TECHNOLOGICAL SOVEREIGNTY: FORGOTTEN FACTOR IN THE 'HI-TECH' RAZZAMATAZZ

PAUL GRANT

Technological sovereignty is the capability and the freedom to select, to generate or acquire and to apply, build upon and exploit commercially technology needed for industrial innovation. It is to be distinguished from technological self-sufficiency, which is the possession of, or the ability to generate readily, all technology required. Australia's past failure to take the sovereignty factor into account has far-reaching implications for future industry/technology strategy.

Keywords: high technology, multinationals, product mandate, R&D, sovereignty, sunrise industries, technology

INTRODUCTION

For a company or a nation, technological sovereignty turns on its capability and freedom to develop and apply technology acquired for one purpose to other opportunities and needs. It is to be distinguished from technological self-sufficiency, which is the possession of, or the ability to generate readily, all technology required. Only the largest and most powerful can hope to secure sovereignty in all relevant technologies by developing an R&D capability or by controlling the terms under which technology is acquired from others. Only fools and the destitute are content with sovereignty in none but the obsolete.

Though Australia, like most other second-rank industrial nations, has proclaimed its intention to cure the deep-seated malaise which besets its secondary industries by moving into technology-intensive, international markets with innovation-based exports, it is almost unique in its failure to recognise the critical role technological sovereignty has to play in achieving that goal. Canada, the country in many respects most similar to Australia, has enshrined technological sovereignty as the keystone of its industrial and technological development policies. Japan has consistently

striven for it throughout this century and its success has been at the foundation of current Japanese prosperity. The 'New Japans' — South Korea, Hong Kong, Taiwan, Singapore and now Malaysia — have set out on the same path with conspicuous success, while less developed countries (LDCs) have enlisted the aid of powerful United Nations (UN) agencies in their attempts to follow suit.

Australia's past failure to take this factor into account has far-reaching implications for its future industry/technology strategies. Its highly-concentrated technology-intensive industries are ill-equipped to move into innovation-based exports because of their technological subservience; and, for that reason, Australia's substantial academic and government research and development (R&D) resources cannot be effectively harnessed to such an objective. At least in respect to manufacturing industry, its large body of civil servants have been pre-occupied with regulatory matters and have conspicuously failed to address the problem of long-term national development. In this situation, talk of 'Hi-Tech' initiatives, new technology-based firms and sunrise industries may be a siren song leading the Australian scientific and civil service community away from the demanding rigours of the hard row toward national prosperity. Current orientation toward gee-whizz hardware appears misplaced and to be damaging the prospects of developing export markets for Australian services.

This paper can do no more than briefly explore the concept of technological sovereignty, cite a few illustrative examples and join with others in pointing once again to the need for realistic long-term policies based upon a frank appraisal of Australia's natural, industrial and human resources. Though the views expressed here develop aspects of a theme the author has explored elsewhere,[1] they do not necessarily reflect any official view of the Commonwealth Scientific and Industrial Research Organization (CSIRO).

WHAT IS TECHNOLOGICAL SOVEREIGNTY?

Technological sovereignty is the capability and the freedom to select, to generate or acquire and to apply, build upon and exploit commercially technology needed for industrial innovation. It is present to the degree that there is the technological capability to undertake such tasks: it is absent to the degree that others are able to restrict or prevent subsequent development or exploitation of that technology. The two elements must be present together and commensurable: scientific and technological capacity without

matching freedom to develop or exploit acquired technology is no more sovereign than complete freedom without the capability to pursue such objectives.[2]

Capability

Capability in this context is a complex matter as it encompasses the ability and capacity of the external professional and industrial infrastructure to support a new technique, as well as the in-house competence of the recipient company to operate and build upon it. The selection and purchase of an advanced automatic machining centre, for example, is likely to require expert engineering and financial and management consultants, and its operation is likely to result in higher demands being placed upon local suppliers of tools, cutting fluids and feed stock. Modification or improvement of the centre may well require support of an appropriate research institution or further specialist consultants. A strong and broadly-based services sector is an important factor in determining corporate, industrial and national capability.

Capability does imply at least sufficient in-house technical competence to brief consultants, negotiate the purchase of and operate new processes or machines, but it does not imply self-sufficiency — that is, the competence (within the company or the nation) to generate the process or machine *de novo*. Nor is it necessary, in the absence of self-sufficiency, to buy the technology in order to establish capability; it can be intelligently copied, though this may require a significant level of skill and industrial capacity within the company or the nation. Capability does not exist, however, where the recipient or licensee does not have the ability to evaluate alternatives and is simply provided with a 'black-box' and operating instructions, or where technical specialists necessary to commission, optimise and perhaps improve upon that box are not either employed within the company or available through independent consultants. In Australia, for example, the exigencies of the last war led to the development of an indigenous capability in many areas of secondary industry where little had existed before, but much of this was lost in the post-war decades by the foreign acquisition of local companies,[3] the substitution of improved black-boxes for existing machines and techniques, and by the failure of local industry to maintain an adequate R&D base to retain technological competence.[4]

Freedom

Freedom is more straight-forward as it refers to the absence of

contractual obligations and management directives that restrict the licensee's utilisation of acquired technlogy. However, freedom is linked to capability in that many such obligations are designed to prevent the licensee developing a significant in-house capability in the transferred technology. This is understandable because the licensor does not want to see the licensee use that technology as a springboard to enter his market or to supplant him in the development of that technology. Technological sovereignty is that springboard.

There are three ways, broadly speaking, in which the licensor may deprive the licensee of sovereignty while allowing him benefit from transferred technology: first, by imposing explicit contractual restrictions upon markets, the conduct of R&D, the retention of any improvements, and the ability of the licensee to use the knowhow after the licence has terminated;[5] second, by making it difficult for the licensee to acquire the necessary in-house capability, either by insisting that he (the licensor) supply certain key elements of the technology (the black-boxes referred to above), or by contractually discouraging the licensee from acquiring the necessary information by his own investigations or getting it from elsewhere;[6] and third, by securing direct corporate control over the licensee.[7]

All three techniques have been commonly associated with the transfer of technology to Australia for many years because Australian governments have had an open-door policy and Australian manufacturers have been traditionally concerned with production for import-replacement with the minimum of R&D investment. While all three are anti-competitive, they seldom fall within the purview of the *Trade Practices Act* because the first two involve agreements that can readily be concluded outside Australia and the third is merely an intra-company management arrangement. Despite Australian apathy, restrictive clauses in international license agreements have been of concern to other nations, resulting in the promulgation of various international guidelines.[8] It has been well appreciated (by others), first, that effective corporate control may be secured with little, if any, equity by virtue of the leverage which a licensor can exert upon a technically inferior licensee under such agreements,[9] and, second, that the requirement to buy certain key ingredients from the licensor can be the vehicle for the covert transfer of large payments to the licensor — that is, by transfer pricing.[10] Despite the importance of the first two agreement-based techniques, this paper will concentrate upon direct corporate control by the licensor because it is common in Australia and because it tends to include features of the agreement techniques as well.

Corporate control

Direct corporate control is usually secured by investment in the licensee. This offers the most secure protection for the licensor's technology and, besides yielding profits (including transferred prices) as well as royalties, has the advantage of removing from view any restrictions placed upon the licensee. Since Australia must get almost all its new technology from abroad,[11] has traditionally seen direct foreign investment as the key to technology acquisition, and has for many years had an open-door policy towards foreign investment, direct corporate control is the most common way that licensors safeguard their technology in this country. As a result, Australia's technology-intensive industries are now largely foreign-controlled and highly-concentrated,[12] at least 77 per cent of its declared payments for imported technology being made by intra-company transfers.[13]

Nevertheless, a company is not necessarily precluded from enjoying technological sovereignty merely because it is owned by another — even by a foreign-based multinational corporation (MNC) — or because its technology is derivative. The former Technical Director of ICI Australia Ltd (ICIAL) and its current Research Manager[14] offer the following criteria to determine whether a subsidiary is 'worth its salt' in this respect:

- its local R&D must be of a 'minimum viable size';
- it must be able to judge what technologies suit local needs best;
- it should be able to determine what are fair and reasonable terms under which new technology should be acquired from the parent or elsewhere, and
- it should be able to "preserve regions of opportunity for itself to build on the licensed technology and to exploit its own discoveries by fair agreement provisions".[15]

The series of innovations generated locally and exploited internationally by ICIAL from the late '50s to the early '70s suggests that it was a member of a very select and steadily dwindling group of Australian MNC subsidiaries in manufacturing which met these criteria.[16] Even so, the extent of the export prerogatives enjoyed by ICIAL — a sensitive touchstone of technological sovereignty — was not clear and has no doubt diminished recently with the general trend towards centralisation of R&D and corporate control in MNCs and with the specific difficulties which have led to substantial layoffs in ICI in Britain.

An extensive survey of the Canadian manufacturing and process industries conducted in 1971 did not find a single Canadian subsidiary "that felt it had the freedom to enter foreign markets at

will with a product which it thought could be produced in Canada and competitively exported''.[17] The few surveys carried out in Australia suggest that the situation is the same here. Indeed, after reviewing data on 1,100 agreements furnished by the Department of Trade in 1964 or 1965, the Vernon Committee issued a prophetic warning:

> The fact nevertheless remains that the export limitations contained in many licensing or franchise agreements or implicit in the understandings reached between overseas companies and Australian subsidiaries are serious disabilities from Australia's point of view. The adverse effects could become even more evident in the future. Australian manufacturing industry has been oriented largely toward the home market for many years but, as stressed in several parts of this report, this situation must change if a high rate of economic growth with balance-of-payments stability is to be achieved.[18]

A measure of either the degree of Australian apathy or the strength of foreign influence on the subject is the fact that the Department of Trade studies on the problem were not completed and published (as the Vernon Committee recommended), the many specific recommendations of the Committee relating to foreign control were ignored, and few subsequent studies have seriously probed the question[19] — even that commissioned by the Jackson Committee in 1975.[20]

Product mandates

Qualitatively, there seem to be five ways a local subsidiary can secure technological sovereignty in a defined field, in other words, a 'product mandate',[21] but they are all critically dependent upon the existence of adequate R&D support, that is, capability.

(i) The parent company may for its own reasons decide to centre a particular activity in its Australian subsidiary or make it the regional base for the development and maintenance of a particular line of products. This seems to have been the case with a number of subsidiaries of American companies during the 1960s and early 1970s,[22] but the current trend may well be from Australia to Singapore. Regionalisation is evident in the European Economic Community, where MNCs are replacing national manufacturing centres (which had their own R&D facilities) with regional product centres (which have their own market intelligence units).[23]

(ii) The product mandate may be obtained by default. This usually occurs when a subsidiary develops an invention in a

field where the parent shows no interest (but approves the subsidiary's investment). Examples of this are the flame ionisation detector developed by ICIAL and the Brodie purifier developed by Union Carbide Australia Ltd.[24] Both were marketed internationally from Australia. There are obvious dangers in such informal mandates because the invention is likely to interest the parent once it shows sufficient signs of success to be taken over. While it is not hard to find cases where this has occurred (with considerable resentment on the part of the Australian subsidiary), it may well be that the local company did not have the capacity to undertake the necessary development.

(iii) A broad product mandate or, rather, a special field of interest can be won by a local subsidiary as a consequence of its growth in relation to the parent or licensor — and of its patriotism. The gradual growth of Comalco's aluminium and alumina expertise in relation to that of Kaiser, ending with the final buy-out of Kaiser, appears to be an excellent example. It remains to be seen to what degree this hard-won, and now Australian-based, technology and expertise can be applied elsewhere within the country or overseas — particularly in Comalco's major Japanese investment.[25]

(iv) The designation of a product mandate may be imposed upon an MNC as a condition of entry or purchase. The designation of L M Ericsson as a principal contractor to Telecom seems to have involved such a condition, though significant exports have not yet appeared.[26] Varian Associates' purchase of Techtron Pty Ltd was conditional on the manufacture of the CSIRO-developed atomic absorption spectro scopic instruments remaining in Australia. It is now the second largest manufacturer of atomic absorption instruments in the world, with annual exports of about $20 million.[27]

(v) An MNC may, as a result of pressure by — or negotiations with — a host government, grant a product mandate to an established subsidiary. Australian cases are difficult to find. While the General Motors proposal regarding Australia's export contributions to the 'international car' arose from negotiations on tariff protection and local content regulations, it is doubtful whether technological sovereignty in terms of an R&D base for engine design and production has been created in Australia, or whether General Motors-Holden's has any say in where its engines can be sent or sold.

Relevance beyond manufacturing

Though the concept of technological sovereignty is most readily exemplified in the context of the secondary manufacturing and process industries, it is no less relevant or important to other sectors. The recent world-wide debate about the growth of MNC dominance in the agricultural and seed industries, and the heated controversy in Australia (and elsewhere) concerning the introduction of plant variety rights, illustrate its relevance in the rural industries.[28] Though it is as important in the mining and extractive industries as it is in the petrochemical and other process industries, technological sovereignty is seldom at issue in the former because the mode of competition does not often turn on proprietary technology, the technology employed tends to be site-specific, and most operators are willing to share their technology with others, rather than enforcing proprietary rights as is common in the process and manufacturing sectors.[29]

In the service sector, however, technological sovereignty has particular significance because it not only has direct influence on the capability of the other sectors, but it offers in its own right an important base for the generation and export of high value-added 'products' — advertising, design and consulting, computer software and systems analysis, banking and financial skills, insurance and marketing.[30] As British entrepreneur, Clive Sinclair, pointed out recently, the UK is inclined to overlook the fact that it is in a poor position to compete on world markets for manufactured goods and to forget that its most important skill-intensive exports relate to banking, insurance and television programming.[31] Though Johns noted in 1968 that comparative advantage in manufacturing had moved to South East Asia,[32] Australian efforts are still focused upon stimulating manufactured exports. While attention has been recently drawn to the export potential of Australian skills in civil and construction engineering, not only is the level of technological sovereignty in the Australian consulting industry low (judging by the levels of foreign ownership), but its capacity and experience have been greatly restricted by direct competition for Australian and foreign clients from Australian State and Commonwealth government agencies (including tertiary educational institutions and their associated consulting companies).[33]

The professional contract-exploration, consulting-engineering and construction-engineering consultants which service the mining and mineral industries are of particular significance. The minerals boom of the 1960s and 1970s obviously provided an excellent opportunity for Australian firms to develop their expertise to the

point where they could realistically quote on major overseas projects. Prior to the boom, a large and exceptionally skilled team of consultants had been built up in the Snowy Mountains Electricity Commission and was looking for work as the Snowy Scheme wound down. In addition, a strong and extensive exploration-oriented government infrastructure had been built up over many years within State mines departments, universities, the CSIRO and the Bureau of Mineral Resources, amounting to an investment of some hundreds of millions of dollars in the field.

This infrastructure could have been an extremely powerful base from which an indigenous consulting industry of international significance could have been built. Owing to the lack of technological sovereignty in the leading private consultants and lack of government support, this important opportunity was not only lost, but was probably turned to Australia's disadvantage. Lobbying from (foreign-dominated) industry associations and individual firms resulted in the Snowy Mountains Corporation being largely excluded from competition in Australia. The massive and technologically sophisticated services of the government infrastructure could not be used as effectively by the small, less-sophisticated Australian-owned consultants as by the large foreign-owned firms. As it was never suggested that these large firms should be admitted to Australia on condition that their technology and skills were shared with local firms, State governments and the (largely foreign-owned) mining companies consistently preferred them over Australian-owned firms (particularly in the role of managing consultants) because of their greater experience, thereby locking out Australian-owned firms more or less permanently.

Much of the experience gained in these major projects was lost to Australia because the managing consultants built up large teams (including many Australian engineers) for each major project and then disbanded them at termination. Moreover, a number of these large foreign-owned firms enjoyed a privileged status with respect to their Australian-owned competitors in that they were able to tender both as consultants and contractors — and sometimes both at once. Because of their multinational character and their mode of operation in Australia, few such foreign-owned consultants had the freedom or the local resources to compete seriously for overseas contracts from an Australian base.[34]

Terminology

It will be clear that 'technology' is being used broadly to signify knowledge necessary to apply a process, manufacture a product or

provide a service. It may be knowledge about process or product characteristics, production techniques (the transformation of labour, materials and other inputs into finished parts), or managerial systems to select, schedule, control or market production.[35] Also, a multinational corporation is taken to be any company with a controlling interest in at least one foreign affiliate or subsidiary, control being assumed to exist at a shareholding of more than 15 per cent.[36]

NATIONAL STRATEGIES AND OPTIONS

Attitudes toward technological sovereignty vary considerably among nations. For the resource-rich who merely want technology to mine and ship their resources, and to create employment by manufacturing for input-replacement, technological sovereignty may be of little concern. Questions of freedom will be of principal concern to small industrialised nations trying to establish or retain footholds in world markets for manufactured products. Newly industrialising countries (NICs) will be concerned with capability as much as freedom and, while less developed countries (LDCs) may put more stress on the need for training schemes, they are highly sensitive to constraints which entrench the technology; both (NICs and LDCs) being likely to enlist the aid of UN and regional agencies in setting favourable guidelines for negotiation. Conscious of the need to preserve their position, the technologically rich will be strong advocates of the sanctity of intellectual property, the unethical character of imitation, and the freedom of international trade, data flows and investments. Their principal instrument for the preservation of sovereignty and the effective exploitation of their technology, however, is the MNC.

The technology-rich

Because direct foreign investment is such an effective way of preserving and exploiting technological advantage, of circumventing national tariff barriers and of repatriating funds by transfer pricing, it is hardly surprising that international trade and national production should now be dominated by MNCs based in the technologically rich nations.[37]

In 1978, according to OECD estimates, the 650 largest corporations in the world (excluding the centrally planned economies) were MNCs, 200 of which had annual sales of over US$1 billion each. In 1971, the USA, West Germany, Japan and the

UK alone accounted for 75 per cent of the stock of all direct foreign investment; the total value added contributed by MNCs that year was estimated to be 20 per cent of world GNP, while the value of internal production by MNC subsidiaries was US$330 billion — that is, greater than the total value of the exports of all market economies, and more important than international trade as a vehicle for international economic exchange.[38] According to UN estimates,[39] there were some 11,000 MNCs with 82,000 affiliates in 1979, of which 21,000 were in developing countries and 61,000 were in developed countries. Of the two hundred largest economic entities in the world, almost half are MNCs.[40]

The past decade has seen considerable realignment and consolidation of MNCs world-wide due to two factors. First, there has been the realisation that, while markets had become global, natural resources were limited. This led to increasing vertical integration and to mergers or alignments which would secure future access to raw materials and provide even greater scale advantages.[41] Second, developments in telematics (integrated computer, communication and management information systems) allowed corporate planning, financial control and the conduct of R&D to be centralised in ways not previously possible.[42] This trend results in subsidiaries (especially in small countries such as Australia) taking on more of a branch plant character.[43] From the MNC's point of view, this not only has the advantage of concentrating its skill-intensive activities at 'home', but it also improves the security of its technology abroad, making it even more difficult for more local companies to compete. While many of the larger MNC's enjoy the important advantages of scale, assured raw materials and world-wide markets, their most important asset may well be their intellectual capital.[44] In 1982, the top 10 US-based MNCs together spent more than $13 billion on R&D, more than the GNP of many nations.[45]

With many MNCs pursuing such tactics in one industry within a host country, the result is a 'branch plant economy' in which technological sovereignty in large sectors of technology-intensive industry is lost.[46] Furthermore, should the host country use tariffs and quotas to protect such an industry from external competition, the technological advance of that industry will surely fall behind that of external competitors, for MNCs will then introduce only such new technology to their local subsidiaries as is necessary to safeguard their respective shares of what is probably a very small and distant market. This is well illustrated by the post-war developments of the Australian electronics industry which, in the early 1970's, was largely foreign owned and heavily protected, used

technology of the 1950's, produced a greater variety of its own components than any other national industry (some of which enjoyed more than 1000 per cent effective protection), and had negligible exports.[47] Tariff protection can be counter-productive from the standpoint of technological sovereignty in another important respect (if there is no restraint upon direct foreign investment) for local companies that rise above the ruck with the benefit of protection form prime targets for foreign take-overs.

Because they possess and trade upon valuable technology, MNCs are powerful advocates of the international patent system and the underlying Paris Convention, which create property rights in technology. Such rights not only provide the basis for the control or regulation of competitors through licensing, exclusion or forced equity participation, but they also furnish a basis for technology exchange (usually in proprietary but non-critical fields) between major MNCs. Such exchanges further disadvantage lesser competitors who cannot participate and they have a natural tendency to develop into the rationalisation of competition and markets, if not into outright cartels.[48] From the position of strength conferred by these tactics, it is then quite possible for MNCs effectively to withhold large fields of advanced technology from second-rank or less developed countries, even though products or processes embodying that technology are being employed under licence within the host nation. This is well illustrated by the fate of Britain — and even the USA — at the outset of the two world wars, when German chemical intermediates were withdrawn.[49]

Not surprisingly, most developed countries both share a concern about the local activities of foreign-based MNCs and, at the same time, strongly support their own MNCs, through which much of their external trade is conducted and their wealth generated. Accordingly, the OECD has developed guidelines relating to both the conduct of MNCs and their treatment, guidelines which Australia and most other member nations have endorsed.[50] Though many of the obligations placed upon MNCs are qualified by reference to the need for practicality and sound commercial practice, effective technology transfer, sovereignty of subsidiaries, and effective reporting are all enjoined, while anti-competitive and predatory activities, together with transfer pricing, are to be eschewed. Similarly, while there is recognition of the need to maintain public order and national security, member nations agree to treat foreign-owned corporations on exactly the same basis as local companies and will make all investment incentives and disincentives 'transparent' to such corporations. While Australia is remarkable — perhaps unique — in its generous and open

treatment of foreign-owned companies, the degree to which unlisted MNC subsidiaries in Australia abide by the OECD guidelines can be judged by the minimal extent to which they adhere to the detailed publication requirements set out.

The technology-poor

Less developed countries have no need to be reminded that the dominance and prosperity of developed nations rests upon their superior technology and upon the world-wide exploitation of it by their MNCs in such a way as to widen the gap between the rich and the poor. Understandably, many LDCs wish to advance themselves by establishing their own scientific and technological bases, aggressively limiting MNC activities both nationally and regionally, weakening the international systems of intellectual property rights and, hopefully, by forcing meaningful technology transfer. In attaining the first objective, many LDCs have been disappointed to find that foreign-trained scientists quickly become alienated when local R&D institutions are established without the infra-structural support which such scientists normally expect.[51] Attention is therefore turned toward the other objectives.

While national laws can be easily written to reduce drastically the power of foreign licensors and curtail the rights of foreign-owned companies,[52] they cannot ensure that knowhow is transferred and that value for money is being given on a case-by-case basis. For this purpose, technology transfer agencies have been established in some fifteen LDCs. In trying to weaken the power of the international patent system, many LDCs are seeking the support of UN agencies to revise the Paris Convention and establish tough international guidelines with the force of law.[53] In the final analysis, however, no amount of rule-changing can confer upon an LDC — by decree, as it were — the capability necessary for technological sovereignty; nor is it likely to force an MNC to part with valuable knowhow at well below market price.

And the in-betweens: some examples

Stimulation of national economic growth via technological innovation and the export of technology-intensive products is now the declared objective of the governments of most countries which fall between the acknowledged industrial leaders and the LDCs. These in-between countries include the newly industrialising countries (NICs) of Asia and Central and South America, as well as many of the smaller European nations and the former British territories of Israel, Canada, Australia, South Africa and New

Zealand. The examples selected for discussion below are primarily the Asian NICs, the 'New Japans' which are so successfully pursuing the Japanese model of national development. Mention will also be made of Canada and South Africa, which are much more like Australia in background and institutions of national government.

At the risk of oversimplification, some general observations are worth making about this disparate collection of countries. First, what the NICs and many of the European nations, particularly the Scandinavian, have in common is a technologically aware civil service that is oriented toward national development rather than industry regulation, so that the problems of technological sovereignty are appreciated and national scientific and technological resources are comparatively well-matched to industrial development objectives. Second, and by contrast, the civil service of British-origin countries tends to be regulation-orientated (sometimes said to be 'against' industry), untroubled by the problem of technological sovereignty and unable to harness effectively national scientific and technological resources to the tasks of national development.[54] Third, hostile international environments have transformed the Israeli and South African civil services into well co-ordinated and technologically aware units, while the presence of a single dominant neighbour which owns much of its industry has given the Canadian civil service a nationalism centred upon technological sovereignty and national development. Finally, most nations in this category of in-betweens are well aware of the importance of supporting their own MNCs as a means of concentrating skill-intensive activities at home, preserving technological sovereignty and generating national income. Sweden, with by far the largest usage of robots per capita, and its family of major technology-intensive MNCs (L M Ericsson, ASEA, Sandvik, Electrolux, etc.) is, perhaps, the paradigm of such an approach.

MITI and the example of Japan

Perhaps too much emphasis has been placed upon the role of the Ministry of International Trade and Industry (MITI) in the rise of post-war Japan as a world industrial power,[55] but its role in safeguarding Japanese technological sovereignty has been crucial,[56] and the influence of its example on other Asian NICs has been far-reaching. Serving as the Ministry of Munitions during the war and taking over many of the strict economic controls, incluing import and export licensing, of the Allied Occupation Forces,[57] MITI was

in a good position to put together the basic Economic Plan for Reconstruction which placed immediate emphasis on the need for Japan to 'level up' its scientific and technological capability without accepting the constraints of direct foreign investment. In the many and often detailed plans for the development of Japanese industry which have been promulgated since then, by MITI and other government agencies, the theme of building national technological capacity while preserving freedom has been consistently maintained.[58]

In the first two post-war decades, MITI's role in the oversight of direct foreign investment and technology import was central. Heavy pressure from US car manufacturers and others to establish operations in Japan shortly after the war were successfully resisted.[59] Proposals by Japanese companies for the importation of technology were assessed in the light of their capacity to effectively absorb that technology and, where needed, the establishment of the necessary infrastructural and corporate capability was first undertaken. MITI then assembled the bids for specific technologies and sent teams of MITI and company experts overseas to evaluate available technology packages, prices and conditions. Hard bargaining then took place at various levels with the need for 'MITI approval' of the ultimate terms always in mind by both sides.[60] Between 1950 and 1970, nearly 13,000 foreign technology introduction agreements, involving the payment of more than $US2 billion, were approved.[61] In competitive markets, individual companies could always be found to sell technology without significant constraints,[62] but in the rare cases where this was not so (for example, in computing) MITI orchestrated a national effort to catch up through R&D, the rationalisation of Japanese firms and forward planning.[63] With the establishment of many industries based on secure domestic markets but also competitive internationally, MITI has presided over successive stages of trade, capital and foreign investment liberalisation since 1964.[64] Even so, the foreign stake in shares traded on the Tokyo Stock Exchange amounted to no more than 3 per cent in 1980.[65]

The contrast with Australian attitudes toward foreign control (technological freedom) is obvious, but what is no less important from the standpoint of technological sovereignty is MITI's realistic assessment of current technological capability within a given field and of the cost and strategies needed to bring it up to international competitiveness. Over the seven year period 1976–82 Japanese government support of specific, well-planned R&D projects in computers, software and integrated circuits amounted to $US355.5 million. Though this represented less than 10 per cent of total

Japanese R&D expenditures in computer-related fields, its co-ordinating effect was strong.[66] MITI's current 10 year program of specific sponsored projects relating to biotechnology amounts to $US80 million and, though a small proportion of the R&D spent by leading Japanese companies which have annual R&D budgets of more than $10 million each, will be influential in co-ordinating effort nationally.[67] MITI forecasts that the Japanese biotechnology industry will have sales of $US16-28 billion by the year 2000 — equivalent to Japan's present petrochemicals industry.[68] MITI also presides over the scrapping of Japan's declining industries[69] and, significantly, it is the new industries that have the political weight in Japan, not the declining industries.[70]

The 'New Japans'

Learning from the Japanese experience, the 'New Japans' are now well-established in international high-technology markets and are already pressing hard on the heels of Japan. During the 1970s, their combined annual growth rate averaged 9.4 per cent as opposed to 6 per cent for Japan and 3 per cent for the USA; in the last half of the 1970s, the annual value of their exports quadrupled to $US79 billion. (These figures do not include those for Malaysia.) The Republic of Korea is already the largest manufacturer of black and white television sets in the world and is now making video recorders and colour television sets of its own design.[71] Korean car manufacturer, Hyundai, is reported to have bought a semiconductor plant in 'Silicon Valley' and is to spend more than $US300 million in establishing an industrial electronics facility in Korea.[72]

Perhaps most like Japan is Korea, which, in 1952, established its strong central planning agency, the Economic Planning Board, incorporating the technological skills of the Technical Development Bureau. As in Japan, foreign investment in Korean companies was virtually impossible and manufacturing industry was built without the benefit of direct foreign investment. Care was taken to build up national technological competence so that foreign technology could be evaluated and secured without 'strings' and so that, once secured, it could be effectively diffused internally without the need for the multiple transfers — and payments — that have often characterised the transfer of technology to LDCs (and Australia).[73] The techniques used by Korea in establishing technological sovereignty are illustrated by the following examples.

When major manufacturers of silicon steel in Japan and the USA refused to supply technology for the Pohang steelworks without

equity, Korea bought it from a minor US manufacturer (Allegheny) that was not established in export markets and was prepared to sell the technology without strings. In shipbuilding, Korea initially derived its technology from Japan and gained much valuable free knowhow by arranging for Korean engineers to work in Japanese shipbuilding yards — until this practice was terminated by the Japanese. Korea was almost unique in forcing General Motors to abandon its firm policy of refusing technology transfer unless it had ownership of the receiving company. In 1971, General Motors realised it was going to be excluded from the Korean motor industry if it persisted with this policy and, therefore, accept a minor shareholding in a joint venture arrangement.[74] When Korea sought to buy colour film technology from Fuji in Japan, it was quoted an extremely high price as the first step in negotiating for a Fuji-owned subsidiary, but this merely encouraged an interested Korean company to join forces with the Korean Institute of Science and Technology to recruit experts from abroad, let contracts to foreign consultants such as Batelle, and redevelop a suitable manufacturing process. As work proceeded, Fuji returned with successively lower offers for its technology until, finally, it proposed an alternative joint venture with another Korean company in which it would have a minority interest and to which the technology would be transferred without charge. The matter was debated extensively by President Park's Cabinet, which eventually made the courageous decision to back a Korean consortium based upon the still unproven locally-developed technology — a gamble which paid off.[75] Korea is now a vigorous competitor on world markets for colour film.

Just as US television manufacturers could not retain control of their technology after sale to Japan in the late 1950s, either by direct investment or by restrictive licensing conditions, Japan was not able to do so when it transferred television technology to Taiwan a decade later. Like Japan, Taiwan had been careful to establish the technological capacity not only to absorb and improve the acquired technology, but also to set up a supportive semiconductor industry. From this base it entered world markets for advanced electronic products in 1980 in direct competition with Japan.[76]

Taiwan has enjoyed the most rapid and extended period of industrialisation and economic growth of any country, far outstripping Japan.[77] When the rump of the Kuomintang arrived from the mainland in 1949, inflation was running at 3000 per cent per annum, but after major fiscal and land reforms took effect, real GNP increased eleven-fold between 1952 and 1980, doubling every seven years after 1963.[78] That this growth rate was achieved

without loss of technological sovereignty through either direct foreign investment or inadequate technological capacity was remarkable; that significant improvements in income distribution were also achieved without significant inflation levels is admirable. While Taiwan's foreign investment policies have been considerably more liberal than those of Japan and Korea, it (like those countries) effectively closed its stock exchange to foreign investors and (like Korea) placed special restrictions upon Japanese investments.[79] Since 1962, direct foreign investment has been permitted in approved projects with limits being set for total foreign investment in particular industrial sectors. Approved investment levels in low-technology resource-based industries amount to only a few per cent, while approved levels in high-technology export-oriented industries are considerably higher, but well below the 33 per cent maximum approved in respect of electronics.[80]

An example of the effective way in which foreign investment was used is the case of the Singer-Taiwan company, established in 1963 at a time when local sewing machine products were of low quality and vital parts still had to be imported. Despite initial opposition from local manufacturers, Singer was established and, as had been agreed, assisted local suppliers to produce better quality parts for the whole industry, which (again with Singer's help) quickly improved. The value of sewing machines exported from Taiwan rose from $US40,000 in 1963 to $US5 million in 1968 and then to $US40 million in 1975.[81]

By 1981, Singapore had established the capacity and sovereignty to win 25 per cent of the world's backlog for oil rig construction — a performance second only to that of the USA. Its plan, announced in 1978, to equip itself to move into high-technology international markets, is well under way with tax-holidays and generous investment allowances for high-technology ventures. Hong Kong, like Singapore, relies less upon control of foreign investment and more upon the provision of the right climate for indigenous entrepreneural activity.[82] It is now the master of creative copying and reverse engineering, improving upon and manufacturing digital watches and electronic games and many other products. For example, in 1972 Astec International was formed in Hong Kong to use cheap labour to assemble electronic sub-systems for computers. Astec engineers quickly mastered the design of these sub-systems, allowing the company to move into the manufacture of its own improved products. It now no longer assembles components for others, but custom designs high value-added electronic products for Ford, RCA, IBM, Burroughs, Olympia and Rank Xerox. Astec is now an MNC with branch plants in Malaysia and the Philippines to undertake its labour-intensive assembly tasks.[83]

While Malaysia may not yet have earned a place among the 'New Japans', it is of particular interest to Australia as a resource-rich former British colony with a legacy of foreign-owned industry. Soon after independence, Malaysia sought to build up its manufacturing industries by inviting foreign manufacturers to establish plants in designated free trade zones; it is now, for example, one of the largest exporters of room air conditioners in the world and assembles a significant number of microelectronic components. However, this did little to improve the technological capability of Malaysian manufacturing industry and nothing for its independence.[84] In 1975, a long-term plan for what might be called the 'Malayanisation' of industry was promulgated under the Industrial Coordination Act (1975) which specified percentages of local corporate ownership to be achieved by given target dates and the establishment of a national equity corporation to aid this transition. As a matter of general approach, the level of foreign ownership was to be in line with a company's export orientation — those producing only for the domestic market were to be wholly locally owned.[85]

Malaysia is also of interest to Australia because of the way in which it has been able to recover technological sovereignty in its principal natural resources — rubber, palm oil, cocoa and tin. Dominant local ownership has been secured through direct negotiation and stock market raids organised by Permodalan, the national equity corporation, rather than through nationalisation, and a set proportion (some 40 per cent) has been set aside for Bumaputras (Malays).[86] Care has been taken to maintain and expand the first-class research institutes supporting these industries. Of particular significance is the recent partnership of one of the largest Malaysian plantations (Sime Darby Berhad) with the California-based International Plant Research Institute to apply modern genetic engineering techniques to improving and developing new plantation crops and to market the new varieties throughout the region.[87]

With its resource-base secure, Malaysia has now embarked upon acquiring ownership of the larger manufacturing industries based on these resources (for example, Dunlop Malaysia[88]). Of direct concern to Australia is the establishment of a Malaysian manufacturing joint venture by Ansell International (the Australian rubber glove manufacturer and one of the very few Australian star performers in manufacturing export markets) and the sale of the profitable Malaysian subsidiary of Humes Industries in anticipation of the local ownership targets.[89]

As if Australia needed any further example of what concerted

national policies can achieve for a small nation against some of the world's most powerful multinationals, Malaysia not only renegotiated its petroleum exploration leases on the more advantageous production-sharing basis, but probably has the distinction of exacting the toughest exploration deal ever from an international oil company. The company was the French-owned Elf-Aquitane and the deal will result in no more than 85¢ profit being returned to France for each barrel of oil produced.[90]

Many spokesmen for Australian industry rightly point out that the spectacular industrial development of Japan and its 'children' was based upon high levels of effective tariff protection.[91] What is often not acknowledged is that the protection given to the infant industries of these countries was part of a nationalistic consensus between the civil service and industry on the need for international competitiveness and technological sovereignty in the long term, and on the need for controlled technology acquisition and training programs in the short term. Without this consensus, protection must have a regressive effect upon technological development and a nation's ability to compete in world markets.[92] An example of such a mistake in an industrialising Asian country is the heavily protected and technologically backward textile industry of the Philippines.[93] Further protection for Australian industry in the absence of such a consensus and at a time when it is said that Australia's relative technological competence in manufacturing has already slipped below what it was in 1939,[94] may well make us "poor folk in Asia".[95]

Canada, Australia and a common problem

When addressing the Australian Academy of Technological Sciences in 1981 on *The Policy Debate in a Resource Hinterland*, J M Gilmour, Director of the Canadian Science Council, gave a picture of the predicament of Canadian manufacturing which exactly portrayed that of Australian manufacturing.[96] Like Australia, Canada thought it had successfully achieved industrialisation in the 1960s 'by invitation' and the use of tariffs — a policy which "protected products rather than indigenous firms". It found, instead, that it had created an unhealthy and strangely stunted form of manufacturing industry, but this realisation did not occur until the early 1970s because the boom years of the 1950s and 1960s created by post-war immigration and the Korean and Vietnam wars had led to complacency. However, throughout the 1960s there was an increasing concern in Canada about the growing dominance of American ownership of Canadian industry.[97]

The Australian Vernon Committee, when making its major economic study in the mid-60s, examined the question of overseas investment in Australia and identified national problems in the imposition of restrictions on export by foreign licensors, in transfer pricing, in local borrowings by MNC subsidiaries and in their entry and expansion by takeover of viable Australian firms. It warned against the vicious circle which would be created if foreign investments continued to be used as a major factor in securing a desirable balance of payments.[98] Unfortunately, while the need for an export-oriented manufacturing industry was stressed, the debilitating and regressive effect of a branch plant economy was not appreciated, it being said that "one of the most potent arguments favouring a high level of overseas investment" was that it would "bring with it the results of recent advances and help to keep Australia in the mainstream of development".[99]

The Vernon Report, though derided by Prime Minister Menzies, led to a brief and rare national development-orientated consensus between a few Australian industrialists, politicians and civil servants which resulted in the creation of the Australian Industry Development Corporation (AIDC) along the lines of the highly successful South African Industry Development Corporation. But the political and national climate in which the AIDC was set up was radically different from that in South Africa. Foreign-owned industry and financial groups first successfully lobbied to confine its powers and functions, and then set out to make it financially unsuccessful.[100] The strict foreign investment guidelines and the close examination of technology acquisition agreements by Treasury and Reserve Bank officials, which provided such important support for the successful operation of the South African Corporation, were absent in Australia. Although the AIDC survived and has even been strengthened, the Vernon Report, and its warnings and pleas for the collection of more information about foreign ownership, have been forgotten. Australian federal civil servants have returned to their preoccupation with regulation, the administration of a plethora of minor and conflicting grants and concessions and, of course, the perennial departmental reorganisation.[101]

Unlike Australia, Canada identified technological sovereignty as a key issue early in the 1970s and investigated the problems in detail through the remainder of the decade, first in the guise of direct foreign investment and the branch plant economy, and then, more recently, in terms of the mechanisms which could be devised for recovering technological sovereignty and halting the process of de-industrialisation.[102] A recent and extensive comparative analysis

of government innovation policies in a number of major Western countries highlights the central role technological sovereignty is now playing in the many and various policy instruments in place in Canada and elsewhere.[103] Evidence of a nationalistic consensus is emerging in Canada. The Canadian foreign investment review process has been greatly strengthened, and a national energy plan has been enunciated whereby Canadian ownership of the national oil and gas industry is to be increased to 50 per cent (from the present 34 per cent) by 1990. Henceforth, companies drilling on Crown land must be more than 50 per cent Canadian owned and up to 80 per cent of the exploration costs of such companies will be tax deductable.[104]

Of the many studies[105] bearing on the problems of Australian manufacturing industry undertaken in recent years, none appears to have recognised the crucial importance of technological sovereignty, despite the example of Japan. Indeed, the 1975 Jackson Report, ignoring many of the cautions of the Vernon Report of exactly a decade earlier, and failing to see the striking lessons of Australia's Pacific neighbours, reinforced Vernon's principal mistake, saying ". . . direct foreign investment is a key element in achieving effective access to overseas technology . . . [and] . . . could become more important in the future."[106] However, the Jackson Committee did recognise that foreign ownership brought with it some problems and recommended that guidelines be established for the gradual 'Australianisation' of major foreign-owned companies. These limited and modest suggestions were not taken up by the subsequent Government White Paper, except by way of reference to the OECD guidelines on multinational corporations, and no plan for the recovery of Australia was advanced.[107]

CONCLUSION

Blame for the malaise of Australian industry is variously assigned to and by industrialists, unionists, scientists, politicians, academics and bureaucrats. If, as argued here, the branch plant character of much of Australian industry and its obverse — technological sovereignty — are at the core, then it is clear from the experience of other nations that lack of a national development perspective in the Commonwealth civil service is a key factor. Companies and unions play to the rules and are not to blame for the lack of perspective which those rules engender; their primary responsibilities are, of course, to their shareholders and members. Ministerial perceptions

of options and consequences are shaped by departments, yet the administration avoids public accountability for the crucial influence it exerts and invokes the device of ministerial responsibility to claim secrecy and anonymity.[108]

What is needed immediately, then, is a well-informed public debate about Australia's predicament and possible ways out, and, without pre-empting that debate, some initial steps to increase the freedom and technological capability — the technological sovereignty — of all sectors of Australian industry. In particular, the following actions are suggested:-

Raising the level of debate

1. Principal Commonwealth departments and statutory corporations should follow the lead of the Treasury and Telecom by producing (and updating) position papers setting out their considered options on issues of national and long-term importance within their purview. These papers should be taken by ministers and Cabinet to be without prejudice to government policy and authority.
2. Principal advisory bodies, such as the Australian Science and Technology Council, should be required to indicate when and how economies can be obtained in identified low priority activities commensurate with any increased spending recommended for 'new initiatives'.
3. The recommendations of the Vernon and Jackson Committees regarding the collection of data concerning foreign ownership, control and restraint of Australian industry should be implemented. Specifically, the Reserve Bank should maintain an up-to-date register of all foreign investments in Australia, including all changes in the beneficial ownership of shares between residents and non-residents. All agreements involving foreign exchange approval should be examined (with the assistance of expert advisers as needed) to record separately payments for knowhow, patent licences and management fees and to require that any restraints on exports be declared. Where desirable in the public interest, the Bank should raise questions of value-for-money, transfer pricing and the need for export constraints in particular cases.
4. As recommended by the Jackson Committee, all non-listed foreign-owned subsidiaries should be required to disclose the same information as listed companies and should be expected to comply with the reporting requirements of the OECD guidelines.

Regaining freedom

1. The recommendations of the Jackson Committee relating to the 'Australianisation' of large foreign-owned companies should be implemented with particular regard to those which have little or no export orientation. The 15 year period within which to achieve this (proposed by that Committee) should apply to firms with significant exports, and a shorter period of 10 years should be applied to those foreign-owned companies which only service the local market 'Australianisation' would involve:-

    - majority Australian ownership,
    - ensuring that almost all directors and senior management personnel were Australian nationals, and
    - the location of a fair proportion of skill-intensive work in Australia.

2. Inducements should be offered to encourage 'Australianisation' of listed companies and the listing of wholly-owned subsidiaries without undue pressure being placed on Australian capital markets; for example, by making non-Australianising companies ineligible for a variety of investment, exploration and R&D subsidies or concessions and subject to higher rates of withholding tax. Australianising companies without majority Australian shareholding could receive all (or some) of these benefits, but a proportion of the amount received (say, half) would be deemed to be payment for the company's shares (at market value) to be held initially by the AIDC for subsequent sale when Australian buyers can be found.
3. Inducements should be offered to foreign companies to grant product mandates to their Australian subsidiaries. These inducements may be of the type indicated above, but the Canadian policy mechanisms used for the purpose might well be suitable.

Improving capability

1. Government procurement preferences should be given to majority Australian-owned companies in the service sector, every attempt being made to secure the co-operation of State governments. These preferences should include the requirement that all government-funded projects should employ majority Australian-owned managing consultants.
2. A few 'national projects' should be identified and supported

on such a scale as to demand State-Commonwealth-company co-operation over a significant period of time, and of such complexity as to demand the determined application of first-rate intellectual skills — managerial, scientific and engineering. Examples might be resource- or energy-related projects such as shale-oil, coal-oil, gas-petroleum or even nuclear power and uranium enrichment (when that becomes politically acceptable), but health, communication or transport projects also offer opportunities.[109] The aim would be to put large and competitive industrial plants in the hands of major Australian companies and, in so doing, to harness and build independent service skills for use elsewhere. While National Energy Research, Development and Demonstration Council (and other special government) funding would be needed, the Industrial R&D Incentives Scheme should remain earmarked for the support of small-scale, high-technology entrepreneurial activities.

3. Ways of encouraging Australian-based MNCs by easing tax restrictions and by providing appropriate support through Australian trade commissioners should be developed. In particular, export-oriented Australian-based consultancies should be encouraged by channelling as much foreign aid as possible through private Australian-owned firms, and by inhibiting damaging competition with Commonwealth and State agencies (including tertiary education institutions).

NOTES AND REFERENCES

1. P.A. Grant, 'Patents and the national interest', paper presented at the Australian and New Zealand Association for the Advancement of Science (ANZAAS) Congress, Canberra, 1975; 'Government and technological innovation' in A. Moyal (ed.) *Innovation and the Governance of Technological Change in Australia*, Occasional Paper No. 3, Science Policy Research Centre, Griffith University, 1979; 'The international transfer of technology for secondary processing projects', *Australian Mining and Petroleum Law Journal*, 2, 2, 1980, pp. 234-63; 'Transnational corporations and technology transfer in J. Langmore and D. Peetz (eds), *Wealth, Poverty and Survival*, Allen and Unwin, Sydney, 1983, pp. 139-60; and 'Resource-based manufacturing and consulting: A question of technological sovereignty', paper presented at ANZAAS Congress, Sydney, 1982.
2. The term 'technological sovereignty' is preferred to 'technological independence' which is used in the literature relating to world development problems. Technological independence is said to give a country the capacity to respond quickly to external economic stimuli and to generate its own technical progress. However, like technological sovereignty, it does not imply

technological self-sufficiency or autonomy. See M. Merhav, *Technological Dependence, Monopoly, and Growth*, Pergamon, Oxford, 1969.

3. This was treated in some detail in Grant, 'The international transfer of technology for secondary processing projects', *op. cit.*
4. For the parlous state of R&D in secondary industry in the mid-1960s see S.H. Bastow, 'Research and the manufacturing industry in Australia', *Journal of the Institution of Engineers (Australia)*, 36, 6, 1964, pp. 37-40. A more recent, and no less depressing, view is R. Johnston, 'Australian science policy. Now we can steer, where do we want to go?', *Current Affairs Bulletin*, 59, August 1982, pp. 20-30.
5. A brief discussion of such restrictions is provided by Grant, 'The international transfer of technology for secondary processing projects' and 'Transnational corporations and technology transfer', *op. cit.* For a more exhaustive catalogue and discussion see OECD, *Restrictive Business Practices Relating to Patents and Licenses*, Paris, 1972.
6. For example, strict prohibitions against disclosure of information supplied to any third party (including consultants) against analysis of chemicals supplied and even against the conduct of R&D in the field. See also UNIDO, *Restrictive Business Practices in Transfer of Technology*, 1976, ID/WG 228/1; OECD, *Restrictive Business Practices of Multinational Enterprises*, Paris. 1977.
7. 'Direct control' is intended to imply control exercised via an equity or shareholding of 15 per cent or more. Note, however, the UNIDO comment in *Restrictive Business Practices in Transfer of Technology*.
8. S.S. Holland (ed.), *Codes of Conduct for the Transfer of Technology: A Critique*, Council of Americas and the Fund for Multinational Education, 1976; OECD, *International Investment Guidelines for Multinational Enterprises*, Paris, 1976; S. Patel, *Significance of Code of Conduct*, Les Nouvelles, Paris, 1980, p. 153 *ff.*; and 'Draft code of conduct', *Pugwash Newsletter*, 11, 1970, pp. 104-12.
9. "So long as countries remain technologically dependent, external control will continue to be exercised in ways that do not necessitate outright or even majority foreign ownership. . . . Even in the case of a domestic firm with no foreign equity or foreign management, the power of independent decision making — at least in certain areas — of local owners and managers may be taken out of their hands through restrictive clauses in technology contracts". UNCTAD Secretariat paper, 'Possible mechanisms for the transfer and development of technology' in A.B. Zahlan, *Technology Transfer and Change in the Arab World*, Pergamon, Oxford, 1978, p. 118.
10. C.V. Vaitsos, *Intercountry Income Distribution and Transnational Enterprises*, Oxford University Press, Oxford, 1974. When technology is associated with direct foreign investment, particularly in the case of oil and drugs, technology suppliers prefer to take their financial returns by way of transfer pricing. See also *fn.* 6 and 9.
11. "We have . . . about 1% of the developed world population, 0.5% of world trade, produce 1.6% of the world's scientific papers, and own about 0.3% of patents currently granted throughout the world". J.E. Kolm, 'Australian R&D — needs and strategies for industrial growth' in J.T. Woodcock (ed.), *Manufacturing Resources of Australia*, Australian Academy of Technology Sciences, Parkville, 1981, p. 276. See Grant, 'The international transfer of technology for secondary processing projects', *op. cit.* for a brief review of the Australian open-door policies in this context.
12. "It is apparent that overseas ownership and control are highly concentrated in certain highly capitalised and technologically complex industries . . ."

Australian Treasury, *Overseas Investment in Australia*, Treasury Economic Paper No. 1, Australian Government Publishing Service, 1972, p. 23. See also R. Johnston, 'The real story of technological change in Australia', paper presented at ANZAAS Congress, Brisbane, 1981, p. 17.

13. Firms performing R&D in Australia in 1978-79 remitted $130.2 M in payment for technology, of which 90 per cent was remitted overseas and 77 per cent was paid to related companies (Australian Bureau of Statistics, *Research and Experimental Development, Private (Business) Enterprises, 1976-77, 1978-79* (Cat. No. 8104.0), Canberra, 1981; See also A. Godfrey, *Proceedings of the Licensing Executives Society Australia Congress*, 1976, pp. 102-14. For an extensive discussion of the problem of monitoring such transfers, see *Strengthening the Negotiating Capacity of Developing Countries*, UN Committee on Transnational Corporation, 1979, E/C 10/50.
14. J.E. Kolm and A. Baklien respectively.
15. J.E. Kolm and A. Baklien, 'Innovation in Australian industry', *Chemical Engineering in Australia*, Vol. Ch E4, 1, 1979, p. 42.
16. These innovations include the flame ionization detector, dipyridyl herbicide synthesis, oxychlorination, levamisole (an anthelmintic), glycolether brake fluids, ammonium nitrate slurry explosives and crosslinkable polythene. See Australian Industrial Research Group, *Research into Reality*, AIRG, Melbourne, 1980.
17. Science Council of Canada, *The Multinational Firm, Foreign Direct Investment and Canadian Science Policy*, Ottawa, 1971.
18. *Report of the (Vernon) Committee of Economic Enquiry*, Commonwealth Government Printer, Canberra, 1965, Vol. 1, p. 286.
19. A recent review of relevant Australian studies is provided in T. Mandeville, D.M. Lamberton and E.J. Bishop, *Economic Effects of the Australian Patent System*, Australian Government Publishing Service, Canberra, 1982, pp. 156-61. For a review of foreign investment issues during the 1950s and 1960s, see *fn.* 12.
20. P. North, 'A contribution to improved understanding of the foreign-owned manufacturing firm in Australia', in Report of the (Jackson) Committee to Advise on Policies for Manufacturing Industry, *Policies for Development of Manufacturing Industry*, Australian Government Publishing Service, Canberra, 1976, Vol. 3, pp. 115-236.
21. The term 'product mandate' is derived from the extensive studies of the Science Council of Canada; for example, as quoted in *fn.* 17.
22. "Australia has become the regional headquarters for 170 US companies . . . US subsidiaries have been increasing export earnings by an average of 28.7% a year since 1967 . . . American firms now contribute one third of all Australia's exports of manufacturing goods." E. Utrecht, *Industrial Estates and Australian Companies in Singapore*, Transnational Corporations Research Project, Research Monograph No. 2, University of Sydney, June 1976. For shift of activity to Singapore, see *Far Eastern Economic Review*, 28 August 1981 and comments of Singapore consultant, R. Prior, reported in *Brisbane Sunday Mail*, 23 January 1983.
23. R.C. Spinosa Cattela, 'Information as a corporate asset', *Information Management*, 4, 1981, pp. 29-37.
24. J.A. Brodie, 'Development of a novel continuous multi-stage crystallisation process', *Proceedings of the Australian Chemical Engineering Conference*, Newcastle, 17-18 August 1972; R. Hinton, 'Case history', *Proceedings of the Licensing Executives Society Australia Congress*, 1975.
25. See Grant, 'The international transfer of technology for secondary processing

projects', *op. cit.* for the early history of aluminium production in Australia; *Rydge's*, April 1983, pp. 42-3 for details of Kaiser's sellout; and *Australian Financial Review*, 11 May 1982 for CRA purchase of 50 per cent stake in Showa Aluminium.

26. *Business Review Weekly*, 27 March - 2 April 1982; *Australian Financial Review*, 28 May 1976, p. 19.
27. Condition of purchase: personal communication from G. Frew, founder and former chief executive, Techtron Pty. Ltd. Production: *LINK*, 1, 1983, p. 15 (Victorian Department of Economic Development).
28. P.R. Mooney, *Seeds of the Earth: Public or Private Resource?*, Inter Pares, Ottawa, 1979; H.R. Harding and D.J. Anderson, 'A patent dilemma? Plant variety rights legislation for Australia', *Current Affairs Bulletin*, 1 May 1982, pp. 4-16.
29. For example, the co-operative R&D activities of the Australian Mineral Industries Research Association.
30. See comments of John Cumming (of Nicholas Cumming, advertising agency) reported in *Australian Financial Review*, 11 May 1982; G.J. Crough, *Foreign Ownership of the Finance Sector in Australia*, Transnational Corporations Research Project, Working Paper No. 4, University of Sydney, October 1976, and speech by G.M. Niall (Chairman, National Mutual Life Association) to NML Annual General Meeting, reported in *Australian Financial Review*, 24 February 1982.
31. BBC Television interview.
32. B.L. Johns, *Tariffs and the Process of Industrial Change*, University of Newcastle Working Paper, July 1968.
33. See the submission by the Association of Architects, Engineers, Surveyors and Draftsmen to the Jackson Committee.
34. J.W. Connell, 'Participation of overseas consultants and contractors', address to the National Construction Industry Conference, Canberra, 1982; comments of Brian Topper, President, Australian Federation of Construction Contractors, reported in *Australian Financial Review*, 28 October 1981.
35. UNCTAD, *Guidelines for the Study of the Transfer of Technology to Developing Countries*, 1972, p. 5; OECD, *East-West Technology Transfers*, Paris, 1983.
36. The minimum equity holding by single (or associated) foreign shareholder(s) as the trigger level for examination under the former Companies (Foreign Takeovers) Act. This definition has been adopted by UNIDO.
37. See Vaitsos, *op. cit.*
38. OECD, 1977, *op. cit.*
39. *Transnational Corporations and the Industrialisation of Developing Countries*, UN Committee on Transnational Corporations, New York, 1979, 10/CONF 4/14.
40. D. Zenoff, 'A multinational look at the transnational corporation', in M. Skully (ed.), *The Future of the Multinational Corporations: The Views of an American Consultant*, Dryden Press, Sydney, 1978, p. 46.
41. D.R. Stewart, 'Minerals-based manufacturing industries', in J.T. Woodcock (ed.), *Manufacturing Resources of Australia*, Australian Academy of Technological Sciences, Parkville, 1981, pp. 141-64.
42. See Cattela, *op. cit.*, p. 29; E. Mekatu, 'The future of the multinational corporation from the Japanese viewpoint', in M.T. Skully, *op. cit.*
43. D. Germindis (ed.), *Transfer of Technology by Multinational Corporations*, OECD, Paris, 1977, Vol. 1, p. 24 *ff.*
44. OECD, *Technological Change and Economic Policy*, Paris, 1980.

45. *Infobrief Research and Technology*, No. 233, 5 June 1983.
46. See Science Council of Canada, *op. cit.*; J.N.H. Britton and J.M. Gilmour, *The Weakest Link: A Technological Perspective on Canadian Industrial Development*, Science Council of Canada, Ottawa, 1978.
47. G.A. Rattigan, 'Opening address' in Australian Academy of Science, Science and Industry Forum, *From Stump-Jump Plough to Interscan*, Canberra, 1977, p. 11.
48. See Grant, 'The international transfer of technology for secondary processing projects', *op. cit.*
49. See Grant, 'Transnational corporations and technology transfer', *op. cit.*
50. The OECD guidelines are set out in full in Australian Treasury, *Your Investment in Australia: a Guide for Investors*, Australian Government Publishing Service, Canberra, 1981.
51. C. Cooper (ed.), *Science, Technology and Development*, Frank Cass, London, 1973.
52. See Grant, 'The international transfer of technology for secondary processing projects', *op. cit.*. In the mid-1970s, Argentine law prohibited MNC staff from teaching or doing research outside their companies, or from standing for election (Germindis, *op. cit.*, p. 17).
53. See Grant, 'The international transfer of technology for secondary processing projects' and 'Transnational corporations and technology transfer', *op. cit.*; United Nations, *The Role of Patents in the Transfer of Technology to Developing Countries*, 1964, Vol. 1, p. 57.
54. W.P. Hogan, 'Government and business links', *Australian Journal of Public Administration*, 42, 1, 1983, pp. 53-72.
55. C. Johnson, *MITI and the Japanese Miracle: The Growth of Industrial Policy 1925-1975*, Stanford University Press, 1982. This exhaustive work seems to give insufficient recognition to the unique features of Japanese culture and work habits, which were essential for an organisation such as MITI to succeed. Johnson recommends, for example, that a MITI-like organisation be established in the USA.
56. OECD, *The Industrial Policy of Japan*, Paris, 1972.
57. C. Johnson, 'The internationalisation of the Japanese economy', *California Management Review*, 25, 3, 1983, p. 12.
58. P.D. Drysdale, 'Japanese research and development and industrial performance' in *Science and Industry Forum Report No. 5*, Australian Academy of Science, p. 12; B.L. Johns, 'Importing technology — the Japanese experience and its lessons for Australia', address to Japan-Australia Conference, Griffith University, 12-19 May 1977.
59. See C. Johnson, 1982, *op. cit.*
60. *A Science Policy for Canada*, Report of the first Lamontagne Committee, 1972, Vol. 2, p. 490 quotes Professor James Quinn in regard to the negotiation procedure.
61. B. Delaryd (Vice-President, Skandinaviska Bank, Tokyo), 'International technology transfer', Address to Swedish-Japan Association, 1971.
62. See 'Licensing technology: the process licensor's point of view', *Chemistry and Industry*, 12 Oct. 1968, for the results of a survey conducted in 1967 of leading companies in the USA, Japan and Europe concerning willingness to license knowhow without equity participation. See also T. Ozawa, 'Imitation, innovation and Japanese exports', in P.B. Kenen and R. Lawrence (eds), *The Open Economy*, Columbia University Press, 1968.
63. See C. Johnson, 1982, *op. cit.*. For a comparative review see OECD, *Impact of Multinational Enterprises on National Scientific and Technical Capabilities: Computer and Data Process Industry*, Paris, 1977.

64. 'Japan's technopolicies', *Far Eastern Economic Review*, 26 June 1982, pp. 47-8.
65. C. Johnson, 1983, *op. cit.*, p. 19.
66. B. Hilton, 'Government subsidised computer, software and integrated grant research and development by Japanese private companies', *Far East Scientific Bulletin*, 7, 4, 1982, pp. 1-21.
67. *ibid.*; P. Popham, 'Japanese biotech firms gear up for round two', *ASIA 2000*, 2, 3, 1982, p. 13.
68. Hilton, *op. cit.*
69. E. Boyer, 'How Japan manages declining industries', *Fortune*, 10 January 1983, pp. 34-9.
70. C. Johnson, 1982, *op. cit.*
71. L. Kraar, 'Make way for the New Japans', *Fortune*, 10 August 1981, pp. 176-84. See also W.K.Y. Chen, *Hyper growth in Asian economies: a Comparative study of Hong Kong, Japan, Korea, Singapore and Taiwan*, Macmillan, 1978. Chen attributes hyper growth to growth of factor inputs, growth of factor productivity, reallocation of resources and, particularly, flexibility of substitution between factor inputs with rapid technological change.
72. P. Robinson, *Australian Financial Review*, 18 August 1983.
73. H. Hill and B. Johns, 'The transfer of industrial technology to Western Pacific developing countries', *Prometheus*, 1, 1, 1983, p. 60.
74. R. Wood, 'Industrial growth underpinned by bought technology', *Australian Financial Review*, 16 November 1978 (Special Feature on Korea).
75. Personal communication during visit to Korean Institute of Science and Technology, 1979.
76. T. Tanzer, 'Tatung makes a PAL', *Far Eastern Economic Review*, 26 June 1981.
77. S.W.Y. Kuo *et al.*, *The Taiwan Success Story, Rapid Growth with Improved Distribution in the Republic of China, 1952-1979*, Westview Press, 1981, p. 9.
78. *ibid.*, pp. 7, 64.
79. 'Japan must learn to live with its new competitors', *Far Eastern Economic Review*, 10 December 1982, p. 69; 'Foreign investment in Korea', *Australian Financial Review*, 12 May 1982; 'Foreign investment in Taiwan', *Far Eastern Economic Review*, 28 August 1981.
80. R. Wood, *op. cit.*, pp. 29-34.
81. See *fn.* 77.
82. Kraar, *op. cit.*
83. W.R.A. Wyllie (Director of Astec), 'Asia's rapidly growing technology base — implications for Australia', paper to conference on *Australia and the Western Pacific Region — The Future*, Melbourne, 19-21 June 1981.
84. Personal communication, R. Pereria, Commercial Officer, Scientific and Industrial Research Institute of Malaysia.
85. A. Rowley, 'Malaysia's dilemma: competition or control', *Far Eastern Economic Review*, 3 August 1979, p. 37.
86. 'Requiem for a rubber planter', *Economist*, 2 September 1981, p. 81; 'Sunset on British estates', *Far Eastern Economic Review*, 11 June 1982, p. 120; and J. Segal, 'Home to hard times: a cautious stock exchange welcome awaits the last of the big British estates to become localised in Malaysia', *Far Eastern Economic Review*, 1 October 1982.
87. A. Ignatius, 'Like a prince with a harem', *Asia 2000*, 2, 3, 1983, p. 15. The two joint ventures are the Agricultural Biotechnology Corporation based on Sime Darby's Ebor Laboratories, and the ASEAN Agro-Industrial Corporation for selling the products of ABC throughout the region.

88. J. Segal, 'Exit Dunlop, smiling: critics claim the British rubber company got too generous a deal from Malaysia', *Far Eastern Economic Review*, 23 July 1982, p. 58.
89. R. Greenwood, 'Why Humes looks towards the US with golden Asian memories', *Business Review Weekly*, 5 September 1981, p. 35. See also *Australian Financial Review*, 5 September 1981, p. 34.
90. The company is Société Nationale Elf Aquitane and the terms of the deal were reported in some detail in the *Far Eastern Economic Review*, 3 December 1982, p. 109.
91. Australian Industry Development Associationn (AIDA), *Annual Report 1981-82*, p. 13; P. Boyce *et al.*, *World Trade Distortions: A Study in Modern Trade Practice*, AIDA Research Centre, Melbourne 1982.
92. See B.L. Johns, 'Importing technology — the Japanese experience and its lessons for Australia', *op. cit.* "Transfer of technology (to LDCs) is in fact useful only if there is assimiliation of the technique side by side with gradual creation of a local scientific and technical capacity. The example of Japan can be taken as a model in this regard", Germindis, *op. cit.*, p. 34. See also G.A. Rattigan, 'Comparison of the IAC and Jackson Committee approaches to industrial development', *Australian Economic Papers*, 16, 2, 1977, pp. 26-43.
93. "The industry in the Philippines has traditionally been domestically oriented. As such it now stands as a sad example of how a highly protected import-substitution policy can result in technological stagnation and a low quality (particularly at the spinning and weaving levels). Garment exports are increasingly important in the Philippines but most fabrics are imported." *Far Eastern Economic Review*, 4-10 September 1981, p. 56.
94. This is Sir Ian McLennan's estimate in 'The effects of advancing technology on Australia', Presidential Address to Australian Academy of Technological Sciences, Canberra, 1977.
95. This phrase is from AIDA, *Annual Report 1981-82*, p. 4.
96. J.M. Gilmour, 'The industrial policy debate in a resource hinterland', in J.T. Woodcock (ed.), *The Manufacturing Resources of Australia*, Academy of Technological Sciences, Melbourne, 1981, pp. 99-128.
97. For example; *Toward a National Science Policy in Canada*, Science Council of Canada, 1968; *Innovation in a Cold Climate*, Science Council of Canada, 1971; and *Report on Intellectual and Industrial Property*, Economic Council of Canada, 1971.
98. *Report of the (Vernon) Committee of Economic Enquiry*, Commonwealth Government Printer, Canberra, 1965, Vol. 1, p. 289, para. 11.74.
99. *ibid.*, pp. 279-80.
100. A brief review of the formation of AIDC is provided in Grant, 'The international transfer of technology for secondary processing projects', *op. cit.*
101. C. Johnson, 1982, *op. cit.*
102. A review of the Canadian debate is provided in Britton and Gilmour, *op. cit.*
103. R. Rothwell and W. Zegveld, *Industrial Innovation and Public Policy: Preparing for the 1980s and 1990s*, Frances Pinter, London, 1981. See, for example, the comparative table beginning at p. 68.
104. 'Canada finds buying back the oil and gas 'farm' no easy matter', *Australian Financial Review*, 11 August 1981.
105. For a brief review of these reports see R.H. Brown, 'Engineered manufacture in Australia', The Institution of Engineers, Australia, *Mechanical Engineering Transactions*, 1980, pp. 108-18.
106. These words were quoted with endorsement by P.J. North, *op. cit.*, p. 98.
107. *White Paper on Manufacturing Industry*, Australian Government Publishing Service, Canberra, 1977.

108. Hogan, *op. cit.*, makes this point.
109. The fields suited to such projects have been identified with remarkable consistency by Kasper *et al.*, *Australia at the Crossroads*, Harcourt Brace, Sydney, 1980, p. 150; the Industries Assistance Commission in its submission to the Jackson Committee (Vol. 3, 1976); and by industrialists (see Stewart, *op. cit.*). The field of energy-related projects has been identified by many; for example, J. Brain *et al.*, *Energy and the Australian Economy*, Longman Cheshire, Sydney, 1981.