TECHNOLOGY AND SKILLS IN MALAYSIA

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ASEAN Regional Studies Promotion Programme
General Editors: C.Y. Ng, R. Hirono, Robert Y. Siy, Jr.

EFFECTIVE MECHANISMS FOR THE ENHANCEMENT OF TECHNOLOGY AND SKILLS IN MALAYSIA

H. Osman-Rani
Universiti Kebangsaan Malaysia
Toh Kin Woon
Universiti Kebangsaan Malaysia
Anuwar Ali
Universiti Kebangsaan Malaysia

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and
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Institute of Southeast Asian Studies

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Foreword

One of the central objectives of the Association of Southeast Asian Nations (ASEAN), as embodied in the Bangkok Declaration under which ASEAN was founded, is the promotion of Southeast Asian studies. In this context, ASEAN warmly welcomed the offer of Mr Zenko Suzuki, the Prime Minister of Japan, in early 1981 to support the launching of an ASEAN Regional Studies Promotion Programme.

After extensive consultations among ASEAN member countries and between ASEAN and Japan, it was agreed that the ASEAN Regional Studies Promotion Programme, initially to extend over a period of five years, should focus on policy-oriented socio-economic research. Given the overriding importance that ASEAN attaches to economic development and the vital role of ASEAN–Japan economic relations in this regard, ASEAN–Japan Industrial Co-operation was adopted as the first topic of research under the Programme. The second topic chosen was Effective Mechanisms for the Enhancement of Technology and Skills in ASEAN. An integrated ASEAN–Japan Overview, together with volumes on the individual ASEAN countries, are the fruits of this second phase of research.

The recent history of ASEAN–Japan relations has been marked by a degree of ambivalence. As the first Asian nation to industrialize successfully and to have risen as a phoenix from the ashes of war-time destruction to the leading heights of industrial and technological power, Japan has always been held with a degree of awe and admiration by its southern ASEAN neighbours. Such awe and admiration have, however, been tinged with a certain amount of suspicion derived from war-time memories, especially as the impact of Japan's post-war economic expansion becomes increasingly felt in the ASEAN region.

On the Japanese side, historical circumstances and the need for economic reconstruction in the early post-war years made it unavoidable that, initially, its external relations were largely oriented towards the West, especially the United States. However, as Japan rose to global economic prominence, and its economic presence in Southeast Asia grew, it increasingly came to attach greater importance to its relationship with the ASEAN countries.

ASEAN first approached Japan collectively in the early 1970s on the question of Japan's production of synthetic rubber and its adverse impact on the ASEAN economies. From such narrow beginnings, the dialogue has quickly expanded into the present broad-based consultative framework of the ASEAN–Japan Forum. Given the historical background, there is a general recognition that while economics must remain the central pillar of ASEAN–Japan relations, the socio-

political context under which such economic relations evolve is also of prime importance. Thus, a central objective of the ASEAN-Japan dialogue is the development of greater mutual awareness, understanding, friendship, and trust between the peoples of ASEAN and Japan, especially among the younger generation. In this regard, it is particularly heartening that the present Programme has begun to bring together many young researchers from both ASEAN and Japan in collaborative research on various important and pressing issues of mutual concern. The interactive thought process involved in such research, and the development of common perceptions on a wide range of issues, cannot but help improve the effectiveness of the dialogue and establish ASEAN-Japan relations on a firm basis. The ASEAN Secretariat and the Japan Institute of International Affairs, as the ASEAN and Japanese co-ordinating units for the Programme respectively, are happy and honoured to be playing a part in this process.

Phan Wannamethee
Secretary-General
ASEAN Secretariat
Jakarta

Kinya Niiseki
Chairman
Board of Directors
Japan Institute of International Affairs
Tokyo

March 1986

Preface

The study on "Effective Mechanisms for the Enhancement of Technology and Skills in ASEAN" was undertaken as the second phase of research under the ASEAN Regional Studies Promotion Programme, the first being "ASEAN-Japan Industrial Co-operation".

Country research teams from the five ASEAN countries and Japan were required to identify and examine problems in their respective countries in technology transfer and skills enhancement. Such a study, involving different countries with varied experiences, naturally poses problems of comparability. Nevertheless, to maximize comparability across countries the study relied on the use of a common core questionnaire as well as a common analytical framework and data analysis procedure. In addition, the incorporation of country-specific factors salient and relevant to technology transfer and skills enhancement was encouraged. The final research design therefore attempts to accommodate such requirements.

Thus, primary data were collected through sample surveys taken on selected industries located in the ASEAN countries. Conclusions were then drawn and recommendations made from the findings of such surveys. From this exercise, five ASEAN-country papers were produced by the respective ASEAN-country research teams. These together with two papers prepared by the Japanese team giving Japanese perceptions and historical experiences on technology transfer and skills enhancement in ASEAN form the basis of an integrated overview which has been published under the title, *Effective Mechanisms for the Enhancement of Technology and Skills in ASEAN: An Overview*. The five country-papers are also being published separately. The monograph that follows is one in the series.

C.Y. Ng,
R. Hirono
and
Robert Y. Siy, Jr.
General Editors

1
Industrialization in Malaysia

Past Trends and Patterns

Prior to Independence in 1957, Malaysia's industrial development was embryonic and geared mainly to the processing of primary commodities. The manufacturing sector was characterized by a preponderance of small establishments and low capitalization (Wheelwright 1963). It was only after the promulgation of the Pioneer Industries Ordinance of 1958 that industrialization became a firmly-based policy objective for Malaysia's national development. Since then and up to 1980, the manufacturing sector has become the most dynamic and the fastest growing sector in Malaysia. On average, the annual rate of growth was 11.5 per cent in the 1960s and 12.5 per cent in the 1970s or about twice the growth rate of real GDP. With this, the share of manufacturing in GDP rose from 8.7 per cent in 1960 to 12.2 per cent in 1970 and 20.5 per cent in 1980. The rapid growth achieved in this sector appears to hold out the promise that the obstacles to economic development can be effectively reduced. This promise has, however, been punctuated by the slower growth in the early eighties (4.9 per cent per annum during the period 1980–83) which is a reflection of the sector's vulnerability to the overall slowdown of the world economy.

In terms of employment, the share of manufacturing increased from less than 9 per cent in the 1960s to about 15.5 per cent in the early 1980s. The growth of employment in the manufacturing sector not only surpassed the population growth rate but also that of total employment in the country. In the 1970s, the growth rate of manufacturing employment was about triple that of population growth and double that of total experienced labour force (Aziz Othman and Tee 1984).

The rapid growth of the manufacturing sector in the 1960s and 1970s was accompanied by rapid structural changes in products, exports, and size as well as in ownership and employment. It was initially based on the processing and/or packaging of domestic resource-based products, mainly rubber and wood products and food. But over the years rapid shifts in the structure have been evident. As shown in Table 1, in 1963, 56.0 per cent of value added or 60.3 per cent of employment in the manufacturing sector was accounted for jointly by four major sub-sectors: food products, timber-based products, rubber products, and beverages and tobacco. By 1982, the combined shares of these sub-sectors of manufacturing had declined considerably to less than 40 per cent

TABLE 1
Peninsular Malaysia: Value Added (VA) and Employment (EMP) in Manufacturing Industries, 1963–82

Sectors	1963		1968		1974		1978		1982	
	VA %	EMP %	VA %	EMP %	VA %	EMP %	VA %	EMP %	VA %	EMP %
Food Products	15.4	16.0	16.1	14.9	17.3	10.7	20.8	8.8	17.3	15.7
Beverages and Tobacco	9.8	7.4	10.6	5.1	6.3	4.1	5.3	2.8		
Textiles	1.9	2.7	3.1	6.6	5.3	13.3	8.0	14.7	7.1	12.4
Timber-based Products	13.6	17.2	12.0	18.0	10.9	17.0	10.4	15.0	18.6	22.1
Paper, Leather & Printing	7.9	9.3	6.8	8.8	6.2	7.2	4.8	5.9		
Chemical and Chemical Products	10.0	4.8	9.1	4.5	6.8	4.0	5.7	3.4	4.9	3.3
Petroleum Products			4.7	0.3	1.8		3.3		2.5	0.3
Rubber Products	17.2	19.7	14.6	15.6	12.7	10.3	9.9	8.6	5.9	6.4
Other Non-Metallic Mineral Products	6.5	5.9	7.1	5.7	4.4	5.1	3.9	4.7	6.0	4.5
Electrical Machinery	1.1	0.8	2.4	1.7	9.4	10.6	10.9	17.0	17.1	15.2
Transport Equipment	1.4	1.9	2.1	2.9	3.2	1.4	3.0	3.6	4.3	4.2
Other Manufactures	15.2	14.3	11.4	15.9	15.7	16.3	14.0	15.5	16.3	15.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total VA (M$M)	420	—	874	—	2,756	—	5,298	—	7,516	—
Total EMP ('000)	—	81	—	121	—	255	—	356	—	515

SOURCES: Malaysia, *Census of Manufacturing Industries, 1963 and 1968*, Department of Statistics, Kuala Lumpur.
Malaysia, *Survey of Manufacturing Industries, 1974 and 1978*, Department of Statistics, Kuala Lumpur.
Malaysia, *Fourth Malaysia Plan, 1981–1985*, Government Printers, Kuala Lumpur, 1981.
Malaysia, *Industrial Surveys, 1982*, Department of Statistics, Kuala Lumpur.

in terms of value added and about 35 per cent in terms of employment. Clearly there was a move towards new labour-intensive industrial sub-sectors, notably electrical machinery and textiles. These two industries contributed 24.2 per cent of value added and 27.6 per cent of employment in 1982 compared with 3 per cent and 3.5 per cent respectively in 1963. Other major manufactures were food, and timber-based and rubber products.

Malaysia's manufacturing sector has a narrow base not only in the structure of domestic industry but also in the structure of exports. In 1970, exports of manufactures were 11.9 per cent of total merchandise exports and by 1980 the share had increased to over 20 per cent. By 1983, the manufactured exports' share in total exports amounted to 29 per cent, in fact overtaking crude petroleum as the largest export earner. Three major industries responsible for the substantial growth in manufactured exports in the 1970s were electrical machinery and appliances (mainly electronics assembly), textiles and textile products, and wood products. These industries together accounted for about two-thirds of Malaysia's manufactured exports in 1982 compared with less than a quarter in 1970. Electrical and electronic machinery alone accounted for 52 per cent of manufactured exports in 1982. Much of the increase in Malaysian manufactured exports is in fact traceable to the establishment of Free Trade Zones and the inflow of foreign investments as well as international subcontracting arrangements where cheap labour-intensive processes have been transferred to Malaysia (Lee 1981). Although it is not easy to determine the actual contribution of foreign firms to manufacturing output or manufactured exports in Malaysia, there is little doubt that it is substantial.

On the whole, there have been increases in firm size, capital-intensity, labour productivity, and wage levels in the manufacturing sector, especially in the 1970s. However, the wage level of most manufacturing branches seems to have increased more slowly than productivity (Fong 1984). This trend with regard to capital-intensity and labour productivity has an important implication in terms of employment structure.

The experience during the 1957–75 period tends to show that as the manufacturing sector expanded, relatively younger workers were employed. The declining trend in the average age of industrial labour was also accompanied by rising educational levels. For example, in 1975, 36.2 per cent of the workers in the manufacturing sector had secondary education and 2.4 per cent tertiary education; but by 1980, the percentage went up to 45.7 and 2.8 per cent respectively. During the same period, the proportion of workers within the 15–24 age group declined from 50.7 per cent in 1975 to 45.8 per cent in 1980, whereas in 1957, it was only 33.5 per cent (Aziz Othman and Tee 1984).

All these changes are directly or indirectly a consequence of certain policies and strategies pursued by the government.

Policies in the Industrial Sector

Malaysia has already gone through the two "easy" phases of the import-substitution (IS) policy (1957–68) and export-expansion (EE) policy (1968–

80) — the dividing line being the 1968 Investment Incentives Act. This Act superseded the earlier Pioneer Industries Ordinance of 1958 which was effective during the phase of import-substitution.

A distinguishing feature of the government's policy in the IS period was that its efforts consisted more of measures to promote industrial development than to participate in it directly. The major instruments to promote private investments in industrial projects were the granting of tax holidays, the establishment of industrial estates, the provision of necessary services and infrastructure, and the imposition of tariff protection. The liberal policy towards foreign investment played an important role in developing import-substitution bias in this early phase of industrial development.

The IS strategy has indeed contributed to the development process of the country. It helped to diversify the economy, reduced excessive dependence on imported consumer goods, utilized some domestic natural resources, created employment opportunities, and contributed to economic growth. Areas where IS has been particularly successful are the renewable resource-based industries such as tobacco, furniture, rubber products, wood products, food, and beverages (Chee 1984). Nevertheless, since most IS industries were based on imported raw materials and intermediate products, the end result was a low value added ratio and poor linkage effects with the rest of the economy. The policy, whether intentionally or not, encouraged the establishment of industrial enterprises involving substantial capital investment, and employment growth lagged far behind output growth (Osman-Rani 1977). In certain cases, the policy also attracted sub-optimal industries that could survive only behind heavy protection. While imports of consumer goods did decline in the 1960s, relatively as well as absolutely, the imports of investment and intermediate goods increased somewhat more proportionately.

Because of the limited domestic market, the emphasis of the industrial policy quickly shifted from an inward-looking to an outward-looking approach to industrialization. However, the liberal policies towards foreign investment continued. Foreign investments were then accorded an important role not only because they were expected to provide product design and industrial technology but also overseas market access. Consequently, government policies have been designed to encourage export-oriented foreign investments while discouraging foreign investments that might inhibit exports. Policies to encourage foreign investments include the provision of tax holidays to firms granted pioneer status and price incentives for export to new industrial establishments or existing ones intending to expand production for exports. Special considerations to encourage exports were also given by the establishment of more Free Trade Zones, frequent overseas campaigns, the opening up of the Malaysian Export Trade Centre in Kuala Lumpur, and the formation of Malaysian "Sogo Shoshas".

Consequently, as noted earlier, there was a rapid inflow of foreign capital, an increase in industrial growth rate, a large absorption of unskilled and semi-skilled labour, notably by the electronics and textiles industries, and a tremendous boost in manufactured exports during the 1970s. Although there has

been an increase in protectionism in the industrialized markets, the share of Malaysia's manufactured exports going to industrial market economies increased substantially. Among the markets for industrial goods that Malaysia has successfully made inroads into are the United States, Australia, East Asian NICs, and the EEC. For example, in 1980 more than one-third of Malaysian exports to Australia and the United States, and about one-quarter of Malaysian exports to the East Asian NICs and the EEC consisted of manufactures. However, the percentage is much smaller in the case of exports to Japan, that is, hardly 5 per cent in 1980 (Ariff and Hill 1985).

The impetus for development of Malaysia's export industries has come primarily from firms in the industrialized countries seeking low cost sources of supply, rather than from Malaysia's very own entrepreneurs looking for market opportunities. The export-orientation has also meant strengthening external linkages by increasing Malaysia's dependence on foreign capital, imported inputs, and overseas markets for its manufactures (Ariff 1984).

Following the New Economic Policy (NEP), since 1970 the government also adopted a more direct and active role in the industrialization process. Under the NEP, the government attempts to redress the imbalance in ownership of equity capital and control of enterprises between foreigners and Malaysians. The government's policy of restructuring the society also aims at an average of 30 per cent equity participation of *bumiputera*s (indigenous community) in the industrial sector by 1990. According to official estimates, the equity share of *bumiputera*s in 1971 was only 4.3 per cent (2.6 per cent individuals and 1.7 per cent trust agencies). However, the industrial equity ownership restructuring was found to be slow in the beginning. To overcome this, the Industrial Co-ordination Act 1975 was introduced. This legislation requires that all industries must apply for new manufacturing licences except the small industries (with shareholders' funds of less than M$250,000 and with fewer than twenty-five full-time workers) and those engaged in the milling of oil palm fresh fruits into crude palm oil, the milling of padi into rice, and the processing of raw natural rubber. In issuing a licence, the Ministry of Trade and Industry is empowered to impose conditions which it deems necessary for a more effective implementation of the NEP.

As a result, the foreign equity share in the corporate sector declined from 61.7 per cent in 1971 to 33.6 per cent in 1983. On the other hand, the *bumiputera* share increased from 4.3 per cent in 1971 to 18.7 per cent (7.6 per cent *bumiputera* individuals and 11.1 per cent trust agencies) during the same period. As supported by Table 2, the proportion of direct foreign investment in total private capital flows had been declining in the 1970s despite the increase in the share of private flows in total. Similarly, the share of direct foreign investment in gross domestic investment also appears to be declining. Most of the restructuring in the industrial sector was done through growth. Even the value of foreign capital, despite its declining share, has increased fourfold from M$4.1 billion in 1971 to M$16.7 billion in 1983.

By the end of the 1970s, a need for a fresh look at the industrial policy for the 1980s was evident mainly because of the turn of world events which badly

TABLE 2
Total Net Resources Flows to Malaysia, 1969–81

Period	Average Annual Net Flows US$ million	Share of Official Flows in Total (%)	Share of Private Flows in Total (%)	Share of Direct Investment in Total (%)	Share of Direct Foreign Investment in Gross Domestic Investment (%)
1969–71	80.4	71.3	28.7	31.3	3.4[a]
1972–76	245.5	49.7	50.3	36.7	4.5
1977–81	569.3	36.6	63.4	24.8	2.5

[a] 1971 only.

SOURCE: H. Hill and B. Johns (1984), Tables 1 and 2.

affected the economy. In addition, its underlying structural weaknesses had further contributed to the sluggish growth of this sector. For the 1980s, the government policy is to undertake more aggressive efforts in export promotion in order to exploit the expected upswing in the world economy. However, recognizing the vulnerability of the export sector and its narrow base, "efforts should be directed towards diversifying exports and promoting selected import-substitution industries" (Malaysia 1984, p. 276). Thus, the 1980s tend to be associated with the "second" and more difficult phases of import-substitution as well as export-promotion policies.

The second phase of import-substitution is expected to involve the production of consumer durables as well as intermediate inputs and capital goods. These products need to be produced in large quantities using more capital- and skill-intensive methods of production in order to enjoy economies of scale. Similarly, the second round of export-expansion is a shift from labour-intensive manufactures to more capital- and technology-intensive products. Such products include machinery, motor vehicles, petrochemicals, and other resource-based industries in which the country is expected to have comparative advantage.

There is thus a policy trend towards "industrial deepening" with the growing importance of heavy and resource-based industries in Malaysia (particularly of non-renewable energy resources) during the remainder of the 1980s and into the 1990s. This reorientation of resource flows necessitates substantial investments and new technology which inevitably require for some time the external assistance of foreign companies. It is most likely that the proportion of foreign equity in the corporate sector is going to increase again as Malaysia approaches the end of this decade. To accompany this, there was also a shift towards greater "privatization" and a closer relationship between the government and the business sector through the concept of "Malaysia Inc."

Foreign Capital Investment

Historically, private foreign capital investment has been important in the economic development of Malaysia. At the time of independence, foreign investment was already concentrated in the rubber and tin industries as well as in trade and commerce, including banking and insurance (see Junid Saham 1980). Foreign investment in manufacturing industries during this period was very negligible and even along with local investment accounted only for a very small proportion of the total investment (Mondragon 1981). By 1970, according to the estimates of Hoffmann and Tan (1980), foreign ownership was still particularly substantial in agriculture (75.4 per cent), mining (72.5 per cent), and trade (63.6 per cent). Although foreign investment in the manufacturing sector is rather a post-independence phenomenon, its rate of increase has been fast. Even with the inception of the NEP, foreign investors still have much to gain. By the early eighties it was evident that the relative foreign share of equity in major economic activities had diminished. However, the manufacturing sector has the highest concentration of foreign control among all sectors in the economy.

Based on the 1981 Financial Report of Limited Companies in Malaysia, covering limited companies with an annual revenue of M$5 million or over, foreign companies obtained 62.6 per cent of total gross profits or 65 per cent of net profit after tax. Evidently, they have gained more than local firms in terms of financial incentives provided by the government (Khor 1984). The Report also indicates that approximately 20 per cent of the companies surveyed were foreign-controlled, and the majority of these companies were in manufacturing (39 per cent), wholesale trade (26 per cent), banking and financial institutions and rubber and other agriculture (11 per cent). Nearly 70 per cent of the foreign-controlled companies were subsidiaries and the rest were branches.

In terms of country of origin of foreign capital, Singapore, Japan, and the United Kingdom are major contributors in Malaysian manufacturing. At the end of 1983, Singapore accounted for 32.9 per cent, Japan 17.3 per cent, and the United Kingdom 15.9 per cent of the total foreign capital investment in Malaysia. Other major investors are from Hong Kong and the United States. These five countries collectively controlled about four-fifths of the total foreign investment or slightly over three-quarters of the value of fixed assets in manufacturing (Table 3).

Most foreign investments are found in food, textiles and textile products, and electrical goods and electronics, which jointly accounted for 40 per cent of the total in 1983. Other major industries which are of interest to foreign investors are non-metallic mineral products, chemical and chemical products, beverages and tobacco, and basic metal products (Table 4).

It may also be noted from Tables 3 and 4 that more than 80 per cent of foreign capital investments were in the form of paid-up capital and the remainder were loans. The equity-loan ratios tended to vary between countries of origin and between industry groups. For example, loans accounted for more than 25 per cent of the total Japanese investment in Malaysia, whereas the

TABLE 3
Malaysia: Foreign Investment in Companies in Production by Country as at 31 December 1983

	Paid-up Capital M$ million	Loans M$ million	Total Capital Investment		Fixed Assets	
			M$ million	$	M$ million	$
Singapore	1,052.2	284.4	1,336.6	32.9	884.2	23.1
Japan	524.5	179.2	703.7	17.3	704.0	18.4
United Kingdom	582.3	62.5	644.8	15.9	680.0	17.8
USA	180.7	46.6	227.3	5.6	306.0	8.0
Hong Kong	304.1	68.6	372.7	9.2	357.5	9.4
West Germany	85.8	23.5	109.3	2.7	109.6	2.9
Australia	79.0	7.9	86.9	2.1	44.5	1.2
Netherlands	41.7	10.3	52.0	1.3	74.5	1.9
India	39.2	18.2	57.4	1.4	52.3	1.4
Others	387.6	82.4	470.0	11.6	606.8	15.9
Total	3,277.1	783.6	4,060.7	100.0	3,819.4	100.0

SOURCE: Calculated from unpublished data provided by Malaysian Industrial Development Authority (MIDA).

TABLE 4
Malaysia: Foreign Investment in Companies in Production by Industry as at 31 December 1983

Industry	Paid up M$ million	Loans M$ million	Total Capital Investment M$ million	%	Fixed Assets M$ million	%
Food Manufacturing	571.2	134.4	705.6	17.4	640.1	16.8
Beverages & Tobacco	230.6	47.7	278.3	6.8	267.6	7.0
Textile & Textile Products	376.1	114.5	490.6	12.1	368.4	9.6
Leather & Leather Products	17.1	—	17.1	0.4	18.0	0.5
Wood & Wood Products	100.2	99.4	199.6	4.9	117.2	3.1
Furniture & Fixtures	18.9	0.4	19.3	0.5	12.8	0.3
Paper, Publishing Printing	26.6	2.4	29.0	0.7	29.8	0.8
Chemicals & Chemical Products	298.1	29.2	327.3	8.1	242.5	6.3
Petroleum & Coal	124.5	—	124.5	3.1	174.5	4.6
Rubber & Rubber Products	95.8	9.4	105.2	2.6	170.9	4.5
Plastic Products	20.7	3.8	24.5	0.6	27.3	0.7
Non-metallic Mineral Products	297.3	104.3	401.6	9.9	390.2	10.2
Basic Metal Products	222.3	29.9	252.2	6.2	100.3	2.6
Fabricated Metal Products	123.3	12.8	136.1	3.4	133.9	3.5
Machinery	58.8	4.9	63.7	1.6	61.5	1.6
Electrical Goods & Electronics	320.4	73.7	394.1	9.7	757.8	19.8
Transport Equipment	166.4	27.8	194.2	4.7	122.7	3.2
Scientific & Measuring Equipment	30.7	12.4	43.1	1.1	34.4	0.9
Miscellaneous Manufacturing	28.7	13.8	42.5	1.0	43.4	1.1
Hotel & Tourist Complexes	149.8	62.8	212.6	5.2	106.0	2.8
Total	3,277.1	782.6	4,060.7	100.0	3,819.4	100.0

SOURCE: Calculated from unpublished data provided by Malaysian Industrial Development Authority (MIDA).

corresponding figure for the British was about 10 per cent. Similarly, the proportion of loans varied from almost 50 per cent in wood and wood products to zero in leather and leather products as well as petroleum and coal.

Table 5 shows the distribution of major foreign investments among industry groups in Malaysia. Singapore, being historically and geographically part of Malaysia's economic development, has been rather diversified and has emphasized smaller and import-substitution types of industries. The major ones are food (21.7 per cent), non-metallic mineral products (14.3 per cent), and basic metal products (11.4 per cent). The British have also been involved mostly in the larger import-substituting industries, of which food (21.3 per cent), beverages and tobacco (16.2 per cent), chemical and chemical products (16.4 per cent), and petroleum products (15.6 per cent) are most important. The structure of American investment is somewhat different and more concentrated than the British. Being a late-comer, it gives more emphasis to chemical and chemical products (36.5 per cent), electrical goods and electronics (15.6 per cent), and beverages and tobacco (23.0 per cent). The Japanese, also a late-comer, invest mainly in export-oriented textiles and textile products (31.9 per cent), and electrical goods and electronics (15.5 per cent), and to a lesser extent in food (10.6 per cent) and wood and wood products (9.5 per cent). A study by Hill and Johns (1984) shows that not only do Japanese firms in Malaysia export a smaller proportion of their output than do their American counterparts, but they also export less to Japan than the American firms export to the United States.

It may also be noted that the bulk of the foreign direct investment in Malaysia is in the form of joint-ventures. There are few wholly-owned or turnkey operations. But the new forms of foreign investment — that is, licensing and franchising arrangements and management contracts — are becoming more and more important (Ariff 1984).

The Need for Technology and Skills in Industrialization

Like most other developing countries, Malaysia is seeking to indigenize the local operations of foreign firms as a means of exercising greater control over subsidiaries and to pursue their indigenization goals with less dependence on foreign firms. To this end, the Malaysian planners are faced with the arduous task of planning in order to facilitate the development of new technical and managerial skills, and to upgrade existing technology.

Importation is perhaps the most effective method of acquisition of technology for Malaysia. In the past, practically all new technology introduced into Malaysia came from overseas by means of importation of machinery and equipment, printed matter, complete plants or turnkey projects, and the transfer of knowledge through the movement of people. Given the present circumstances, very little new technology is likely to be developed locally in the near future. However, considerable adaptation of imported technology to local conditions is highly desirable. Hence, the policy of technological independence in the Malaysian context does not mean the development of technology

TABLE 5
Malaysia: Foreign Investment in Companies in Production by Selected Country and Industry as at 31 December 1983

Industry	Singapore		Japan		U.K.		USA	
	M$ million	%	M$ million	%	M$ million	%	M$ million	%
Food Manufacturing	290.0	21.7	74.6	10.6	137.4	21.3	11.5	5.1
Beverages & Tobacco	28.8	5.9	—	—	104.2	16.2	52.3	23.0
Textile & Textile Products	77.2	5.8	224.3	31.9	6.4	1.0	5.5	2.4
Leather & Leather Products	5.4	0.4	—	—	—	—	—	—
Wood & Wood Products	60.8	4.5	67.0	9.5	4.9	0.8	2.8	1.2
Furniture & Fixtures	14.6	1.1	1.4	0.2	—	—	0.5	0.2
Paper, Publishing & Printing	21.7	1.6	0.2	—	2.7	0.4	0.4	0.2
Chemical & Chemical Products	63.4	4.7	19.5	2.8	105.8	16.4	83.0	36.5
Petroleum & Coal	—	—	—	—	100.5	15.6	—	—
Rubber & Rubber Products	25.3	1.9	11.8	1.7	19.3	3.0	10.3	4.5
Plastic Products	8.4	0.6	11.9	1.7	0.9	0.1	—	—
Non-metallic Mineral Products	190.5	14.3	53.7	7.6	38.8	6.0	1.0	0.4
Basic Metal Products	150.3	11.4	48.7	6.9	16.8	2.6	—	—
Fabricated Metal Products	42.9	3.2	19.2	2.7	25.5	4.0	1.6	0.7
Machinery	9.0	0.7	19.9	2.8	16.7	2.6	6.9	3.0
Electrical Goods & Electronics	80.9	6.1	109.2	15.5	35.3	5.5	35.5	15.6
Transport Equipment	61.4	4.6	22.6	3.2	25.2	3.9	5.1	2.2
Scientific & Measuring Equipment	—	—	2.0	0.3	—	—	4.0	1.8
Miscellaneous Manufactures	1.4	0.1	11.3	1.6	3.8	0.6	6.6	2.9
Hotel & Tourist Complexes	148.3	11.1	4.9	0.7	0.5	0.1	—	—
Total	1,336.6	100.0	703.7	100.0	644.8	100.0	227.3	100.0

SOURCE: Calculated from unpublished data provided by Malaysian Industrial Development Authority (MIDA).

unknown in other countries. That would not be necessary and neither would it be practical. Rather it means the mobilization of Malaysian efforts to exploit its internal resources effectively through selection, adaptation, dissemination, and usage of the highly productive new technology already developed elsewhere.

Beyond the mere act of importation, Malaysia is also making institutional and policy adjustments. In this respect, both the quantitative and qualitative elements of manpower planning have been considered. Such planning is all the more significant given that the easier phases are giving way to the more difficult phases of the "second round" of import-substitution and export-orientation through the expansion of resource-based and heavy industries. Such undertakings will involve not only the capacity of the economy to accumulate capital and utilize it effectively, but also the capacity to develop new engineering and technical skills as well as management and marketing abilities.

2
Transfer, Adaptation, and Development of Technology

Introduction

The transfer of technology may be defined as "a process in which a country is free to choose autonomously, from among different alternatives of scientific and technological knowledge, those which are best suited to its natural conditions and to its development objective, its capacity for assimilation and its pattern of living" (Capriles 1977). But what has been happening in most developing countries, including Malaysia, is that technology has not effectively been transferred in the sense defined above. Since the industrialization programme began in earnest in the late fifties, technology transfer to Malaysia has often been regarded as very limited, whether in terms of feasibility studies, engineering design and detailed engineering, plant construction and installation, industrial processes, training of managerial and technical personnel, or marketing information. The choice of technologies and improvements to processes and product design are basically determined by the foreign companies or technology suppliers. At the same time, Malaysia's ability to choose, use, and assimilate imported technology has been hampered because of the lack of technical, managerial, and organizational capacities, particularly so during the early stages of its industrialization programme. These characteristics are not only typical of Malaysia but are also shared by many other developing countries (see UNCTAD 1981).

The above characteristics and the lack of policy on technology development in effect create a situation whereby domestic manufacturers repeatedly seek transfers of all or most elements of technology, thereby making little use of domestic technology and skills and even less effort to build them up for their own research and development (R&D) activities. The use of imported technology and its attendant skills appears to be more profitable to the domestic manufacturers when given as part of a licence "package" or by entering into a joint-venture arrangement with foreign partners. While such an arrangement may be beneficial for domestic manufacturers in the short run, this dependence may be detrimental for the economy as a whole in the long run, especially with respect to development of domestic as well as appropriate technology.

The economic structure and factor endowments of developing countries meant that the need for technologies is quite different from that in the developed

countries. The domestic market is comparatively small, and productive sectors differ in availability and cost. Multinational companies operating in Malaysia tend to use relatively more capital-intensive techniques than their local counterparts, which is also a consequence of the existing incentive system. This lack of adaptation to suit the domestic factor endowments can also be related to their substantial investment in capital-intensive technologies, their excessive concern for global technological standardization, their greater familiarity with the management of capital-intensive techniques, and their near-monopoly position — thus allowing them not to be concerned with the country's objective of appropriate technology. And during the recent bad years for the world economy, the trends seem to show that while the technology importing countries are pushing hard for a more rapid transfer of technology, the technology exporting countries are increasingly concerned with the possible negative effects of such technology transfers on their own exports and domestic employment situations.

Technology transfer into Malaysia must also be seen in the context of technology transactions taking place under very imperfect market conditions which generally favour the technology supplier. This may become increasingly costly to domestic manufacturers and would involve considerable payments in foreign exchange. Furthermore, technology transfer often takes place in the form of a package with foreign technical expertise and capital equipment, hence leading to hidden costs and making it more difficult to evaluate the price of the technological component. The "price" as expressed in direct costs may only be a small portion of the full cost, as the sale of technology to domestic industries is generally accompanied by restrictive conditions that lead to substantial increases in the true costs of a transfer.

A technology supplier is therefore often in an advantaged position to dictate the terms and conditions of the transfer of technology, which are basically designed to yield high rates of return and to protect the competitive position of the supplier. Such high rates of return may take the form of profits not only earned on equity, but also earned from sales of intermediate goods, capital equipment, spare parts and technical services, not to mention transfer pricing.

In this respect, the price paid to obtain any particular technology may also reflect the lack of technical, financial, legal, and commercial expertise required for the acquisition of information about the technology and for the evaluation of the various alternatives which may exist. This disadvantage is particularly felt by the smaller companies which are generally Malaysian-owned and controlled. The large-sized companies, on the other hand, tend to have greater access either because of their better organizational ability or because they are established through joint-ventures with foreign manufacturers.

The Transfer of Technology Policy

Having recognized the need to expand the country's manufacturing base and thus the need for foreign investment and technology transfer, the Ministry of Trade and Industry has a formidable task to ensure that the inflow of

investment and technology is orderly and beneficial to the economy as a whole. Given the constraints under which the Ministry has to operate within an open economic structure with the private sector as the main instrument to achieve manufacturing growth, the Ministry, as far as technology transfer is concerned, resorted to the policy of screening and approving any agreement signed by a domestic company and its foreign partner.

Prior to 1968, manufacturing companies had to submit such agreements to Bank Negara Malaysia under the Foreign Exchange Control Act in lieu of any royalty or technical fee remittances overseas. Since Bank Negara Malaysia was then mainly concerned with the amount of remittances, agreements were not subjected to any proper screening process.

The Investment Incentives Act of 1968 was basically designed to attract foreign investment by providing total or partial tax relief to companies involved in new manufacturing projects or expanding into new products. Companies granted these incentives were subjected to certain conditions by the Ministry of Trade and Industry, one of which required them to submit all agreements signed with other companies for the Ministry's approval. Following the implementation of the Industrial Co-ordination Act of 1975, the Technology Transfer Unit was established for the specific purpose of screening these agreements. The impact, as expected, has not been very substantial since its functions are mainly regulatory rather than control. Functioning principally as a screening unit for any agreement signed between Malaysian and foreign companies, the Technology Transfer Unit has three main objectives:

1. To ensure that the agreement will not be prejudicial to the national interest;
2. To ensure that the agreement will not impose unfair and unjustifiable restrictions or handicaps on the Malaysian party; and
3. To ensure that the payment of fees, wherever applicable, will be commensurate with the level of technology to be transferred and will not have adverse effects on Malaysia's balance of payments (Burhan Abdullah 1983).

The technology transfer agreements cover licence rights over specific processes, formulae or manufacturing technology (patented or otherwise); the know-how and expertise necessary for the setting up of a plant; and the provision of technical assistance and various supporting services. Under these arrangements, specific agreements entered could be in the form of (i) joint-venture, (ii) technical assistance, (iii) know-how, (iv) licence, (v) patent and trade mark, (vi) sales commission, and (vii) turnkey contracts.

The agreements have to define in detail the technological content and the principal features of the technology; anticipated production; quality and specification of products; and particulars of technical assistance and the manner in which they are to be provided. The technology to be supplied should incorporate the latest developments known to the supplier, innovations/breakthrough in technology, including new patents applied for or registered.

Prior to the establishment of the Technology Transfer Unit, domestic companies under licence generally had to bear a higher direct cost for

technology as demanded by their technology suppliers. The mode of calculating technical assistance and royalty fees tended to favour the technology suppliers. The latter also tried to maximize their gains by insisting on agreements of an indefinite period.

However, the Technology Transfer Unit has now insisted that all technical fees or royalty payments should be based on net sales rather than gross sales, and this has been defined as gross sales less sales discount or returns, transport costs, insurance, duties, taxes, and any other charges. A rate of 1 per cent to 5 per cent of net sales is normally considered acceptable. The practice of itemization of service under separate agreements and capitalization of know-how fees/royalties is, however, not encouraged. If no technical assistance fees are involved, domestic industries may have to pay substantial emoluments for acquiring production engineers or management personnel from overseas. However, the Technology Transfer Unit has now issued a set of guidelines relating to such payments so as to minimize production costs on the part of domestic industries. As regards agreements of indefinite periods, the Unit now insists that the duration of agreements should be adequate for full absorption of technology. The life of any patent relating to technology is also taken into consideration. The period should be limited to no more than five years. Any extension of the five-year period should be made with the approval of the Ministry which will insist on grounds such as the upgrading of technology transferred.

Even if we can assume that the direct costs of technology transfer were not excessive, domestic manufacturers might still be disadvantaged substantially if restrictive conditions were imposed in agreements signed with foreign technology suppliers. These might include restrictions on export outlets, the level of technology transferred, and the domestic R&D activities. The Ministry of Trade and Industry has, however, tried to eliminate such restrictions so as to allow domestic manufacturers more room to expand their operations. For instance, if the technology suppliers insist on export restrictions, the Ministry will demand that consent for sales outside the restricted territories should not be unreasonably withheld. At the very least, the Ministry requires the technology supplier to allow its domestic licensee to export to other ASEAN countries.

A few technology suppliers would insist on fixing the price of the licensed product while some others would insist that Malaysian licensees purchase all material inputs and components at prices fixed by the former. The first restriction has now been disallowed by the Ministry of Trade and Industry. The second type of restriction appears to be more common; such tie-in purchases strengthen the position of the technology supplier and hence enable it to maximize its gains by selling over-priced components, intermediate inputs, capital equipment, and spare parts. Furthermore, the obligation to purchase key inputs from the technology supplier enable the latter to monitor the activities of the Malaysian licensee, including a constant check on the production figures of the domestic licensee for the purpose of determining technical or royalty fees.

In order to avoid such a situation the Ministry has now laid down a number of guidelines regarding purchases of components or intermediate inputs. These include:

1. The domestic licensee should determine alternative sources of supply as far as possible;
2. A clause binding the domestic licensee to purchase all imported components and supply through the technology supplier should be avoided, unless no suitable alternative source is available;
3. If a provision is included such that components and imported supplies will be obtained through the technology supplier, the domestic licensee should seek to include the following stipulations: (i) prices to be based on international competitive prices, with the manner of determining such prices described; (ii) the most favoured licensee clause will apply to pricing; (iii) where the domestic licensee's supplies are "bought out" components and intermediate inputs, the price to be charged will be the same as that paid by the technology supplier plus reasonable handling charges.

The effectiveness of such regulations will, however, depend to a large extent on Malaysian expertise and the information base for the selection of the most appropriate technology and the ensuing agreements. In the long run, the regulations and selections must be directed towards the reduction of technological dependence and the development of domestic engineering and innovative skills.

In view of the above, the cost of technology transfer into domestic industries is to a certain extent influenced by the bargaining strength of the foreign company, the Malaysian company or subsidiary or joint-venture partner, as well as the Ministry of Trade and Industry. Each of these parties has its own view of the value of technology and its own preferences as to how it should be transferred.

It is in this context that the Ministry of Trade and Industry, while having in common with the Malaysian company the desire to acquire technology at low cost, has to make its calculations based on the choices open to it. Such calculations include the social costs and benefits of each source of technology, the linkages with other industries, the use of domestic resources, the direct costs of technology (for example, royalties) as well as the hidden costs, such as possible overpricing by the technology supplier of inputs to the local company. However, in this respect, the Ministry requires the back-up of expertise in engineering, management, and law so as to ensure a beneficial transfer of technology to the domestic industries.

Even though the technology to be imported or developed can be identified and chosen, the deficiencies of skilled labour, including the R&D personnel, may still prevent its efficient implementation. The scarcity of skilled industrial labour has often been a bottle-neck in the transfer of technology to Malaysia. It is therefore a policy of the government that adequate training be provided at the technology suppliers' plant facilities as well as in the local plant.

Channels of Technology Transfer

The transfer of technology manifests itself in many ways, the important ones being: 1. exchange of information and personnel through technical cooperation programmes; 2. direct employment of foreign experts; 3. imports of machinery and equipment and related literature; 4. licence agreements and production processes, use of trademarks and patents, and so forth; 5. direct foreign investment; and 6. books, journals, and other published information.

In their quest for the various elements of technology to establish new industries or to improve existing production techniques, domestic industries have resorted to most of the above methods, either singly or in combination. But above all, it is the flow of direct foreign investments that has influenced the extent and nature of technology transfer. Foreign investments from the developed countries are expected to be accompanied by technology transfer through licence or technical assistance agreements, the flow of information, use of patents/trademarks, use of production processes and engineering designs, employment of foreign personnel, and the import of machinery and plant equipment. However, the use of any of these channels of technology transfer will also depend on the kind or level of technology that is needed by producers in the host country.

In view of the different channels of acquiring the various elements of technology, a spectrum of organizational frameworks for technology transfer has been evolved in Malaysia over the recent years. As shown in Table 6, between 1970 and 1983 the Ministry of Trade and Industry scrutinized and approved a total of 989 agreements, the majority of them since 1978 (639 out of 989). This is perhaps an indication of the increasing effort towards industrialization in Malaysia, particularly marked since the middle of the 1970s. The fact that 53.5 per cent of all agreements approved since 1970 are in the form of technical assistance and know-how agreements, while another 23.3 per cent are in the form of management and joint-ventures, indicates a high concentration of the types of agreement for technology transfer into the manufacturing sector. All this is also indicative of the shift from the "packaged" type to the "unpackaged" type of foreign capital and technology transferring process. This shift has mainly been the outcome of the New Economic Policy equity guidelines.

Table 7 shows that Japan accounts for a substantial portion of all agreements signed between 1975 and 1983, that is, 31.8 per cent of the total. The other countries that are relatively important in this context are the United Kingdom and the United States, accounting for 13.5 and 10.3 per cent respectively. The increase in the number of agreements signed with Japanese technology suppliers has been particularly marked since 1980 — and this coincides with the present administration's "Look East Policy".

The importance of Japan as a technology supplier to domestic industries is further enhanced if we examine figures on the imports of capital equipment of machinery, which constitute one element of technology transfer. Japan is a prominent supplier of machinery. Between 1978 and mid-1983, for example,

TABLE 6
Types of Agreements 1970–83

Types of Agreements	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	Total (%)
1. Technical Assistance & Know-How	9	15	33	34	28	27	30	21	48	54	57	64	48	61	529 (53.5)
2. Management	—	1	13	5	3	12	7	7	11	13	13	6	10	13	114 (11.5)
3. Joint-venture	—	2	7	6	7	6	6	4	7	8	14	22	14	14	117 (11.8)
4. Service	4	2	9	5	5	12	5	1	12	3	6	7	2	7	85 (8.6)
5. Trademarks/ Patents	3	2	4	3	6	1	5	—	4	4	4	8	8	7	59 (6.0)
6. Basic Engineering	—	—	—	—	—	—	—	—	—	—	5	5	4	4	18 (1.8)
7. Others	—	—	—	—	—	—	—	—	—	—	15	19	8	25	67 (6.8)
Total	16	22	66	53	49	58	53	33	82	87	114	131	94	131	989 (100.0)

SOURCE: Ministry of Trade and Industry.

TABLE 7
Agreements by Country of Origin 1975–83

Countries	1975	1976	1977	1978	1979	1980	1981	1982	1983	Total	%
1. Japan	22	21	7	32	21	32	35	33	46	249	31.8
2. United Kingdom	10	6	4	13	11	20	17	6	19	106	13.5
3. USA	6	4	1	9	8	11	14	10	18	81	10.3
4. India	3	5	8	7	5	5	4	4	4	45	5.7
5. West Germany	—	1	4	6	11	9	11	10	2	54	6.9
6. Australia	3	2	1	—	4	10	5	6	2	33	4.2
7. Hong Kong	1	—	3	3	2	9	2	3	2	25	3.2
8. Singapore	3	2	2	1	2	4	7	5	3	29	3.7
9. France	2	4	—	—	2	—	7	—	4	20	2.7
10. Italy	1	1	—	1	1	2	—	—	—	6	0.8
11. Panama	—	—	3	—	1	1	—	1	—	6	0.8
12. Switzerland	—	—	—	2	1	—	3	1	2	8	1.0
13. Norway	—	—	—	—	1	1	—	2	1	5	0.6
14. South Korea	—	1	—	1	—	—	—	2	4	8	1.0
15. Others*	7	6	—	7	17	9	26	12	24	108	13.8
Total	58	53	33	82	87	114	131	94	131	783	100.0

* Others include also agreements signed with Malaysian Companies.

SOURCE: Ministry of Trade and Industry.

around 34–40 per cent of Malaysia's machinery needs originated from Japan. Only the United States, amongst the other developed countries, appears to challenge the position of Japan in this respect. Even then, its share was well below that of Japan's that is, an average of 26 per cent during the same period. Other less important countries are West Germany and the United Kingdom.

Table 8 shows that most of the agreements signed between 1975 and 1983 are in the electronics and electrical industries (16.1 per cent), fabricated metal industries (11.2 per cent), and chemical industries (11.0 per cent). These three industries account for more than 38 per cent of all agreements signed, thus reflecting the strong need for technology transfer in these relatively new industries.

Adaptation and Development of Technology

The modification by MNCs of processes and products to suit host country circumstances is dependent on many factors, including the type of technology and product, the social and economic situation of the particular country, and the individual country's view of how its subsidiaries can function most efficiently and profitably over the long run. In general, fewer foreign-controlled companies appear willing to adapt their product than to modify their processes (Frank 1980). Product adaptation is likely to be greatest among manufacturers of import-substitution goods, especially consumer goods. But for products which face international rather than country-specific demands, firms may prefer to train service personnel, rather than to simplify the products. Companies also tend to be reluctant to develop a new product or modify an existing one if the market is not large enough to permit recovery of costs. As noted by Gillis et al. (1983), besides possessing greater technical skills for adapting technologies to local conditions than do most, if not all, of the developing countries, Japan tends to have greater bargaining power in getting foreign technologies because of its large domestic market. The expected scale of output, labour skill levels, and the availability and quality of local inputs, subcontractors, transportation, and communication facilities may all lead to adaptations. However, the most common reason for changing production processes tends to be the advantage of comparatively cheap labour (Frank 1980). Labour-intensive industries may find it easier to adapt their processes to use more host country labour, but capital-intensive industries may find it difficult to substitute labour for capital. Unlike most MNCs, Japanese-based corporations are generally willing to tailor their products to local conditions but in practice do little in the way of process modification. The design of plants and processes is generally drafted and/or approved by the parent firm (Chee and Lee 1983; Sim 1978).

Besides the willingness of foreign companies to accommodate host country desires for technological transfer and adaptation, the ability of a developing country to acquire and adapt new technology depends primarily also on the host country's capacity to absorb new information as defined by the skills of its people, and host country policies toward technological transfer and information generation and dissemination in general.

TABLE 8
Agreements by Industry Groups 1975–83

	1975	1976	1977	1978	1979	1980	1981	1982	1983	Total	%
1. Electronic & Electrical	17	9	5	21	15	19	16	19	15	136	16.1
2. Fabricated Metal	8	3	5	7	16	6	14	7	12	88	11.2
3. Chemical	3	—	4	19	8	11	21	5	15	86	11.0
4. Motor Vehicles & Shipping	5	4	—	5	7	10	11	11	31	84	10.7
5. Food	4	7	2	2	7	8	12	1	37	50	6.4
6. Textiles	6	7	2	4	—	8	5	2	5	39	5.0
7. Basic Metal	—	5	3	3	5	7	10	13	5	51	6.5
8. Scientific & Optical Equipment	2	6	1	5	4	5	—	3	5	31	4.0
9. Pulp, Paper Printing	4	1	6	5	4	—	—	4	—	25	3.2
10. Rubber & Leather	6	—	1	2	5	8	14	2	7	45	5.7
11. Non-Metallic	1	6	1	1	7	5	4	16	9	50	6.4
12. Palm Oil & Petroleum	1	—	—	8	3	6	3	3	4	28	3.6
13. Hotel	—	5	1	—	2	4	2	4	8	26	3.3
14. Plastic	1	—	2	—	3	5	6	1	2	20	2.6
15. Others	—	—	—	—	—	2	13	3	5	24	3.1
Total:	58	53	33	82	87	114	131	94	131	783	100.0

SOURCE: Ministry of Trade and Industry.

One major problem in the process of adaptation and development of technology is related to the fact that a technology supplier very often insists on using its usual machine suppliers in its own country and it generally contracts foreign engineering designers. Even domestic manufacturers are often reluctant to try domestic technologies when they are available. To them, this may be a much more risky proposition compared with the use of already tested foreign technologies.

It has often been reported that most foreign subsidiaries in Malaysia do not undertake research and development (R&D) because such activities are often handled by the parent companies. Those companies which did undertake R&D confined the activity to simple experimental development and application research (Sim 1978; Rahim Bidin 1983).

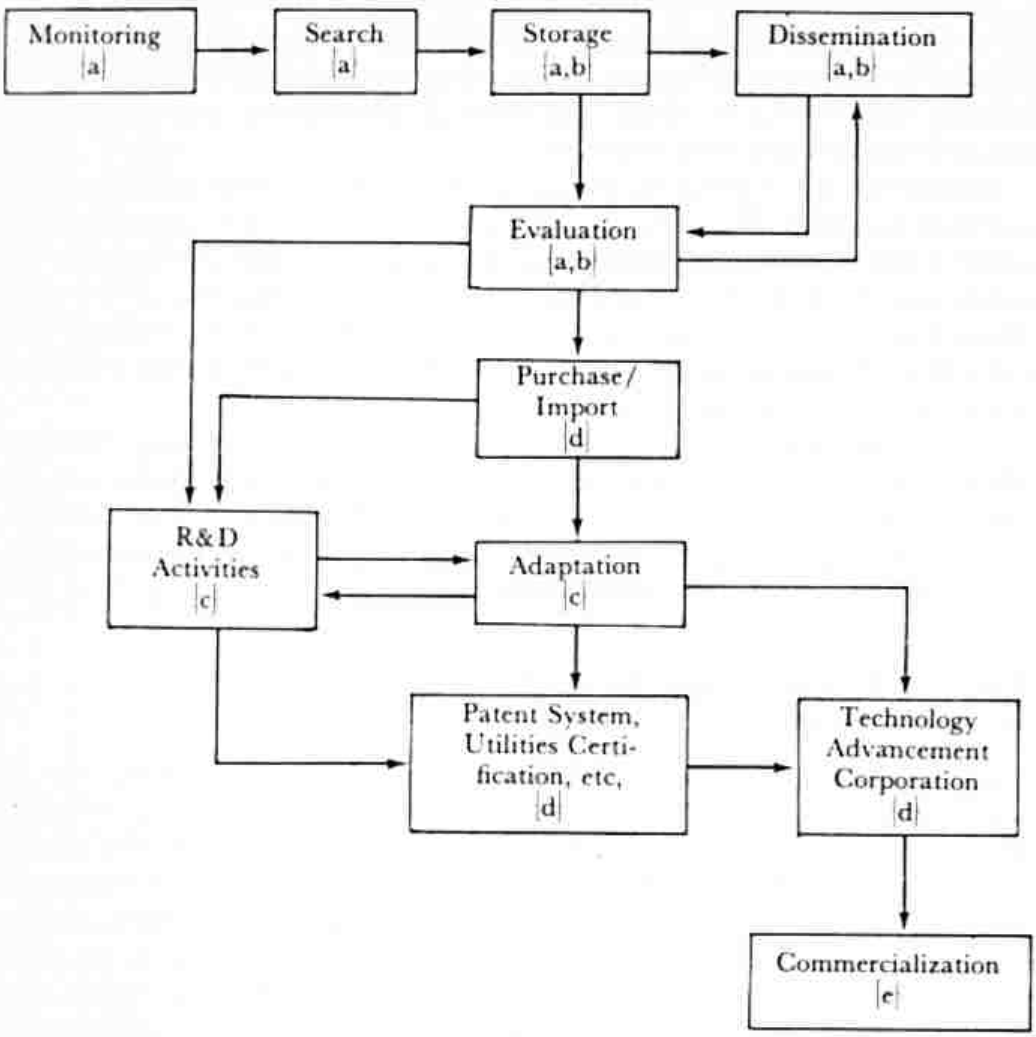
Despite the many problems discussed above, both domestic manufacturers and their foreign counterparts operating in Malaysia have to be encouraged to adopt a more realistic approach regarding adaptation and development of technology. It is in this respect that the role of the Ministry of Science, Technology, and Environment is important — through extensive monitoring of technology adaptation and transfer in the country, it can enhance the country's technological development.

In the development of infrastructure in support of the technology transfer process, various activities are being implemented or are under consideration in Malaysia. Figure 1 shows the interactions among various activities (modified from Zaharudin Idrus 1983), in which the activity of adaptation is assumed central to the technology transfer process.

Transfer, Adaptation, and Development of Technology in the Public Sector

Many institutions involved in R&D activities have been established in Malaysia, including SIRIM (Standard and Industrial Research Institute of Malaysia), PORIM (Palm Oil Research Institute of Malaysia), RRIM (Rubber Research Institute of Malaysia), and MARDI (Malaysian Agricultural Research and Development Institute). However, most of the research institutions are agricultural-oriented. Only SIRIM is involved in research activities that are directly related to manufacturing technology. SIRIM, established in 1975, has the basic role of encouraging and stimulating the application of science and technology for the development of industries through standardization, industrial research, technical support services, consultancy and advisory services, and technology transfer. An important component of SIRIM is the consultancy, extension, and technology services. In this respect, its basic objective is to enable the utilization of domestically generated and imported technology so that new technologies may be commercially applied in domestic industries. The Research Division of SIRIM concentrates on developing techniques and processes applicable to local industries. The research approach is adaptive in nature to assist in developing local industries. This Division also provides design and fabrication services and undertakes projects in engineering

FIGURE 1
Interaction of Transfer of Technology Activities



Note: [a] = Policy Level; [b] = Documentation and Information Centre; [c] = To be undertaken by R&D institutions; [d] = Trade arrangements. Licensing agreements if import of technology is required. Ministry of Trade and Industry/MIDA involvement required; [e] = Private sector involvement and government support.

design and draughting, industrial design, low-cost automatic systems, and development. However, for lack of experience and qualified personnel, the effectiveness of SIRIM leaves much to be desired.

Based on a study of thirty-four joint-ventures between foreign companies and public enterprises, Abdul Razak (1983) made the following conclusions:

1. Nine out of every ten companies had no formal facilities for carrying out R&D activities. The few companies that did do R&D limited it to the improvement and maintenance of existing products and processes.
2. The importation of machinery and materials by the surveyed companies was either from foreign parent companies or from whatever sources the latter chose. The need to import these was due to the unavailability of domestic sources of supply of the exact nature and specifications of the imported technology.
3. Export activities were more often the responsibility of foreign personnel of the joint-venture companies.

The above conclusions seem to indicate that foreign companies which participate with government agencies in manufacturing still have substantial control over the management and decision-making. According to the study, this was primarily because of the lack of domestic technical and managerial resources. These factors tend to limit the process of adaptation and transfer of technology.

Transfer, Adaptation, and Development of Technology in the Private Sector

In Malaysia, the private sector and foreign investment are the major thrust in the industrialization programme. Whether the most appropriate technology is transferred via direct investment depends upon the degree of substitutability between factors of production and the composition of production in the manufacturing sector. However, considerable evidence suggests that, in many large-scale and capital-intensive manufacturing operations where there is a large foreign investment (Lim 1975, 1981), opportunities are limited for choosing the most appropriate type of technology. In the case of most Japanese companies, it was found that they introduced their production technology intact to Malaysia through joint-venture projects. Adaptations were made only in a very limited number of cases (Chee and Lee 1979).

In such cases, adaptations were mainly with respect to production equipment and product design rather than in terms of new products. Adaptations were more frequent the higher the degree of Malaysian ownership and control and the greater the independence of the subsidiary from the parent company. This is quite logical from the point of view of Japanese parent companies which are reluctant to bear any extra R&D costs locally since such activities have already been established in Japan. This may well apply to other foreign companies operating in Malaysia.

The most important reason for technological adaptation concerned the need to scale down plant and equipment to cater for the lower domestic demand in

Malaysia. There were relatively few instances of adaptation to take advantage of low labour cost or to make up for the absence of skilled labour. Most of the other reasons given for adaptation were related to requirements of the domestic market dictated by special characteristics of demand, government regulations and standards, or the quality of raw materials and components purchased domestically under mandatory requirements.

None of the Japanese companies studied by Chee and Lee (1979, 1983) had established R&D facilities, a finding that applies equally well to other foreign companies such as those in the electronics and electrical industries (Cheong and Lim 1981; Lim 1978). Japanese companies tend to rely heavily on their parent companies for most of their durable and non-durable capital goods.

Some of the joint-venture or technical assistance agreements signed by Malaysian and foreign companies have a prohibitive clause which makes it obligotary on the part of affiliated companies to purchase certain key non-durable capital goods from their parent or related companies unless this was regarded as disadvantageous to them in terms of cost, quality, or time of delivery. Apart from such restrictive clauses, it is also possible that heavy reliance on Japanese products may be due to their competitiveness and the bias of most foreign managers.

By and large, the experience of Japanese-Malaysian joint-venture companies indicates that the machinery used in Japanese companies is not the most up-to-date by Japanese standards. In some cases, the reason is that the most up-to-date machinery is too sophisticated and too capital-intensive to suit the volume of domestic operations. In fact, the size of the domestic market, rather than factor endowments, appears to dictate the choice of technology. The purchase of used machinery is not, however, found to be very common among Japanese firms.

Conclusion

Despite widespread criticism of the role of foreign companies in the transfer of technology, there should be some learning effects in some industries. The success in the transfer of technology is not simply the function of the willingness of foreign suppliers but also the absorptive and controlling capacity of the host country. However, precise data on these aspects are hard to come by. In part, this may reflect the lack of all round emphasis on the issues of technology transfer.

In their study, Cheong and Lim (1981) rightly concluded: "It is unfortunate then that Malaysia's dealings with foreign and multinational companies have so far been confined only to matters regarding tax rates or concessions, local equity participation, repatriation of profits, tariff protection, import quotas and so on. There is very little consideration regarding the types of technologies these companies introduce into the country and how these may be diffused, the decentralization of management decisions, participation in national research and educational activities, and linkages with local industries. Yet these factors

are much more vital to the country's industrial development than the fiscal contributions the companies make."

In short, compared with some other developing countries, such as South Korea, Taiwan, Mexico, and India, Malaysia still lacks legislation, manpower training, and government control of technology transfer. This weakness is due partly to the small domestic market which undermines Malaysia's bargaining power, and partly also to institutional and social factors. Malaysia's absorptive capacity for foreign technology has depended largely on its financial ability to purchase foreign capital equipment and technical services, but not on its domestic institutions in internalizing foreign knowledge and technology. The ability to develop institutions capable of performing such a task is the ultimate test of self-reliance or technological independence. What Malaysia needs is the ability to identify the foreign technologies that will make the greatest contributions to economic development, the ability to adapt them to local conditions, the ability to supply them where needed, and the ability to use them effectively.

3
Transfer, Adaptation, and Development of Technology: Case Studies

This chapter proposes to examine several interrelated aspects of the transfer of technology in selected groups of industries in Malaysia. Of special significance will be the various channels through which foreign technology is transferred and the adaptation of this technology in the Malaysian environment. Closely related to the issue of technology transfer will be a discussion on the development of local skills.

The major focus of this chapter is an analysis of the following groups of industries as case studies:

1. Japanese electronics industries,
2. non-Japanese electronics industries, and
3. Japanese non-electronics industries.

The information was initially obtained through a mailed questionnaire survey. In June 1984, 154 questionnaires were sent to companies whose addresses were made available by the Malaysian Industrial Development Authority. After one month, only 12 questionnaires had been returned by the firms; another 24 questionnaires were returned by the Dead Letter Office because of wrong or changed addresses. In August, a second questionnaire together with a reminder letter was sent to all non-respondents. This was followed up either by phone calls or a third reminder letter in October. In November, four research assistants were sent out to the various firms which still failed to respond. Finally, 55 questionnaires were collected. After eliminating the incomplete returns, there remained questionnaires from only 49 firms, of which 11 were Japanese electronics firms, 19 non-Japanese electronics, and 19 Japanese non-electronics. The emphasis here is on the electronics industry; however, comparisons will be made between Japanese and non-Japanese electronics firms on the one hand; and between Japanese electronics and Japanese non-electronics firms on the other.

General Performance of Surveyed Firms

As expected, the recent years have been rather trying for many industries as the world experienced one of its worst economic crises. It is generally true that

many industries experienced slow growth, some even negative growth, resulting in retrenchment and declining sales and profits.

An examination of the performance during the difficult period of 1981–83 of the 49 surveyed firms showed mixed results. Based on the three indicators of performance (sales, employment, and gross profits which tend to be positively correlated), some firms managed to show an increasing trend, even though slow, some more or less constant, while others declining. Generally, about half of the electronics firms, whether Japanese- or non-Japanese controlled, reported a drop or were stagnant in their performance. Roughly the same mixed pattern emerged with regard to Japanese non-electronic firms.

Similarly, an examination of the characteristics of firms by size and by market-orientation produced rather inconclusive results. Perhaps the performance of a firm depends substantially on individual management capabilities and some elements of luck.

Data on other indicators of performance such as changes in wage rates and expenditure on various items (like machinery and equipment, training, R&D, royalties and other fees) are too inadequate to justify an analysis free from bias. However, it was found that very few firms (6 out of 30 which responded) claimed to have spent some money on research and development. Judging from this response, R&D does not seem to get the priority it deserves. On the other hand, many firms (19 out of 30 that responded) mentioned that they spend money on trainig of staff/workers. In 1983, the average expenditure per firm on training came to around M$100 thousand to M$200 thousand. Expenditure on royalty ranged from less than 0.5 per cent to more than 5 per cent of annual sales value. However, this expenditure generally accounted for less than one per cent of the individual firm's sales value. The majority of the firms that responded to this question are domestic-market-oriented. The few firms which responded to the question on consultancy fees reported that the fees amounted to no more than 0.3 per cent of their annual sales.

With regard to the performance of the firms compared to their competitors, local as well as foreign, most firms responded to practically all the items listed in the questionnaire. The results may be summarized as follows. On the availability and cost of materials, the majority of companies-whether Japanese electronics, non-Japanese electronics, or Japanese non-electronics firms-reported that they seemed to be neither at an advantage nor disadvantage vis-è-vis their local and foreign competitors. Similarly, there was no clear difference in the response pattern of the three groups of industries with respect to cost and availability of labour. The majority of firms regarded themselves as either at an advantage or neutral when compared with foreign competitors and, as expected due to mobility of labour, most firms reported that they had neither an advantage nor a disadvantage as far as local competitors were concerned. Although multinational firms located in Malaysia would be thought do have an advantage over their foreign competitors in this regard, the pattern of results that emerged was not that clear, as one-third of the electronics firms surveyed claimed that they do not have this advantage. Being labour-intensive, this is not surprising considering the recent rising cost of labour and high labour turnover.

Most of the surveyed firms claimed that they were either unaffected by or at a disadvantage compared with foreign competitors in terms of both availability and cost of parts and components. This applied to all types of firms. But no clear pattern emerged with regard to competition against local competitors. On the other hand, except for a very few, most firms felt that they were not effected by their local competitors in terms of availability and cost of credit- an indication that foreign firms are not discriminated against. In fact, in a few instances, they even had an advantage over their local competitors because of their established financial strength. Practically all firms regarded their standing vis-à-vis foreign competitors as neutral in this regard.

On the availability and cost of technology, marketing information, access to government, prices and quality of products, few firms claimed that they were at a disadvantage compared to their local competitors while the majority claimed to be unaffected. With respect to foreign competitors, no definite pattern could be observed amongst non-electronics firms; amongst the electronics firms, however, most responded that they were either unaffected or at a disadvantage.

The performance of these firms appeared to be highly influenced by the decision-makers in the firms. In many cases, it was observed that the parent company played a considerable role in the decision-making process. This was particularly so for the Japanese firms. The next important group of people involved in the companies' decision-making process was the top level executives. In the Japanese-controlled companies, it was clear that the majority allowed expatriates (Japanese) to make the important decisions, while local executives played a less important role. Of course, there were exceptions to this. The middle and lower-level personnel played much less significant or insignificant roles in the decision-making process in all surveyed firms without exception.

With regard to the companies' future plans, their responses to questions relating to production methods/process, products, equity participation, training of the local labour force, research and development, and Malaysianization of key posts, were in the main non-committal although a few companies did indicate their willingness to train the local labour force and to carry out R&D activities. However, the extent of such activities and their expenditure allocations depended on many factors, including their parent companies. In all, there seemed to be a sense of cautiousness among these firms in planning for the future and a conflict of interests between private and social motives.

The following sections analyse the data obtained from a survey of 11 Japanese electronic, 19 non-Japanese electronic, and 19 Japanese non-electronic firms in Malaysia. The major objective was to seek information on the performance of the firms in the realm of technological transfer and the development of local skills. The general characteristics of these surveyed firms are first described, followed by a brief description of their general performance. The extent to which these firms have transferred their technology to their Malaysian counterparts in then examined. Finally, the extent to which the Japanese firms have developed and upgraded local skills is discussed.

Case I: Japanese Electronics Firms

General Characteristics of Surveyed Firms

The data analysed here were collected from Japanese companies, the extent of Japanese ownership varying from 43 to 100 per cent. The oldest firm began its operations in 1966 while 4 other firms started in 1974, 2 in 1976, and the rest between 1979 and 1983. The majority of these firms (6) are located in the Free Trade Zones of Selangor and Johore. Since firms located in FTZs must export at least 90 per cent of their output, it is therefore not surprising to find that the entire output of these six firms was exported. (This feature was also found in other surveyed firms with the exception of two- one of which exported only 7 per cent of its output while the other catered entirely to the local market.)

Of the 11 firms surveyed, 8 had an output at a value exceeding M$20 million; one firm exceeded M$100 million. The rest of the sample had outputs ranging in value from M$2.6 million to M$17.6 million. The company with the lowest value of output started operations only in July 1983—the output value given represents the value for the months of July-December only.) Most of the firms in the sample can, however, be regarded as big electronics companies, some of which are well-known multinationals that are publicly listed in the Kuala Lumpur Stock Exchange.

The firms surveyed produced a range of electronic and electrical goods, both components for industrial use as well as final consumer goods for household consumption. These goods, especially electronic components, have a high value to volume ratio. Of the 4 firms that produced final goods for household use, 2 produced entirely for the domestic market while the other 2 produced entirely for export, particularly to the United States and Europe. The remaining 7 firms were typical electronics firms that produced components like semi-conductors and integrated circuits and catered wholly for international markets. Among the leading export markets were other Asian countries, the United States, Japan, and Europe. Exports to the home country (Japan) were mainly to the parent company while exports to the other countries were through other subsidiaries of the parent company or foreign trading companies. These Japanese firms tended to export more to countries other than Japan.

As is frequently reported in other studies on the electronics industry, the main activity of the firms in this industry was the assembly of parts into components for further use in the production process or into final goods for immediate household consumption.

With regard to the sources of supply of raw materials, parts and components, and machinery to firms for their assembly operations, several interesting features emerged:

1. Firms that produced final consumer goods do obtain some of their raw materials from Malaysia. Of the 3 firms that used raw materials in their production process, one obtained as much as 52 per cent while the other two obtained 35 and 16 per cent from Malaysia. On the other hand, firms that produced electronic components imported the bulk of their raw

materials from foreign sources, notably Japan. If any local materials were utilized, they constituted less than 5 per cent of the total supply. Only one firm engaged in the production of components reported a total use of as much as 20 per cent of local raw materials.

2. The importance of foreign sources of supply is even more marked in the case of parts and components. All firms surveyed obtained 80 to 90 per cent of their parts and components from foreign countries, of which the two most important were Japan and "Others". Only 4 firms obtained a portion of their parts and components from Malaysia but this was usually less than 20 per cent, except for one that reported about 35 per cent.
3. The reliance on foreign sources for the supply of machinery was almost total and complete. With the exception of one firm which acquired about 40 per cent of its machinery from local sources, the rest of the firms bought all their machinery from abroad. While foreign sources of supply of parts and components were slightly more diversified, there was virtually only one source of supply of machinery, that is, from the home country, Japan. Such machinery was invariably acquired from either the parent company itself or from other subsidiaries of the parent company. Only two firms obtained some of their machinery from Malaysian trading companies—the supply representing about 20 per cent in one case and 40 per cent in the other. The latter was the only firm that acquired 40 per cent of its machinery from Malaysia. Only 4 firms obtained some of their supplies of raw materials or parts and components from Malaysian trading companies, but such supplies accounted for only 4 to 35 per cent. It can thus be seen that the electronics industry is import-intensive in its use of inputs and thus reduces the net gains in foreign exchange earnings while at the same time giving rise to considerable opportunities for transfer pricing. This is especially so considering that the bulk of the parts, components, and machinery is acquired from parent company or its other subsidiaries.

In terms of numbers employed, 10 out of the 11 firms surveyed were big establishments employing more than 300 employees. Two of the 10 employed between 301 and 400 employees, 3 between 401 and 600 employees, 3 between 801 and 1000, while the remaining 2 employ between 1,201 and 1,300. There was only one firm which employed fewer than 100 (71 to be exact), mainly because it was a very new firm.

The job designations reflected the hierarchical structure prevalent in most capitalist enterprises. Of the total 7,601 employed in the 11 firms surveyed, 1.7 per cent were managers, 3.6 per cent engineers and technicians, 4.9 per cent supervisors, 69.4 per cent factory workers, and the remaining 20.3 per cent were clerical, sales, and general workers. These firms employed predominantly Malaysians (98.9 per cent) with the remaining 1.1 per cent being made up of Japanese who of course occuppied the higher positions in the occupational structure. Of the total number of Japanese employed, 73.5 per cent were managers, 17.2 per cent were engineers and technicians, and the remainder were consultants.

Transfer of Technology

The transfer of technology is examined here with reference especially to the extent of technology transfer from Japanese electronics firms to domestic companies, the conditions under which such a transfer takes place, the ease of access to technical information, the costs of technological transfer, and whether any adaptation of foreign technology has taken place.

According to data collected from the survey, the choice of products or the type of products to be manufactured was mainly decided by the parent company. Of the 11 firms surveyed, 8 mentioned that the decision regarding what to produce was determined by the parent company, 4 reported that it was determined by the company's own technical capability, while only one company mentioned that Malaysian Government policy was a factor. For 7 out of 8 firms producing electronic components such as semi-conductors and integrated circuits for the export market, foreign demand was considered the main factor influencing the types of products manufactured. Product diversification and competition from abroad were also regarded as quite important. The firms producing mainly for the domestic market quoted the needs of the domestic market as an important factor. The other factor mentioned was product obsolescence.

The availability of various technological options for a firm's production process determined whether a firm could have the choice of the technology most suited to the country's needs. From this survey, only two firms said they had substantial choices of technology, five replied that they had only limited choices while two replied that there were no choices available.

The experience of firms with regard to R&D was mixed. Five firms had made no formal efforts to conduct R&D in any area while for those which had 4 concentrated on R&D relating to production methods or processes only, and one did research on the use of raw materials and the introduction of new products as well as on production methods. It would seem that the majority of firms, albeit a small majority, do claim to have local R&D facilities aimed at continuously improving their production methods, though few have such facilities for new product invention or the use of raw materials. Most of the R&D facilities were started only lately — between 1978 and 1981. In the three years since 1981, however, many firms had not introduced any new products; of those that had, two had new products comprising more than 40 per cent of their total output while for the remaining two the rate was between 5 and 10 per cent.

For all the firms under study, most of the ideas regarding their products and technology came from the parent companies. Only one firm reported that ideas were also obtained from both the local and foreign personnel in the local firm, as well as from its own research and development activities. One firm also mentioned foreign equipment suppliers as an important source of information.

The three main reasons for adopting present technology were as follows: advice from parent company (9 firms), quality standards (6 firms), and cost considerations (5 firms). In addition, two firms mentioned each of the following reasons: most up-to-date technology, government incentives, familiarity with

techniques, and efficiency considerations. Only one firm considered technical agreements as a reason.

All 11 surveyed firms reported that the main method of technology transfer was in the form of know-how and technical assistance from the parent company. In addition, 7 firms said that technological transfer had been given emphasis through training and seminars, while 2 cited patents/trademarks/licence as an important method.

For most firms (9 in all) the bulk of the total cost of technology transfer was taken up in the form of payments for the importation of new machinery and equipment through the parent company. For a limited number of surveyed firms (3) part of the cost was in the form of payments for the importation of new machinery through local agents and machinery producers. Most firms also incurred expenses in sending their staff overseas, usually to Japan, for training, while for some there were also payments for royalty and technical fees. It is difficult to state the exact amount spent on these items as respondents have refrained from giving such information.

Eight firms said they had agreements relating to technical assistance, royalty, patents or trademarks with foreign companies while three said they had none. For those that replied in the affirmative, 6 said that they had made one such agreement so far, while the other two reported that they already had between 3 and 6 agreements so far. Most of the agreements were of a 5-year duration with one even for as long as 10 years.

Only 4 firms replied that there were restrictions imposed by the technology suppliers, the most common being the need to obtain approval for exports and the restrictions on the areas to which the products could be exported.

Except for one firm which said it had no access to new information developed by the parent company, and two others which did not respond, all others had access to new information developed by their parent companies. Among them, 4 said they could have full access with agreement pertaining to patents, trademarks, technical knowledge, and R&D, while one had full access except to R&D. Two replied that they could even have full access without any need to sign an agreement while one reported that an agreement pertaining to patents and trademarks was necessary but was not required for technical knowledge and R&D.

The mode of payment for technical fees, patents, and trademarks ranged from lump sum payments (one firm mentioned that it has to pay a lump sum of $1.3 million for a set) to the more usual payment calculated as a percentage of net sales, normally from 1 to 5 per cent.

All surveyed firms had sought assistance from their parent companies in the last three years in the areas of production and industrial engineering, marketing, and management. One firm had sought such assistance from local sources as well. Nevertheless, in general, Japanese electronics firms in Malaysia are very dependent on their parent companies for assistance in these areas.

It has often been mentioned that one of the benefits of attracting foreign firms to invest in Malaysia is that the establishment of such industries will create

"spin-off" effects which will in turn encourage the growth of local firms. This suggests that the demand by big firms for a portion of their inputs from local firms will lead to growth of the latter. From the survey, however, it was found that this is not generally true. Only six firms acquired inputs from local sub-contracting firms — 5 acquired 1 to 25 per cent of their needs and one 26 to 49 per cent. Thus the bulk of purchases are done overseas leading to the loss of valuable foreign exchange and the lack of development of complementary local industries. On the question of dealing with local suppliers, the survey respondents mentioned irregular supplies, high costs, low technical level, and lack of variety as being among the major problems, though 4 firms mentioned they did not encounter and major problems.

On how difficult it had been to acquire new ideas on technology and products, most surveyed firms, mentioned that it had been relatively easy. This was because such ideas were readily available from the parent company which was obviously willing to provide them to its own subsidiary.

Development of Local Skills

The upgrading of skills among Malaysian workers has always been a major long-term objective of government policy. Indeed, the government hopes that by bringing in more foreign firms which have the expertise and skills, the skills of Malaysians employed in these firms will continously be upgraded.

All firms surveyed (except two) had their own training programmes for upgrading the skills of their employees. Most firms had regular programmes to impart skills to the factory workers, while some even had regular programmes for training technicians/engineers and management staff, though irregular training programmes for the latter two categories were more usual. Besides, there was on-the-job training for all three categories while technicians/ engineers and management personnel were also encouraged to attend short courses or seminars from time to time.

As mentioned earlier, all the firms surveyed employed some Japanese expatriates, usually at the managerial level including technicians/engineers and consultants. These Japanese expatriates were employed because they possessed the required technical or managerial expertise, as reported by 8 firms, and because they were required to train the local staff (mentioned by 9 firms). Another firm also pointed to the lack of qualified or experienced local personnel as a third reason.

In comparing the present level of skills and efficiency of local employees in general with that of three years ago, 8 firms confirmed that there had been a slight improvement among the local managers, one considered that there had been a substantial improvement while another said that there had been no change. The situation with regard to the second category—engineers and technicians — was slightly better. Six firms said that there had been a slight improvement but 5 others confirmed that the improvement over the last three years had been substantial. The situation with regard to the factory workers was broadly similar to the first category with 8 firms saying that there had been a slight improvement and 3 firms saying that the improvement had been

substantial. From the survey results, it can thus be seen that the improvement in skills and efficiency is fastest among local engineers and technicians.

The main constraints acting against the transfer of skills to local personnel were:

1. Language barrier, especially for factory workers; it was also a constraint though less serious for technicians and engineers;
2. Lack of interest and commitment to learn among some workers;
3. High absenteeism and turnover especially among factory workers, but also to a certain extent among technicians and engineers;
4. Lack of discipline and dedication; and
5. Inadequate time for training.

Case II: Non-Japanese Electronics and Electrical Companies

Major Characteristics

Nineteen companies in the industry responded to our questionnaires. Of this, 13 were located in the Bayan Lepas Free Trade Zone, Penang; 2 in the Batu Berendam FTZ, Melaka; and one each in Kuala Lumpur, Prai Industrial Estate, Sungai Petani, and Petaling Jaya. The majority of the companies started production in the early 1970s with the establishment of the FTZs in Peninsular Malaysia and as a consequence of government promotion of this industry.

Seven of the companies were wholly-owned by American interests; 2 wholly-owned by West German interests; one each wholly-owned by Canadian and British interests; 3 with majority Malaysian interests; one with majority British interests; 2 with majority Hong Kong interests; and the last two with majority interests held by other foreign nationals.

In 1983, 2 of the companies produced less than $1 million worth of output; 7 companies produced between $1 million and $20 million; 5 companies produced between $21 million and $50 million; while 3 companies produced over $50 million. The total value of output by the 17 companies which provided the data amounted to $864.6 million, with the smallest company producing only $0.5 million worth of output and the biggest company producing 54.5 per cent of the total value of output.

The products of these companies were chiefly electronic components which included integrated circuits, semi-conductors, capacitators, transformers, telecommunications components, radio components, and resistors. There was one company that produces electric fans and another assembling air-conditioning units. Their major activities could be classified as the assembly of components and parts as well as the production of final goods. A few firms were involved in activities such as packaging and production of semi-finished products, and a couple of companies did the testing of components and the manufacturing of high precision tools.

Out of the 19 companies, 12 of them exported 100 per cent of their products; 3 of them sell direct to consumers/retailers; one sells 100 per cent of its products to industry; and the rest produce partly for export and partly for the domestic market. This indicates the preponderence of export-oriented

companies in the FTZs as perceived by the government. For these export-oriented companies, the destination of their products was mainly the countries of their origin with a substantial proportion going to their own parent companies or their subsidiaries in other countries. It is observed that 10 such companies exported more than 70 per cent of their production to their countries of origin; 6 of them exported more than 70 per cent to their parent companies while another 3 exported more than 70 per cent to subsidiaries of their parent companies and 5 of them between 10 and 60 per cent to such subsidiaries. Almost all the companies exported direct to their buyers.

Similarly, it was observed that the sources of raw materials, parts and components, and machinery, were the countries where their parent companies were situated. In the case of raw materials, 8 companies obtained more than 70 per cent of their needs through their parent companies. Some went through the subsidiaries of their parent companies and foreign trading companies. Only 2 companies obtained more than 50 per cent of their raw materials through Malaysian trading companies; another obtained about 40 per cent and a fourth obtained less than 30 per cent through Malaysian trading companies.

In the case of parts and components, sources ranged from the parent companies and their subsidiaries to foreign trading companies which all play important roles, but some firms albeit a small proportion — do go through Malaysian trading companies. In the case of machinery purchases, 8 companies obtained more than 80 per cent of their needs through their parent companies. Subsidiaries of their parent companies and foreign trading companies too play a significant role in this respect. However, once again, the role of Malaysian trading companies is negligible.

The total number of employees involved in the surveyed firms in 1983 consisted of 12,763 in 9 wholly-owned foreign companies and 1,590 in 7 joint-venture companies, thus representing an average of 1,418 employees per foreign establishment and 227 employees per joint-venture respectively. In terms of employment, this indicates that the number employed per establishment is relatively greater in the wholly-owned foreign companies although the distribution within this group of companies is rather skewed.

Sixteen companies supplied the relevant data with respect to the distribution of employees according to occupational category. On average, it was found that managerial personnel comprised 1.8 per cent, engineers/technicians 10 per cent, supervisors 3.4 per cent, skilled factory workers 60.2 per cent, and unskilled factory workers 13 per cent. The remaining 22.6 per cent were clerical, sales, and general workers. According to the companies, a substantial proportion of factory workers were classified as skilled and only a small percentage is unskilled. This may not really reflect the overall picture in the electronics industry where most activities are assembling operations requiring little technical skill. Operators are simply given a short period of on-the-job training, after which they are regarded as skilled labour.

In terms of the total cost of production, the companies reported that on average raw material purchases comprised a major portion of the cost (about 38 per cent), followed by parts and components (28 per cent), while the cost of

labour averages about 25 per cent. The other costs averaged less than 10 per cent; only 3 firms listed the payment of professional fees or licence and royalties, although it amounted to less than 1 per cent of their total costs.

Transfer of Technology

In general, the respondents indicated that there was limited transfer of technology from the parent companies or joint-venture foreign partners. This was explicit in all the answers obtained through the questionnaires and interviews.

The majority of the companies responded that the choice of products to be manufactured assembled locally was decided mainly by the parent companies. This was particularly so for the wholly-owned subsidiaries. However, in wholly-owned Malaysian companies and joint-ventures with majority Malaysian shareholding, such decisions were made by local management and shareholders. The next most important factor that appears to have determined the choice of products was the firms' own technical capability to produce.

The main factor influencing the types of products manufactured was the nature of foreign markets. This was unavoidable since most of the electronics companies in the FTZs were export-oriented. The next most important factor in this respect was the "available technology" that the companies were exposed to. In this respect, therefore, much depended on the parent companies or their overseas partners. The "need to diversify products" also seemed to be an important factor influencing the types of products manufactured. For companies catering for the domestic markets, the characteristics of this market obviously have some influence.

With regard to the choice of technology for domestic production, 12 of the companies indicated that the choices opened to them were limited while 7 others indicated that the choices were substantial. Research and development in areas such as production methods/processes, raw materials, new products, and the marketing system, in all the participating companies seemed to be very limited. In the case of wholly-owned subsidiaries, R&D activities were mainly carried out by their parent companies so as to avoid duplication of activities and to exploit economies of scale in R&D work. Only four companies indicated that they had some form of R&D in production methods/processes; one each in raw materials and marketing systems; and 5 companies indicated that they had started R&D in areas related to new products.

Of the 19 responding companies, only 9 indicated that they had introduced new products during the last three years. One firm mentioned that these new products currently accounted for 60 per cent of its total output; 3 indicated 50 per cent; 2 indicated 30 per cent; and another 2 about 10 per cent. One firm did not give any indication.

On ideas relating to products and technology adopted by the companies, the parent companies seemed to play a dominant role. However, with regard to products alone, other major sources of ideas included local personnel, foreign equipment suppliers, local competitors, foreign personnel, foreign competitors, and R&D, in order of importance as listed by the companies that responded.

In the case of technology selection, besides the role of parent companies, other sources included local personnel, foreign personnel, foreign equipment suppliers, R&D, and foreign competitors. The roles of foreign and local consultants, and local equipment suppliers seemed to be insignificant. Many reasons were given for the adoption of a particular technology by the companies, the most important factors being cost considerations, followed by quality standards, efficiency considerations, continuity of existing production, familiarity with the technique, advice of parent companies, and the most-update technology. In short, the major reasons for adopting the present technology were centred on the interests of the companies concerned not social or national interests.

The most important method or channel by which technology was expected to be transferred to the local companies was through know-how and technical assistance from the parent companies. In the case of both wholly-owned companies and joint-ventures, equipment suppliers too played an important role in the technology transfer process. The other important channels included training and seminars for the local personnel and patents/trademarks/licences with technology suppliers. One of the companies reported that its joint-venture partner was an important source of technology.

Out of the 19 companies, 13 responded to our questions regarding the total cost of technology transfer during the previous three years. The response to each detail varied, but in absolute terms, the largest amount of expenditure was in terms of machinery and equipment imports. More importantly, these purchases were made through the parent companies and their foreign partners. The local subsidiaries and joint venture companies were thus dependent upon their parent companies and foreign partners respectively for the purchase of new machinery and equipment. However, a smaller quantity was purchased directly from the machinery/equipment producers or through local agents.

The purchase of second-hand machinery did not seem to be popular. Only 2 companies reported to have bought second-hand machinery which in terms of value was minimal. (One of the companies produced resistors while the other manufactued and fabricated high precision tooling.) Four companies had bought new machinery and equipment made locally, the average value per company having amounted to slightly more than $300,000. Two of these companies had a significant amount of Malaysian shareholding while the other two were wholly-owned subsidiaries of foreign multinational companies.

Only 5 companies reported to have sent their local personnel for overseas training. A major portion of the total expenditure on such training, that is, $500,000, had been spent by a wholly-owned American subsidiary producing integrated circuits to send its local personnel to be trained by the parent company in the United States and by the parent company's subsidiaries in Bangkok, Singapore, Japan, and Hong Kong. Two other wholly-owned foreign subsidiaries each spent $100,000 on such training at their parent companies' head offices. The remaining cost of training, amounting to $30,000, was incurred by two companies — one with British majority shareholding and the other with Malaysian majority shareholding.

Despite the dependence of most of the companies upon technical know-how provided by either their parent companies or foreign partners, only one company reported the payment of royalties and technical fees amounting to $186,500 during the 1981–83 period. This was made by a wholly-owned Malaysian company which assembled air-conditioning units.

Accordingly, 11 of the 19 companies informed us that they did not have any form of trademark agreement with foreign companies. Five companies, however, reported that they have some form of agreement with either their parent companies or foreign partners. Only 3 companies gave details of such agreements — the first company has signed trademarks agreements for all its products for a period of 10 years; the second had an agreement also for 10 years; and the third had two agreements each of five years' duration.

With regard to restrictions imposed by their licensors, only four companies made any attempt to provide details. One company reported that there were no restrictions whatsoever imposed by the licensor. Another company needed approval for its exports. Two companies were prohibited to export their products, and one of them was also required to purchase its raw materials from the foreign licensor.

To the question of accessibility to new information developed by the parent companies, the responses given were quite mixed. Four companies reported they had no access to information on patents 2 reported that they had full access but with agreement, 4 reported to have full access without agreement, and one had partial access.

Relating to trademarks, 4 companies reported that such information acquired by their parent companies was not available to them, 4 reported full access to such information with agreement, 3 had full access without agreement, and one had partial access.

On technical knowledge, 3 companies reported that they had no access to such information acquired by their parent companies, 3 reported full access with agreement, 8 reported to have full access without agreement, and one had partial access.

With regard to R&D, 3 companies reported having no access to such new information, one reported having full access with agreement, 7 had full access without agreement, and 2 reported having partial access.

Only two companies indicated the mode and rates of payment for obtaining technical know-how, patents, or trademarks. The first firm which has a minority Malaysian shareholding and produces television sets and refrigerators paid a trademark/royalty fee of one per cent of net sales. The other company, a fully-owned Malaysian company, paid its foreign licensor a lump-sum payment of $18,500 per model of air-conditioning unit it produces plus a trademark fee and royalty of 3 per cent and 4 per cent of net sales respectively.

The survey also attempted to obtain information regarding outside assistance which companies might seek in areas such as production engineering, industrial engineering, marketing, and management. In the case of production engineering, 10 companies had sought assistance from local sources, while only 2 had sought such assistance from other sources. In the case of industrial engineer-

ing, 5 companies received assistance from their parent companies, 4 companies sought local assistance, and 2 companies assistance from other sources. In marketing, 4 firms had help from their parent companies while 3 others had sought local assistance. In the case of management, 6 companies had sought local assistance while 4 companies had help from their parent companies.

The role of local sub-contracting firms in supplying inputs to the 19 companies was minimal, that is below 25 per cent of the total input requirements. Four companies did not get supplies of inputs from local sub-contractors, 4 companies were supplied between 26 and 49 per cent, and only one company was supplied with more than 50 per cent of its needs. Although most of the companies which deal with local suppliers did not seem to have major problems with the latter, some companies encountered problems relating to inferior products, lack of variety, and irregular supplies.

In response to the question on how difficult it was to acquire new ideas on technology and products, the majority of companies found that it had been fairly easy, while 4 companies reported it had been very easy. Only 2 companies found that it had been rather difficult. This pattern seems to coincide with the strong linkage with parent companies in terms of transfer of knowledge and information.

Development of Local Skills

There were numerous ways in which companies trained their employees for the transfer of skills. For the factory workers, on-the-job training seemed to be the most important method. At the same time, some companies organized regular training programmes and also sent their employees for short courses or seminars. For technicians and engineers, on-the-job training too seemed to be predominant amongst most of the companies surveyed. Apart from this, regular training programmes, short courses/seminars, and formal courses in higher institutions of education were also regarded as important avenues for technicians and engineers in most big companies. For management personnel, on-the-job training, formal education, and short courses/seminars seemed to be the more important methods of training.

Although one of the main reasons for having expatriates in local companies was the training of local staff, the most important reason cited was the need for technical/management expertise. Related to this was the lack of qualified and experienced local personnel and the need to initiate innovation. (One company also cited the need to protect the investment made by the parent company.)

With regard to the companies' assessment of the general skills and efficiency of the local personnel, the findings were mixed. At the managerial level, most companies reported a substantial improvement compared to the situation three years earlier. Three companies reported a slight improvement while 4 companies reported no change.

At the level of technicians/engineers, some companies reported substantial improvement while others reported a slight improvement; three companies reported no change. At the level of factory workers, the majority of companies reported a slight improvement while only three companies said the change had been substantial; four companies reported no change at all.

Most of the companies reported that there were no major problems regarding the transfer of skills to local personnel, especially at the managerial and technician/engineer levels. However, at managerial level, the only constraints that were pointed out by two companies were the language barrier, costly training, and lack of discipline and dedication. At the technician/engineer level, a few companies mentioned the lack of qualifications, lack of interest and commitment to learn, costly training, inadequate time for training and fast changing technology, the latter being quite significant.

In the case of factory workers, the major constraint seemed to be absenteeism or high turnover although language barriers and lack of qualifications were also problems.

Case III: Japanese Non-Electronics Industries

General Characteristics

The 19 firms selected for study in this section tended to be well diversified, covering the manufacture of textile and textile products, plastic products, diesel engines, transport equipment, wood products, rubber products, chemical products, metallic-based products, food, and non-metallic mineral products. Except for one, all the firms started their operations in the 1970s or earlier. Six were Japanese-controlled in the sense that the Japanese equity shares exceeded 50 per cent—in fact, 3 were 100 per cent Japanese-owned and another 3 more than 70 per cent Japanese-owned. The remaining 13 firms were mixed-private companies with the Japanese equity shares ranging from 36 to 49 per cent; twelve of these were actually Malaysian-majority owned firms.

The Japanese-controlled (defined as Japanese-majority owned) firms were generally bigger in size, with an average employment of 486 workers compared with 156 workers for the Malaysian-controlled companies. For the former, the range was from 67 to 1,184 workers, while that for the latter was from 13 to 537. Employment size and structure of the companies tended to correspond to the size of output, fixed assets, and ownership structure. The value of output of Japanese-controlled firms varied from $1.6 million to over $100 million a year, while for the Malaysian-controlled firms it was from $0.84 million to $140 million, the majority of them actually producing less than $5 million. Thus overall, the Japanese-controlled firms produced greater value of output. Measured in terms of fixed assets, the average value per Japanese-controlled firm was $17.4 million in 1983 while that of the other firms was only $6.2 million.

The proportion of Japanese expatriates at management level tended to be highly related to ownership structure. On average, Japanese managers accounted for 40 per cent of total managers in this sample. Of the 63 managers in Japanese-majority controlled companies, 34 of them (or 54 per cent) were Japanese. Only 5 companies (all of them quite small, employing fewer than 100 workers) did not have even a single expatriate, and only 3 employed foreign technicians or engineers who all happened to be Japanese. The overall picture was that 15 out of the 19 firms did employ Japanese managers.

All the six Japanese-controlled firms were export-oriented — 4 of them exporting 100 per cent, one 84 per cent, and the other 60 per cent. Among the 13 locally-controlled enterprises only 3 exported more than 50 per cent of their products, the highest exporting 70 per cent. The remainder, of course, catered mainly to the domestic market. Of the 9 firms which exported at least 50 per cent of their products, only 3 exported more than half of their output to Japan and of the 3, one was Japanese-controlled. Apart from Japan, other major destinations were European countries and other Asian countries.

There was no clear distinction in production activities between Japanese-controlled and locally-controlled firms. Both groups were involved in assembly, packaging, and production of semi-finished as well as finished goods. But, as expected and in accordance with government policy, the firms producing import-substitution goods were mainly Malaysian-controlled.

Except for 2 companies, both of Malaysian-majority shareholding, all the rest of the exporting companies send their products to the parent companies, subsidiaries of parent companies, or foreign trading companies. This reflects the minor role that Malaysian trading companies have been playing in this country.

As most of the products of large firms are meant for export, the firms are rather weak in providing forward linkages with the rest of the economy. However, in examining the backward linkages that are manifested in the use of local content for various inputs, it was found that the linkages are a little stronger. At least 6 companies purchase most of their raw material requirements from Malaysian suppliers. But of these 6, only one firm is Japanese-controlled — and this company is producing mainly rubber-based products. From among the other 5 Japanese-controlled companies, only 2 use local raw materials for as much as 15 to 25 per cent of their requirements. The others use imported materials. However, even among the 13 Japanese-minority controlled firms, 8 import most of their raw material needs from Japan; of these 4 import 100 per cent and the other 4 import 60 to 80 per cent of their requirements.

Turning to the import of parts and components, 7 firms indicated that they purchased more than 60 per cent of their production requirements from Malaysian suppliers, 7 imported most of their parts and components from Japan, and one imported mostly from the United States. (This last firm had no American interests in it.) The others did not provide the information requested. However, most firms (14 of them) were found to have imported most of their capital machinery equipment from Japan irrespective of whether they were Japanese or non-Japanese controlled. Of these, 8 firms imported 100 per cent from Japan. However, one firm is known to have purchased 80 per cent of its machinery requirements from Malaysia, and another 5 companies also purchased 10 to 40 per cent locally.

Most of the purchases of inputs from overseas were from parent companies or foreign trading companies. Correspondingly, almost without exception, most purchases of Malaysian inputs come through Malaysian trading companies. In general, the propensity to import is higher among Japanese-controlled com-

pared with Malaysian-controlled companies. In addition, the Japanese-controlled firms are more capital-intensive in their techniques of production. The average capital-intensty per firm (measured as capital-labour ratio) tended to be much higher for Japanese-controlled compared with Malaysian-controlled firms, that is, $45.7 thousand as against $27.2 thousand. However, there are locally-controlled firms which are also highly capital-intensive.

Transfer of Technology

Not all products and technologies from the developed countries are appropriate for a developing country. A choice has to be made. Information on who makes the choice of products in our sample of 19 firms provides some evidence to demonstrate that the parent companies are the most influential decision-makers. Eleven firms out of 19 reported that parent companies were important in making the decision on what to produce; of these 5 depended entirely on their parent companies. The next in importance were the local company (claimed by 9 firms) and technical capability to produce (claimed by 7 firms). Other factors like government policy, customers, and trading companies played virtually insignificant roles in the choice of products. Further investigation revealed that all the Japanese-majority controlled firms depended at least partially on their parent companies in deciding what to produce. Only one of them did not take into account the influence of local companies. Other than this, two companies, both locally-controlled, mentioned the local company as the sole factor in deciding what products to produce.

As to the related question of what factors influence the type of products to be manufactured, the majority regard market demand (whether foreign or local, depending highly on the orientation of the firms concerned) as crucial. The survey showed that 9 firms mentioned domestic markets, 7 mentioned foreign markets, 6 mentioned competition from local firms, and 4 mentioned competition from abroad as important factors. Again, it was found that government regulations (for example, on pollution control, health safety, and location) were not regarded at all as important. Neither were factors like product obsolescence and availability of raw materials.

To the question as to whether there was a choice of technology for use in production, 15 firms responded "yes" but most of them (12 in number) considered the choice limited. Only 4 firms replied "no". The 3 firms which mentioned a substantial choice of technology available to them were producers of rubber products, plastic products, and spark-plugs.

There are two major sources of ideas on products and technology according to the firms surveyed. One is the parent company and the other is foreign personnel in the firms. Other sources are relatively insignificant, including the firm's own research and development. Only 2 firms got ideas from their R&D on products and one on technology in the previous three years. This may reflect the limited success of R&D among firms in Malaysia in adapting foreign technologies and much less in developing their own new product technologies.

Of the total number of firms in this survey, 10 firms were in fact engaged in some form of R&D. Among these, 8 were involved in production

methods/processes, 5 in new products, 4 in marketing system, and 3 in raw materials. Nevertheless, 9 firms had introduced new products in the previous three years, but only 2 had introduced new products valued at as much as 50 per cent or more of their total output. The rest were within 10 to 25 per cent of their total production. Since only 2 firms among the 9 which had introduced new products in the previous three years were actually involved in their own R&D on new products, this concurs with the earlier findings that most firms still depended heavily on parent companies for ideas and decisions to produce. It is probable that the affirmative response of 5 firms in doing R&D for new products reflected their "product adaptation" activities. All the 5 firms were the relatively bigger Malaysian-majority controlled firms. Among the 6 Japanese-majority controlled firms, only 2 were engaged in R&D, and both concentrated entirely on production techniques.

Looking at the reasons for adopting present technology, it is apparent that many (a total of 7) firms considered "quality standards" and "advice from parent company" as major factors. The next most important factors tended to be "continuity of existing production" as mentioned by 6 firms, and "most up-to-date technology" and "adaptation to local conditions" as given by 5 firms each. The latter two factors were cited by 4 of the 5 Malaysian-majority controlled firms. It does seem that there have been attempts to adapt technology or output to local conditions, undertaken mainly by locally-controlled firms. Other less important reasons for adopting the present technology were limited choice of technology (2 mentioned by locally-controlled and 2 by foreign-controlled companies) and familiarity with techniques (all the 4 firms mentioning this were locally-controlled firms). Factors like cost, efficiency, government incentives, and industrial relations were not important.

The main methods of technology transfer that the firms under study relied heavily upon were know-how and technical assistance from parent companies (involving 14 firms) and joint-ventures (involving 11 firms). Of the 14 firms that depended on the parent company, 9 of them also depended on the joint-venture for technology transfer, while 3 others (all 100 per cent Japanese-owned firms) relied exclusively on their parent companies. The other significantly important channel for technology transfer seemed to be training/seminars. Only 3 firms obtained their technology through patents/trademarks/licensing—all of them locally-controlled firms; 2 firms did rely on equipment suppliers; and another 2 on literature. None of the firms considered the turnkey method of technology transfer as important.

Data on the cost of technology transfer were scanty. Many firms were either secretive about it or simply did not bother to check their files for the figures. Only 10 firms provided data on the cost of importing new machinery and equipment which averaged $3.38 million per firm over the previous 3 years. One firm quoted a figure of almost $1 million as the value of local machinery and equipment. No firm mentioned having purchased second-hand machinery in the previous 3 years. Two firms had paid local consultants a fee totalling $227 thousand. Six firms spent $184,300 (or an average of $30,717 per firm) on the training of local personnel who were sent mainly to Japan. Payments for

royalties and technical fees came to $7.88 million amongst 6 firms or about $1.3 million per firm in the previous three years. Overall, the biggest proportion of expenditure on technology transfer seemed to go towards the purchase of capital machinery and equipment. However, payments for royalties and technical fees could be quite substantial and in fact, as the data implied, could be higher than the expenditure on training of the labour force or hiring of local consultants.

Our survey data also indicated that more than half (12 out of 19) of the firms did have agreements with foreign companies relating to technical assistance, royalty, patents, or trademarks. Of these, 7 firms had one, 1 firm had 2, and another one had 3 agreements signed. The durations of such agreements ranged from one year to whole life, but the majority were within 3 to 5 years.

Upon further investigation, however, it was discovered that for at least 8 of 12 firms which had such agreements, some form of restrictions had been imposed. The most common restrictive conditions seemed to be tied purchases of machinery and equipment or tied purchases of raw materials. All five firms subjected to such agreements were locally-controlled firms. To what extent this restriction served as a means of transfer pricing was difficult to conclude. At best it could be suggestive of such practices. Another common restriction was the condition regarding export market arrangements which was found in 4 contracts — 2 by foreign-controlled and another 2 by local-controlled firms. The market arrangement appeared to favour the foreign companies. The market arrangement for foreign-controlled firms stipulated that the recipient needed to obtain approval from the supplier for it to export, while for the local-controlled firms, the recipient was barred totally from exporting. There were also contracts which imposed tie-in conditions on the appointment of key personnel (2 firms); some prohibited the production of competitive products (2 firms); and some required local sales agents to be appointed by the suppliers themselves (also 2 firms).

Agreements also involved parent companies. Although more than half of the firms surveyed had full access to new information developed by the parent companies, they were generally subject to agreements with respect to patents, trademarks, technical knowledge, or R&D. However, five firms mentioned that they had full access to information made available by parent companies free from any formal agreement with respect to technical knowledge and R&D They were, however, not foreign-majority joint-venture companies.

In general, most firms felt that they had no difficulty in acquiring new ideas and information on either technology or products. Almost without exception, the main reason given by firms was that their parent companies could help. If there was a problem, it was simply because of secrecy. But very few firms regarded this as a problem.

Development of Local Skills

Generally, the Japanese non-electronics firms had their own training programmes for their employees. These programmes varied between firms and between occupational categories. However relatively few firms had formal training

programmes of their own. Those that did catered mostly to factory or production workers. Nine firms had formal training programmes for the workers, 6 firms for technicians/engineers, and only one firm for managerial personnel. The firms which had such programmes were mainly the bigger ones, including most of the Japanese-controlled firms.

Most firms encouraged on-the-job training, particularly for the factory workers. Perhaps this was the easiest and cheapest form of training but required a good and experienced supervisor. On-the-job training was also given to technicians/engineers and managers, although to a lesser extent. Of the 19 firms responding to this question, 14 firms had on-the-job training for factory workers, 10 for technicians and/or engineers, and 7 for the managerial group. For the technicians/engineers as well as the managers, training through short courses or seminars was more popular, although a few firms did encourage the factory workers to participate in this type of training, too. Rarely did firms consider formal training in educational institutions as important. Only 3 firms indicated that they did send employees to formal institutions, including universities and colleges, for training.

Fifteen of the firms in this survey engaged expatriates (all but one happened to engage only Japanese expatriates), mostly at the management level. Three of them were found to have employed Japanese technicians/engineers—all three being Japanese-minority owned firms. No Japanese or other expatriates were hired at the supervisory or lower levels. Of the 15 firms that gave reasons for having expatriates in their firms, two-thirds said it was because of their technical/management expertise. The expatriates were also partly needed to fill the gap created by the lack of experienced or qualified local personnel and also to train local staff. Five firms gave each of these reasons for employing expatriates. Nevertheless, about half (8 in number) of the firms which responded employ Japanese expatriates because of company policy. Some of these firms stipulate explicitly in their signed agreements on joint-venture that Japanese expatriates must be employed.

On the whole, the training of staff had been quite successful. The survey showed that the majority of firms considered that the skills and efficiency of local employees had improved in varying degrees over the previous three years. Six firms said that the performance of their Malaysian managers had improved substantially, 6 firms also endorsed that the improvement made by their local technicians/engineers had been substantial, while only 4 firms felt that their factory workers had improved substantially. However, many of the firms still felt that the improvements had only been slight — the number of firms saying that there has been a slight improvement in the skills and efficiency of managers, engineers/technicians, and factory workers were 9, 10, and 8 respectively. There were a few firms which insisted that there had been no change in the overall performance of local employees. In fact, 2 firms said that the performance of their factory workers had worsened in recent years. None of the Japanese-majority owned firms claimed substantial improvements in the performance of local personnel at any level. On the other hand, the majority of firms which considered that local employees had not improved or had even

worsened were Japanese-majority owned firms. This might be linked to the emphasis on quality and efficiency by this group of firms.

Among the main reasons for the poor performance or the constraints on transfer of skills to local employees were language barriers, lack of qualifications, lack of interest and commitment, and lack of discipline. The first two reasons seemed to be relevant not only to factory workers but also to technicians, engineers, and managers. However, the latter two reasons (lack of interest and lack of discipline, including absenteeism) were prevalent amongst the factory workers only. The other constraints mentioned were lack of time available for training, high cost of training, and even secrecy of information. Despite these problems, the overall picture was not considered too bad. No firm gave government policy as one of the constraints. At least one-third which supplied the data claimed that they did not have any major problems at all regarding the transfer of skills to local personnel whether at the top level or at the bottom — two of these firms were Japanese-majority owned and five were Malaysian-majority owned. Except for two of these 7 firms, the rest felt that their Malaysian workers' efficiency and skills had generally improved in recent years.

4
Summary and Policy Implications

The need to possess indigenous sources of technological development in tune with the national requirements is strongly felt in Malaysia, as in other ASEAN countries. This objective of "technological independence" does not necessarily mean that Malaysia should develop its own new technology, but rather more realistically the mobilization of local efforts to exploit the national resources effectively through selection, adaptation, dissemination, and usage within the country the highly productive technology already developed elsewhere. Such a strategy seeks to accomplish the maximization of the country's choices through the enhancement of skills and technology. This means developing skills which permit appropriate choices of technology, provide better bargaining strength in obtaining foreign technology, and foster local research and development into processes and products suitable for the domestic needs, resources, incomes, and tastes. With these skills, local workers will discover, develop, and finally innovate new techniques on the basis of imported technology. This stage of technology transfer whereby local workers will be able not only to independently exploit the imported technology, but also to improve on it to suit local conditions, is the stage of "adaptation and development of technology".

In the present situation, however, Malaysia does not seem to have the sufficiently broad and effective techno-sociological base nor the structure of demand for technology to make possible the adaptation of imported technology and its development an easy task. Thus it is necessary for the recipient firms within this environment to engage in activities which give opportunities for in-house "learning by doing" via a process of what can be called "technological apprenticeship", that is, a process emphasizing adaptation and marginal improvement of products and techniques of production instead of the more advanced stage of development of new products and/or production techniques.

This study of the three groups of firms — the Japanese electronics industry, non-Japanese electronics industry, and Japanese non-electronics industry — indicates the presence of some of the factors that may be conducive to the development towards technological independence, but there are problems that need to be tackled through appropriate policies. Having set the objectives of achieving technological independence, the present chapter will review the findings of this study and look at the policy implications.

Summary of Findings

Of the 49 companies selected for analysis, 11 were Japanese electronics, 19 non-Japanese electronics,, and 19 others Japanese non-electronics firms. Most of the firms began production in the 1970s. The term "Japanese companies" refers loosely to those companies that have Japanese shares totalling more than 30 per cent. However where necessary the term "Japanese majority controlled" or for simplicity "Japanese-controlled" firms is used to refer to those firms with Japanese majority (more than 50 per cent) shares. In reality, as the study indicates, the Japanese may still have considerable control over a joint-venture company even if their shares amount to less than 50 per cent.

Overall, there were no major differences between the three groups of industries under study. The similarities and some minor differences are summarized as follows.

By international standards, the firms are on average quite small, manufacturing less than M$50 million worth of products a year. But generally, the foreign-controlled firms tend to be bigger and mainly export-oriented compared with the Malaysian-controlled firms. The foreign-controlled firms tend to have higher productivity and are more capital-intensive than the local ones, irrespective of whether they produce electronic goods or not. The high productivity achieved by foreign-controlled firms may reflect the technological superiority of these firms.

The occupational structure of electronics and non-electronics industries is basically similar as is the case for Japanese and non-Japanese firms. A large proportion (65–75 per cent) of the employees falls into the category of factory workers. Foreign expatriates occupy only the top management or professional posts. It does seem that there are more Japanese expatriates in the Japanese firms compared with non-Japanese expatriates (for example, Americans and Europeans) in their respective firms. The Japanese expatriates account for about half of the managers and a much smaller proportion of technicians and engineers. The proportions are relatively higher in Japanese-majority owned compared with Japanese-minority owned firms. The non-Japanese electronics firms tend to hire fewer expatriates than do Japanese electronics firms. However, there is no evidence to suggest that the non-Japanese have less control over their companies.

This study also shows that although there are some choices of technology available to the electronics industry in Malaysia, and new information is not exactly inaccessible, there is a considerable degree of control over these companies—whether they are wholly-owned foreign firms or joint-ventures with local companies—by the parent companies. In fact, a lot of the crucial decisions pertaining to technological processes are handled by the parent companies, for example, on choice of products, techniques of production, advice and assistance on production and industrial engineering, marketing and management skills (see Tables 9, 12, 13, and 14). This happens in not only the Japanese firms but also the non-Japanese. Hence, the often quoted criticism that foreign investors control the technology and more importantly the amount of

TABLE 9
Decision on Choice of Products

Decision-Makers	Japanese Electronics Firms	Non-Japanese Electronics Firms	Japanese Non-Electronics Firms
Parent Co.	9	12	11
Foreign Co.	1	—	2
Local Co.	—	5	9
Trading Co.	—	—	—
Malaysian Govt. Policy	1	—	—
Technical Capability	4	7	7
Others	—	2	1
Total No. of Firms Responding	11	19	19

TABLE 10
Factors Influencing Types of Products

Factors	Japanese Electronics Firms	Non-Japanese Electronics Firms	Japanese Non-Electronics Firms
Competition from Local Firms	1	1	6
Competition from Abroad	2	3	4
Domestic Markets	2	6	9
Foreign Markets	7	12	7
Diversification of Products	1	7	3
Government Regulations	—	—	1
Product Obsolescence	1	1	2
Available Technology	1	10	4
Others	—	—	1
Total No. of Firms Responding	11	19	19

technical information and knowledge to be passed on, seems to be validated by this survey.

The foreign multinationals tend to invest largely to expand or to control their market shares, whether international or domestic, and not so much because of investment incentives or to comply with the needs of the host country. The Malaysian government policy and incentives that go with them are not important in influencing a company's decision on what to produce, how to produce, and for whom to produce. In some cases, in fact, certain factors, such

TABLE 11
R&D Activity

Activity	Japanese Electronics Firms		Non-Japanese Electronics Firms		Japanese Non-Electronics Firms	
	Yes	No	Yes	No	Yes	No
Production Methods/ Processes	5	4	6	12	8	8
Raw Materials	1	5	1	17	3	13
New Products	1	5	5	13	5	11
Marketing System	—	6	1	17	4	12
Total No. of Firms Responding	10		18		16	

TABLE 12
Sources of Ideas on Products and Technology

Sources	Japanese Electronics Firms		Non-Japanese Electronics Firms		Japanese Non-Electronics Firms	
	Product	Tech.	Product	Tech.	Product	Tech.
Foreign Personnel	1	1	2	4	5	7
Local Personnel	1	1	5	7	1	2
Foreign Competitor	—	—	2	2	1	—
Local Competitor	—	—	3	1	3	1
Parent Co.	11	11	10	10	9	10
Catalogues/Magazines	—	—	1	1	—	—
Own R&D	1	3	2	3	2	1
Local Consultants	—	—	—	—	—	—
Foreign Consultants	—	—	—	—	—	—
Foreign Equipment Supplier	—	1	4	4	—	—
Local Equipment Supplier	—	—	1	1	—	—
Others	—	—	1	1	—	—
Total No. of Firms Responding	17		17		18	

TABLE 13
Reasons for Adopting Present Technology

Reasons	Japanese Electronics Firms	Non-Japanese Electronics Firms	Japanese Non-Electronics Firms
Cost Consideration	6	13	3
Limited Choice of Technology	—	3	4
Quality Standards	8	12	7
Industrial Relations Problems	—	—	1
Up-to-date Technology	4	4	5
Technical Agreements	2	1	3
Government Incentive/ Policy	2	1	2
Continuity of Existing Production	2	1	6
Familiarity with Technique	2	5	4
Advised by Parent Co.	9	4	7
Adaptation to Local Conditions	—	3	5
Efficiency Consideration	4	7	1
Total No. of Firms Responding	11	18	18

TABLE 14
Channels of Technology Transfer

Channels	Japanese Electronics Firms	Non-Japanese Electronics Firms	Japanese Non-Electronics Firms
Turnkey Plant	—	—	—
Joint-venture	1	1	11
Patents/trademarks/ Licence	2	3	3
Equipment Suppliers	—	7	2
Assistance from Parent Co.	11	11	14
Literature	1	1	2
Training/Seminars	7	8	8
Others	—	—	—
Total No. of Firms Responding	11	17	17

TABLE 15
Major Problems of Dealing with Local Suppliers

Problems	Japanese Electronics Firms	Non-Japanese Electronics Firms	Japanese Non-Electronics Firms
Inferior Products	2	5	6
Irregular Supplies	2	4	5
Lack of Variety	2	5	4
Expensive	3	2	5
Not Available	1	1	1
No Major Problem	4	8	6
Total No. of Firms Responding	10	17	18

as government bureaucracy and labour laws, are regarded as hindering the interests of these companies.

On the other hand, market demand or competition in open markets is considered crucial in influencing the types and amounts of goods to be produced, the quality of the product, and the technology associated with it. This market-driven competition seems to be far stronger and effective than any incentives that have been created by government policies.

The survey results also indicate that the electronics industry in general has not produced any significant technological spin-offs for local industries. The bulk of purchases of parts and components as well as capital machinery and equipment, and to a lesser extent the raw materials, are from overseas, and not uncommonly from the parent companies themselves. The percentage of input bought from local sub-contracting companies is very small, mostly less than 25 per cent of the total requirements. Although many of the electronic companies which deal with local suppliers do not seem to encounter major problems, there are companies which complain of irregular supplies, lack of variety, low quality, and high prices. In general, however, firms which produce final consumer goods mainly for the domestic market or resource-based non-electronic goods tend to obtain a significant amount of their raw material requirement from Malaysia. These are also companies which may have their own R&D activities.

By its very nature of export-orientation, the electronics industry, which concentrates on the assembly of parts and components, at best provides only very minimal linkages with local industries. Most of the exports are to the home countries of the foreign investors, especially to the parent companies. But the Japanese firms tend to export a smaller proportion of their output back to Japan compared with the proportion of output that non-Japanese investors export back to their home countries.

Companies tend to adopt several channels of technology transfer according to their needs and capabilities. The most common channels of technology

transfer from overseas to the domestic producers of electronic as well as non-electronic goods are assistance from parent companies and training/seminars (Table 14). Of course, these are mainly for increasing the efficiency of the firms themselves rather than simply for the purpose of upgrading skills of local personnel. The survey also indicates that the non-Japanese electronics firms are more dependent on equipment suppliers than the Japanese electronics firms. This is quite understandable since the majority of non-Japanese electronics joint-ventures do import a significant amount of their capital equipment from Japan. This may reflect the Japanese superiority in the production of the capital goods.

The role of patents/trademarks and licensing seems to be limited in all the types of industries surveyed. Of the few companies using licensing as a channel of technology transfer, most (at least 5 out of 8) are associated with "brand name" products, which suggests access to markets in which quality standards had already been set by foreign firms and foreign imports. Many of these companies with licensing agreements do have future development plans for their product and/or technology but are heavily dependent on foreign companies for them and do not embark on their own research and development. Nevertheless, the sample is too small to enable us to make any generalized conclusion as to whether there is a link between licensing and technology dependence as exhibited by the firms in this survey.

The experience of firms with regard to R&D activities is rather mixed. In all the three groups of industries, there are companies which are engaged in R&D and expend funds on it, but the number is smaller than those without their own R&D efforts (Table 11). Among firms with R&D activities, the Japanese electronics firms tend to concentrate more on production methods/processes while the non-Japanese firms vary their activities, emphasizing both production methods and products. The Japanese companies tend to rely more on parent companies for basic research and new products than the non-Japanese firms. Among the possible reasons for the lack of R&D in the electronics industry (especially in the semi-conductor industry which provides a major component of the electronics industry in Malaysia) are the short duration of the product life, the high cost of R&D, highly competitive prices, and the small domestic market all of which do not justify investing in R&D to generate appropriate technologies for the host country.

However, the Japanesee non-electronics companies do R&D not only on production processes but also on other activities such as product design, marketing systems, and raw materials. On cursory inspection of the available data, these firms are found to be mainly the domestic market-oriented producers. Although the data are by no means conclusive, engaging in R&D by these domestic-oriented firms may reduce the probability of technological dependence. In fact, there are instances where firms acquire new ideas on products and/or technology through their own R&D (Table 12), and consequently try to adapt their technology to local conditions. But these instances are found only in non-Japanese electronics and Japanese non-electronics firms. Japanese electronics firms do not seem to be involved in either technology

adaptation nor product adaptation. Set up mainly to control foreign markets, many of these companies are quite understandably not keen to do their own R&D and even to transfer technology to their local partners.

A high proportion of the cost of technology transfer is still due to the importation of machinery and equipment. But, if anything, there are indications that the allocation of funds for training and R&D is increasing as the country is more interested in understanding the technology imported.

In short, the opportunities for technology transfer through "learning by doing" have been substantially reduced because of several factors in particular the heavy dependence on parent companies, lack of linkages with local producers, limited R&D activities, and private business interests superseding national interests. The lack of adaptation of imported technology to meet local conditions easily leads to high dependence on imported elements. In addition, some trade practices of foreign multinationals are deemed restrictive. A licensor, for example, often controls exports and sales or requires that equipment and raw materials be purchased only from him. Imported technology can be costly because of high royalties, high fees for technical advice, and high costs of equipment and manpower training, as suggested by the limited data obtained in this survey.

If there is any potential for technology transfer, it is very limited in the electronics industry. The non-electronics industries, especially the smaller domestic market-oriented industries, tend to have greater potential for the enhancement of technology transfer. The limited data contained in this study supports the contention that locally-contolled joint-ventures tend to be more sensitive to the government policies and are more conducive to the creation of a technologically self-reliant society.

Of course, the willingness or otherwise on the part of foreign investors to impart their knowledge and know-how is only one aspect of the problem. Another aspect is the absorptive capacity of the host country's work-force for such skills and technology. Despite some training provided by the firms for their workers, especially on-the-job training and the company's own formal training programmes, there are still problems inherent in the process of transferring the skills and technology to local personnel. The major problems include the lack of interest and lack of work discipline particularly among production workers; the language barrier; and the lack of qualifications not only among the factory workers but also to a lesser extent among the executives, including managers, technicians, and engineers. This reflects the fact that Malaysia still lacks a pool of middle and high-level manpower, notably entrepreneurs, engineers, technicians, and researchers. Factory workers at the production level still need disciplinary training to equip themselves better for a modern industrial labour force. An overall lack of well-trained personnel in key areas may make it difficult for Malaysia to take advantage of its own available natural resources.

Policy Implications

It should be clear that improved efficiency in production through technological upgrading of product designs and manufacturing techniques has become

increasingly important for Malaysia as the economy seeks to expand further into more competitive world markets for its manufactured goods. Technology is also the key to more extensive and effective use of the domestic resources.

For technology to be transferred it has to be well integrated into the life of the country, and the country must have the people who know how to run the machine, maintain it, and translate its results into action. More than that, the country has to have the social, economic, and political structure that is conducive to technological development. The transfer of technology then engages the values and interests of diverse actors in a competitive arena. Often, the objectives of sellers and buyers of technology are multiple and some of them can be in conflict with each other; not all of them are consistent with the broader social goals of the host country. If these goals are to be achieved, then the host country needs to formulate policies to enable the desired technologies to be transferred or developed in line with the social values and national objectives.

Thus, private businesses should be mindful of the technological development aspirations of a nation struggling to industrialize, and be willing to consider adjustments in the commercial, economic, as well as social spheres. From the host country's point of view, the acquisition of technology is an end in itself; through this it is hoped that a pool of technologically skilled citizens will be built up, that the know-how will be widely circulated throughout the nationally-owned industry, and that the outflow of foreign exchange will be reduced. On the other hand, technology is not a free good. Most industrial technologies are owned by private enterprises, and therefore, if they are to be transferred, they have to be paid for. Nevertheless, despite the apparent divergent priorities, exchanges are possible, based on mutual interest and advantage.

Suggestions to Government by Private Firms

The Malaysian Government, like most governments of developing countries, is sensitive to such issues as employment composition, the degree of technological dependence, the brain drain, and equity participation. For most foreign firms, however, these are disquieting and, at best, only secondary considerations. Private motives such as business control and profit-making are certainly more crucial to the foreign companies. To achieve these objectives, the surveyed firms generally recognize that the host government has a role to play in encouraging the transfer of technology. This is implied from the survey results which show that the majority of firms think the government should play a greater role — rather than leave it to the private sector — in enhancing the transfer of technology and skills (Table 16). In addition, there have been suggestions that the government should not be involved in negotiations of contractual terms and conditions, and should reduce the number of bureaucratic rules and procedures. This, of course, has always been a point of conflict between the government and the business sector.

Nevertheless, many firms agree that the government should strengthen the incentives for industrial research and development, provide more technical training, and promote technical co-operation programmes. While the electronics firms generally feel that the government need not conduct research

TABLE 16
Firms' Suggestions to Government to Encourage Transfer of Technology

Suggestion	Japanese Electronics Firms	Non-Japanese Electronics Firms	Japanese Non-Electronics Firms
Conduct research on specific problems	1	2	5
Local sources of technical information	2	1	3
Provide incentives for more research	4	11	7
Liberalize imports	3	3	2
Lessen bureaucratic rules and procedures	3	14	7
Provide more technical training	6	8	10
Promote technical co-operation programmes	3	6	7
Be involve in negotiations of contractual terms and conditions	—	—	2
Leave the private sector alone	1	1	2
Others	2	—	3
Total No. of Firms Responding	11	19	19

on specific problems of the industry concerned (where there may already be sufficient R&D activity for this industry especially that carried out by the parent companies), some non-electronics firms think that the government should conduct research to supplement the needs of specific industries.

Views of the Government

While the government is prepared to give concessions and is quite flexible at the implementation level, the investment attitude of foreign investors must also be conducive to the aspirations and needs of the local business community and the Malaysian society as a whole. They have to be sincere enough to assist in the economic and industrial development of the host country when they negotiate for investment projects in Malaysia. To accommodate these expanded aspirations of the society, foreign partners should at least be prepared to provide counter concessions as evidence of their spirit of co-operation-in-progress. The major concessions that foreign investors should consider are:

1. Foreign investors should be willing to accept a minority position in joint-enterprise arrangements. Many Japanese firms have shown their

TABLE 17
Types of Training Provided by Firms to Employees

Type	Japanese Electronics Firms			Non-Japanese Electronics Firms			Japanese Non-Electronics Firms		
	F	T	M	F	T	M	F	T	M
Own Training Programmes									
Regular	7	6	4	8	9	5	7	2	—
Irregular	—	4	4	5	5	4	8	5	1
On-the-job Training	10	11	7	14	15	8	14	10	7
Formal Education Institutions	—	2	1	4	10	8	3	4	3
Short Courses/Seminars	1	7	7	7	11	9	2	8	10
Others	1	3	2	—	—	—	—	1	1
Total No. of Firms Responding		10			18			18	

NOTE: F = Factory workers; T = Technicians and Engineers;
M = Management Personnel

TABLE 18
Main Constraints on Transfer of Skills to Local Personnel

Problems	Japanese Electronics Firms			Non-Japanese Electronics Firms			Japanese Non-Electronics Firms		
	F	T	M	F	T	M	F	T	M
Language Barrier	6	4	1	3	—	1	5	4	3
Lack of Qualifications	3	1	1	4	2	—	4	5	2
Lack of Interest & Commitment	4	2	3	1	2	—	7	1	1
Lack of Discipline	2	1	1	1	1	1	5	1	1
Costly Training	—	2	—	—	1	1	—	1	3
Absenteeism/High Turnover	5	6	1	6	—	—	5	—	—
Fast Changing Technology	—	3	—	1	3	—	—	1	—
Govt. policies (Labour Laws)	—	1	—	—	—	2	—	—	—
Inadequate Time	2	3	2	—	—	—	3	4	3
Secrecy	—	—	—	—	—	—	—	1	2
No major problem	2	2	3	7	9	10	6	6	8
Total No. of Firms Responding		11			15			18	

willingness to hold equity shares valued at much less than 50 per cent. It is only when local partners are dominant and in control that the transfer of technology can have a better chance of being accelerated.

2. Foreign investors should yield managerial control gradually within a specified planning period to the local people. Unless this is made possible, the transfer of technology and skills is going to be very difficult and prolonged.
3. Foreign partners must be willing to share the technology and the markets. More importantly, they must be partners not only in the economic but also in the social development of the country as a whole. This includes the need to overcome language and other communication and cultural barriers between them and the Malaysians.

Manpower Development

One obvious conclusion that emerged time and time again was that high priority must be given to producing more skilled scientific and technical personnel. Malaysia's current rate of training still falls critically short of its needs especially in view of the future development when the economy picks up steam again. Shortages of experienced and qualified scientists and engineers will act as a brake on industrial expansion where so much of the fast growth will be in technology-intensive fields.

The government can therefore enhance the capacity to absorb foreign technology and skills through reorienting the school, college, and university curricula from being too academic-oriented to one that is more technically biased. In Japan, for example, the output of engineers and technicians was increased many-fold years before the country embarked upon its industrialization programme. The present engineer/population ratio in Malaysia is about 1/1,500 whereas in developed countries it is 1/400. Therefore, unless values inculcated in schools towards employment of a technical nature are correct, there may arise a problem of divergence between the need and actual demand for this type of labour force.

The current educational approach also seems to be relatively biased towards high-level manpower compared to the middle-level. This bias has been acknowledged in the Fourth Malaysia Plan, given the significant shortages of middle-level skilled manpower, especially in the vocational and technical fields.

There is little doubt that the process of "learning by doing" does take place in the industries studied, although it may be difficult to conclude that it is widespread, that is, affecting all levels of the occupational hierarchy. Its impact must be greater among those who are considered technically skilled, which include the managerial and professional, technical and supervisory categories, as well as the skilled factory workers. However, on average, these groups of workers account for less than 45 per cent of the Malaysian labour force in manufacturing; while the rest are either unskilled or semi-skilled. But if technological progress is to be enhanced, particularly through "learning by doing", the unskilled and semi-skilled at least deserve equal attention. It is also important that they be given better opportunities to upgrade their skills.

No less important, there must be a good working environment, opportunities for promotion, security of employment, and training to help develop a more disciplined industrial work-force.

In view of the country's current drive towards heavy industries and eventually high-technology industries, it is obvious that the manpower needs of these programmes will be low in terms of quantity but high in terms of quality. This must also take into consideration the nature and adequacy of training facilities available in the manufacturing firms, the legislation and regulation on employment conditions and industrial relations, for example, the mandatory requirements for the training and upgrading of the labour force and limitations on the number and the role of foreign nationals that may be employed within a certain time frame.

Research and Development

The adequate supply of manpower at all levels, the purchase of technology, and the proper research are not mutually exclusive activities — rather they are complementary. In fact, there can be no importation of efficient technology if the country does not have the capacity for R&D which will enable the imported technology to be understood and adapted. Industrial research has only recently been seriously recognized as a vastly important means of discovering how to direct the international quest for technology and of increasing the bargaining power when purchasing it. R&D helps create the necessary institutional framework within which economic development strategies are formulated.

Unlike countries like Japan or Korea, the scientific and technological infrastructure which exists in Malaysia has not yet succeeded in linking itself to form a system. All the components of that infrastructure remain basically unconnected and act almost independently of one another. Hence, it is not yet possible to make science and technology an organic part of the development scheme. There has clearly been a lack of integration among the bodies which create knowledge and those which utilize it. There is a gap separating the industrial sector from the educational and research sector, sometimes even giving rise to mutual feelings of suspicion and distrust. Hopefully, with the spirit of "Malaysia Inc." that is being stressed by the government, there will be a continuous dialogue and communication between researchers and industrialists so that interaction can be achieved. In this context, however, the attempt to create a comprehensive institutional framework linking industry, government, and research institutions, including universities, requires a political will and committed community that goes beyond technical consideration. In this regard, the promotion of technical co-operation programmes linking public and private sector interests will certainly be beneficial to all parties. At least, the government should create a climate to encourage this and help to maintain that climate. It must be recognized that what is perhaps more crucial than the potential for good ideas and people, is the supporting environment — the climate that activates latent entrepreneurs, scientists, and technologists. For example, the idea of the government giving achievement awards to local manufacturing firms which produce quality goods is a positive step towards this

direction. Similarly, the establishment of "science parks" (centres for the exchange of ideas between technologists and academicians) at selected institutions in Malaysia, as already being mooted by the government, is an encouraging sign.

It is also often argued by many firm managers that R&D in a developing country is a risky undertaking because production scales do not allow amortization of high costs. As is demonstrated by this study, this need not be so. In cases where firms produce for domestic markets or domestic resource-based goods, it may even be necessary for the firms to build R&D units of their own. Otherwise, the government may have to require a foreign company operating in Malaysia to invest in local research projects as a precondition for operating within the country.

As a possible alternative, the government can support the industrial R&D activities, but on condition that the firms that would use the results of that R&D initiate the project, indicate what they need, and back up the need with a substantial amount of investment from their own funds. As a manager of an electronics company puts it: "The true innovators of change, certainly in the electronics field, will not be available to ASEAN unless a real financial incentive for relocation and establishment of such technical bases in the area are formulated reasonably quickly. In other words, technology transferred will always be 'old technology' unless ASEAN can encourage proper R&D (not pseudo-efforts) departments to relocate to this part of the world." But to start with, the government should be willing to fund a substantial portion of the industrial research and development.

Choice of Industry

The survey also points to certain important areas for choice by the planners, in particular, the choice of industry. If technological independence is to be a major objective, the selection of industry or products for domestic manufacture must be made with a view to maximizing the potential of firms to assimilate and later to adapt, extend, or improve upon the relevant foreign technology. It does seem that medium-scale industries which are domestic resource-based and/or domestic market-oriented tend to be more receptive to doing R&D and to adapt foreign technology to the tastes, incomes, and needs of the local population. Unfortunately, these small and medium-sized entrepreneurs are now facing a problem of not knowing where to get the latest information on specific technology and on its appropriateness. This is where a Technological Centre may be necessary for such knowledge and information.

Considerations of appropriate industry, of indigenizing technology, and of developing R&D activities must also be assessed by the authority when they invite multinational corporations to locate wholly-owned subsidiaries or to enter into joint-ventures with local firms. The findings of this study tend to suggest that mainly the local majority-controlled firms are more receptive to policies conducive to the creation of some potential for technological self-reliance.

Licensing, too, has the disadvantage of creating a psychological climate of

dependence on foreign sources. However, it may be better than joint-ventures for industries that depend highly on export markets. But its success in enhancing technology will hinge substantially on the local manpower capacity to absorb foreign technology and the terms of licensing agreements, the latter again depending on local know-how and experience.

Transfer of Technology and Skills among ASEAN Countries

Transfer of technology and skills is limited to the exchange not only between a developed and less developed country, but also among the developing countries themselves. One of the significant factors inhibiting effective transfer of technology among the developing countries is the lack of information on each other's capabilities. There is thus a need for greater exchange of information among ASEAN members in respect of each other's capabilities and requirements, and the relevant policies and guidelines formulated by them for the transfer of knowledge and know-how. This in turn requires developing and strengthening appropriate institutional arrangements for easy exchange and availability of the required information in this regard.

ASEAN countries need to find ways for private corporations and government institutions to pool their resources and expertise in co-operative research and development efforts. The major advantage is its ability to avoid costly duplication in research involving common needs and requirements, and to combine the best personnel in a common effort.

The important areas of information for exchange include:

1. areas in which each ASEAN country is in a position to export technology to other member countries; and
2. training facilities available and the institutions and the personnel which can impart the technology.

There may even be a need to set up a common Technological Centre or Bank of Technology to provide not only the necessary risk-bearing capital for the development of technologies which can be utilized for industries in ASEAN countries, but also the necessary advice and information. To assist in developing the limited resources, Japan could then be approached to provide assistance by way of specialist manpower, finance, and equipment to strangthen its role. ASEAN countries as a group might then exercise greater negotiating power with potential suppliers of technology.

In conclusion, it should be emphasized that there is no short-cut solution to the problem of technology transfer. It involves time, money, people, and the will-power to succeed. The decisions and the actions that ASEAN countries undertake with regard to R&D and skill formation in the next few years will determine whether or not they will eventually become technologically independent nations.

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THE AUTHORS

H. Osman-Rani, Associate Professor of Economics at Universiti Kebangsaan Malaysia, received his M.A. in 1974 and Ph.D. in 1977 from the University of the Philippines. He served as Dean of the Faculty of Economics, Universiti Kebangsaan Malaysia in 1982–84. He has published several articles relating mainly to industrial development; his most recent book (co-edited with E.K. Fisk) is *The Political Economy of Malaysia* (1982).

Toh Kin Woon, Ph.D. (University of Malaya), is currently Associate Professor at the Faculty of Economics, Universiti Kebangsaan Malaysia. He has served as a Joint Honorary Research Fellow under the Commonwealth Academic Staff Fellowship at the Department of Economics and the Institute of Local Government, University of Birmingham, England, and as a visiting lecturer and researcher at the University of Sydney, Australia. He has also served as a consultant to the FAO and ESCAP, and has written many papers on development issues such as the role of the state, public enterprises, and manpower.

Anuwar Ali, is presently Associate Professor at the Faculty of Economics, Universiti Kebangsaan Malaysia. He received his Ph.D. from the University of Kent, Canterbury, England in 1982, and has been actively involved in research projects and writing papers especially on matters relating to manpower and industrialization. He was one of the UNIDO experts responsible for the recently announced Industrial Master Plan of Malaysia.