industries based on oil, and, to a lesser extent, on chemicals. However, by virtue of the diminishing emphasis likely to be laid on vertical integration, the linkages between the elements of this cluster on the one hand and the rest of industry on the other, may be weakened.

The petrochemicals industry

The petrochemicals industry accounts for some 25 per cent of the chemical industry's turnover, and provides the basic inputs needed for all organic chemicals. Petrochemicals, which may be solids, liquids or gases, include both synthetic organic chemicals and some inorganic chemicals. In the former category plastics, synthetic fibres and synthetic rubbers are the major items; in the latter, ammonia is the most significant product. The main uses for organic chemicals are in packaging, building, construction, textiles and transportation equipment. These industries typically absorb two-thirds of a country's consumption of petrochemicals.

The modern use of the term 'organic' refers to the presence of the element carbon. Although a few carbon-containing compounds are thought of as inorganic chemicals, they are not relevant here. Over a million organic compounds now exist, and far outnumber the inorganic compounds.[1]

Figure 1 shows the flow of processing involved in moving from the fuel inputs - either oil or gas - used, through to basic petrochemical products such as ethylene, to more advanced products such as polyethylenes and some of their applications. Ethylene is the most important basic petrochemical product; as one writer put it recently, "ethylene is to petrochemicals and plastics industry what flour is to the baking industry."[2] It may be obtained, or "cracked", from oil, to generate ethylene. Ethane, a natural gas liquid, is, however, cheaper as a feedstock than crude oil, and its extensive use by companies in the United States gives them a considerable cost advantage.

Just over half of all organic chemical production is for plastics rubbers and synthetic fibres. Through the process of synthesis,

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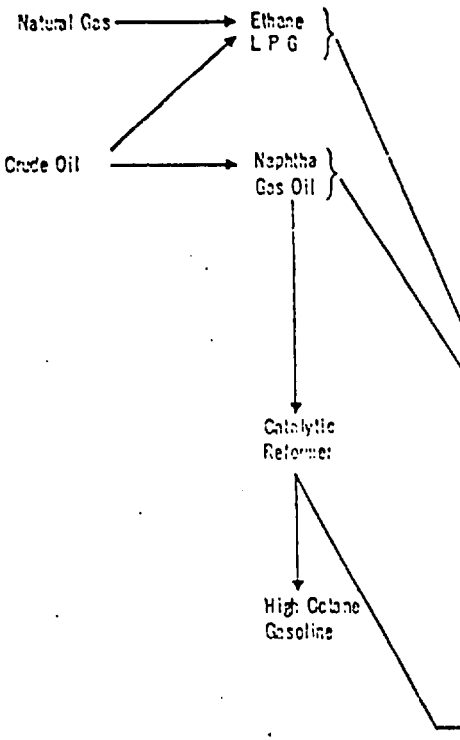
1. J.R. Palmer and B.A.J. Shaw, Chemistry Explained, (Slough: University Tutorial Press, 1980), Chapter 12.

2. "Honeymoon is over for ICI's new boss", The Guardian, 17 June 1982

OIL REFINERY



Some - OTEC
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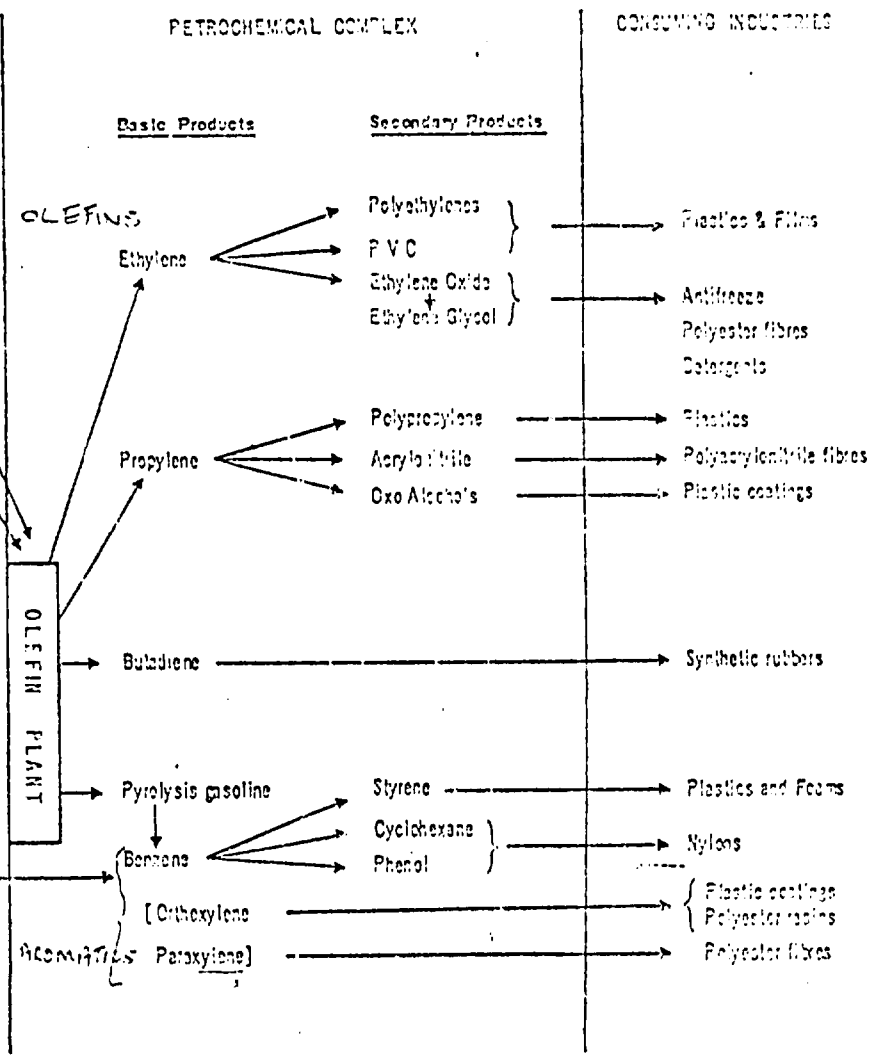
Figure 2 • *Chart 2*



complex molecules are built up from simpler ones. One of the most important examples of synthetic production is polymerization, which creates plastics.

The five major plastics materials are the two types of polyethylenes (high density polyethylene, or HDPE, and low density polyethylene, or LDPE); polyvinylchloride (PVC), polystyrene and polypropylene. Polyethylene, which accounts for around 20 per cent of world plastics demand, is made directly from ethylene and is the simplest bulk plastic. It was invented by ICI in 1933 in low density form, and is ubiquitous in the form of plastic bags and transparent sheeting. Ironically, in mid-1982 the same firm which invented the material closed the bulk of its British polyethylene capacity in what was referred to at the time as "the beginning of the most important restructuring of the United Kingdom chemicals industry since world war II".[1] Thirty years after polyethylene was invented, HDPE, which uses considerably less energy to make, was devised, and after that linear-LDPE, requiring still less energy input, was invented. The latter product, licensed by Union Carbide, allows very thin sheets to be moulded, thereby cutting down further on raw material inputs. The process has been widely adopted by those firms which have acquired the license. Its attraction was considerably increased after energy prices rose in the 1970s. The two polyethylenes share many applications but its slightly greater rigidity gives HDPE an advantage in applications such as crates.

The output of the industry is spread between a number of ISIC categories, including 351 (industrial chemicals), 352 (other chemical products), 355 (rubber products) and 356 (plastic products). In all categories (except, since 1970, rubber products) the importance of these items in developed market economies and centrally planned economies has been growing consistently. In the developing countries, their importance has been growing in all branches other than rubber

1. "BP and ICI make vital survival pact", The Guardian, 18 June 1982.

products. In 1978 these four branches' total net output accounted for 12.1 per cent of developed market economies' total manufacturing output in 1978. In that year the US ITC estimated world petrochemicals value added to be $120 billion.[1] From table , which shows the distribution of value added in three of these branches (industrial chemicals, chemical products and rubber products) between groups of countries, it is apparent that the developed market economies' share of world activity has been falling during the 1970s. The centrally planned economies' share peaked in 1975, and has declined thereafter in all three branches. The share of the developing countries, by contrast, has increased in all the branches during the 1970s.

International trade in chemicals has grown roughly in line with international trade generally. In 1973 chemicals trade represented 7.3 per cent of the value of world trade, and in 1980 it represented 7.7 per cent. In the intervening years it fluctuated between 7.2 per cent and 8.0 per cent.[2] As a share of developed market economies' exports, chemicals averaged 10.3 per cent during the 1973-1980 period; while for centrally planned economies it averaged 5.0 per cent and for non-oil exporting developing countries 3.0 per cent. For no group of countries was there any marked trend in evidence. Nor was there any clear trend at work in the share of countries within world chemicals trade. Over the 1973-1980 period developed market economies accounted for a virtually unchanged 86 per cent of all chemical exports. Centrally planned economies accounted for just over 6 per cent and non-oil exporting developing countries for around 5 per cent.

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1. Cited in IMF, "Trade Policy Developments in Industrial Countries", July 1981, p.20.

2. Calculated from GATT, International Trade 1980/81 (Geneva, 1981), Appendix tables A17 - A22.

The 1960s

The chemicals industry and its petrochemical adjuncts experienced extremely rapid growth in the 1960s. Indeed, in developed market economies chemicals was consistently the fastest-growing branch of industry from the late 1950s to the late 1960s, recording growth nearly twice as large as manufacturing overall.[1] Growth in world oil refining capacity also reflects this phenomenon, since the basic petrochemicals products are obtained after refining oil and/or gas. From 603.1 million tonnes per year of refining capacity across the world in 1950, the industry grew to a capacity of 1,735 million tonnes per year in 1965 and 4,085 million tonnes per year in 1981.[2] This growth reflected both supply and demand factors. First, innovations in products, such as HDPE, opened up new uses for plastics and it became substituted for other materials such as wood, metals, glass or paper. Similarly, polypropylene became used in place of hessian, rope and twine in sacking and similar uses. As production grew and economies of scale were exploited, costs fell, in turn facilitating further substitution into petrochemicals products. Between 1955 and 1975 world plastics output grew from 5 million tonnes to 40 million tonnes annually. On the demand side, the relatively high and stable rates of GDP growth achieved across the world in this period was accompanied by growing demand for such consumer durables as automobiles and household goods like electrical appliances, in which plastics were increasingly being used. As for more research-intensive chemical products such as pharmaceuticals, growing real income was fuelling greater health expenditure and thus the need for more drugs and more new preparations.

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1. UNIDO, World Industry in 1980 (Vienna), p.113

2. Institute of Petroleum (London) "Petroleum Statistics", (1981 edition).

The major demand in the 1970s

After this period of extremely rapid growth, however, the late 1960s and 1970s witnessed a considerable deceleration in the demand for chemical products. Between 1967 and 1979 chemicals output (defined as ISIC 35) grew at an annual average rate of only 6.1 per cent in developed market economies, while in the 1973-1979 period alone it fell to a growth rate of only 3.8 per cent.[1] During the 1973-1981 period, consumption of three of the five major plastic products fell in Europe. In this period consumption of LDPE fell at an annual average rate of 0.2 per cent; that for PVC at 0.7 per cent and that for polystyrene at 1.0 per cent. Only for HDPE (3.0 per cent) and polypropylene (10.0 per cent) did demand grow.[2]
There were three main reasons for this. First, growth of real GDP in developed market economies decelerated markedly, and this quite naturally depressed the rate at which overall demand for chemical-using products grew. Secondly, the adjustment in real energy prices after 1973 (and again during 1979 and 1980) changed the trend-growth of demand for all oil-derived products as price-elasticity began to operate. Manufacturers looked for more energy-conserving methods of production and for less energy-intensive product mixes, with the result that the rapid substitution of the 1960s into such materials as plastics proceeded less quickly. Finally, the extent of substitution into petrochemicals-based products slowed as a consequence of the change in relative prices brought about by higher oil prices.

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1. UNIDO, World Industry in 1980, (UNIDO), p.116.

2. Estimates from BASF.

The extent of the fall in oil use in developed market economies can be judged from figure 2, which reproduces estimates provided by the International Energy Agency for the period 1973-1980. For the membership of the Agency as a whole, the amount of oil used to produce a unit of GDP fell by nearly 18 per cent during the period, reflecting more efficient use of oil derivatives as well as substitution away from oil to other fuels.[1]

More immediately relevant for the petrochemicals industry is the fact that naphtha demand fell at an annual average rate of 2.2 per cent during the 1973-1979 period, after growing at an annual average rate of no less than 16.3 per cent during the 1965-1973 period.[2]

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1. "IEA Warns Against Slippage in Progress Towards Balanced Energy Economies", (IEA/OECD) Press Release, 82/6), June 28, 1982, Annex 3.

2. Esso Europe, "Energy in Europe", (London, 1981), pp.6-7.

-30
-20
-10
0
+10
+20
+30
+40
United Kingdom (31.8%)
Turkey (7.9%)
Switzerland (16.8%)
Sweden (23.5%)
(-12.8%) Spain
(-23%) Portugal
Norway (19.7%)
Netherlands (13.7%)
Luxembourg (40.7%)
Italy (21.2%)
Ireland (18.9%)
Greece (1.7%)
Germany (24.8%)
Denmark (32.3%)
Belgium (29.0%)
Austria (19.2%)
IDA EUROPE (21.3%)
New Zealand (10.2%)
Australia (0%)
Japan (27.3%)
PACIFIC (24.4%)
United States (13.7%)
Canada (13.7%)
NORTH AMERICA (13.7%)
IDA Average (17.9%)

A problem which, obviously, can beset any industry is the deceleration, stagnation or even decline of demand for its output from its accustomed clients. In the case of many petrochemical producers this problem of end-user decline has arisen since the 1970s. The position is, however, made somewhat more complex than usual by the fact that substantial portions of some firms' output is consumed by other divisions of the same firm - the so-called captive purchase phenomenon.

In the United Kingdom, the fall in industrial production from its mid-1979 peak to its mid-1982 level was no less than 13.4 per cent. This decline not only affected demand for such items as plastics from car manufacturers, but also has tended to have a disproportionately severe effect upon the smaller and less diversified supplier firms.[1] Rising net import penetration in such industries as "white goods" (domestic consumer durables such as refrigerators), as well as textile tyres, and some construction requisites compounded the problem.

In the United States total car demand has been depressed since its 1973 peak, while, within the total, domestically-produced sales have fallen to a low of only 73 per cent of total sales for the last two years. A plastics company economist was quoted in 1982 as saying that, "the United States auto business is probably permanently diminished",[2] and in view of the 1981 sales volume, which was the lowest for 20 years, some diminution in demand from this source may be expected. There is, however, a countervailing force at work, in that plastics use per car is forecast to grow considerably during the 1980s. Continuing the search for weight reduction, car companies are expected to reduce by 26 per cent the average amount of steel used in each car between 1980

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1. NEDO, Chemicals: Contraction or Growth? (London, National Economic Development Council, 1981), p.9.

2. "Big Oil's Retreat from Petrochemicals", Business Week, 1:3:82, p.91.

in 1976 but increased by 37 per cent the amount of plastic used.[1] Further increases in the penetration of plastics could occur if such parts as wings were moulded from it; together the substitutions currently considered feasible could roughly double the weight of plastic used in a car. Other areas for growth include plastic containers, preferred as the energy costs involved in making glass and tin cans make them unattractive.

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1. Study by Arthur Anderson & Co., cited in Business Week, 15:6:81.

New supply factors

Possibly the most significant public policy decisions taken in the petrochemicals industry in the last decade concern the planned growth in capacity in certain members of OPEC, the Organization of Petroleum Exporting Countries. What is the basis of this expansion and what might its consequences be?

This interest in petrochemicals production follows from the OPEC members' enhanced oil refining plans since 1973. The adjustment of oil prices in 1973, with its attendant increments to the OPEC members' governments' revenues, spurred the long-standing intention to invest more heavily in the processing of oil, rather than merely exporting it in crude form. Although Venezuela had long-established refining capacity, few of the other members did. Indeed, even by 1980 the thirteen members were between them only refining 6.25 mn b/day of their crude oil output, against a peak crude throughput, in 1979, of 30.9 mn b/day. In 1980 refined output was equivalent to only 14.9 per cent of crude oil production, and this refining capability was in turn equivalent to only 7.5 per cent of world refining capacity.[1] Arguing that "it is a natural and logical development for OPEC national oil companies to move into the field of product refining to produce hydrocarbon based industries",[2] present plans are for the OPEC members between them to be able to process 9.3 mn b/day of oil by 1984.[3]

The problems which beset earlier developing country producers in the petrochemicals industry were familiar to many types of industry. First, in order to develop an indigenous productive capacity tariffs and other forms of import barrier were raised. Substantial state

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1. OPEC Annual Report 1980 (Vienna, 1981), p.189.
2. OPEC Bulletin, June 1980, p.8.
3. OPEC Bulletin, March 1981, p.17.

[illegible] typically in the form of a new entity, has also been a feature of the industry at the earlier stages of import substitution. These two characteristics have, however, tended to raise domestic prices and consequently restrict demand. This in turn has militated against the fullest exploitation of economies of scale. Moreover, exports of surplus produce have been hampered by the very fact - high price - that constrained home demand, while simultaneous efforts being made by neighbouring countries' governments also to develop their chemicals industries have resulted in import barriers there too. A number of instances of this pattern of frustrated development are provided by the Latin American petrochemicals industries. Many of the projects initiated there were extremely large (the Dow Chemical facility established in Argentina in the early 1970s was that country's biggest private foreign investment in a decade) and suffered from chronic excess capacity. Prices too have been prohibitive, ranging up to one and a half times international levels.[1] Developing countries have also sometimes suffered from excess capacity in refining. While companies or government agencies in the larger markets, such as Argentina or India, were able to negotiate marketing concessions in return for yielding access to oil companies, many smaller countries have been plagued with excess capacity because of their modest demand for refined products.[2]

Three questions arise in connection with the impending appearance of petrochemicals from oil and gas exporting countries such as those in OPEC. The first is at what price will oil and gas inputs be made available to the new petrochemical plants? In particular, will they have access to fuels at cost-plus prices, or at international prices? The second question concerns the way in which the output of these new plants is to be marketed, given that only a small fraction of the intended capacity will be for domestic needs.

1. T.S.Gobo, "The Petrochemical Industry", Appendix B in J.N.Behrman, The Role of International Companies in Latin American Integration (Lexington, D.C.Heath, 1972), pp.149-176.

2. P.Odell, Oil and World Power (Harmondsworth: Penguin, 1979), p.166.

its thinking [illegible] companies already active in the business.

There is still some uncertainty over the pricing to be adopted by OPEC member states' hydrocarbons agencies when supplying oil and gas to their petrochemicals plants. When oil is pumped from the ground associated gases (methane, ethane, propane, butane and others) are present too, dissolved in the oil itself. Hitherto, much of this gas was simply flared, or burned away, so that utilizing it as a production fuel implies virtually no opportunity cost. In 1979, in Saudi Arabian oilfields, up to 75 per cent of associated gas was flared; in Iraq, 84 per cent, and in Abu Dhabi, 60 per cent. Together the seven Arab Gulf States flared a total of 248.2 trillion cubic feet of gas in 1981.[1] In 1980 the OPEC member states flared a total of 116,354 mn cubic metres of natural gas, or 69 per cent of all the gas flared in the world.[2] A major gas-gathering system, to be completed by 1985, will allow Saudi Arabia's state oil agency Petromin to market 600-700,000 b/d of liquified petroleum gas. Most of it will be sold abroad at market prices.[3]

Early in 1982 the Supreme Petroleum Council of Saudi Arabia announced that it would sanction ethane and methane supplies to new petrochemicals plants at an initial price of 50 cents per million BTU. This is approximately 13 to 20 per cent of the price paid by producers located in the US.[4] This price is, however, expected to rise once the joint ventures start to hit an agreed rate of return on their investment.[5]

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1. "Petrochemicals: Gulf States Plan Ahead", OPEC Bulletin, April 1982, p.6.
2. OPEC, Facts and Figures, (Vienna, 1981), p.28.
3. "Petromin applies skills of oil marketing to natural gas", I.H.T. Survey, May 1982, p.135.
4. "US Petrochemical firms face big threat from new plants in cheap-energy areas", Wall Street Journal, 12:2:82, p.20.
5. "Saudi Plants, using cheap feedstocks, worry world's petrochemical makers", Wall Street Journal, 5:3:82.

capital costs will be considerably higher in Middle East than in the least. Initial estimates of the cost differential were high; figures of a 100 - 200 per cent premium on Middle East construction were seen. More recent estimates centre on 50 per cent. The ethylene plant in Qatar co-owned by CdF Chemie was finished at a 60 per cent construction cost premium, while the Saudi minister for industry has suggested that a 25 per cent premium may be attainable. Given that certain extra facilities are needed to cope with the high temperature and the dusty and salty atmosphere, this is likely to be an irreducible minimum.[1] Despite these factors, all commentators expect there to be, whether or not producers wish to exercise it, very substantial scope for competitive pricing.

The second question, that of through which channels the output will be marketed, is related to the first. For from the outset of the large OPEC projects it was clear that there would be substantial oil and chemical company involvement, partly because the new producers needed their marketing expertise, but also partly because the Western companies saw these projects as a way of securing access to oil supplies for their own downstream operations. What made the propositions more alluring for the Western companies was the relatively small investment outlays needed. In Saudi project, "incentive crude" (that is, access to crude oil in return for involvement in downstream investments) was offered initially at the rate of 1,000 barrels/day for each $1 million invested. This was later halved. In 1981 a number of agreements were entered into, and of these 60 per cent are being funded by the Saudi industry ministry's Public Investment Fund, with the foreign company having to find only 15 per cent. Details of one agreement made in 1981, that between Shell Oil of US and SABIC, entail Shell buying 1 billion barrels of

1. "Cost gap between Arab and Western plants is shrinking", F.T. Survey, 17:12:81, p.IV.

[illegible] oil during its involvement in building a petrochemicals [illegible] at Jubail.[1]

The seven petrochemicals projects underway in Saudi Arabia are all in the form of joint ventures with SABIC, the Saudi Arabian Basic Industries Commission, and, as table 1 indicates, all should come onstream between 1983 and 1985. What is important to the Saudi authorities is not ownership, however, so much as marketing. Indeed, far from public ownership being pursued as an end in itself, it is intended to return as much as 75 per cent of the Saudi holdings to the private sector. But the foreign partners are committed to absorbing 75 per cent of each plant's output.

Another form of entree being followed is buying shares in ready-established Western companies. Interests in Kuwait - possibly the Kuwait Petroleum Company - have bought a 25 per cent share in Hoechst AG, West Germany's major chemicals firms and the world's biggest pharmaceuticals supplier. This acquisition, carried out in 1982, raises the possibility of cooperation in petrochemicals, which since 1979 have been a weakness in Hoechst's performance.[2] Profits fell by 23 per cent in 1981 and a further 4.2 per cent in 1982. If Kuwait supplies the company with raw materials, profitability in some years might be improved, but, in line with its preference for a relatively un-integrated structure (unlike BASF, for instance) Hoechst managers prefer to look for spot feedstock bargains. This is their current policy even though their purchases of ethylene alone, at 1 mn t/year, represent 9 per cent of all European ethylene demand.

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1. "Shell in £19.5 bn deal for supplies of Saudi oil", F.T., 24 April 1981.

2. "Hoechst stake costs Kuwait £300 mn", The Guardian, 15:5:82; "Foreign interests control one-third of Hoechst", F.T., 9:6:82.

3. "West Germany's corporate alchemists", The Economist, 5 June 1982, p.88.

Table 1

SABIC's Affiliate Companies

Name of Project	Signature Date	Location	The Joint Venture Partner	Feedstock	Production M.T./Y.	Product(s)
Saudi Iron & Steel Co. (HADEED)	3/1979	Jubail	Korf-Stahl	Iron Ore & Natural Gas.	500,000 650,000 900,000	Sponge Iron (DRI) Steel Billets Steel Rods, Bars
Saudi Steel Rolling Mill Co.(SULB)	5/1979	Jeddah	Korf-Hondel	Steel Billets	140,000	Rods and Bars
Saudi Methanol Co.	11/1979	Jubail	Japanese Consortium	Methane	600,000	Chemical-Grade Methanol
National Methanol Co.	2/1981	Jubail	Celanese-Texas Eastern	Methane	650,000	Chemical-Grade Methanol
SAFCO-Jubail Fertilizer Co.(SAMAD)	12/1979	Jubail	Taiwan Fertilizer	Methane	500,000	Urea
Saudi Yanbu Petrochemical Co. (YANPET)	4/1980	Yanbu	Mobil Chemical Co.	Ethane	450,000 330,000 200,000 90,000	Ethylene Ethylene Glycol L.D. Polyethylene H.D. Polyethylene
Al-Jubail Petrochemical Co. (KEMYA)	4/1980	Jubail	Exxon Chemical Co.	Ethylene	260,000	L.D. Polyethylene
Saudi Petrochemical Co. (SADAF)	9/1980	Jubail	Shell Oil Co.	Ethane	655,000 295,000 231,000 454,000 370,000	Ethylene Styrene Crude Industrial Ethanol Ethylene Dichloride Caustic Soda
Arabian Petrochemical Co. (PETROCHEMYA)	5/1981	Jubail	Dow Chemical Co.	Ethane	500,000 180,000	Ethylene High/Low Density Polyethylene
Eastern Petrochemical Co. (SHARQ)	5/1981	Jubail	SPDC Ltd. (Japanese Consortium)	Ethylene	100,000 300,000	Linear Low-Density Polyethylene Ethylene Glycol

Source: International Herald Tribune, May, 1982.

Kuwaiti interests are also buying ready-made capacity in furtherance of their marketing ambitions. Following the purchase, for $2.5 billion, of the California-based Santa Fe Corporation in 1981, the Kuwait Petroleum Corporation in 1982 purchased the bulk of Gulf Oil's refining and marketing operations. The $2 billion deal comes on top of Gulf Oil's divestment, since 1977, of one-third of its European assets at a price of $200 million.[1] The funds will be used to consolidate Gulf's petrochemicals and plastics operations,[2] while for the Kuwaiti corporation, the acquisition represents a step towards becoming a fully-fledged integrated oil company. At present the corporation buys its crude oil from the Kuwaiti government at the posted Kuwaiti price. It then markets the oil, either unprocessed or in refined form. It will also hope to make a profit from transporting the products to its buyers' locations.[3] Another subsidiary of the Corporation is developing oil exploration interests.[4]

Other Middle Eastern states are planning entries to various parts of the chemicals industry - although on a smaller scale. A joint venture between Saudi, Kuwaiti and Bahraini interests is planning a $400 million plant in Bahrain to produce 360,000 t/year of methanol and the same volume of ammonia. Among other members of OPEC, Nigeria, announced in mid-1982 its intention to begin the first phase of a petrochemical plan. This will involve building three plants, producing carbon black, high octane gasoline and synthetic detergent, attached to oil refineries already in operation in Bendel State. The full five-year petrochemical programme is estimated to cost $2 billion.[5]

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1. "Kuwait set to buy European refineries", The Times, 26:4:82, p.13.
2. "Gulf will shut its chemical operations in Western Europe", F.T., 2:3:82.
3. "Kuwait Petroleum Corp. Eyes a Major Role in US Market", J.H.T. Survey, 13 July 1982, p.105.
4. "Kuwait steps up exploration in other nations", Oil & Gas Journal, 14:6:82, p.
5. "Nigeria gives go-ahead for first phase of $1 bn petrochemical plan", F.T., 16:6:82.

Indonesia is also starting construction of an olefins complex worth $2 billion, involving three plants, producing ethene, LDPE and HDPE. The plan will be in the form of a joint venture, involving Exxon Mobil and a Japanese firm.[1] Table 2 summarizes current capacity in the OPEC member states.

Yet another type of entry to hydrocarbons processing can take the form of "borrowing" capacity. An innovative agreement is that signed between two subsidiaries of Montedison, the major chemicals firm in Italy, and Pemex, the state-run Mexican hydrocarbons firm, in 1982. Montepolimeri and Montedipe will import Mexican crude oil and process it into 100,000 t/y of polyethylene, polypropylene and other products, worth around $80 million per year. Pertamina, the Indonesian oil concern, had occasionally rented refining capacity in Shell's Singapore facility during the 1970s.

All of these examples are illustrations of the principles identified by A.Parra, who noted that national oil companies "in exporting developing countries, in lieu of their own international affiliates, are cautiously moving downstream through a variety of arrangements".[2] Furthermore, "parallel, and perhaps complementary, to the trend towards vertical co-operation, national oil companies in some (oil) exporting developing countries are starting to seriously consider the internationalization of their activities".[3]

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1. "Indonesia to enter $1 bn joint venture in petrochemicals", F.T., 21:4:82.
2. A.A. Parra, "The International Role and Commercial Policies of National Oil Companies", OPEC Review, Vol.6, no.1, Spring 1982, pp.1-13.
3. ibid., p.5.

Table

Estimated petrochemicals capacity of OPEC members, at end-1980, and planned expansions to end-1982 (000 tons)

	methanol	ethylene	ammonia, urea, ammonium	benzene & derivatives	propylene
Algeria	100	120	1,945	252 (1987)	
Ecuador	-	140 (1987)	875 (1985)	-	
Gabon	45,000t capacity for domestic use; no expansion planned.				
Indonesia	-	330 (1985)	3,895	560 (1985)	-
Iran[a]	-	300 (1982)	1,774	-	110 (1982)
Iraq[a]	-	150	3,567	-	-
Kuwait	330 (1984)	330 (1984)	1,617	475 (1984)	-
Libya	330	330 (1982)	660	-	-
Nigeria	-	-	-	15 (1983)	-
Qatar	-	280	1,254	-	-
Saudi Arabia	1,200 (1984)	2,387 (1985)	800		
UAE	-	-	-	-	-
Venezuela	-	150	2,129	-	53

Notes: a. Estimates only.

b. Only the basic products capacities have been listed; secondary products have been omitted.

c. All figures are estimates, drawn from capacities advised by member governments of OPEC.

Source: Compiled from OPEC, Annual Report, 1980, (Vienna, 1981), pp.118-132.

Outside OPEC, Canada will become a major new source of traded petrochemicals during the 1980s. Successive governments there have resisted the trend south of the border towards deregulating energy prices. After Ottawa imposed price controls on natural gas, to make it substantially cheaper than oil, a major investment boom in bulk petrochemicals was started. Between 1982 and 1986 / between $6.5 and $8 bill[illegible] will be invested, mostly in Alberta, in petrochemicals capacity.[1] US chemicals firms own around 70 per cent of the Canadian industry, so this infusion of investment represents for the most part a relocation of US capacity to take advantage of certain natural and legislatively-created comparative advantages. First, the gas price controls mean that ethylene, for instance, can be produced in Alberta for 14 cents/lb as against 25 cents/lb on the Gulf of Mexico. Second, the Canadian dollar's 10-15 per cent trading discount against the US dollar means that the 12 per cent petrochemicals tariff imposed by the US is offset. Moreover, as US gas prices continue to rise with the advent of full US gas deregulation, the Canadian advantage will be greater still.[2] The US Natural Gas Policy Act of 1978 requires that some 40 per cent of American natural gas be decontrolled by 1985. Recent pressures may accelerate the pace at which the remainder is also decontrolled.[3] The result of this investment is that Canadian plants are expected to double, to 6 per cent, their share of world petrochemicals output by the late 1980s. And their share of US imports should grow appreciably too, given that virtually all the new capacity is intended for export sales. This is made all the more likely by present forecasts that Canadian products will enter the US market with at least a 10 per cent price advantage.

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1. Oil Week (Alberta), 8:2:82, pp.76-82.

2. "A petrochemical boom that threatens the US", Business Week, Feb 8 1982, p.32.

3. "As controls are eased, industrial users brace for rises in gas prices", Wall Street Journal, 12:2:82.

Supply and demand - an overview

Imminent changes in supply, resulting from substantial capacity increments underway in Canada and certain OPEC member states, as well as changed patterns of demand, have now been noted. Also, the problems arising for existing European firms due to intensified competition, as companies cut prices to precipitate the demise of others and as exports from the United States persist, have been examined. It is time now to assess the relative importance of these factors in shaping the present problems of the industry.

Looking first to Saudi Arabian petrochemicals supply, it appears that by the late 1980s plants there will be able to provide 8.5 per cent of world methanol production, 7.2 per cent of world ethylene glycol production, 7 per cent of world ethanol production, and between 1 and 2.5 per cent of ethylene, polyethylene, styrene and urea production. By 1990 this capacity could supply around 10 per cent of European base chemical needs.[1]

These figures are substantial; but they are not large relative to the degree of excess capacity that already existed in the very early 1980s due to inappropriate capacity planning by existing producers. It has been stressed throughout this section that "the entire West European industry is suffering from chronic overcapacity in base chemicals and in the five major plastics materials", with ethylene producers carrying 29 per cent overcapcity and polypropylene producers 30 per cent overcapacity.[2] One analyst has referred to "irresponsible pricing" and "poor planning" by European petrochemical producers, of whom "many have behaved as though competition was non-existent".[3] In the United States, on the other hand, although there is unquestionably a great deal of excess refining capacity, petrochemical

1. "Hard times for Europe's chemicals", Arabia, Dec 1981, p.76.
2. "BP and ICI do a swap", F.T., 18 June 1982.
3. W. Greenwell & Co., Chemical Research Newsletter, 24 March 1982 p.2.

Table 3

Survey of demand forecasts for various petrochemical products

	Product	Market	Period	Growth rate forecast (annual average, %)	Source
1.	Ethylene	Europe	1980-1990	2.5	Greenwell
2.	Plastics:				
	HDPE	"	"	3.5	"
	LDPE	"	"	3.0	"
	Polystyrene	"	"	2.0	"
	Polypropylene	"	"	7.5	"
	PVC	"	"	2.5	"
3.	All plastics	"	"	[illegible]	Assoc. of Plastics Manufacturers in Europe
4.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.	Ethylene	USA	1981-1987	[illegible]	[illegible]
6.	Ethylene	World	1982-1992	3.9	Shell (1982)
	"	Europe	"	2.5-3.0	"
	"	World	"	6.4	Predicasts (1981)
	Olefins & aromatics	World	1980-1990	5.0	Exxon (1981)
	Ethylene	Europe	1980-1984	2.7	CEFIC (1981)
7.	Naphtha	Europe	1980-1990	1.4	Esso (1980)
8.	All plastics	LDCs	1973-2000	11.4	Pétrole et Techniques (198
		DMEs	"	4.5	

Sources for table

1,2 M. Greenwell, London; Chemicals Research Newsletter, cited in "BP and ICI do a Swap", F.T., 18 June 1982.

3 T. Hutchinson, president, Association of Plastics Manufacturers of Europe. Cited in "Chemicals demand stays depressed", F.T., 16:4:82.

4. National Economic Development Office (London), "Industrial Review - Petrochemicals", July 1981, p.13.

5. T.B. Tarrillion, "Will Profitability return to US ethylene?" Oil and Gas Journal, 7 Sept 1981, pp.91-102.

6 All forecasts cited in T.Wett, "Growth in ethylene capacity slows, but plenty of potential still exists", Oil and Gas Journal, 7 Sept 1981, pp.85-90.

7. Esso Europe, "Energy in Europe", (London, 1981), pp.6-7.

8. "Scénario de l'industrie pétrochimique mondiale à l'horizon 2000: Situation de l'Europe", Pétrole et Techniques, Mai 1980, no.271, pp.19-25.

capacity is broadly attuned to long term growth potential. Plant existing in mid-1982 is judged to be sufficient to meet US domestic and export demand until 1985; beyond that one new full-scale ethylene plant per year will be needed to maintain equilibrium between supply and demand.[1]

The second point concerns the growth of demand. Although there is virtual unanimity within the industry that demand will grow far more slowly henceforth than in the boom period of the 1960s, there is - as table 3 shows - a range of different growth forecasts available. There is, nonetheless, once again agreement that the industry will see growth. No currently available forecast points to falling or even stagnant demand. It follows that some elbow room for existing and newly entering firms will exist, and that, in contrast with other industries where lower growth forecasts pertain, firms are by no means likely to have to compete for a shrinking market.

Third, there are two significant implications for international trade in chemicals arising from the foregoing demand and supply discussion. First, it appears certain that a substantially greater volume of Canadian exports will find their way into the American market. Although, as table 4 shows, Canada has in the past been a relatively minor trading nation in chemicals, this is likely to change rapidly. The implication of this is that American producers will try all the harder to export more of their own output, mainly to Europe. Meanwhile, because of the second major change afoot, which is a growing volume of Middle Eastern chemicals appearing in Europe, European countries are likely to experience an appreciable rise in import penetration in many chemical products. Because Europe (defined

1. T.Wett, "Growth in ethylene capacity slows, but plenty of potential still exists", Oil and Gas Journal, 7 Sept 1981, pp.85-90.

Table 4

Shares by region of world exports of chemicals, 1973-1980, by value

	1973	1977	1978	1979	1980
Developed Countries	87.1	86.4	86.8	87.0	86.7
of which:- USA	14.8	-	14.7	15.2	16.1
Canada	1.9	-	3.7	2.4	2.6
Japan	5.4	-	5.5	5.0	5.0
EEC - 9	55.5	-	54.7	54.9	53.6
others	9.5	-	8.2	9.5	9.4
Socialist countries	6.5	6.7	6.3	6.1	n.a.
oil-importing LDCs	4.4	5.1	5.2	5.0	n.a.

Source: Calculated from GATT, International Trade 1980/81 (Geneva) table A17.

in table 4 as the nine members of the EEC) has tended to account for over half of world export of chemicals, there is scope for some increase in net import penetration without it having a serious effect upon the region's firms' remaining net exporters. As table 5 shows, European countries' trade surplus in chemicals has slipped slightly after 1973, but remains in excess of 24 per cent.

Tariff barriers levied by those developed market economies with petrochemical capacity of their own tend to be fairly uniform. Basic feedstocks can usually enter countries free of duty, or with small duties, whereas intermediate products such as polyethylenes face rather higher tariffs. This escalating tariffs phenomenon, seen so frequently in other industries, means that, in the estimation of OPEC, new entrants require a minimum 20 per cent cost advantage to overcome the tariff.[1] Whether firms will attempt to use their influence over trade policy to have these barriers increased as new sources of supply arise will depend to a great extent on their success, in the intervening period, in adjusting in a relatively liberal climate. The following section judges the severity of their problem and the way the firms are currently groping for solutions to them.

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1. A.Ferronkhi and M.V.Samii, "OPEC Trade Prospects: Barriers to Export Diversification", OPEC Review, Vol.6, no.1, Spring 1982, pp.59-80, esp. p.67.

Table 5

Trade surplus in chemicals of the 9 members of the EEC, 1973-80

	trade surplus, $ billion	surplus as per cent of exports
1973	6.78	29.1
1978	15.53	28.2
1979	17.76	24.7
1980	20.35	25.1

Source: Calculated from GATT, International Trade 1980/81, (Geneva), table A20.

Problems for firms in the industry

Although for many firms presently involved in the downstream processing of oil, disinvestment in the face of more intense competition may prove relatively easy (compared, say, to firms in the footwear or steel industries) problems undoubtedly exist.

The first which merits attention arises from the fact that many firms have for some time been intending to diminish their interests in bulk petrochemicals and concentrate in future on speciality items. Typical examples of the latter would be solvents, resins, synthetic elastomers, oilfield chemicals and lubricant additives. Pharmaceutical products, whose development requires considerable outlays on research, and whose marketing involves quite different networks and skills from those involved in bulk items, are also an attractive line. At root, the appeal of this path lies in the possibility of its yielding the firm control over its customers' responses. Whereas, say, ethylene is relatively homogenous and can be purchased from any supplier, in speciality items the importance of performance, reinforced by brand loyalty, can transcend price alone, and the supplier there has the chance of introducing some price-inelasticity to the demand he faces.

The first point to be noted is that this process of "going downstream" or refining the product-mix is of more concern to chemical companies than it is to oil companies. For all the talk of oil companies diversifying into a wide range of other activities, as late as 1980 a survey of the 26 biggest oil companies found that they were, on average, still dependent upon oil operations for 85 per cent of their revenue. Petrochemicals accounted for only 6 per cent of their revenue, and sales completely divorced from oil accounted for a mere 5 per cent.[1] Of a sample of seven oil companies in 1981, only 0.5 per cent of their total earnings was derived from their

1. Figures compiled by Chase Manhattan Bank, cited in "The Financial Response to Structural Change", paper by J.M.Dean, BP Ltd., at Institute of Petroleum, 15 June 1982.

chemical companies have tended to show higher profitability on their investments than have the chemical divisions of oil companies, a fact which is widely though to reflect chemical companies' better spread of interests.

The second point to note is that this procedure has been going on for some time already. As table 6 shows, between 1970 and 1980 all of the major European chemical companies increased the share of total sales generated by speciality items, so that by 1980 the lowest proportion of sales generated by such items was 20 per cent. For instance, Dow Europe, although still regarded by many as a producer of commodity chemicals, is moving quickly out of these items. The firm has abandoned completely its manufacture of fibres and PVC, for instance, and by 1981 was obtaining one-third of its $3.5 bn turnover from pharmaceuticals and similar high-value items.[2] Dow Chemicals is shifting its research budget, so that from taking 36 per cent in 1977, R&D on high-margin speciality products will absorb 43 per cent of the budget in 1982. Similarly with Phillips, which plans to raise from 7 per cent in 1978-1981 to 35 per cent in 1981-1985 the share of chemicals capacity investment going to speciality items.[3] State-owned DSM, based in the Netherlands, provides another example of this shift in strategy. In 1982 the company announced plans to shut 20 per cent of its low density polyethylene plant while concentrating more on exporting technology and expertese. Through its subsidiary Stamicarbon, DSM has sold expertese on fertilizers to such countries as Libya, Burma, Bangladesh and the USSR.[4]

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1. "In search of profits", Petroleum Economist, July 1982, pp.286-290.
2. "DOW plans to keep growing in Europe", Fortune, 19:4:82, p.76.
3. "Dutch set for big changes", The Times, 3:6:82.
4. "US Petrochemical firms face big threat from new plants in cheap-energy areas", Wall Street Journal, 12:2:82, p.20.

Table 6

Major European Chemical Companies' Sales of Speciality Chemicals

Company	Speciality sales as % of total sales	
	1970	1980
Akzo	12	28
BASF	20	30
Bayer	32	42
Hoechst	30	40
ICI	17	27
Montedison	15	20
Rhone Poulenc	26	37
Solvay	3	20

Note: Specialities defined to include pharmaceuticals, agrochemicals (excluding fertilizers), fine chemicals, etc.

Source: W. Greenwell & Co., Chemical Research Newsletter, 24 March 1982, p.7.

By the early 1980s, these high-profit, high-specialty items were disproportionate contributors to many chemical firms' profits. In ICI, for instance, the pharmaceuticals division (along with agriculture) was the major earning division in 1981, for the first time, with doubled profits in 4 years attributable in large measure to the division's strong presence in the very fast-growing blood-pressure drugs.[1] In 1981 Hoechst spent fully 40 per cent of its R & D budget on pharmaceuticals research, while in 1981 Exxon reported that speciality products yielded 25 per cent of its total chemicals revenue and 58 per cent of all chemicals earnings. For Gulf the proportion was 33 per cent of chemicals revenue.[2] In contrast to the generally dismal profitability of European chemicals firms in 1980 and 1981, (the average return on assets in 1980 and 1981 was a mere 1.9 per cent), it was noted that "all of the European majors reported varying degrees of satisfaction with agricultural chemicals, pharmaceuticals and with some of their speciality products".[3]

Indeed, the pharmaceuticals business was itself a very substantial one by the 1970s. By 1981 worldwide pharmaceutical sales were estimated at $76.3 billion, and were thought to be growing at an annual average rate of between 6 and 8 per cent. The United States market accounts for around 20 per cent of all sales, Japan for 12 per cent, and West Europe together for a further 30 per cent. Other markets are Canada (2-3 per cent) and Australia and New Zealand (5 per cent). Developing countries together account for some 10 to 15 per cent of world consumption. On a consumption per capita basis, this means that inhabitants there use around $5-worth of drugs each per year, as against $70-worth in developed market economies.

By comparison, the chemicals industry is around seven times as large. In 1980 sales of chemicals in developed countries totalled $471 billion, with Europe accounting for $235 billion, the United States for $161 billion and Japan for $75 billion.[4]

1. "The Chemicals Changes Creating a New ICI", Business Week, 15 March 1982, p.3.
2. "In Search of Profits", Petroleum Economist, July 1982, pp.286-290.
3. "Recession slashes profits", Petroleum Economist, July 1981, p.287.
4. "Chemicals follow steel", The Economist, 8 August 1981, p.17.

The third point to note about this strategy is that it is largely a question of extent for the companies involved. As yet very few companies have abandoned entirely their bulk products interests to rely totally upon speciality products. There are two main reasons for this style of business portfolio management. The first is that selling high value-added items is not a skill easily acquired. It involves different methods of working, usually entailing a large sales force and a highly sophisticated marketing and advertising apparatus. Sometimes the amount of advertising that is allowed is regulated. In the United Kingdom, for instance, no more than 9 per cent of a company's turnover is allowed to be spent on promotion because of government rules; in West Germany, by contrast, the figure is nearer to 25 per cent.[1] The latter figure in itself can constitute a barrier to entry, with marketing acumen built up over years a necessary business attribute.

The second reason for wariness over the high value-added part of the market is the extremely high - and rising - costs involved in R&D in drugs and pharmaceuticals which generally constitute a barrier to entry for most prospective newcomers to the industry. It is estimated that ten years ago developing a drug from basic research through to the marketplace cost, on average, $10 million. Now it is estimated to cost, on average, $70 million, with even $100 million not unknown. This cost escalation reflects the increasingly stringent standards imposed by public health agencies such as the Food and Drug Administration of the United States, and also the nature of medical research today. Increasingly, research involves investigation of the human cell itself, and this is, with present technology, necessarily a very costly business.[2]

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1. "Market remains buoyant", F.T. Survey, 2 June 1982, p.14.

2. "Continuing debate over high cost of development", F.T. Survey, 2 June 1982, p.14.

The simplest way for a firm to acquire the know-how and goodwill necessary to make progress in the speciality chemicals area would be to buy a company already active in it. But if too many firms pursue these already in the field, they will naturally bid up the price of the former firms and impose still larger entry costs upon themselves. A further difficulty with this strategy is that pharmaceutical firms themselves are often extremely large enterprises. In 1980 the top ten companies had combined sales of $19.2 billion. Although this is modest in comparison to big chemical companies' turnover (in 1981 the three biggest companies, Hoechst, Bayer and BASF, each had sales approaching $19.2 billion) it means that such acquisitions are neither trivial nor relatively risk-free.

Following an alternative strategy, Monsanto entered on long-term sponsorship with Washington University at St Louis in 1982 to obtain its pharmaceutical R&D outside the aegis of an established commercial company. At a cost of $24 million over 5 years Monsanto will obtain access to exactly the research best tailored to its own needs. Moreover, the company believes it can also dispense with the need for a large-scale marketing network. This is because the degree of specialisation being pursued is such that only a handful of sales will be sought. Drugs to treat haemophilia, for instance, can be marketed easily to the small number of centres dealing with that ailment.[1]

For these reasons there still exists a gulf between chemicals and pharmaceuticals firms. As tables 7 and 8 show, only Hoechst and Bayer were among the largest operations in both industries.

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1. "Monsanto's academic route to growth", Business Week, 21:6:82, p.37.

Table 7

Top Ten Pharmaceutical Companies

Ranking 1980	(1979)	Company	Sales $m	Change %	Profit $m	Change %
1	(1)	Hoechst, West Germany	2,413	+11.8	n.a.	-
2	(3)	Merck, US	2,287	+14.1	607	+ 8.7
3	(4)	American Home Products	2,193	+13.4	603	+11.6
4	(2)	Bayer, West Germany	2,182	+19.4	n.a.	-
5	(5)	Warner-Lambert, US	1,926	+11.1	271	+ 1.1
6	(7)	Bristol-Myers, US	1,905	+19.6	379	+25.9
7	(6)	Ciba-Geigy, Switzerland	1,805	+17.7	n.a.	-
8	(9)	Pfizer, US	1,644	+14.9	388	+20.0
9	(8)	Roche-Sapac, Switzerland	1,461	+ 8.2	130	+ 5.7
10	(12)	Lilly, Eli, US	1,426	+16.1	330	-

Source: Chemical Insight, cited in F.T., 2:6:82.

Table 8

The World's Top Ten Largest Chemical Firms - 1979

	Sales $m	Change +%	Net Profit (loss) $m	Change +%
Hoechst	14,109[1]	+ 9.6	282	-14.5
BASF	14,071	+ 7.1	182	-42.0
Bayer	13,801[1]	+20.7	370	+67.8
ICI	13,687	+ 5.9	311*	-71.6
Du Pont	13,652	+ 8.6	716	-23.7
Dow Chemical	10,626	+14.8	805	+ 2.7
Union Carbide	9,994	+ 8.9	890[2]	+60.1
Montedison	8,372	+13.9	(482)	-
Exxon[3]	8,228	+23.1	402[4]	-11.8
Shell[3]	7,633	+ 2.5	(57)[4]	-

1 Sales include only 50% of 50%-owned associates; other data based on balance sheet totals.

* Before extraordinary items.

2 Reflects change in accounting procedures.

3 Chemicals only, and excluding intersegment transfers.

4 After-tax operating results.

Source: Chemical Insight, cited in F.T., 1:4:82.

Another problem which attends this shift in output-mix on the part of chemical companies concerns the financial implications of their plans. During the 1980 to 1982 period losses have been substantial: in Europe, plastics firms' losses alone have run at $200 million per month for around a year. Those firms involved in refining have shared in an industry-wide $10 billion loss in 1981.[1] This means that cash flow for redundancy and other closure costs is severely depleted. Yet unless these costs are incurred, further losses will not be halted and the position will deteriorate further.

Finally, companies are increasingly aware that despite the extremely sophisticated nature of many of the products involved in the pharmaceuticals industry, there are some developing countries already making strides towards developing their own pharmaceuticals business. An instance is the Arab Company for Drug Industries and Medical Appliances, (ACDIMA), which was set up by the Council of Arab Economic Unity in 1976. The objective of ACDIMA is to coordinate the drugs industry in the 16 Arab countries now involved in the scheme. Based in Amman, Jordan, the scheme undertakes feasibility studies, financing and marketing. Since around 65 per cent of the $1.5 billion worth of drugs consumed in the member countries in 1980 were imported, there is clearly considerable scope for further import-substitution. One major project, expected to be finished in 1984, is a $150 million antibiotics plant in Baghdad. This plant will supply half the Arab countries' antibiotics demand, which in turn constitutes around 20 per cent of total pharmaceuticals demand.[2]

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1. "Downstream without a paddle", The Economist, 3 July 1982, p.70.
2. "Acdima gears up", Arabia, July 1982, p.70.

"Help Oil's Refining Firms Petrochemicals"

The next question to be asked concerns the oil companies' prospects. To what extent are they likely to follow chemicals firms downstream into speciality products? The evidence available during the early part of the 1980s suggests that few will. Instead, the trend appears likely to be in the opposite direction - away from processing oil altogether, and more towards finding it and giving advice to others wishing to enter the industry for the first time.[1]

What are the reasons for this apparently dramatic change of strategy, relatively seen after the oil firms appeared to be growing so strongly? The most important reason is that oil demand since 1979 has fallen sharply, and, moreover, is not now forecast to resume growth for the rest of the decade.

This means, of course, that the industry's ability to plan on the assumption of ever-rising revenues has been completely undermined. It also means that the return likely to be gained from owning refining and other downstream capacity will be less than was once anticipated, given that through the 1970s, capacity was growing in excess of demand. It also means that periodic inventory revaluations, which were a potent source of profits in years like 1980, will not recur. Indeed, the drop in crude oil and refined products' spot prices seen in 1982 threatened to force a substantial downward revaluation of much of the major firms' 950 million barrels of stocks.

The critical difference between the oil and chemicals companies in dealing with their downstream operations is that the former tend to have less diversified business portfolios than do the latter. Chemical companies can try to look to speciality products for faster growth in revenue, whereas oil-based companies tend not to be able to do this. In 1982, in the United States, the ten largest oil companies owned 55 per cent of the country's ethylene capacity and 44 per cent of benzene capacity, and in both these products markets have, as has been

1. This view stands in contrast with the forecast offered in the last issue of this Survey. (See EIU, 1981, p.119).

[illegible] consistently earned a smaller rate of return from their petrochemical assets than have chemicals companies - a reflection of their different product concentration.[1] As a review of 1980 operating conditions summarized the position, "generally, the chemicals subsidiaries of the oil companies were disadvantaged by product ranges less diverse, and further removed from final consumers, than those of the chemical companies".[2]

Typical of the portfolio shuffling in progress in oil companies is the withdrawal of ARCO investments from downstream activities. In 1982, 34 per cent of the firm's assets were accounted for by chemicals, metals and oil refining facilities; by 1986 the company plans to reduce this share to 26 per cent, while oil and gas exploration receive the excess.[3]

Cutbacks in other forms of refined products capacity have also been in evidence. The number of oil-company owned service stations in the United States fell from 220,000 in 1972 to 151,000 at the end of 1981, for instance.[4]

Exploration is the area of the industry most favourable to small but skill-intensive operators. A move by many oil companies towards divesting much of their downstream capacity and concentrating on selling expertese in precisely such areas was identified as long ago as 1978 by Turner, who predicted that,"in most cases the tradition company will move from being integrated to a form which is best described as a "skills bank" .... international companies will find themselves in a supporting role, supplying markets, management, technology and finance as circumstances dictate".[5]

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1. "Big Oil's retreat from petrochemicals", Business Week,1:3:82,p.91
2. "Recession slashes profits", Petroleum Economist, July 1981, p.287
3. "Energy and Natural Resources", Business Week, 11:1:82, p.59.
4. "Pressures that will force the industry to shrink", Business Week, 22 March 1982, p.47.
5. L.Turner, Oil Companies in the International System (London, George Allen & Unwin, 1978), p.216.

Table 9

Comparison of rate of return on assets obtained in petrochemical operations of US oil and chemical companies, 1977 - 1981

	Oil companies	Chemical companies
1977	4.8%	6.3%
1978	3.5%	6.5%
1979	5.6%	6.8%
1980	2.9%	7.0%
1981	- 0.5%	6.0%

Note: "Oil companies" refers to estimated after-tax returns of 12 large US oil companies.
"Chemical companies" refers to after-tax returns of US chemical companies with sales in excess of $1 billion.

Sources: 1977 - 1980: Cited in "Big Oil's Retreat from Petrochemicals", Business Week, 1 March 1982, p.91.

1981: "In Search of Profits", Petroleum Economist, July 1982, pp.286-290.

Paradoxically, however, some chemical companies are also reaching following oil companies upstream and preparing themselves to offer oil and gas exploration services, even though they do not all possess the capacity to refine the natural resources they may thereby discover. BASF from West Germany has, through its Wintershall subsidiary, bought a 18.5 per cent share in a West German oil exploration company Deminex, and is bargaining for a share in Qatar's offshore natural gas reserves.[1] BASF does however possess its own refineries and intends to create, with them, its own naphtha which will in turn be used as the primary input for its petrochemical needs. In 1982 BASF plans to allocate DM200 mn to oil and gas exploration.

These shifts in firms' business concentrations may appear complex but can be summarised graphically. Figure 3 illustrates the movements underway in various types of companies. Broadly speaking, the oil companies are reacting to the prolonged period of excess capacity in oil refining and the imminent arrival of competitively-priced bulk petrochemicals from OPEC members, Canada and some centrally planned economies and are in consequence increasingly concentrating on exploration and R&D for other agencies. Most chemical companies are similarly planning to divest themselves of their bulk chemicals operations and move to speciality items. BASF, by contrast, has announced plans to integrate its operation still more closely, by identifying its own oil and gas inputs, to run through its own refineries and crackers, and thence to offer a full range of chemicals. Meanwhile pharmaceutical companies are boosting their own R&D expenditure; while OPEC members' oil agencies are making their initial push towards refining, marketing and producing the simpler petrochemicals.

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1. "West German chemical giants face urgent need to reshape industry" I.H.T., 26 April 1982, p.7.

Policy

The problems and opportunities facing chemical and petrochemical producers in developed market economies and developing countries cannot be fully understood without reference to the actions of official policymakers. The actions of other groups, such as trade unions or consumer groups, should also be made explicit. This section discusses the evolution of official policymaking, as it has affected the industry, and the influence of other groups.

Government policy with regard to the industry in the United States / Japan, and in Europe has tended to follow quite closely the precendents set by intervention in other industries. In other words, both the style and the substance of industrial policy as pursued in the three areas is typical.

In Europe, there has been a considerable degree of multilateral discussion, culminating in some cases of portfolio swaps. By mid-1982, European petrochemical producers were estimated to be losing $200 million each month, and approaches were made by executives of Solvay and ATO-Chimie to EEC industry commissioner Viscount Davignon to sanction open discussions about closures. The normal operation of the Treaty of Rome's anti-cartel rule prohibits collusion between firms on such matters as price or capacity, so what is needed from the commission is a dispensation to begin talks.[1] Italian and French industry representatives, from firms whose industry is largely state-owned, prefer a Europe-wide cartel to be set up, similar in some respects to that established for the steel industry, so that redundancies could be coordinated and phased in.[2] So far only outline talks have been undertaken, with different companies' representatives urging one another to desist from dumping. A set of petrochemical product demand forecasts has also been commissioned,[3] but it is unlikely

1. "Cartels: here we go again", The Economist, 19:6:82, p.78.
2. "ICI plants under threat", Sunday Times, 28:3:82, p.17.
3. "Petrochemical study move", F.T., 22:5:82.

that the commission will act until CEFIC, the European Council of Chemical Manufacturers' Federations, has reached a decision on whether market forces should be allowed to slim the industry. Moreover, a sizeable minority of firms are known to be hostile to the idea of a "crisis cartel" in the industry. Also, European subsidiaries of US-owned petrochemical and plastics firms could not participate due to United States antitrust law. It is felt in some quarters that it is the firm with the heaviest losses and the greatest amount of capacity in need of cutting back that are most anxious to involve the EEC and thereby possibly further avoid painful cutbacks. The French Ministry of Industry is believed to favour an EEC plan. Similarly Belgian and Italian interests are thought to favour the idea.[1]

In the meantime closures have been going ahead. What makes these closures less awkward for firms to manage than would be the case in many other industries is, of course, the relatively small size of the workforces involved. The fibres workforce at ICI in Britain was halved over a decade but this still only involved 10,000 employees.[2] The rearrangement by BP and ICI of their petrochemicals capacity in mid-1982, which was referred to as "one of the most significant developments in the sector since the war", and involved ICI leaving completely the low-density polyethylene business it invented 50 years ago, entailed a relatively modest 1,800 job losses.[3]

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1. "Sizeable job cuts loom at ICI", The Times, 23:4:82.
2. "Rift opens over calls for EEC Chemicals Cartel", F.T., 15:7:82.
3. "A formula for Success?" The Times, 18:6:82.

Despite the meagre case for governments' intervening to retain employment, such intervention has occurred. In the United Kingdom, tax concessions were offered to BP, Shell and Esso, the constructors of a $800 million plant at Mossmorran, Scotland to use North Sea ethane to create ethylene, despite the fact that other European producers are struggling to close ethylene capacity.[1] Very few jobs will be created in this project - at most 2,000 construction jobs for three years. Yet a sufficiently strong case was made by the three firms involved in the scheme that they were able to obtain an extremely advantageous tax arrangement - one to which competitors objected immediately afterwards.

Countries with relatively strong trade unions, and with long-established state ownership in oil-based and chemical operations have, by contrast, tended to continue with subsidies even at extremely high cost per job retained. Italy's Montedison (denationalised in 1981) provides a clear example of this. In 1980 the firm was offered state subsidies to allow it to retain 20 per cent of its 12,800-strong workforce, but during 1981 and 1982 the precipitous fall in the lire against the US dollar, the currency in which 90 per cent of Montedison's oil-based feedstocks were invoiced, increased losses intolerably.[2] Thus 1,800 workers were dismissed in early 1982 and base products cut out of the firm's portfolio. Indeed, as recently as 1980 Italian firms' capacity in certain low-value items, such as some man-made fibres, was still increasing. An inquiry into alleged subsidisation by the Italian government and contravention of Article 92 of the Treaty of Rome established that while EEC fibres capacity fell 23 per cent between 1977 and 1981, in Italy it rose by 8 per cent.[3]

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1. "Petrochemical plant threatened in tax wrangle", F.T., 13:4:82
2. "Montedison's plastics unit to cut 14 per cent of work force", I.H.T., 17:2;82.
3. "Italy accused of subsidising fibres industry", F.T., 18:5:82.

The French government has prepared a chemicals industry reorganization, but not all companies have wanted to be involved. Total, the operating title used by the Compagnie Francaise des Petroles announced initially that it preferred to be free to slim its petrochemicals industry as it wished, and not be compelled to take an interest in the attempt to rescue loss-makers elsewhere in France.[1] Eventually, Total began discussions with the French government to sell its entire chemicals interests, arguing that being involved in a partly state-owned and directed scheme would deny its shareholders sufficient control over the business during a very difficult time.[2]

Japanese firms' actions to reduce excess capacity in bulk products are similar in style to those which brought about the original increments to capacity. MITI, the Ministry of Trade and Industry, assisted firms in the 1960s with tax concessions and subsidies, and ethylene output grew at an annual average rate of 30 per cent between 1965 and 1970. Now that some 30 per cent of the country's 6.2 million tonnes of ethylene capacity is surplus to needs, MITI is providing a framework for firms to restructure. The ministry is encouraging R&D, which has tended to be a more modest share of Japanese producers' turnover, typically 2 per cent, than in the United States (at 3 per cent or West Germany (4.3 per cent). Mergers are being arranged, overseas joint ventures encouraged, and a "scrap and build" policy, whereby old capacity is replaced by more modern and efficient capacity of the same size, is being undertaken.[3] Illustrative of the firms' problems was the 77 per cent fall in profits reported between 1981 and 1982 by Mitsubishi Chemicals, Japan's largest producer.

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1. "Total group seeks to stay out of chemicals stake-up", F.T., 26:5:82.
2. "Total talks on sale of chemicals division", F.T., 26:6:82.
3. "Race against time for traditional producers", F.T., 10:2:82.

Petrochemicals
/ [illegible] volume fell 10.2 per cent.[1] Similar difficulties beset the country's refining companies, which, by operating at only 56 per cent of capacity in 1981, plan, under the aegis of MITI, to scrap 1 million b/day of capacity from their existing 5.94 million b/day capability.[2]

The history of government involvement in the United States / industry is quite different. For the post-war period has seen an extremely complex set of laws governing oil taxation spring up, and between them these laws have brought into being a proliferation of small-scale oil refineries as well as - until recently - very competitive and profitable oil and gas-based chemicals operations. The tangle of regulations has been referred to as "some of the most elaborate and confusing governmental controls ever imposed on an American industry"[3] and as "a fantastic and inordinately complicated patchwork".[4]
The November 1974 entitlements programme subsidized imported oil and awarded certain benefits to smaller refiners, as those with secured access to United States / price-controlled oil had to compensate those without.

An important consequence of this policy was very fast growth in United States / firms' petrochemical exports. The industry's trade surplus grew consistently through the 1970s, reaching $10 billion in 1979. Export sales eventually accounted for between 11 per cent of total output (as with ethylene and butadeine) and 33 per cent (with polyxylene). Imports of these products, by contrast, typically accounted for under 2 per cent of total demand.[5] These exports encountered considerable opposition overseas. "Unfair trading" by

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1. "Downturn at Mitsubishi Chemical", F.T., 16:3:82.
2. "Japanese oil refiners at lowest capacity for two decades", F.T., 7:5:82.
3. Fortune, 12:1:81, p.38
4. D.Rostow, A National Policy for the Oil Industry, (Yale U.P., 1948) p.XV.
5. J.F. Frank, "The Changing Competitive Position of the US Petrochemical Industry: Can We Maintain our Strong Exports?" Chemicals Conference, Cherry Hill, N.J., 29-30 July 1980.

United States companies, due to their access to controlled feedstock prices, was alleged by the United Kingdom industry's official working party.[1] Although the source of this complaint is being undermined by progressive energy price decontrol in the United States, dumping allegations have been made. In general, however, trade conflicts have been relatively few. The EEC commission ended one anti-dumping inquiry against Japanese exporters of polypropylene film, after a persistent 30 per cent Japanese price advantage was identified, following the exporting firms agreeing to raise their prices.[2]

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1. NEDO, "Petrochemicals - Industrial Review", July 1981, p.9.

2. "EEC Commission closes two anti-dumping cases", F.T., 22:6:82.

Summary and conclusions

During the 1960s and 1970s there was exceptionally rapid growth of capacity in most branches of the petrochemicals industry. Acting in the belief that demand for petrochemicals products would continue to outstrip industrial output generally by a factor of around two, planners reacted only slowly to the deceleration of demand seen in the 1970s. As the process of substitution, for instance into plastics from wood and steel, slows down, and real prices have increased, consumers in households and in industry have scaled down the rate at which their demand for such items is increasing. At the same time as demand is forecast to continue decelerating, the traditional centres of the industry in Europe, Japan and the United States are anticipating new sources of supply - much of it at very competitive prices - to become significant within three years. Canada and the Middle East are the areas most involved here. Given that, after a serious slump in 1980-1982, demand for petrochemicals is expected to continue growing (albeit much more slowly than before) there should in principle be adjustment paths open to all the firms now involved in the industry. In anticipation of lower rates of return to their investments once new sources of supply appear, some firms are shutting their capacity in its entirety, either to concentrate on operations elsewhere in their business portfolio, or to leave the oil and chemicals business completely. Other firms envisage forms of joint venture with new suppliers, such as those in OPEC countries, which will allow them to adjust while maintaining a foothold in an industry which they know intimately. For the most fully integrated firms, increased emphasis on the most research-intensive parts of the business, such as drugs, is being advocated.

What makes these strategies rather harder to execute at present is first, the fact that considerable financial strain has been suffered in those parts of the industry downstream from oil exploration, as a result of the slump in oil demand, and, second, the fact that many companies at once are trying simultaneously to enter the pharmaceutical and drugs business. They are, in consequence, raising the danger that they will between them recreate the conditions of excess supply which their policies are an attempt to combat.

Faced with a series of worldwide and fairly simple forces at work, the section has highlighted the ways in which different firms have attempted to adjust to be in a position to enjoy a high rate of profitability later in the 1980s.

Figure 5

The changing pattern of vertical integration in the oil and chemical industries