

Ballance, Robert

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in the wake of the austerity measures associated with the IMF programmes may have induced capital exporters to leave their money abroad.

However much the methods of estimating the flight of capital may differ, Argentina, Venezuela and Mexico are regularly identified as the countries with the highest level of capital flight in absolute terms. In relation to external indebtedness, however, capital outflows from smaller countries are also significant. As a rule, mistaken economic policies led sooner or later to capital flight. Controls on capital transactions could only stem the flow, not prevent it; they lead to illegal capital exports that are very difficult to record statistically.

Nevertheless, the flight of capital is not the inevitable fate of the countries in question. In general, it is a symptom of economic mistakes and not the cause of economic problems. Moreover, in the economic conditions that prevailed (negative real interest rates, an overvalued currency, and so forth) the export of capital can prove a more efficient alternative to investment at home, as in these circumstances the domestic use of the resources is bound to lead to the waste of capital. In theory at least, the export of capital leaves open the possibility that the capital will return home when the economic climate improves and can then be invested efficiently.

INDUSTRIAL POLICY

Industry-specific Strategies in a Protectionist World

by Robert Ballance, Vienna*

The period from 1950 to 1974 was one of exceptional economic progress, particularly in manufacturing. This article examines how some of these developments have altered the objectives and methods of formulating industrial policy in western countries. Following a brief discussion of sector-wide policies and strategies, evidence from two industries – steel and advanced electronics – is used to illustrate the growing range of strategic choices and the interaction between public policy-makers and private industry. Finally, some generalizations with regard to industry-specific strategies are presented.

Since 1950, policy-makers in various capitals have witnessed a relative decline in the international role of their country's manufacturing sector. A marked deterioration occurred in the case of the US, although similar trends emerged in the UK and elsewhere. For instance, during 1963-78, the combined share of world manufacturing value added in eight western countries declined from 46 to 33 per cent.¹ Opposite trends were observed in other countries, notably Japan and West Germany.

The redistribution of industrial capabilities led to several modifications in the international framework

which, heretofore, had guided policy-makers in the fields of industry, trade, finance and investment. First, experience suggests that the operation of such a system usually requires a powerful leader or regulator. The internationalization of economic relations is thought to proceed most rapidly when one nation has a near monopoly of power.² But as the range of industrial capabilities between western countries narrowed, more

¹ Cf. R. Ballance and S. Sinclair: *Collapse and Survival: Industry Strategies in a Changing World*, London 1983.

² The UK performed this function prior to the 1930s (cf. C. P. Kindleberger: *The World in Depression, 1929-39*, Berkeley 1973). A similar role was played by the US until the mid 1970s when a vacuum in international leadership emerged (cf. OECD: *Interfutures, Facing the Future: Mastering the Probable and Managing the Unpredictable*, Paris 1979).

* UNIDO. The views expressed in this paper are those of the author and are not necessarily those of the organization with which he is affiliated.

policy decisions came to be fashioned by negotiation between countries or coalitions of countries. Under these conditions it is increasingly difficult to achieve the necessary political consensus between countries to deal with emerging problems.

Second, several governments became hesitant in their efforts to sustain the post-war network of policies and institutions which regulated the international trading system. The gradual spread of new industrial capacity has accentuated the importance of foreign markets and suppliers at the expense of domestic competitors. For several reasons, policy-makers were faced with a greater margin of uncertainty. These included:

- ☐ an unfamiliarity with the characteristics of foreign markets and suppliers and the inability to influence these firms through domestic policies;
- ☐ the creation of large tracts of overseas capacity, particularly in industries where adjustment pressures are already evident;
- ☐ the possibility that external suppliers may impose constraints on domestic firms by cutting deliveries, raising prices or enforcing embargos;
- ☐ the fear that reliance on imported capital goods may relegate domestic users to inferior technologies or lessen their ability to influence the nature of technological advances.

The consequences of the industrial realignment were reinforced by another, more specific, type of convergence. For a wide range of manufactures, relative factor abundance in western countries has gradually become more similar. Thus, several determinants of comparative advantage – relative

differences in national endowments of capital, unskilled and skilled labour – may no longer dominate while others, such as resource endowment, are not germane.³ Under these circumstances the pattern of specialization in production and trade depends heavily on factors such as non-competitive firm behavior and government intervention.

These fundamental changes in world industry have altered both the objectives and the process of policy-making in western countries. National considerations have partly supplanted international guidelines in the choice of industry strategies. One result has been a growing number of industry-specific disputes which often pit the US against Japan, the European Community or its individual members. Given these trends, it is perhaps appropriate to search for common threads in the national strategies. Some possibilities are briefly sketched below.

The Manufacturing Sector

It would be a simple process to distinguish between national strategies if each were characterized by a single or well-defined set of priorities. If so, countries might be depicted as subscribing to a strategy giving an overriding emphasis to R and D and associated industries (computers, advanced electronics, aerospace) or, perhaps, one of preserving sunset industries (steel, textiles and footwear). Other examples would be strategies reflecting the traditional dichotomy

³ For instance, steel is not necessarily produced most efficiently where iron ore and coal are found, given modern transportation and the influence of market location. Similarly, the importance of Heckscher-Ohlin trade is largely confined to labour-intensive products. Cf. W. Cline: *Reciprocity: A New Approach to World Trade Policy*, Institute for International Economics, Washington D.C., 1982.

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V E R L A G W E L T A R C H I V G M B H – H A M B U R G

between open and closed economies, export promotion and import substitution, or a strategy of emulating technological leaders.

But national strategies are neither simple nor coherent. They are seldom applied consistently over time, being altered abruptly by voters, by changes in the priorities of top-level bureaucrats or by major shifts in global economic circumstances. Moreover, the real priorities underlying an industrial strategy are rarely obvious and are not always clearly defined even in the minds of policy-makers. Finally, no country follows a strategy which is common to the entire manufacturing sector. An emphasis on "high-tech" industries may be pursued simultaneously with efforts to delay or deter the contraction of other industries.⁴ In brief, many modern-day strategies are neither clear cut nor sufficiently broad to permit simple characterization.

If a broad interpretation of national strategies offers little grounds for generalization, can more useful insights be gained by limiting the discussion to industry-specific strategies? At this level of disaggregation an additional simplification is helpful. Briefly stated, in most countries – including the technologically advanced – a large portion of total manufacturing output will probably always consist of certain traditional and standardized activities – the production of building materials, food, clothing and "ordinary" consumer durables. Transport costs, national differences in consumer preferences and declining returns to scale (e.g. for natural-resource-based products) are among the reasons why most countries produce a similar set of goods. While such industries may be the frequent subject of domestic policy debates, they are less frequently the subject of international disputes.

The industries which are the main focus of international disputes typically fall into one of two categories. The first consists of industries which are relatively important in terms of capital investment, domestic output and/or employment. The contraction of these industries, euphemistically known as "mature" or "sunset" industries, can pose economic and political problems. In the second group are highly specialized industries, often regarded as technology-intensive. In the opinion of some policy-makers, international leadership in these fields (usually referred to as "sunrise" industries) depends upon "who gets there first". And once established, technological pre-eminence is thought to provide a lasting competitive advantage.

Among western countries, examples of industries falling in the first category may include steel, autos, bulk

chemicals or machine tools. The reasons for contractive pressure involve over-capacity, which often results from previous misjudgements about expected levels of demand⁵, the establishment of new competitive capacity – e.g. petroleum refining in the Middle East and Mexico and new steel mills in many developing countries – or a surge in import penetration. Related explanations are widespread obsolescence (as in the American steel industry) or poorly timed expansion programmes which were abruptly undercut by new technological advances. Here, the major issue confronting policy-makers is how to accommodate a contraction in industry size. A secondary concern can be to find the means to rejuvenate the industry and to restore some measure of international competitiveness.

The importance which policy-makers attach to the second cluster of industries apparently derives from their belief that comparative advantage may be achieved artificially. Through various forms of government intervention, any developed country may aspire to technological leadership in some phase of manufacturing. Moreover, technological pre-eminence in a particular phase (e.g. semiconductors and integrated circuits) may help to confer leadership in related product lines (computers, automated machine tools) and their applications (computer-aided design and manufacture). And strategies to foster these types of activities are regarded warily by foreign competitors since the establishment of a pre-eminent position could affect a much wider range of industries on an international scale.

Further generalizations are difficult without a closer look at the actual policies and strategies. Two industries – steel and advanced electronics – are chosen for this purpose. Steel is a mature industry, typical of the first group of activities while advanced electronics is representative of the second. The purpose of the discussion is to identify similarities and differences in national strategies as well as some of the forces and conditions that determine the choice of a strategy.

Steel – an Ageing Industry

Prior to the 1970s, growth of the West's steel industry was steady. Buoyant demand meant that producers

⁴ Policies which favor one set of industries implicitly discriminate against others. Thus, policy-makers may encounter pressure to assist industries other than those which are accorded the highest priority. The result is a set of co-ordinated strategies which, sometimes, borders on the schizophrenic.

⁵ A relevant example is the experience of the British Steel Corporation: in 1971, the Government endorsed plans to expand capacity to almost 40 million tonnes by 1980. Ironically, 1980 began with a tripartite dispute between government, industry and labour regarding a production level of 15-16 million tonnes. Cf. *The Economist*, 12 April, 1980.

were not troubled by excess capacity, the threat of substitutes or declining rates of profit. The eventual conversion into a mature industry changed all this. Prior to the mid 1970s, world consumption of crude steel had grown steadily but thereafter fluctuated erratically. But producers did not restrict their capacity expansion during this period, apparently anticipating only a brief downswing. Until 1974, the world's steel industry operated at over 90 per cent of effective capacity. Afterwards, utilization rates plummeted to less than 60 per cent.⁶

Fundamental changes in the structure of manufacturing signalled the onset of maturity in the steel industry. Today's major growth areas are telecommunications, energy, aerospace and computers. Unlike the leading industries during the first two thirds of the century, these fields are not intensive users of steel. Thus, steelmakers are dependent on user industries which, themselves, are losing ground relative to overall economic activity. Other, economy-wide structural changes have a similar effect. The service sector's share in GDP has grown relative to the production of material products, and investment has given way to consumption in the expenditure of national income. Because both services and consumption are less steel-intensive than investment in the production of material goods, the industry's share in output and employment is likely to decline further. It is against this background that the following strategies should be seen.

Protectionist Strategies – the US Approach

By 1960 the US had already become a net importer of steel. Since that time the restraint of imports has been a prominent policy objective. As imports rose, protectionist sentiments grew stronger. In 1969, voluntary export restraints were negotiated with the EC and Japan. Although these restraints were abolished with the passage of the Trade Act of 1974, protectionist pressures soon re-emerged. Because the campaign occurred in the midst of a bad recession it benefited greatly from public support. There was also a change in tactics that took into account the new test for dumping contained in the Trade Act of 1974. This shift was said to be on the advice of the Carter Administration which was anxious to deflect a new drive for import quotas.⁷ The American Iron and Steel Institute (AISI) also played a leading role. It filed a petition in 1976 charging that Japanese producers had unfairly diverted shipments of

steel to the US as a result of an agreement to restrict imports to the EC. The AISI attempted to document charges of unfair practices and forcefully advocated the need for stronger import restraints.

At the height of the protectionist drive, a steel caucus of about 150 Representatives and Senators demanded that the Administration produce an effective means of import restriction by the end of 1977. Soon after, the Carter Administration introduced a trigger price mechanism (TPM). The mechanism set a minimum price for imports based on "constructed costs" using Japanese data. Foreign steel could be sold in the US at prices above the minimum, but imports at prices below these levels would prompt a preliminary review to determine whether the government should launch a full-scale investigation of dumping practices.

But American steel producers remained dissatisfied with the levels of protection accorded by the TPM. They turned to litigation in an attempt to replace the TPM with a stronger form of import restraint. In 1980, the US Steel Corporation filed an extensive anti-dumping petition against European producers which led to the suspension of the TPM. The suit violated an agreement whereby the Administration had established the mechanism in return for an industry pledge not to file anti-dumping charges. When the Administration reinstated the TPM with a 12 per cent increase in the minimum price of imports and new quantitative restrictions, US Steel withdrew its petition. Subsequently, several firms again filed anti-dumping suits and appealed for countervailing duties to equal the subsidies received by foreign competitors. This step again led to suspension of the TPM. The legal cases affected most of the steel exported to the US by the EC. A compromise was reached in October 1982 just hours before a deadline that would have brought penalties into force. Governments and industries alike agreed to a quota system that would limit Europe's exports, on average, to 5.4 per cent of the American market.

Throughout this entire period the efforts of law-makers and steel producers were actively supported by the United Steelworkers Union. Because producers had traditionally offered only minimal resistance to the union's demands, the gap between steel wages and the average for manufacturing widened from 30 per cent in the mid 1960s to 70 per cent by 1980.⁸ Viewed in this light, the union had very good reasons for endorsing the protectionist drive. All these circumstances led to a paradoxical situation in which steel producers, while

⁶ Cf. OECD, *op. cit.*, p. 369.

⁷ Cf. H. Mueller and H. van der Ven: *Perils in the Brussels-Washington Steel Pack*, in: *The World Economy*, Vol. 5, 1982, p. 263.

⁸ Cf. K. Kawahito: *Japanese Steel in the American Market: Conflict and Causes*, in: *The World Economy*, Vol. 4, 1981, p. 248.

offering some of the highest wages and benefits of any American industry, were appealing for government intervention to shield them from international competition.

The protectionist campaign encountered some opposition. Parts of the US bureaucracy were reluctant to endorse these measures. They were concerned with wider ranging trade relations with the EC; retaliation in the form of trade restrictions on American exports of chemicals, textiles or agricultural products was feared. The zeal with which steel firms supported the protectionist campaign also varied. Several had made long-term commitments to import specific types of steel that were in short supply. As a result, they opposed at least some aspects of the campaign. A few firms had begun to diversify – into oil-refining, chemicals or activities outside the manufacturing sector – and their enthusiasm for protection was lukewarm. In general, however, American steel users lacked unity and failed to marshal an effective response to the industry's pressure groups.

The Davignon Plan

Beginning in 1976, the European Community adopted a strategy of cartelisation which was reminiscent of the tactics employed in the 1920s. The cartel was a voluntary one intended to promote market stability by fixing levels of crude steel production, minimum prices for imports and duties to prevent dumping. In return, producers were expected to reduce excess capacity with the help of cash payments from the EC. But the cartel's operation was plagued by a further decline in demand which contributed to a series of internal disputes. These included intra-EC price wars and dumping allegations, objections to the public subsidies to specific steelmakers and disagreement on the need for compulsory rather than voluntary controls to enforce the cartel. In part, these disputes reflected the underlying heterogeneity of the European steel industry resulting from differences in the extent of public ownership, the degree of specialization in bulk steel, specialty steel and steel products, and the extent to which steel makers were integrated into the country's industrial structure.

The Davignon Plan has striven to deal with the problems of considerable excess capacity and the failure, or inability, of several major producers to modernize their steel-making capacity. But it has also faced another difficulty which was new to the 1980s: the cartel's effectiveness was subject to the EC's changing fortunes in the "steel war" with American producers. Most European suppliers would probably have opted for

a continuation of the American TPM, provided that trigger prices were not set too high. This would have allowed them access to the US market without any formal investigation of the extent to which their operations are subsidized. However, as protectionist pressures mounted in the US, voluntary export restraints became a more attractive option. Closure of the American market would have meant that six million tonnes of steel being exported to the US would be diverted back to Europe.

The Japanese Approach

In contrast to the internal differences that have plagued the European cartel, the homogeneity of the Japanese steel industry facilitated a consensus strategy. During the 1970s five producers accounted for 70 per cent of Japan's output and all had similar cost structures. Although the product mix of the firms differed, the market share of each producer was relatively constant. The framework for the strategy included the provision of monthly voluntary guidelines by MITI and weekly meetings attended by executives of the five companies and MITI officials. Many raw materials were bought through joint negotiations between the five firms and their suppliers. Investment programmes and plans for modernization were also closely co-ordinated. These tactics enabled the industry to weather the global slump in steel in the 1970s without serious cutbacks in capacity. Japan soon became the world's leader in the use of continuous casting as the proportion of output accounted for by this technology rose from 20 to 80 per cent between 1973 and 1983.⁹

Falling steel prices and new capacity in developing countries subsequently led to a deterioration in the Japanese industry: in 1983, major steel producers reported losses for the first time in decades. Like their American counterparts, some steelmakers proposed that their government file dumping charges against foreign exporters in Brazil, South Korea and Taiwan.¹⁰ However, such a tactic is not likely to gain wide acceptance. Most Japanese steelmakers are reluctant to ban imports since – unlike the US industry – they ship so much steel abroad themselves.

⁹ This process yields significant reductions in energy use and other improvements in efficiency. In contrast to the Japanese situation continuous casting accounted for only 31 per cent of US steel production in 1983 while, in the EC, the corresponding figure was approximately 50 per cent.

¹⁰ Wages are cited as one of the main reasons for the price advantage of new competitors. In the US, the share of wages in total costs is about 24 per cent; in Japan that share is 18 per cent but in South Korea the corresponding figure is 4-5 per cent. Subsidies are thought to be another important explanation. Estimates put these subsidies at 40 per cent of production costs in Brazil and 10-20 per cent in South Korea and Taiwan. Cf. *Far Eastern Economic Review*, 17 November, 1983.

Product Diversification

A strategy of product diversification reflects a desire to lessen the firm's dependence on crude steel production. One alternative is to shift into the production of higher quality steels. Another is to move downstream, through integration, from crude steel into steel-using operations that are more closely related to engineering activities. A third version, specialization in non-steel activities, has been adopted by American firms and is tantamount to a partial exit from the steel industry.¹¹

The popularity of a diversification strategy reflects the consequences of the slump in demand and the rise in production costs which occurred during the 1970s. Diversification into higher quality or specialty steels offers better demand prospects and a lesser threat from competitive substitutes. Some Japanese steelmakers adopted this tactic by specializing in "high-strength" steels which compete with aluminium in the manufacture of automobiles, containers and other mass-produced items. Alternatively, producers who choose to move downstream into engineering activities are usually part of large, integrated firms. Their steel-using operations are of a sufficient size to absorb demand fluctuations and to subsidise losses in the steel-producing activities. This arrangement works to the benefit of the firm because the engineering and metalworking phases of the operation are assured that they will obtain the types of steel required.

In comparison to other industries steelmakers have traditionally eschewed international commitments, whether through joint ventures, technology-swapping agreements or capacity-sharing arrangements. There is recent evidence, however, that such attitudes may eventually be reversed. Despite criticism within the industry, some American firms have begun to search for foreign technical assistance leading to "a multitude of agreements. . . between Japan's big five and the USA's top ten".¹² This option also opens up the possibility for

traditional steelmakers to concentrate on those product lines where they are most competitive while importing semi-finished steel from abroad.¹³ The purchase of a modest share in Wheeling Pittsburgh by Nisshin Steel suggests another dimension to the strategy. Heretofore, foreign investors were discouraged from such moves by the antiquity of the US industry. But American-based production has gradually become more attractive as a means of avoiding protectionist pressures in that country.

Advanced Electronics – an Emerging Industry

The advanced electronics industry is defined to include equipment such as computers and automated machine tools as well as their main components (e.g. semiconductors and integrated circuits). Beginning from a negligible base, the industry has expanded rapidly, overtaking consumer electronics as the predominant sub-sector in the electronics field.¹⁴

Governments have actively encouraged industrial applications of advanced electronics as a way to improve product quality and reduce costs. Manufacturing activities consist mainly of making materials, forming them into shapes, joining the bits together and then assembling the parts into finished products. A product's quality and reliability are dependent on the performance of these tasks and electronic capital goods and computer control of manufacturing processes are expected to perform more consistently than workers in this regard. Moreover, the cost of a product largely depends on the level of efficiency attained in the joining and assembly phases and the use of electronic capital goods is expected to lead to improvements. Many government officials apparently hope that new systems of electronic capital goods will eventually serve as the basis around which other industries may reorganize.

Promoting a National Champion

A national champion may be defined as an industry based on advanced technology and fostered by government and business in intense competition with similar partnership in other countries.¹⁵ In most western countries the computer industry was an early choice for this strategy. The provision of state funds for R and D, preferences in public procurement for domestic firms, government-assisted mergers and favourable loans were some of the policies employed to spur the take-off of computer firms in the late 1960s and 1970s. As international competition has mounted, governments have become more generous. In 1984, West Germany announced a four-year programme of \$1.2 billion to aid

¹¹ For example, in 1980 steel operations accounted for only 11 per cent of operating income at US Steel. Others, notably Armco and National Steel, steadily moved out of steel as their financial position permitted (cf. R. Reich: *Making Industrial Policy*, in: *Foreign Affairs*, Spring 1982, pp. 851-81).

¹² R. Ballance and S. Sinclair, *op. cit.*, p. 122.

¹³ US steelmakers have recently attempted to complete such agreements with firms in Brazil but the deals have not gone through.

¹⁴ By 1978, the value of industrial products and components accounted for 68 per cent of all electronics production in the US and 53 per cent in the EC. The corresponding figure for Japan was lower but was rising rapidly. Cf. *Institute of Developing Economics: The Electronics Industry in Japan*, Tokyo 1980.

¹⁵ Cf. G. Ohlin: *Subsidies and Other Industrial Aids*, in: S. Warnecke (ed.): *International Trade and Industrial Policies*, London 1978, p. 320.

the microelectronics, communications and computer industries by reducing risks, improving training and developing applications. Subsequently, Britain unveiled a \$170 million addition to an existing programme for the same purpose. And France embarked on a five-year project costing \$17.5 billion to boost competitiveness in the electronics industry.

Governments also played an indirect role in fostering the industry's development. In the US, regulations on fuel economy and stringent emission controls are making that country's auto industry one of the largest markets for chips and, eventually, microprocessors. More subtle forms of government intervention are typified by the Japanese Government's decision in 1965 to subsidize research on integrated circuits while simultaneously preventing US manufacturers from establishing a domestic presence before local producers were ready to compete.

The EC has attempted to formulate an overall plan for the development of computers, microelectronics and telecommunications as well as a common policy on public procurement. The programme includes direct financial assistance to aid firms producing computers and microchips and indirect support through the creation of a European network for advanced communications. In addition, public procurement policies would provide for all "qualified" EC firms to have the opportunity to tender bids and calls for governments to allocate a small percentage of their annual equipment purchases to suppliers in other EC countries. A major flaw is the inability of European governments to agree on the treatment of US subsidiaries. Countries that have no domestic computer industry of their own argue that foreign subsidiaries should qualify as home producers while the French Government has opposed the inclusion of foreign subsidiaries in any Community-wide programme.

In order to boost the home market for robots, the Japanese introduced a leasing scheme similar to that employed in the early 1960s to help fledgling computer companies. Because acceptance of robots has been slow in most fields of manufacturing, Japanese producers have been forced to export their new products. Under the auspices of MITI and with the support of the Japanese Industrial Robot Association, a robot-leasing company was established in 1980. By providing robots to users at subsidized rates, the

Government intended to encourage more – and smaller – firms to accept automation. With this financial assistance, purchasers can depreciate 53 per cent of the total cost of sophisticated robots in the first year.¹⁶ In addition, the Government has funded research by the larger electrical companies and has accepted money from potential users of robots to set up research projects at government laboratories.

Joint Ventures and Foreign Know-how

Their heavy dependence on American and Japanese suppliers has spurred many European governments to take more aggressive steps to promote home production in key areas of advanced electronics. This dependency is apparent in the market for computers where the EC accounts for about one quarter of world usage but only 15 per cent of production in western countries. The industry's fragmented condition has consistently frustrated efforts to devise a Community-wide strategy. Because of their weak position various governments and producers have turned to the Japanese for technology-swapping agreements in order to withstand American competition.

A similar situation prevails in the field of semiconductors where European firms supply only about 40 per cent of the Community's requirements.¹⁷ And there are sound commercial reasons to be concerned about the extent of dependence on foreign suppliers of components. First, there is a history of sudden shortages of key microelectronic components and the vulnerability of users in third markets is great. Second, American and Japanese customers are thought to enjoy commercial and technological advantages through their participation in the design of new semiconductor products. Finally, some Europeans fear a US embargo on high technology exports.

Most governments carefully control the activities of foreign firms. The French strategy is intended to encourage those joint ventures which will facilitate the acquisition of foreign technologies. Because the leading French firm lacked the latest technologies to produce integrated circuits, the Government stipulated that partnerships with local firms were a precondition for American producers to manufacture in France. The American participants were expected to supply the technology and to train French engineers. In exchange, they were not required to put up any cash and were offered 49 per cent of equity in the new ventures which receive substantial government funding. These new companies, plus the major French producers, will be the preferred suppliers of chips and circuits for the telecommunications and defense industries.

¹⁶ Cf. *Far Eastern Economic Review*, 4 December, 1981.

¹⁷ In 1980, two of the world's ten largest producers of semiconductors were European. By 1983, the ten largest firms were all American or Japanese. Cf. *The Economist*, 10 March, 1984.

Co-operative Strategies

At a time when many industrial applications are still at the conceptual stage, access to the results of R and D is crucial. Simultaneously, the heavy and continually rising costs of research can be prohibitive to all but the largest firms. In response, there have been various attempts to spread the cost burden and to share the results of R and D. Two Japanese programmes funded by Nippon Telegraph and Telephone (NTT) and MITI provide examples. Begun in the mid 1970s, they were intended to develop new generations of advanced integrated circuits, microwave systems and computers. Engineers from NTT worked jointly with large private companies which received no public funds to cover their participation costs. Instead, firms expect large orders from NTT once the programme yields results. The MITI project broke new ground with the creation of a co-operative research laboratory where some 120 researchers from five companies worked together for four years to develop "very large-scale integrated circuits". Private participants are obligated to repay MITI's financial outlay if they earn income from the patents but must first convert the basic know-how into marketable products.

American attempts at collaboration are less advanced. One programme, initiated in 1982, is a consortium known as Microelectronics and Computer Technology Enterprises. In addition to spreading the costs of R and D, the consortium provides a means of sharing scarce talents and of avoiding duplication of research. A helpful Justice Department removed one obstacle by granting anti-trust clearance to the new undertaking. Another initiative is a joint venture between American firms and universities. The non-profit organization, which is sponsored by the Semiconductor Industry Association (SIA), was created to fund long-term research at universities.

There is further evidence that mounting Japanese competition has led American firms into more aggressive forms of collaboration. In the field of semiconductors the competitive position of major suppliers was undercut when Japanese firms reduced prices and moved into the US market. One response was IBM's purchase of a stake in Intel, a producer of chips that has been particularly hard-hit by Japanese competition. The move was prompted by the fear that commercial failure of domestic suppliers would make IBM dependent on foreign producers of chips. This was only one in a series of joint ventures, technology exchanges and ownership agreements involving IBM, Burroughs, Digital Equipment, Texas Instruments and Sperry. Closer co-operation between producers of

sophisticated electronic products and their suppliers is further suggested by the observation that "contracts for chips no longer go automatically to the lowest bidder, especially if the lowest bidder is a Japanese company".¹⁸

Integration Strategies

A twofold integration movement is underway and is expected to continue in the future. Firms involved in the design and production of components have begun to move downstream. One advantage is that the skills acquired in the production of chips and integrated circuits are valuable in other, more profitable, parts of the market. Despite declining profits, American and Japanese companies have maintained semiconductor operations in the hopes of using that knowledge more profitably in downstream activities. Integration has also been undertaken by the users of electronic components. Computer manufacturers take up to 40 per cent of all the chip makers' output. Because their operations are dependent on adequate supplies, these firms have become major producers of "captive" semiconductors for internal use. Thus, IBM has spent huge sums on research and claims to be one of the world's largest producers of semiconductors. Similar tactics are being adopted by users of chips and integrated circuits in the automobile industry, in consumer electronics and office equipment. The funds available to these conglomerates permit them to concentrate R and D expenditures on technology development for advanced electronics.¹⁹ There is a danger that captive operations will not keep abreast of the rapidly changing state of technology. However, very large-scale integration means that virtually entire systems are implanted on a chip and many equipment makers prefer in-house development in order to protect proprietary designs.

Protectionist Strategies

Under pressure from the Japanese, various parts of the American industry turned to Washington for relief.²⁰ Their efforts were complicated, however, by significant differences in the two countries' legal systems and the far-flung nature of the industry. For instance, producers of semiconductors have long hoped for government

¹⁸ Cf. *Business Week*, 1 October, 1982.

¹⁹ Japan's diversified electronics firms are thought to devote nearly 30 per cent of their sales revenues to R and D or to new plants.

²⁰ More subtle tactics can be found in Japan. Nippon Telegraph and Telephone offers one example. Although it must accept applications from all suppliers, including foreigners, it continues to rely only on traditional ones. For instance, all optical fibre cable is bought from six Japanese firms according to informal quotas.

action on their claim that Japanese firms were dumping.²¹ The Justice Department initiated an investigation of US subsidiaries of six Japanese companies for possible violation of anti-trust laws. The charges included conspiring to fix the price and to limit the quantity of 64K-RAM chips exported to the US. Thus, the investigation focused on alleged efforts to steady, or even boost, prices rather than anti-dumping allegations. The approach of the Justice Department was regarded as an attempt to open a more general investigation of Japanese laws that permit industries to establish cartels, to fix prices and allocate markets and to eliminate smaller competitors within their home market. The complications introduced as a result of the international character of the industry are reflected in the reaction of the SIA to the dispute. The position of the industry association, which represents nearly 50 producers and users of chips, was ambivalent since several of its members buy chips from Japan and, therefore, benefit from the low prices. The Association's position was further complicated by the fact that the two leading producers of semiconductors, IBM and Texas Instruments, have operations in Japan but neither are members of the SIA.

Summary and Conclusions

Since the mid 1970s, several interrelated trends have combined to alter the nature of industrial policy in western countries. These trends have implications for a number of important industries such as autos, petrochemicals, aircraft, microbiology and various types of heavy machinery in addition to those surveyed here in this paper. First, in the present atmosphere of competitive coexistence, governments have gradually found it possible – or have deemed it necessary – to adopt more *dirigiste* approaches to industrial issues. But the growing involvement of government also created greater scope for influencing its decisions; there are simply more decisions to influence. Once the willingness to accept an enlarged mission for government became apparent, interest groups in various industries found the dispersion of authority much to their liking. Although the whole of government is impervious to control by any group, its many separate parts have proved to be uniquely susceptible to special-interest pressures. A direct consequence of this merger in decision-making authority is that some industrial policies are no longer devised solely by public officials. Nor are industry strategies necessarily the exclusive responsibility of corporate officials. Instead, both

processes are interrelated, being assembled through negotiation between public officials, industry representatives, foreign competitors (and their own government representatives), importers and, sometimes, trade unions.

Second, in the present environment the dominant firms in major industries are – more than ever before – vulnerable to decisions taken abroad. They may depend on imported raw materials, intermediate inputs or technologies. Overseas markets can be crucial and prolonged imbalances in exchange rates will undermine international competitiveness. Alternatively, unexpected moves by foreign competitors, such as new export initiatives, takeovers or the establishment of subsidiaries, alter abruptly the conditions in the home country's industry. Major firms in internationalized industries have continued to pursue traditional strategies designed to cut costs or identify new market niches. But under the present conditions they will also be more prone to turn to their governments for assistance; their chances of success are greater when the perceived threat is foreign rather than domestic.

Third, the gradual convergence of factor proportions has fostered the expectation that comparative advantage (or disadvantage) is malleable through industrial policy. Both governments and special interest groups have been encouraged to redouble their efforts to influence the international standing of key industries. Thus, the distinction between the policy-making authority of public officials and the corporate responsibilities of industrialists has been further eroded. A related consequence is that the competitive ability of internationalized industries has come to depend on elements of market structure and industrial organization. The majority of industries in question are composed predominantly, if not exclusively, of large firms operating in an oligopolistic manner. And where factor proportions are roughly similar, the outcome of strategic firm behavior may overshadow the role of more conventional trade determinants.

In the present environment, countries, rather than industries or firms, are generally regarded as the real competitors in major markets. In this atmosphere the formulation of industrial policies reflects a variety of considerations relating to international investment, technology, elements of firm behavior as well as government's willingness itself in the field of industry-specific strategies. Given the significance of each of these elements, a more explicit and co-ordinated set of international rules is required to deal with the consequences of protection in an era of competitive coexistence.

²¹ The unit price of one particular type of chip, the 64K-RAM, had fallen from \$20 in 1980 to \$5 in mid-1982. US producers regarded this development as a Japanese attempt to buy market share. However, shipments from Japan subsequently slowed down and prices stabilized.