Japan's Role in Technology Transfer in Malaysia*

*Dr. Anuwar Ali***

1. Introduction

This paper will principally examine the country's experiences in terms of technology transfer and the impact of Japanese investments on such development given that the latter has been a major player in the industrial development of the country. In Section 2 we shall briefly examine the industrialisation process in Malaysia in terms of both the flow of foreign direct investment (FDI) and technology transfer from the early phase of the country's industrial development.

Section 3 will examine the nature of technology transfer into domestic manufacturing enterprises, especially in terms of formal agreements between domestic licensees and foreign licensors. In this section, we will also highlight the institutional framework by which the Malaysian government tries to regulate the flow of technology transfer for the benefit of domestic industries. Section 4 will examine the major issues relating to technology transfer and the role of Japanese DFI in such activities. Lastly, Section 5 will highlight some of the major thrusts that would have to be prioritised for future technological development.

---

* Commented by Gowit Jira, President ANTECH Communication Company Limited.
** Faculty of Economics University Kebangsaan Malaysia Bangi, Selangor, Malaysia.

At the outset, it may be useful for us to examine the meaning of "technology transfer". Generally, technology transfer into domestic industries involves not only the transfer of written information, but also person-embodied skills, know-how and the adaptation of production processes by their technology suppliers, which are mainly, in the context of Malaysia, FDI emanating from the rich industrial countries. There are a number of different modes by which this can be effected; the principal ones via the purchase of technology through a licensing and management agreement; imports of machinery and equipment; technical assistance contracts; and turn-key arrangements. While the preferred or most popular methods of transfer differ from industry to industry and from firm to firm, the transfer is generally influenced by the objectives and capacities of the users and by the desire of the supplier to control or extract maximum rent from the use of the technology.

We may also make a distinction between what has generally been referred to as a "packaged" technology transfer on the one hand and "unpackaged" technology transfer on the other. The former refers to a mode whereby technology is purchased as an important component of an investment package which will be complemented by management, marketing services, and equity participation. During the initial years of a manufacturing operation, this approach is generally favoured as it reduces the start-up time and the costs

of establishing the operation in a developing country. However, the drawback of this approach is that it tends to perpetuate technology dependency upon the industrial countries. In this sense, many developing countries, depending on their respective technological capabilities, will try to "unbundle" the package to allow separate approaches to the different components being offered such as management, production methods, marketing strategies, and control systems.

The other common method of technology acquisition is through licensing, involving "pure technical collaboration agreement" which exclude foreign equity participation. In fact, Japan's early industrial expansion has been linked to its technological capability at acquiring and adapting American and European technologies mainly through this approach. However, the effectiveness of this approach will greatly depend upon both the industrial infrastructure and science and technology capabilities within the economy.

In the case of Malaysia, domestic manufacturing enterprises have resorted to most of the above methods in their quest for technology. However, technology acquisiton within a small economy with a narrow industrial base such as Malaysia is often complex in view of the generally open-policy towards FDI. While the role of the latter has become increasingly preeminent in the country's industrialisation drive, the issue of technology transfer must

also be examined in the context of a number of other factors, including the willingness of DFI, mainly via multinational companies (MNCs) to transfer technologies that are deemed essential for domestic industries, the appropriate price of such technologies as well as the indigenous tecnological absorptive capacity.

FDI inflows ere particularly marked during the 1985-90 period, during which, according to the Sixth Malaysia Plan, "there was a remarkable increase in proposed foreign capital investment from about M$1,000 million in 1985 to more than M$18,000 million in 1990. Apart from efforts by the government to enhance greater FDI, the nation has also benefited from the relocation of industries from the industrialised countries, notably Japan, South Korea and Taiwan as a result of rising costs of production and appreciation of currencies in these countries. Malaysia has, therefore, positioned itself favourably to take advantage of these opportunities," (Malaysia, 1991; p.132). FDI in approved projects during the 1985-90 period amounted to M$34,908 million, out of which Japan's share is significantly high with 25.7 percent of the total. During the Sixth Plan period, it is projected that M$80,000 million will be invested in the manufacturing sector, out of which M$33,000 million will be via FDI.

2. Industrialisation Process: FDI, Technology Transfer and Acquisition

Ever since the country embarked on its industrialisation programme in the early 1960s, imported technologies of the industrial countries including Japan have been relatively dominant, the consequence of FDI inflows into most of the import-substitution industries at the early stage, and subsequently, at the export-oriented phase. During the early period, 'search' activities for new products and processes were significant, with the FDI component playing a major role in this respect.

During the second stage, when the industrial base was expanded and export-promotion was encouraged since the early 1970s, the importation of technologies was still prominent as in the preceding phase, but on a more selective basis depending on the needs of the industry sectors that were promoted, while a limited amount of indigenous technologies appeared in the established industry sub-sectors. At this stage, much of the production activities would also relate to product and process adaptation, especially within the domestic-oriented industries.. It was during this phase that the Free Trade Zones were established to encourage the location of MNC activities in the electronics and textile sub-sectors.

Since then, FDI has been dominant in export-oriented activities. In 1989, for instance, foreign-controlled firms contributed more

than 90 percent of the export sales of the electronics industry and the machinery and electrical appliances industry. Their dominance in the export of rubber products; basic metals and metal products; textiles and garments; and food, beverages and tobacco was also significant. Their overall contribution accounted for nearly 55 percent of the exports of the manufacuring sector in that year (Malaysia, 1991a; p.51).

During the third phase, i.e. during the early 1980s when heavy industries were promoted to encourage greater inter-industry linkages, the development of indigenous technological capability became generally adequate especially for adaptation and local fabrication purposes. This major industrial thrust was followed by the launching of the Industrial Master Plan in 1986, which was later complemented by the introduction of the Action Plan for Industrial Technology Development in 1990. It was also during this period that the participation of Japanese MNCs became increasingly prominent.

During the first two phases, the process of "learning by doing" and "learning by adapting" are important components of technology transfer and acquisition. A crucial prerequisite for this process of learning to be effective is the supply of an industrial labour which is fully equiped with the necessary technical skills and experience. This would imply that shopfloor technicians, engineers and technically trained managers are

needed in increasing numbers such that secondary, technical and vocational education, and in-service training must be emphasised. For the third phase, "learning by design" becomes more critical so that design engineers play a more dominant role and advanced technical and engineering education is thus required, while in-service training for technical personnel becomes a significant component of technology upgrading.

The increasing technological competence of many of the domestic firms suggests that they are better positioned to-day to acquire and adapt the technical and organisational components of imported technologies accompanying FDI than they were in the 1960s and the 1970s. A significant number of them is currently undergoing a technological phase in which they have increasingly mastered the production technologies to run fairly sophisticated manufacturing operations ranging from food processing to electronics industries. While these technologies are generally associated with the initial steps in technology acquisition consisting primarily in the ability to acquire operational skills to run a production facility efficiently, other more complex stages of technological advancement (including innovative technology, design, engineering and consultancy technology) are as yet to be fully developed locally.

Moving to a higher phase of industrial development would inevitably require the promotion of high-technology industries.

But their development must be accompanied by not only an increasing supply of a highly-skilled labour force but also a substantial increase in R&D and technical training expenditure. In both the areas of R&D and in-service training, it is equally important to stress the role of industry itself. It is in all these areas that human resource planning should focus its attention in attempting to develop both the critical skills needed by industry and, more importantly, labour's capacity to innovate. There is liitle doubt, as indicated by the experience of most industrial countries or the newly industrialised countries that innovative capacities will determine the economy's competitiveness.

Basically, existing human resource development does not really emphasise on the capacity to innovate. The lack of funds for purposes of R&D may be an important factor in this respect while domestic industries are too reluctant to allocate substantial funds for these activities. But equally important, the existing industrial structure, arising from FDI practices and the nature of existing investment incentives, encourages the adoption and importation of highly capital-intensive equipment from the industrial countries. This not only discourages the adoption of appropriate technologies in domestic industries but also negates the capacity to innovate as the dependence on imported technologies is allowed to be perpetuated.

Foreign direct investment in general seems to discourage meaningful transfer of technology and the development of domestic innovative capacity. If there is any transfer at all, it is normally between the principal licensor or investor with its subsidiary or affiliates established in Malaysia. It is thus internalised within its global production structure. There is a reluctance on their part to allocate funds for R&D activities since most of these activities are controlled by their head offices in the industrial countries where extensive R&D facilities have already been established (See Anuwar Ali & Muhd. Anuar Adnan, 1990;p. 151-171 and Ozawa, 1982; p. 7-53).

The shortage of qualified and technically experienced scientists and engineers locally is an added impediment to the establishment of R&D facilities. Consequently, the top management of foreign MNCs tends to perform mostly management and organisational functions rather than innovative functions, unlike their counterparts in the industrial countries. These factors tend to have a stifling effect on the development of domestic entrepreneurship. Nevertheless, in an industrialising economy, it is domestic enterpreneurship which must play a more prominent role in taking initiatives that would direct the activities of domestic capital into manufacturing concerns. The apparent lack of domestic entrepreneurship does not imply that there are very few individuals who can see commercial or industrial

possibilities, but more often, implies that certain features of the economic environment inhibit entrepreneurial development, especially in manufacturing activities.

This creates an industrial structure which leaves domestic entrepreneurship in areas which contribute least towards an independent industrialisation process; namely into services industries including trading, and into small-scale manufacturing activities utilising low-level technologies. This tendency is reinforced by other structural features characteristic of open economies like Malaysia's where a high demand for luxury consumer goods tend to ensure that the areas of economic activity of highest profit, into which domestic entreprenuers are attracted, are found in commercial activities related to consumption goods.

Of significance to Malaysia's industrialisation programme is the omnipresent FDI, right from the early import-substitution phase up to the current export-led phase. During the last few years, FDI presence has become more conspicuous, especially as the consequence of the liberalisation measures on foreign equity participation in 1986. As indicated in Table 1, the share of proposed foreign capital investment in newly approved manufacturing projects increased substantially since 1987, reaching a peak in 1989 with 70.8 percent of the total proposed capital investment.

Apart from responding to the more liberal investment climate in Malaysia, this trend is also a reflection of the changing patterns of investments made by Japan and the newly industrialised countries of this region. During the 1985-90 period, Japanese FDI flows has been a major source of capital for the mafacturing industries. Table 2 shows that Japan has been a significant player in this respect and its share in terms of total FDI has always been relatively high, with the exception of 1986.

Despite the growing importance of Taiwan since 1987, investments from Japan will undoubtedly have an important impact on the country's industrial thrust. This is further illustrated in Table 3. Among the industries in which Japanese FDI predominate include textiles, plastic products, machinery, electrical and electronics, and transport equipment. Japanese substantial participation in these industries is largely an extention of its comparative advantage in these areas.

3. Nature of Technology Transfer into Domestic Industries

Technology transfer basically implies the act of purchasing a technology from another country based on the mutuality of interests. This means that, in the case of the importing country, there is a price to be paid for the technology import. In theory, domestic industries, for instance, need to assess

whether the technology transferred is suitable in the context of their own technological capability and the various inputs available at their disposal. Likewise, they have to assess whether such an import is within their capacity to bear the costs of such transfer, including the direct and indirect costs imposed by the technology suppliers. In practice, however, these are indeed complex questions because any technology import will have numerous repercussions within the domestic economy.

An important objective in encouraging FDI is the expectation that they would facilitate technology transfer; and this equally applies to Japanese investments. The acquisition of such technology is perceived as a crucial component in ensuring rapid economic growth, especially via the transformation of the economy towards one with a larger industrial base. The flow of technology transfer into Malaysia, as shown by the number of formal contractual agreements, has increased rapidly in recent years. However, it must be noted that these numbers are a simple indicator of technology transfer; and may not reflect the reality of technology acquisition within domestic industries. Indeed it is difficult to measure with any certainty the complex nature of technology transfer.

During the 1975-89 period, the Ministry of International Trade and Industry (MITI) scrutinised and approved a total of 1,579 agreements. While the number of such agreements averaged less

than 60 a year before 1980, it nearly doubled during the post 1980 period, reaching a peak of 198 agreements in 1989. This, to a certain extent, is indicative of the increasing effort towards industrialisation via substantial DFI inflows.

Almost 50 per cent of all agreements approved since 1975 were in the form of technical assistance and know-how agreements and another 20 per cent were in the form of management and joint-ventures (See Table 4). While this indicates that a high concentration of technology transfer was in manufacturing, it also shows a shift away from the "packaged" type of FDI and technology transfer process, particularly apparent since 1985 when the number of trademarks and patents agreements increased substantially so that by the end of 1989 the share of such agreements was 14.0 per cent of the total.

Japan accounted for the higest proportion (34.0 per cent) of all agreements signed during the 1975-89 period. The other countries that were relatively important were the United Kingdom and the United States, accounting for 13.1 per cent and 11.1 per cent of the total respectively (See, Table 5). The increase in the number of agreements signed with Japanese technology suppliers had been particularly marked since 1980, which happened to coincide with the launching of the government's "Look East Policy" and also the relocation of Japanese small and medium-scale enterprises in relatively cheap-labour countries including Malaysia.

The importance of Japan as a technology supplier to domestic industries is further reflected via the import of capital equipment or machinery, which constitutes an important component of technology transfer. Since the mid-1970s around 35 per cent to 40 per cent of local machinery needs originated from Japan. Only the United States, amongst the other industrial countries, appears to challenge the position of Japan in this respect. Even then, it share was well below that of Japan's. However, capital equipment or machinery alone do not constitute a technology; it represents only that part of the technology embodied in hardware, while the remainder, as implied earlier, is comprised of disembodied knowledge which can only be acquired through enhancing indigeneous technological capability.

Most of the agreements approved during the same period were in the electronics and electrical industries (18.7 per cent), chemical industries (13.2 per cent) and the fabricated metal industries (9.9 per cent). These three industries account for more than 42 per cent all agreements approved, thus reflecting the strong need for technology transfer in these industries (See Table 6).

Under the Industrial Coordination Act of 1975, all manufacturing firms requiring project approval are also required to submit any agreement signed with any foreign company for approval by the Ministry of International Trade and Industry whose main

objectives are, first, to ensure that the agreements will not be prejudicial to the national interest; second, to ensure that the agreement will not impose unfair and unjustifiable restrictions on the Malaysian party; third, to ensure that the payments 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; and, lastly, to ensure a meaningful transfer of technology.

Even if the direct costs of technology transfer were not excessive, domestic manufacturers might still be disadvantaged substantially if restrictive conditions were imposed by their foreign technology licensors. These might include restrictions on export outlets, the level of technology transferred, and domestic R&D activities. Anticipating the negative impact of such restrictions, MITI tried to minimise them to allow domestic manufacturers more flexibility to expand their operations and to become, in the long run, less dependent on their foreign technology suppliers. For instance, if the licensors insist on export restrictions, MITI will demand that consent for sales outside the restricted territories should not be unreasonably withheld.

A number of technology licensors insist on fixing the prices of the licensed products while others insist that the local

licensees purchase all material inputs and components from them and at prices fixed by them. The second restriction appears to be more common. Such tie-in purchases undoubtedly strengthen the position of the technology suppliers, thus in the process they are able to maximise their gains by selling over-priced components, intermediate inputs, capital equipment, and spare parts. Additionally, the obligation to purchase key inputs from the technology licensor enables the latter to monitor the activities of the local licensee, including a constant check on the production volume of the licensee, mainly for the purpose of determining technical fees.

In order to avoid such a situation, MITI has laid down a number of guidelines regarding purchases of components or intermediate inputs. Firstly, wherever possible, the domestic licensee should determine alternative sources of supply. This implies the need for achieving a higher level of technological capability within domestic industries, via more in-service training and R&D allocations. Secondly, any 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. Thirdly, if such a provision cannot be avoided the domestic licensee should stipulate that the price are to be based on internationally competitive prices.

Despite all the above stipulations, the experience of MITI shows that it is difficult to ensure the real transfer of technology given the Ministry's lack of experience and expertise to assess the "technology content" that is imparted to domestic licensees or the local personnel, not to mention the meticulous task of keeping track of the increasing number of technical assistance or joint-venture agreements submitted for approval.

The cost of technology transfer to domestic industries is, to a large extent, influenced by the bargaining strength of the foreign technology licensor, the local company or subsidiary or joint venture partner; and to a certain extent MITI. Each of these parties has its own perception of the value of the technology and its own preferences to how it should be transferred. The Ministry, reflecting the aim of the government to ensure effective technology transfer to local companies, is desirous that technology be acquired at lowest cost, basing its calculations on long-term national interests rather than the immediate returns to the firm. 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 over-pricing by the technology licensor of inputs to the local licensee.

While this is the objective of the government, in practice, it invariably has to balance between the need for technology transfer and the need to attract FDI into the country. This has been the dilemma for many developing countries, where the options are really limited. To a large degree, the fixing of royalty payments by MITI has therefore been flexible in its attempt to encourage FDI into the promoted industries and to accomodate the increasingly technological needs of these industries in the form of new machinery, aquipment and processes as well as management expertise and marketing know-how. With growing industrialisation, this becomes inevitable because of the need for diversification and production of more technologically-advanced products, where the availability of technology is relatively scarce and costly. In such cases, technology owners have not always been willing to transfer their technology under the country's terms of technology regulation, particularly if this accompanied by controls over FDI, including local equity conditions.

Technology payments required for new and increasingly complex technologies may have to be significantly higher than the maximum rates generally approved by MITI. The effective absorption of more complex technologies may also require a longer period, which often exceeds the duration prescribed in guidelines. While regulatory controls continue to be applied for relatively mature and standardised technologies, the acquisition of the latest

techniques in high-technology areas and sectors of special priority is increasingly being encouraged and promoted through various incentives, including exemptions from regulatory norms and guidelines.

Like in most developing countries, technology transfer regulations in Malaysia have not been utilised to screen for more "appropriate technologies", partly because technology transfer is processed by administrators lacking the necessary technology background (See also Segal, 1987; p. 1-32). In this respect, it is therefore critical that the country's technology assessment capability be upgraded to ensure that the negative effects of technology transfer can be minimised (See Malaysia, 1991; p. 193).

4. Technology Transfer via Japanese Investments: Major Issues

Despite the rapid pace of technological progress and its global commercialisation during the last two decades, the actual choices open to domestic industries as far as applied technologies are concerned may be rather limited. The bulk of the technologies applied locally has their origins from a relatively small number of MNCs of the industrial countries including Japan which confer proprietary rights; and thus they can impose obligations/restrictions upon those permitted by the owners to make use of such technologies.

This concentration of technology-generating capacity arises because most R & D activities are being done within the industrial countries. Although the international patent system was intended to protect and encourage innovations, the system seemed to work against the interests of developing countries [See World Bank (1979), p.65-66]. In such a situation, domestic industries in Malaysia find it almost impossible to reduce the technological gap between them and their counterparts in the industrial countries. In practice, most domestic firms therefore become increasingly dependent upon the technology licensors of the industrial countries for the supply of technologies. The choice of technologies are therefore largely determined either by large Japanese or other industrial country MNCs or technology suppliers, although recently the existence of technology transfers by the newly-industrialised countries (NICs) provides an option which is open to domestic manufacturing enterprises.

Technology transfer can also be viewed as transactions which take place under very imperfect market conditions generally favouring FDI from the industrial countries. This is even more true in cases where the transactions take place between the principal MNC or technology supplier and its subsidiary or joint-venture partner in Malaysia. Aside from the oligopolistic nature of technology supply, the ability to choose and assimilate imported technologies has also been hampered because of the lack of

indigenous technological capability, particularly in locally-owned or managed firms.

Domestic firms in Malaysia, given their generally limited pool of highly skilled personnel, often lack sufficient knowledge and expertise about the technologies they hope to acquire from their potential suppliers. Technology suppliers are reluctant to disclose full information about their product to potential buyers until all transactions are completed to protect the proprietary value of the product. As such valuable technological knowledge is not readily given away; it has to be purchased at a cost. Thus, buyers lacking in technical expertise will generally agree to purchase the technology without sufficient knowledge of its eventual functional performance.

The price paid to obtain any particular technology may also reflect the lack of technical, financial, legal and commercial expertise required to acquire information on the technology and for the evaluation of the various options which may exist. This disadvantage is particularly felt by the small and medium-scale enterprises, despite the fact that the government has earmarked them as playing major roles during the next phase of the country's industrial thrust. Their larger counterparts, 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 Japanese MNCs.

Terms and conditions attached to technology transfer are generally restrictive to local licensees on aspects such as export outlets, purchasing and pricing policies, technology diffusion and in-house R&D. One of the most common restrictions is the export prohibition on goods produced under licensing or technical assistance agreements. There are also cases in which licensees are prohibited from producing competitive products; they are normally required to secure prior approval from their Japanese licensors before they could sell intermediate products that are also covered under such agreements. Licensees are also required to sell their products through local agents or marketing firms appointed by the licensors.

As indicated earlier, another common constraint faced by domestic industries is the tied purchases of materials from the licensors, which will consequently have significant implications on the need to broaden the country's industrial base. According to Bank Negara Malaysia (Central Bank), in its Survey of Private Investment in 1989, on average 65 percent of the total expenditure of manufacturing firms was incurred on the purchase of raw materials. Of this, a high proportion, averaging 53 percent represented imported materials (Malaysia, 1991a: p.47). For several industries, the import content of their raw material requirements were even higher, at 97 percent for the electronics industry, 82 percent for the paper products and printing

industry, and 63 percent for the transport equipment industry.

In view of the above, the supplier-buyer relationship in international technology purchases can be viewed as a "bilateral monopoly" where the price tends to be determined through a series of negotiations between two parties. If both sides are equally strong in the negotiating process, the final negotiated price would be reflective of a price determined in a competitive market. However, if one party is in a weaker bargaining position, the final negotiated price would deviate from the competitive one. Thus, where buyers have less than sufficient mastery and knowledge about the technology, the suppliers would be able extract larger economic rents from the technology transaction.

In Malaysia the largest proportion of technology transfer payments made by firms is incurred in the form of payments for new machinery and equipment. These purchases are normally made through the parent companies of foreign-controlled firms. Royalties were a popular mode of payment for contracts involving continuing technical assistance or the use of patents and trademarks. Royalty payments usually range from 1 to 5 per cent of net sales. Lump-sum payments were also utilised for the payment of technology purchases. Another expense for technology transfer among the Malaysiah firms is the cost of overseas

training for local staff. This expense has been found to be common among Japanese firms but is less prevalent among the other foreign firms.

When licensees lack the technical, financial and commercial expertise in technology transfer negotiations, they may receive very disadvantageous terms or may be paying unreasonably high prices. This appears to be the case among many small and medium-scale firms in Malaysia who are known to be paying royalties for expired patents. Thus, there is a clear need for programmes to educate small firms on the various aspects of technology sourcing, purchase, and negotiation.

The situation is reinforced by other factors such as the Japanese companies' inherent strength and their considerable negotiating and bargaining skills built up through extensive experience in transferring technology. On the other hand, domestic manufacturing firms generally lack any significant expertise in acquiring technology and thus substantial costs incurred for acquiring advanced technology even at the negotiation stage. The bargaining power of the Japanese companies tends to be greater at the beginning of the relationship when the need for their resources and expertise is greatest. Once the facilities are operational, the recipient enterprise becomes more adept, the services of its Japanese counterpart then become less indispensable; and there could be a shift in the relationship

favouring the local enterprise. Even then, when Japanese interests hold equity and management control, the situation may no be as straitforward.

We must also note that equity ownership by local capital in companies where FDI participate does not necessarily mean management control. With some exceptions, most of the FDI operations appear to be effectively controlled by expatriates, who are personnel from the parent companies. This is particularly apparent in companies which are dependent on the foreign partner to provide the technical know-how and which are dependent on the foreign partner to provide market access. It is in this sense that the extent of foreign equity participation may underestimate the full impact of its control and influence in the domestic economy.

In the Malaysian context, however, the indigenization of management, particularly at the second rung, has been observed among some of the FDI activities. Although most of the key posts are still held by expatriates, efforts have been made to Malaysianise the next-in-line senior posititons. This is generally practised by US and European-based FDI to minimize the costs of employing expatriates. However, there appears to be a tendency among Japanese companies to retain a higher proportion of expatriates at the senior level.

The above can also be related to the extent of local decision-making autonomy versus the global strategic framework of FDI operations in Malaysia. This issue has a crucial bearing on FDI investment and operating behaviour. Obviously, a FDI with relatively centralised systems of decision-making will be less susceptible to leverage by local factors than one which practices a more decentralised style of management.

In terms of technology identification and the sourcing of capital equipment and machinery, it is generally the parent companies which make the decisions or give technical advice to local operations on these matters. It is often in the interest of the parent companies to maintain this type of relationship, as in some cases, the parent companies are also the technology suppliers. This situation may also apply to local subsidiaries at the initial stage when they still lack the expertise to determine their need for technology, capital equipment and machinery.

We must also acknowledge that a very significant proportion of international trade is intra-firm, whereby the costs of technology transfer can be disguised through transfer pricing manipulations. Vertically integrated firms (i.e. where the various stages of production from raw-materials into finished goods are undertaken by the same firm or its subsidiaries) relocate their profits internationally by using transfer pricing

i.e. under-pricing goods for export while selling them at market prices within foreign markets. The motives for their behaviour are to minimise global tax burdens and avoiding political risk.

In such a situation, the pricing of the technology or its components and peripherals may not reflect competitive market values, but may instead be dictated by transfer pricing considerations to minimize taxation on corporate income. Thus, in a country like Malaysia where the withholding tax rate on repatriation of royalty payments under technical or licensing agreements is lower than the corporate profit tax rate, technology transfer may be over priced to reduce such taxation. Domestic industries' bargaining position vis-a-vis Japanese companies as technology suppliers with respect to technology transfer has tended to weaken in recent years due to the intensifying competition among developing countries for FDI in general and "high-tech" investments in particular [See also Djeflat (1988), p.149-165]. In addition, in those "sun-rise" industries characterised by rapid pace of technological change, they are unable to catch up and as such are much more vulnerable and dependent upon the large Japanese MNCs to provide the latest improvements.

There is no doubt that technology suppliers or Japanese investors are generally better positioned to dictate the terms and

conditions of technology transfer. High rates of return obtained by them may take the form of profits earned on equity, as well as from sales of intermediate goods, capital equipment, spare parts and technical services, not to mention transfer pricing. Thus, although technology may be transferable to a domestic enterprise, the costs can be very substantial; and such costs will, to a large extent, be determined by the technological gap between the foreign technology supplier and the domestic enterprise, and the socio-economic environment in the receiving country.

The existence of in-house R&D activities is one of the principal indicators of a firm's technological capability. It also presents one of the most effective apportunities for upgrading technical skills within such a firm. Generally subsidiaries of MNCs, including Japanese ones, which benefit directly from the R&D conducted at parent companies, do not initiate substantial R&D locally. The subsidiaries were simply takers with whatever product specifications and technology that were felt to be appropriate by the parent company. Most of the basic research, product design, product development and process development are conducted by the parent companies. Only in the area of product adaptation, one can observe a certain degree of activity in some local subsidiaries. Local firms were also lacking in R&D resources although a few of the larger ones have small R&D units engaged in quality control or product and process adaptation.

In Malaysia, Japanese firms tend to rely more on parent companies for basic research and new product designs than their non-Japanese counterparts. Possible explanations for the lack of R&D in the Malaysian electronics industry for example (especially in the semiconductor industry) are the following: the short product life-cycle, the high costs and economies of scale required in R&D, highly competitive prices, and the small domestic market. However, in domestic-oriented firms, the Japanese companies have tried to diversify their R&D activities in terms of process alteration, raw materials substitution, marketing research and product design. Although this is by no means conclusive, we may hypothesise that the R&D activities of domestic-oriented import-substituting firms may in the long term contribute to technological independence.

One view often expressed is that technology imports reduces the urgency to develop indigeneous technologies as such imports become substitutes for indigeneous technological development. This observation may well apply to many domestic firms. Principally, they have little option to do otherwise because the development of domestic technologies itself requires economies of scale; and currently local firms are unable to take the risks of utilising untested domestic technologies, even if they are available. At the same time, there is a lack of new-technology based firms operating in Malaysia and owned by local entrepreneurs.

An enterprise in theory may initially have to depend on imported technologies rather than develop its own know-how, but subsequently will proceed to adapt these technologies to suits its needs. The adaptive activity, in turn, may lead the enterprise to establish in-house R & D facilities and thereby enhancing its experience to generate its own technological capabilities. Technical progress can either be externally induced or be achieved through the process of "learning by doing" which involves the accumulation of experience by the working population at all levels in the course of production. Undoubtedly, this process does take place in domestic industries, although it may not be widespread; i.e. affecting all levels of the occupational hierarchy. It may only affect those who are considered technically skilled; but the occupational structure of the manufacturing sector is such that it hinders this kind of technical progress since the semi-skilled and unskilled account for a large proportion of the manufacturing labour force [See, Anuwar Ali, (1984), p.44-59].

5. New Directions for Technology Transfer Enhancement

The above analysis indicates that a common characteristic of Japanese FDI revolves around its need to have control over product choice and production methods, leaving the local subsidiaries or joint-venture partners very limited control over technology. Most of these subsidiaries are tied in terms of

their requirements such as machinery and equipment, parts and components from their parent companies. Expenditures for such purchases usually constitute a large proportion of the total costs of technology transfer, although there are usually other payments such as royalties and fees for technical assisstance and foreign technical expertise.

Very little R&D is being carried out in the local subsidiaries as these activities are principally conducted by the parent companies to avoid duplication and to exploit economies of scale. Consequently, the parent companies are also the major, sometimes exclusive, source of technical information and assistance. This technological dependence was in fact found to be relatively more pronounced among the subsidiaries or affiliates of Japanese MNCs.

Given the increasing inter-dependence of the Asean economies in general, and the Malaysian economy in particular, with that of Japan, it is indeed in the long-term interest of Japan to create an environment that would make Japanese firms more responsive to the needs of many domestic industries by enhancing the latter's capacity to absorb Japanese technology and making technology transfer from Japan less restrictive.

At the same time, domestic industry too must play an important complementary role, providing a conducive environment for real technology transfer. A common drawback is also related to the relatively underdeveloped S&T inftastructures within the country.

For example, there is generally a lack of interaction between industry and the universities and research institutes. An effort to link these essential sectors into a productive, interdependent system requires substantial planning and government initiatives. It necessitates the creation of a supportive environment for creativity and innovation, and making it possible for more interaction between entrepreneurs, scientists, technologists, researchers, and educators.

o Prioritising Potential Industries

In Malaysia, there is an absence of explicit policies on technology transfer, adaptation and development, especially in relation to the role of FDI. Specific guidelines must be formulated in order to avoid ambiguity and to permit the concentration of scarce resources in priority areas of technology development. Closer scrutiny of technology agreements must be initiated in order to minimize restrictive clauses and, if possible, to encourage technology livensors to build real technological capacities. The latter is indeed a crucial element to enhance the industrial base of the economy, and this requires a positive response from Japanese technology licensors.

It is essential that policy-makers specify priority industries and types of firms for technological upgrading and development. Scarce resources had been scattered among many sectors, and that

the implementation of the Action Plan on Industrial Technology Development should concentrate efforts on target sectors, especially those industries with potential comparative advantages. A shift in focus must be made towards medium and small-scale industries that are resource-based or domestic market-oriented; and this should include specific measures to enhance the development of the new-technology based firms.

o Support for Increased Technology Competence

The weakness of the existing education system is considered to be a primary factor contributing to the low technological capability in domestic industries. The reorientation of the technical and vocational schools and university curricula is a necessity as the needs of industry has become more technologically complex. There is also a significant shortage of middle-level skilled manpower so that there must be a shift in the orientation of local schools to reduce the supply gap. A key problem was the lack of linkages between various academic institutions and local firms, although there seemed to be numerous opportunities for mutually beneficial collaboration. The government should therefore be encouraged to establish linkages between the two groups by providing the seed fund for joint ventures between local firms and institutions in training and R&D.

Alternative schemes for expanding acitivities in technical training must also be examined. These may include the proposal

to subsidise training programmes in priority industries. Attention should be given to expanding the supply of qualified personnel to disseminate skills to the industrial work force. Additionally, there must be more publication and wider dissemination of technical textbooks, handbooks, and manuals. Such materials are important elements in skills development and technology transfer process, and thus should enjoy the support of the relevant public agencies.

The importance of on-the-job training must be emphasised as the primary vehicle for building the capacity of a firm to apply new technology. It also suggested that foreign firms should opt for holding training programmes at the local site in addition to those held at parent-company headquarters. The justification was that having the training on-site permits the testing of the technology against local requirements.

o Incentives for R&D and Technology Transfer

Direct incentives should be provided and strengthened to encourage technology transfer and local R&D activities. These may include; special promotional incentives for foreign firms tied to the presentation of a definite plan for technical manpower development and skills upgrading; government subsidy for R&D projects on condition that the beneficiary firms initiate the projects, specify their needs and contribute a portion of the

investment required for the R&D project; the reduction of import duties on laboratory equipment and the offering of tax credits for investments or expenditures for local R&D work; to establish and R&D laboratory which local firms could use. Such a facility would permit even smaller firms to use equipment which would normally be beyond their budgets, and to pay according to the extent of usage.

6. Concluding Remarks

While the paper has identified and highlighted the major problems relating to the real transfer of technology by Japanese firms in Malaysia, it is important to emphasise that, although these major problems are partly the consequence of the country's nascent industiral and technological base and the under-development of its human resources in comparison to industrial countries, they are also partly related to factors emanating from the capital and technology exporting countries. There is little doubt that manufacturing enterprises, after spending substantial efforts and investments on R&D and technology improvements, would expect to get back these costs, including a certain margin of economic rent. In this sense, the activities of Japanese FDI in Malaysia, or for that matter even in the other industrial countries, are a logical extension of their long-term and strategic objective to maximise profits.

While it is crucial for Malaysia to reduce these problems with appropriate strategies, via effective policy planning and implementation, it is equally important that industrial countries like Japan also realise the current needs of the ASEAN region as a whole for technological enhancement. While in the short term, the amount of FDI may be important to induce economic growth, in the long term development perspective the quality or type of foreign investments ought to be the more crucial factor. This means that investments made by Japanese firms, for instance, must be viewed in terms of their impact on technology acquisition and enhancement as well as the inter-industry linkages that could be developed within the domestic economy.

Table 1

Proposed Capital Investment In Approved Manufacturing Projects (1955-90)
(M$ million)

	1985	1986	1987	1988	1989	1990
No. of Projects	625	447	333	732	792	906
Potential Employment	53,597	40,230	60,068	142,875	176,628	169,764
Local Capital Investment	4,727.6 (83.1)	3,475.3 (67.3)	1,873.9 (47.6)	4,215.9 (46.4)	3,562.7 (29.2)	10,539.0 (37.4)
Foreign Capital Investment	959.3 (16.9)	1,687.9 (32.7)	2,060.0 (52.4)	4,878.0 (53.6)	8,652.7 (70.8)	17,629.1 (62.6)
Total	5,686.9	5,163.2	3,933.9	9,093.9	12,215.4	28,168.1

Source: Malaysian Industrial Development Authority (MIDA)

Figures in brackets are percentages.

Table 2

Sources of Major Foreign Investment In Approved Projects (1985-90)
(M$ million)

	1985	1986	1987	1988	1989	1990
Japan	264.4 (27.6)	116.3 (6.9)	715.1 (34.7)	1,222.0 (25.1)	2,690.4 (31.1)	4,212.6 (23.9)
Taiwan	31.9 (3.3)	10.8 (0.6)	243.0 (11.8)	829.6 (17.0)	2,159.9 (25.0)	6,339.1 (36.0)
Singapore	100.2 (10.4)	183.7 (10.9)	258.5 (12.5)	419.6 (8.6)	914.7 (10.6)	895.3 (5.1)
United Kingdom	26.9 (2.8)	49.5 (2.9)	76.8 (3.7)	196.5 (4.0)	764.1 (8.8)	867.2 (4.9)
United States	11.9 (1.2)	53.6 (3.2)	162.7 (7.9)	535.1 (11.0)	320.8 (3.7)	567.3 (3.2)

Source: MIDA

Total Foreign Investment: 1985 - $ 959.3
1986 - $ 1,687.9
1987 - $ 2,060.0
1988 - $ 4,878.0
1989 - $ 8,652.7
1990 - $17,629.1

Figures in brackets are percentages of the total.

Table 3

Japanese FDI in Companies in Production
as at 31.12.1989
(M$'000)

Industry	Paid-Up	% of Total Foreign Paid-Up	Fixed-Asset	% of Total Foreign Fixed-Asset
Food Mfg -	48,179	4.9	61,851	6.8
Beverages & Tobacco -	12	-	10	-
Textiles -	248,483	40.7	293,430	46.6
Wood Products -	27,779	27.8	9,108	6.1
Paper & Printing -	650	0.7	996	0.6
Chemicals -	55,949	12.2	57,672	10.0
Petroleum -	105,242	20.4	320,625	26.1
Rubber Products -	16,418	6.6	28,098	4.5
Plastic Products -	48,867	62.1	86,972	66.2
Non-Metallic Mineral Products -	51,967	10.0	140,765	15.5
Basic Metal -	67,142	23.7	72,364	26.1
Fabricated Metal -	20,025	7.5	23,360	11.6
Machinery -	52,684	40.4	105,765	62.2
Electrical and Electronics	768,555	62.7	1,139,564	43.0
Transport Equipment -	107,033	44.6	177,014	68.4
Scientific Equipment -	13,550	18.6	21,091	14.3
Miscell -	12,539	17.4	35,199	33.7
TOTAL	1,645,074	25.7	2,573,884	26.7

Source: MIDA

Table 4

Types of Agreements Approved 1975-1989

Types of Agreements	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Total	%
1. Technical Assistance & Know-How	27	30	21	48	54	57	64	48	61	71	51	50	53	67	77	779	49.3
2. Management	12	7	7	11	13	13	6	10	13	10	6	10	5	7	12	142	9.0
3. Joint-Venture	6	6	4	7	8	14	22	14	14	17	9	19	11	11	15	177	11.2
4. Services	12	5	1	12	3	6	7	2	7	2	1	1	1	2	12	74	4.7
5. Trademarks and Patents	1	5	-	4	4	4	8	8	7	1	19	33	30	44	53	221	14.0
6. Turnkey and Engineering	-	-	-	-	-	5	5	4	4	6	-	1	-	1	1	27	1.7
7. Others*	-	-	-	-	5	15	19	8	25	12	10	9	10	18	28	159	10.1
Total	58	53	33	82	87	114	131	94	131	119	96	123	110	150	198	1579	100

Source: Ministry of International Trade and Industry, Malaysia.

* Others include supply and puchase, sales, marketing and distribution.

Table 5

Agreements by Country of Origin 1975-1989

Countries	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Total	%
1. Japan	22	21	7	32	21	32	35	33	46	39	33	38	37	54	87	537	34.0
2. United Kingdom	10	6	4	13	11	20	17	6	19	11	14	21	17	17	21	207	13.1
3. USA	6	4	1	9	8	11	14	10	18	12	13	12	12	22	23	175	11.1
4. India	3	5	8	7	5	5	4	4	4	2	6	1	-	2	2	58	3.7
5. West Germany	-	1	4	6	11	9	11	10	2	2	3	2	5	5	6	77	4.9
6. Australia	3	2	1	-	4	10	5	6	2	5	3	9	3	16	2	71	4.5
7. Hong Kong	1	-	3	3	2	9	2	3	2	7	4	7	7	5	9	64	4.1
8. Singapore	3	2	2	1	2	4	7	5	3	8	2	3	4	4	3	53	3.4
9. France	2	4	-	-	2	-	7	-	4	1	-	4	3	2	4	33	2.1
10. Italy	1	1	-	1	1	2	-	-	-	-	2	1	1	-	3	13	0.8
11. Panama	-	-	3	-	1	1	-	1	-	-	-	5	1	-	-	12	0.7
12. Switzerland	-	-	-	2	1	-	3	1	2	2	1	1	1	3	2	19	1.2
13. Norway	-	-	-	-	1	1	-	2	1	2	5	-	2	1	-	15	0.9
14. South Korea	-	1	-	1	-	-	-	2	4	6	1	3	1	-	3	22	1.4
15. Others	7	6	-	7	17	10	26	11	24	22	9	16	16	19	33	223	14.1
Total	59	53	33	82	87	114	131	94	131	119	96	123	110	150	198	1579	100

Source: Ministry of International Trade and Industry, Malaysia.

Table 6

Agreements by Industry Groups 1975-1989

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Total	%
1. Electronic & Electrical	17	9	5	21	15	19	16	19	15	21	20	12	29	37	40	295	18.7
2. Fabricated Metal	8	3	5	7	16	6	14	7	12	3	9	22	21	17	7	157	9.9
3. Chemical	3	-	4	19	8	11	21	5	15	17	16	15	18	29	27	208	13.2
4. Transport Equipment	5	4	-	5	7	10	11	11	22	17	20	15	4	1	15	147	9.3
5. Food	4	7	2	2	8	14	15	4	21	6	10	8	8	16	21	146	9.2
6. Textiles	6	7	2	4	-	8	5	2	5	6	1	7	2	6	4	65	4.1
7. Basic Metal	-	5	3	3	5	7	10	13	5	5	1	1	2	-	6	66	4.2
8. Wood and Wood Product	4	1	6	5	4	-	-	4	1	6	-	4	1	-	-	36	2.3
9. Pulp, Paper, Printing and Publishing	-	-	-	-	-	-	-	-	-	-	3	4	1	3	-	11	0.7
10. Rubber and Rubber Products	6	-	1	2	5	8	14	2	7	5	4	13	8	22	18	115	7.3
11. Non-Metallic Mineral Products	1	6	1	1	7	5	4	16	9	17	7	7	12	4	10	107	6.8
12. Hotel & Tourist Complex	-	5	1	-	2	4	2	4	8	7	4	4	1	2	6	50	3.1
13. Plastic	1	-	2	-	3	5	6	1	2	7	-	4	-	2	6	39	3.5
14. Others	3	6	1	13	7	17	13	6	9	2	1	7	3	11	38	137	8.7
	58	53	33	82	87	114	131	94	131	119	96	123	110	150	198	1579	100

Source: Ministry of International Trade and Industry, Malaysia.

REFERENCES

Anuwar Ali, (1984), "The Need for Technical Skills and Innovative Capacity : The Case of Manufacturing Industries in Malaysia", Akademika, No.25.

_____ & Muhd Anuar Adnan, (1990), "Technological Acquisition and Absorption Via Multinational Companies: The Malaysian Experience, "Jurnal Fakulti Ekonomi", Vol. 21 & 22, Universiti Kebangsaan Malaysia, Bangi, Malaysia.

Djeflat, A., (1988), "The Management of Technology Transfer: Views and Experiences of Developing Countries", International Journal of Technology Development, Vol.3, Issues No.2-3.

Malaysia (1991), Sixth Malaysia Plan 1991-95, National Printing Department, Kuala Lumpur.

_____, (1991a), Bank Negara Quarterly Bulletin, Vol.6, No.1, March-June, Kuala Lumpur.

Ozawa, T., (1982), "The Role of Transnational Corporations in the Economic Development of the ESCAP Region : Some Available Evidence from Recent Experience", in ESCAP/UNCTC Publication Series B. No.2 United Nations, Bangkok.

Segal, A., (1987), "Learning by Doing", in A. Segal (ed)., Learning by Doing: Science and Technology in the Developing World, Westview Press, Boulder, U.S.A.

World Bank, (1979) "International Technology Transfer: Issues and Policy Options", Staff Working Paper No.344, July, Washington D.C.