FLYING GEESE IN ASIA: THE IMPACTS OF JAPANESE MNCs AS A SOURCE OF INDUSTRIAL LEARNING

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ABSTRACT
Pacific Asia has looked to direct foreign investment (DFI) to achieve economic growth and technological catch-up, and Japanese multinational corporations (MNCs) have responded massively. This paper evaluates Japanese MNCs as a source of industrial learning and technological transfer in the region, drawing from a large research literature and from the authors’ own surveys of Japanese DFI in the electronics sector. Japan’s historic learning-based approach to industrialisation is captured by the flying geese metaphor of structural transformation. As an explanation of the transfer of technological know-how from Japan to Pacific Asia, however, the flying geese model is problematical. This paper reflects on the effectiveness, problems and dilemmas of Japanese MNCs in transferring such know-how to the region from a political economy perspective summarised as a ‘reverse product cycle model’. This model portrays DFI as a ‘bargain’ between Japanese MNCs and host countries, and which becomes more difficult to negotiate as DFI moves from low-skilled manufacturing to more innovative activities. The bases for this hypothesis relate to the increased complexity of industrial know-how and the conflicting motivations between MNCs and host countries in early stages of the product life cycle. In practice, however, this ‘bargain’ has developed differently among Asian countries, and we illustrate these differences by comparing the experiences of South Korea, Taiwan and Malaysia.

Key words: Japanese MNCs, industrial learning, the reverse product cycle model, Malaysia, Taiwan and Korea

In Freeman’s (1987, 1988) model of long-run industrialisation, the Japanese economy features highly distinctive innovation systems and leading exemplars of flexible production, the signature development of post-Fordism, or what he signifies as ‘the information and communication techno-economic [ICT] paradigm’ (see also Fruin 1992; Kenney & Florida 1993). This model has global relevance as Japan has become a leading exporter of manufactured goods and as Japanese multinational corporations (MNCs) have expanded their overseas’ operations substantially during the last 20 years (Edgington 1993). Indeed, in the USA, the only national economy now larger than Japan, the Federal Government sponsored a study to assess what the United States might learn from Japanese-style production systems (Liker et al. 1999). Japanese competitiveness has subsequently been critiqued (Porter et al. 2000), but its industrial companies are tenacious and remain powerful (Nihon Indasutoriaru Paomansu Linkai 1997; Karatsu 1999). The student of industrialisation once thought only to be
good at copying, has now apparently become a teacher.\footnote{1}

This paper reflects on the impacts of Japanese MNCs in Pacific Asia as a source of industrial learning or know-how.\footnote{2} Countries in the region have actively sought to ‘catch-up’ economically and technologically with advanced countries by attracting direct foreign investment (DFI), and Japanese MNCs have invested there to a greater degree (overall) than those from the United States or from Europe. Indeed, these MNCs bind together a Japanese centred, dynamic division of labour that is the Asian basis for the global triad of dominant economic regions (Gibb & Michalak 1994). Moreover, Japan is still the only country in Asia, or beyond the realm of the North Atlantic, to reach industrial core status, providing a cultural model impossible for US or European MNCs to duplicate. Japanese imperialism in the first half of the 20th century that threatened Asia, often savagely, also helped nurture notions of independence from European colonists (Wong 1997). Whether or not Japanese MNCs can significantly aid the technological aspirations of other Pacific Asia countries, however, is uncertain. Moreover, within the developing (or latecomer) countries of Pacific Asia, there is recognition that technology growth is facilitated by various institutional channels, such as original equipment manufacturing (OEM), licensing and joint ventures as well as by DFI. Consequently, host country attitudes towards Japanese MNCs have varied greatly (Andersson & Poon 2001).

Debates about the implications of MNCs for local technology transfer are not new and the conventional view of MNCs as sources of industrial learning and catalysts for modernisation has long been questioned. For example, Latin American dependency theorists saw MNCs as agents of ‘underdevelopment’ (Frank 1967) and Canadian nationalists have criticised MNCs for their ‘truncating’ effects on domestic technology capacity (Britton & Gilmour 1978, p. 130). Moreover, Japanese production systems are regarded as distinctive, notably because Japanese MNCs have helped pioneer the idea of firms as learning organisations (Patchell 1993a, 1993b). In addition, host countries in Pacific Asia are acutely conscious of technological transfer issues and have introduced various policies to stimulate transfers of know-how from MNCs.

The special relationships or ‘embrace’ (Hatch & Yamamura, 1996) between Japan and Asia is captured by the ‘flying geese’ metaphor, which centres upon the importance of Japanese DFI for Asian industrialisation (Phongpaichit 1990; Kwan 1994; Dobson & Yue 1997; Itagaki 1997; Edgington & Hayter 2000). According to the proponents of this (made-in-Japan) economic model of development, the Japanese MNCs, the ‘lead geese’, are prime organisers of a rapidly evolving division of labour in Asia, as successive waves of DFI incorporate new (Asian) industrial spaces while upgrading the spaces previously industrialised (Ozawa 1999). Readily incorporated within neo-liberal orthodoxy the flying geese model powerfully communicates a sense of close links between the explosion of Japanese FDI in Asia and Asian growth (Nomura Research Institute 1995; Dobson 1997). However, with its connotations of apparent seamless transfer of Japanese capabilities to Asia, this model has not gone uncontested (see Bernard & Ravenhill 1995; Fujita & Hill 1996; Hatch & Yamamura 1996; Hart-Landsberg & Burkett 1998). The recent Asian currency crisis and economic slowdown in Japan has sharpened this censure while pointing paradoxically to a long-term commitment to Asia by Japanese companies (Edgington & Hayter 2001a). Moreover, Japan’s own industrialisation and the original formulation of the flying geese model that addressed solely domestic transformation in Japan, did not anticipate a major role for DFI.\footnote{3} Can, therefore, the rest of Asia be expected to develop via a revised flying geese model that gives primacy to overseas investments and MNC-centred industrialisation?

This study examines both the experiences of Japan, ‘the teacher’ and of ‘student’ host countries in Pacific Asia who are learning (or have
learned) the secrets of industrialization. In the latter regard, the discussion distinguishes between host countries that differ in terms of the stage of industrialization and attitudes towards DFI from Japan. In particular, the study focuses on the experience of two north-east Asian host countries, namely South Korea and Taiwan, that have attracted Japanese DFI since the 1960s, and Malaysia in Southeast Asia, a country that has been especially active in enticing Japanese MNCs since the 1980s. Examples are used from the electronics industry because it exemplifies well the ‘staged development’ patterns inherent in the flying geese model (Edgington & Hayter 2000) and because it has been the leading export sector for the three case study host economies. The discussion is based on a review of the burgeoning literature that seeks to make sense of Japanese MNCs as a source of learning in Asia, combined with our own field research conducted in Japan, Hong Kong, mainland China, Singapore and Malaysia during 1997 to 2001.

The remainder of the paper proceeds in the following way. The second section emphasises the historical significance of the Japanese approach to the ‘problem of industrial transformation’, one which largely avoided DFI from overseas and featured a remarkable commitment to understanding leading-edge technology and institutions overseas, regardless of origin (Freeman 1987; Fruin 1992; Reischauer 1991). The evolution of Japanese MNCs as learning organisations has been an inherent, dynamic component of this commitment. In the following three sections, the evolution of Japanese MNCs in Asia is traced and their effectiveness, problems and dilemmas of Japanese MNCs in transferring ‘learning’ and ‘know-how’ to host countries in early stages of the product life cycle. In practice, however, this ‘bargain’ has developed differently among Asian countries, and in sections three and four the experience of South Korea, Taiwan and Malaysia is compared. The authors claim these differences help underpin variations in overall economic performance among Pacific Asia countries during the last 30 years or so. In the conclusion, the assessment of this model includes thoughts on China, where Japanese FDI has recently focused.

INDUSTRIALISATION AND ‘LEARNING TECHNOLOGY’: JAPANESE EXPERIENCE FOLLOWING THE MEIJI RESTORATION AND THE SECOND WORLD WAR

In the modern history of industrialisation, initiated by the Industrial (and related) Revolution(s) in the United Kingdom in the late 18th century, Japan became the world’s most important example of a ‘late developer’ (Saxenhouse 1999). In this regard, choice and outside forces shaped the timing of Japan’s late development. For over 250 years, during the Tokugawa or Edo period (1600–1867), unified Japan chose self-imposed exclusion from the rest of the world and developed an enormous lag in technological and institutional development compared to the leading industrial powers. Suddenly, in the 1850s, threatened by US and British warships, Japan was forced to allow foreign ships (and sailors) to gain refuge and replenishment at (selected) Japanese ports, and to sign ‘unequal treaties’ (already imposed on China) with Western powers. The once mighty (Tokyo-based) Tokugawa Shogunate was defenceless to outside threats and, perhaps with surprising ease, was overturned by a dynamic cadre of samurai who justified their revolution through control of the (Kyoto-based) emperor, the symbol of national unity (Reischauer 1991, pp. 114–122). In 1868, Japan changed the name of the year period to ‘Meiji’ (Enlightened Rule) in honour of the emperor who posthumously inherited the name in 1912.

However, this period, subsequently labelled the Meiji Restoration, was not simply a political revolution. The symbolic restoration of the emperor justified and channelled a massive national commitment and energy to play catch-up with
the West and become a global power. According to Reischauer (1991, p. 131), Japan’s transformation from feudalism to a modern nation state in just two decades was an ‘an extraordinary and perhaps unique story’.

Under the slogan Wakon Yosai (Japanese Spirit, Western Technology), the Meiji Restoration, established Japan’s signature to the ‘problem of industrial transformation’ (McMillan, 1985, p. 10). Japan learned from the West on virtually all aspects of economy and used this learning as the basis for industrial (and military) leadership. Hand picked students, including girls, were sent around the world to learn science and technology in disciplines wherever they were most advanced, while foreign experts in leading edge industries were paid high salaries to work in Japan. Domestically, the Japanese government innovated a system of popular education (including girls in the primary grades) ‘free of the aristocratic aura and religious domination of many Western educational systems of the time’ (Reischauer 1991, p. 127). If this system proved vulnerable to indoctrination, Reischauer argues that by the early 1890s Japan had become more egalitarian than Britain and was fostering learning as a broad basis for long-run competitive advantage.

The Japanese approach to the problem of industrial transformation was rooted in the philosophy of Frederich List (1922) (see Fallows 1995). Thus, investment in transportation and communication infrastructure was a priority as the government sought to provide the conditions to allow the realisation of List’s ‘productive forces’ across the industrial spectrum. Neither branch plants nor foreign loans were welcome. Rather, the government strove hard, eventually successfully, to replace the unequal treaties with tariff barriers to protect ‘infant industries’, and the foreign experts were engaged only temporarily. Whether industry was small scale or large scale, the Japanese sought to ‘reverse engineer’ Western technology (Freeman 1988). In this approach, defined as ‘innovation mediated production’ by Kenney and Florida (1993), ‘copying’ set the stage for selecting, adapting and improving technology (and institutions) to Japanese conditions, that in turn provided the basis for global innovation. In the case of cutlery, a small-scale industry, metal workers in the remote community of Tsubame, using cutlery samples provided to them by Tokyo wholesalers, conducted trial and error experiments on a part-time basis (Patchell & Hayter 1992; Hayter & Patchell 1993). In the case of ships, the ‘high-tech’ product of the late 19th century, vital to military and industrial power, the government was directly involved in highly focused, subsidised efforts to transfer technological know-how (Howe 1996).

As Howe (1996) notes, during the Tokugawa period of seclusion the construction of ocean-going ships was forbidden and Japan did not have the navigational abilities to cross the Pacific. In the 1840s, however, Japan began to study Western shipbuilding technology, an interest accelerated by the arrival of US ‘black ships’ in Tokyo Bay in the 1850s. To master the complex, rapidly evolving naval technology, Japan imported foreign ships, established a government-controlled shipyard, organised exhaustive demonstrations of ship performance, hired the best naval architects from around the world, obtained licences, sent workers to foreign shipyards, suggested specifications to enhance capability, and stimulated private sector involvement initially around the giant Mitsubishi zaibatsu (or financial conglomerate). The record speaks for itself. In 1867, Japan was able to muster a navy of nine foreign-built ships with a combined horsepower of 2,000 hp. By 1907, Japan had constructed a naval fleet (and merchant marine fleet) on a par with US and European technology, although still importing key components, such as engines. The horsepower was over 1 million. By 1918, Japan had mastered all aspects of shipbuilding technology, was domestically self sufficient, and a major exporter.

A key part of the story of Japan’s rise to the forefront of shipbuilding technology is the stimulation by the government of the private sector. Thus, in the period, 1883–1906, almost 75 per cent of Japan’s warships was imported, and just over 1 per cent were built in private yards (Howe 1996, p. 289). Over the next 15 years, imports provided only 7 per cent of Japan’s warships, the rest being supplied from naval yards (48%) and private yards (45%). The government had ‘targeted’ shipbuilding as a development priority, built shipyards that channelled and demonstrated learning processes, wrote efforts to learn Western technology, and
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gave accreditation to preferred shipyards. Long before Japan’s Ministry of International Trade and Industry (MITI), established in the post-1945 period the Japanese government led by the Ministry of Finance saw its role as ‘facilitator’ and ‘guidance councilor’ for private sector initiative (Johnson 1982).

In fostering industrialisation, the Japanese government supported the domination of giant firms over a large population of small and medium-sized enterprises (SMEs). Nevertheless, Japanese policy contrasted sharply with the West, where conventional economists shared Marx’s view about the inevitable demise of SMEs. Moreover, in Japan, SMEs did not simply provide a reservoir of cheap labour, as favoured by conventional interpretations of the dual model (Patchell 1992). As Fruin (1992) emphasises, SMEs played vital roles in creating specialised and cooperative social divisions of labour during Japanese industrialisation, a development he contends was an institutional response to the technological gap between Japan and the West. To ‘catch-up’ with more powerful Western firms, Japanese companies had to focus their activities more sharply and mutually share their expertise.

By 1914, Japan’s emergence as a world power, with its own colonies in Asia, was rapidly enlarged and equally rapidly destroyed during the Second World War. Japan’s economy was effectively de-industrialised. In re-industrialising, Japan’s approach closely paralleled that of the Meiji Restoration. Again the emperor was restored to help hold together the nation and channel its energies, only this time the restoration depended upon US acumen, especially that of General MacArthur, rather than samurai from Kyushu. Again, Japan opted for a ‘Listian’ model of development based on economic nationalism rather than the ‘Anglo-saxon’ model of economic liberalism. While the latter favoured priority on Japan’s low-wage comparative advantage in textiles, the former encouraged policy emphasis on the progressive development of the main and leading edge technologies in consumer and producer goods (Okimoto 1989). The creation and ascendancy of MITI reflected this choice, albeit not without debate (Johnson 1982). Again, industrialisation was realised through the relentless pursuit of ‘reverse engineering’ with Japanese control tightly protected by tariff barriers and constraints on inward DFI.

In two or three decades, Japan became a global economic giant.

In the electronics sector, Gregory (1986, p. 421) notes that mass merchandisers in the United States, and eventually Europe, provided the major impetus for Japanese firms to launch into global markets. Thus ‘Sears, Roebuck, J.C. Penny, Montgomery Ward and other leading chain stores in the United States placed massive contracts with Japanese makers supplying designs, specifications and quality control . . . Only Sony insisted on selling its products under its own trademark in overseas markets at the outset’. In the late 1960s mass merchandisers in the US (and Europe) shifted their purchases to Hong Kong when assemblers trimmed costs below that of Japanese manufacturers, using Japanese components. Hong Kong then became the world’s largest producer of transistor radios. Initially, Hong Kong assembled transistor radios aimed at United Kingdom and other Commonwealth country markets, facilitated by the system of Imperial Preference. The first transistor radios assembled in Hong Kong, by Champaign Engineering (later renamed Atlas Electronics) were under subcontractor arrangements with Tokyo Tsushin Kogyo KK (later renamed Sony Corporation). ‘Hong Kong entrepreneurs were quick to “reverse engineer” the latest Japanese radio models and produce near-replicas which were sold at prices considerably below those of Japanese makers. However, rather than attempt to inhibit this process, Japanese radio manufacturers, also producers of important components, generally rode with what they came to accept as the natural course of events’ (Gregory 1986, pp. 422–423).

During the 1980s and 1990s, as Japanese DFI proliferated around the world in the wake of Japanese exports, Japanese firms have become the teachers rather than the students. In this regard, the interpretation of Japanese industrialisation as a minor variation of ‘regulation theory’ (Peck & Miyamachi 1994) and not especially significant in economic geography’s ‘cultural turn’ (Sayer 1997, p. 22) misses the point. Japanese industrialisation is of global significance as a model of learning and innovation (Asanuma 1989; Fruin 1992; Freeman 1987, 1988; Kenney & Florida 1993; Patchell 1993a, 1993b). There is extensive documentation of the distinctive, deeply embedded features of
Japanese industrialisation. There is particular recognition of the uniqueness of Japan’s social divisions of labour, inter-firm relations (especially the co-development of principles of competition and co-operation), human relation practices within firms and factories, and the organisation of research and development (R&D) in relation to manufacturing. If the world is a classroom, the Japanese have been remarkably diligent and ultimately imaginative students, transforming lessons elsewhere into distinct Japanese practices. If economic geographers think geography matters, then the Japanese model continues to deserve serious attention. Above all, Japan is the (non-western) model of industrial learning, one that has unusual significance for Asia.

FLYING GEESE, PRODUCT CYCLES AND DEVELOPING ASIAN HOST COUNTRIES

The flying geese model was originally developed as a metaphor for domestic structural transformation as Japan evolved from student to teacher of industrialisation based on the ‘long term’ philosophy of reverse engineering that envisaged copying and reconstruction of established technology from elsewhere as a necessary step for global innovative leadership. As a metaphor of domestic sectoral transformation three characteristics of the flying geese model are worth noting. First, reference to ‘leading edge’ sectors does not mean that they were given exclusive priority in Japanese policies, public or private. Indeed, Japanese firms have vigorously sought to maintain the viability of mature industries in Japan, even if this attitude has become harder to sustain in recent years because of ‘hollowing out’ (Edgington 1997, 1999). Second, the transformations achieved by Japan during the Meiji period and after 1945 were not automatic or certain outcomes. Rather, as revealed by the post-1945 policy debate over whether development priority should exploit established low-cost industries or progressively promote more sophisticated and value-added production, there was much controversy in the way that public policy towards manufacturing evolved (Johnson 1982).

Third, in the original model, the flying geese are domestic, as reverse engineering relegates DFI from abroad to a demonstration or partnership role, and then only on a temporary basis. Even when Japan enlisted the help of powerful foreign MNCs, for example, German chemical firms in the 1930s or European auto firms in the 1950s, the arrangements took the form of joint ventures that were temporary, or at least terminated after a few years. In the electronics industry, Japanese firms absorbed overseas technology through licences and OEM (original equipment manufacturing) arrangements when exporting (Ozawa 1974; Gregory 1986). In Japanese thinking (comparable to many Western countries), at least in the early stages of development, industrial leadership and foreign control were incompatible.

When the flying geese metaphor was itself transformed as a framework for Japanese DFI, Japan’s history of technological independence and self-interest implied the suspension of that belief for other countries. Thus, in the translation of the flying geese model to an Asian context Japanese DFI, rather than indigenous firms, have been anticipated to play a pivotal role in the dynamic shift of industries from one country to another (Chen 1989; Yamazawa 1990). As Bernard and Ravenhill (1995) note, in the Asian context the flying geese model has become closely associated with the product cycle model of international investment, which in its original formation predicts the relocation of ‘mature’ products to low wage regions (Vernon 1966). The idea that the flying geese (here the Japanese MNCs investing overseas) can change factor endowments in (Asian) host countries implies that technological capability is transferred back along the product cycle model. That is, the flying geese model predicts a staged sequence of expansion for any industry, beginning with mature products, from Japan to the NIEs (newly industrialising economies), followed by ASEAN, China, Vietnam and India. Indeed, through the transfer of know-how via Japanese FDI, the model raises the possibility that the technology gap between Japan and Asia might be narrowed (but not closed).

In political economy terms, the flying geese framework predicts (‘promises’) that host countries will achieve progressively improving levels of technological capability by moving back along the product life cycle and is predicated on a changing bargain between Japanese MNCs over time. An assessment of the dynamics of this
bargain and the promise of technological catch-up through DFI can be illustrated by the ‘reverse product life-cycle’ model shown in Figure 1, based on Hobday’s (1995b) studies of ‘latecomer country’ development in Asia. It provides a simple, stylised framework for assessing the nature, direction and determinants of the impact of Japanese DFI and learning on Asian countries. Its purpose is to locate the case-study material presented in sections 4 and 5, and to generate further questions for analysis.

As a template, the model suggests that in the ‘mature stage’ (Stage I in Figure 1), Japanese MNCs are looking for cheap labour locations overseas, while developing (Asian) host economies are themselves looking for investment and exports. In this initial stage the establishment of mass production and assembly operations requires workers to learn simple skills and ‘factory culture’ under tight supervisory control. While MNCs have a bargaining advantage rooted in location options, the motivations of these two main parties are generally congruent.

In the innovation, or fast growth stage (Stage II in Figure 1), production depends upon a greater level of skilled workers with ‘enterprise specific skills’ (ESS) and local suppliers that provide ‘relation specific skills’ (RSS). For Kioke and Inoke (1990), ESSs are created when workers add to productivity improvements through ‘depth’ and ‘width’ of experience as they learn to solve both routine problem and more significant changes that occur on the shop floor. Figure 1. The reverse product cycle model and the transfer of technological capability.
floor (see Patchell & Hayter 1995). For many observers, supply relations are at the heart of the competitive advantage of Japanese production systems (Asanuma 1989; Patchell 1993a). Consequently, the RSS defines the technological bonding between core firms and their suppliers as they organise stable exchanges of technological know-how in a way that promotes innovation in a mutually beneficial way. In this stage, there is still strong overlap in the motivations of (Japanese) MNCs and (Asian) hosts, although the former is likely to face increasing concerns in donor economies (Japan) over the ‘export of jobs’. The development of worker skills and supply systems in host economies is also more complicated.

In the more advanced R&D stage (Stage III in Figure 1), the transfer of expertise to host economies is highly problematical. In this stage, the need for a highly educated workforce and sophisticated external economies within host countries has to be related to the threats such transfers pose to the core competitive advantages of MNCs. Thus, the motivations of MNCs and host economies in transferring technology are in direct conflict to some extent, and any such transfers are likely to be carefully controlled, if not entirely prohibited. That is, its movement back along the product cycle becomes more difficult as local skills requirements increase for both individual workers and supply systems (i.e. the lessons become harder), while the motivations between MNC and host country (regarding the transfer of technology) are increasingly in conflict.

The reverse product cycle model and its implications for technology transfer between MNCs and host economies can be further elaborated by reference to Ernst’s (1997) indicators of the ways in which know-how is potentially transferred from Japanese firms’ headquarters to their Asian subsidiaries. Thus Ernst’s (five) indicators are: increases in value-added production (from low to high); the training of local personnel (simple or comprehensive); the localisation of management (degree of localisation); the localisation of innovation capacity – involving design and development capacity (present or absent); and R&D capability (present or absent). Adding value, training, product design and R&D strongly suggest contributions of one kind or another to the ESS while investment in local management also implies greater likelihood of subsidiaries undertaking initiatives and solving problems. Ernst’s indicators do not reflect the RSS although he admits the significance of non-Japanese subcontractors for local development. The ESS and RSS, however, are difficult to measure and Ernst’s indicators help crudely identify a broad-scale chronology of Japanese DFI in Asia in relation to technology transfer (Table 1). To Ernst’s indicators we have added an indicator, namely the technology transfer from Japanese MNCs’ subsidiaries in Asia to local (non-Japanese) supply firms. We also consider the impact of the ‘hollowing out’ of industry through DFI on Japan.

Three broad stages in the changing bargain between Japanese DFI and Asian host countries can be identified. From the 1960s to about 1984, notwithstanding a few export-oriented investments, Japanese DFI in Asia emphasised investments in import substitution factories oriented towards local markets, especially Southeast countries, such as South Korea and Taiwan. Malaysia, Singapore and Hong Kong also became important destinations (Edgington 1993). The endaka (yen appreciation) of 1985 stimulated a second period of Japanese DFI in Asia, especially Southeast countries such as Thailand, Indonesia and the Philippines, to serve global export markets. A more volatile period (Stage II in Table 1) commenced in 1993 after a second major endaka, and was greatly complicated by the Asian currency crisis of 1997/98 that triggered an intensive rethinking by Japanese MNCs of their operations throughout Asia (Edgington & Hayter 2001a). This crisis also marked a time when the technology transfer implications of DFI became problematical because of the ‘hollowing out’ of industry in Japan (Edgington 1997). In this period, China has become the overwhelmingly dominant host country, while other very low wage countries, such as Vietnam and India, also began to receive some investments.

The remainder of this paper reveals how the stylised learning processes portrayed in Figure 1 and Table 1 have varied considerably among Asian host countries.

JAPANESE FLYING GEESE IN ASIA I:
NORTHEAST ASIAN CASE STUDIES

Analysis of Japanese electronics DFI in the Pacific Asia region by Edgington and Hayter (2000)
Table 1. Stages of Japanese MNC activity in Pacific Asia: impacts upon technology transfer and ‘hollowing out’ in Japan.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Technology Transfer</th>
<th>Impact upon ‘hollowing out in Japan’</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: 1960–85 (import-substitution oriented factories)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>II: 1985–93 (export-platform oriented factories)</td>
<td></td>
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</tbody>
</table>

1. Technology transfer
(a) Technology transfer from HQ to Asian subsidiary

<table>
<thead>
<tr>
<th>Feature</th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
</tr>
</thead>
<tbody>
<tr>
<td>value-added nature of production</td>
<td>Low value-added</td>
<td>More value-added</td>
<td>More value-added</td>
</tr>
<tr>
<td>training of local personnel</td>
<td>Simple</td>
<td>More comprehensive; increasing technical skills</td>
<td>Comprehensive, increasing technical skills</td>
</tr>
<tr>
<td>localisation of management</td>
<td>Joint ventures, but little localisation</td>
<td>100% Japanese equity and little localisation</td>
<td>Some localisation (e.g. use of Regional HQs and IPOs)</td>
</tr>
<tr>
<td>localisation of innovation</td>
<td>Absent</td>
<td>Commencement of local design and development centres</td>
<td>Increasing use of local design and development certain locations</td>
</tr>
<tr>
<td>local R&amp;D capability</td>
<td>Absent</td>
<td>Largely absent</td>
<td>Commencement of local R&amp;D centres in certain locations</td>
</tr>
</tbody>
</table>

(b) Technology transfer from Asian subsidiary to local Non-Japanese firms

<table>
<thead>
<tr>
<th>Feature</th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint ventures, but little localisation</td>
<td>Increasing use of local Japanese suppliers</td>
<td>Increasing use of Pan-Asian supply management, and OEM arrangements with Asian NIEs</td>
<td></td>
</tr>
</tbody>
</table>

2. Impact upon ‘hollowing out in Japan’

<table>
<thead>
<tr>
<th>Feature</th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little impact, except in textiles and ‘smoke-stack’ industries</td>
<td>Increasing shift of production to Asia; higher emphasis on added-value production in Japan</td>
<td>Many Japanese factories begin to specialise in production for domestic market only</td>
<td></td>
</tr>
</tbody>
</table>
showed that northeast Asian countries comprised the very first wave of Japanese flying geese (here the major electronics MNCs) during the 1960s. Japanese firms, such as Sharp, Sanyo and Hitachi, arrived in Hong Kong, Taiwan and South Korea searching for cheap labour and access to local markets. For these Northeast Asian NIES, Hobday’s (1994a, 1995a) accounts indicate that Japanese firms provided all the forms of industrial learning presented earlier in Table 1 for period I. During the start-up phase (Stage I of the reverse product cycle model in Figure 1) Japanese firms acted as exemplars for local firms and helped initiate the very first electronics’ ventures and export industries. As part of joint venture arrangements, they began training local engineers and technicians, transferring valuable foreign technical and management skills. However, in general, local firms in these countries retained control and provided the major contributions to host country growth, investments and employment in this sector. What Hobday (1995b) calls ‘latecomer’ firms imitated Japan’s own historical experience, as outlined earlier in the paper. They graduated from their joint ventures with Japanese MNCs by assimilating part of the latter’s technological know-how, and gaining access to export markets. This was done by strategies such as licensing and OEM arrangements as local firms in Northeast Asia upgraded their electronics capabilities and narrowed (but not truly catching-up with) the technological gap between themselves and the Japanese electronic sector leaders. By the end of the 1990s, large-scale South Korean firms (the chaebol) achieved world class technological capabilities in semiconductor memories as well as colour TVs, camcorders and CD players. In Taiwan, small and medium-sized enterprises emerged to become the largest exporters of printed circuit boards for personal computers (PCs) and major suppliers of colour monitors, finished PCs, fax machines and calculators (Hobday 1995b). Hong Kong’s development was different. While it achieved significant export success in fax machines, digital watches, cordless telephones and workstations, it lost much of its industrial capacity in the 1980s as local firms relocated to China and as MNC factories left the territory (Berger & Lester 1997). Hong Kong will not be examined further here.

South Korea – The example of how Samsung Electronics Corporation (SEC), South Korea’s largest electronic producer, entered the sector under joint venture and OEM arrangements with Japanese firms is an illustrative case (see Hobday 1995a, 1997; Kim 2000). The founder of Samsung, Lee Byung Chull, was educated in Japan during the Korean colonial period (1910–1945) and established fortuitous contacts with Japanese firms after 1945. Kim (2000) notes that Samsung had considered cooperation with American firms, but due to the language difficulties inherent in using American technology it established ties with Japan’s Sanyo and NEC in a bargain tied to their entry into the South Korean market. Table 2 shows the joint venture arrangements between Samsung (and South Korean firms Goldstar and Anam) and Japanese electronics firms in the 1960s and early 1970s. Hobday (1995a) observes that Japanese companies in this early period were more likely to use joint ventures than US firms in Asia, both to gain entry into local markets and to contract manufacturers for overseas exports. US firms, however, created wholly owned branch plants in South Korea for low cost semiconductor exports back to the US market. Moreover, these US firms imparted little technological know-how as they imported most of their raw materials and components. By contrast, Samsung sent 106 employees to Sanyo and NEC for training in the manufacture of radios, colour televisions and simple electronic components. Under its joint ventures with Sanyo, NEC and Sumitomo, SEC was able to absorb foreign technology in a variety of consumer goods and components. Importantly for the purposes of this paper’s argument, all of these joint ventures were under Samsung’s management control, allowing it to develop eventually as a vertically integrated assembler and parts manufacturer of a wide array of electronic products (radios, television sets, telecommunications and semiconductors).

In the 1970s the South Korean government intervened to restrict further DFI per se by withdrawing lucrative tax benefits for Japanese (and US) investors while allowing tie-ups between domestic and foreign firms. Japanese (and most) MNCs subsequently retreated from the South Korean market due both to government policy as well as rising wage costs. Indeed, until
after the 1997 Asian financial crisis, South Korea remained virtually closed to DFI in electronics. Japanese MNCs, however, continued to maintain important links with South Korean electronics companies. Licensing arrangements in particular persisted, as these became the only way for Japanese MNCs to access South Korean markets and an important means by which South Korean firms obtained foreign technology. Japanese MNCs appear to have dominated these licensing arrangements. Moreover, as wages rose in Japan, Samsung, and other South Korean chaebol such as Goldstar, offered alternative locations for large-scale, low-cost standardised goods under OEM arrangements. It was not straightforward for Samsung and other local firms to extend their know-how beyond simple assembly under OEM and licensing arrangements with Japanese (and also US) electronics companies. Indeed, Hobday (1995a, p. 67) comments that ‘OEM was a harsh industrial training school for South Korean firms who learned their skills from Japanese and American MNCs. Invariably they had to provide the highest quality at the lowest prices’. Gradually, local firms grew in competence, and OEM buyers from Japan (and elsewhere) provided South Korean firms with product designs, staff training in quality controls, and engineering support, though not through DFI directly. This strategy allowed Samsung, and other electronic majors such as Goldstar and Daewoo Electronics, to concentrate on increasing their manufacturing capabilities through intensive training of employees, particularly shop-level technicians, mirroring Japanese OEM relations with US firms in previous decades (Kim 2000).

During the 1980s, South Korean firms gained rudimentary R&D expertise to reverse engineer products and learn how to impose processes, equivalent to Stage II of the reverse product cycle (Figure 1). However, once South Korean firms’ learning reached advanced levels then further access to Japanese technology depended upon expensive licensing agreements and purchases of key components. Hobday (1995b, p. 63) notes that the South Korean integrated circuit industry imported nearly 75 per cent of all materials and equipment needed for production during the 1980s and that royalties often comprised 10 per cent of corporate sales. Goldstar, for instance, licensed 4 and 16 megabit DRAMS from Hitachi. Korean firms also remained largely dependent upon Japanese (as well as US) firms for key components, capital and materials through their OEM and licensing agreements.

During the next period (following the endaka in 1985) Samsung and other South Korean firms took important steps to move closer to the technology frontier (Stage III in Figure 1) by setting up their own research institutes, both at home and overseas, including Silicon Valley in the United States. Decades previously, to compensate for private sector deficiencies, the government had funded applied R&D initiatives.
Thus the Korea Institute for Science and Technology (KIST) was set up in 1966 to help absorb and adapt foreign technologies. The Ministry of Science and Technology also invested in training and vocational programmes (Hobday 1995b). By around 1990, private sector R&D had become significant in South Korea and allowed firms to enter joint-technology developments with Japanese companies in a broad range of products, such as telecommunications, computers and semiconductors (Hobday 1995a, p. 70). In addition, South Korean firms acquired overseas technology-intensive firms (such as Samsung’s 51 per cent control of Japan’s hi-fi audio maker LUX in 1994) and followed Japanese companies into Southeast Asia. Indeed, Samsung’s component producing subsidiaries in Thailand and Malaysia supplied more than 80 per cent of their output to Japanese companies during the last decade (Kim 2000). In the 1990s, Samsung also established joint ventures with Chinese partners as a prerequisite to its market entry into the PRC. According to Kim (2000, p. 162): ‘Its joint ventures [in China] are thus the mirror of those it established in Korea in the 1970s with Japanese partners, trading production know-how for market success – only now the know-how is Samsung’s’. Even if they remain more heavily dependent upon foreign sources of technology and market channels than equivalent Japanese companies (Hobday 1995a, 1997), South Korean firms such as Samsung have moved a considerable distance back along the product life cycle. Taiwanese firms have enjoyed similar, perhaps greater success.

Taiwan – As with South Korea, aided by prior colonial links (1895–1945), Japanese MNCs and their investments were important in the initial development of an electronics industry in Taiwan, beginning in 1963 when Sanyo formed a joint venture with a Taiwanese importer to serve the domestic market. This company was one of the first in Taiwan to produce white goods such as air conditioning products, audio electronics, and then later on TV sets and VCRs and in 1970 it began exporting to the United States and other global markets (Hobday 1995a, p. 104). Hitachi, Matsushita, Mitsubishi, Sharp and Toshiba were among other Japanese MNCs that invested in Taiwan’s electronics sector in the 1960s, many as part of joint ventures with local companies. Japanese MNCs were also active in licencing technology to Taiwanese firms. In total, Dodwell Marketing Consultants (1974) recorded 14 cases of 100 per cent Japanese equity holding, 36 joint ventures and 38 cases of technology licensing. A selection of Japanese joint venture and licensing arrangements in Taiwan as of 1974 is shown in Table 3.

In addition to the Japanese MNCs, Philips of Holland and several US-based MNCs, including RCA, became significant players in Taiwan’s electronics sector in this early period, in Philips’ case since 1961. As in South Korea, Japanese firms initially focused on Taiwan’s domestic market and then began to export whereas the United States exported at start-up and subsequently also served local markets. The United States also had a stronger preference for 100 per cent equity control of their subsidiaries in Taiwan while Japanese MNCs were more willing to enter into joint ventures, if not to the same degree as they did in South Korea, possibly because of the smaller size of Taiwanese firms (Ernst 2000a, 2000b). In Taiwan, in contrast to South Korea, government policy ensured that virtually equal treatment was granted to domestic and Japanese MNCs. Indeed, in Taiwan there was considerable competition among firms and some MNCs, notably RCA, were casualties. Yet, Taiwanese firms, small and large, were not ‘crowded out’, an effect that occurred in Southeast Asian countries such as Singapore or Malaysia (see Lim & Pang 1991). Rather, the opposite occurred. As Hobday (1995a, p. 112) notes: ‘Japanese corporations acted as pacing horses for (Taiwanese) firms. They stimulated competition in consumer electronics and white goods, and helped to create a thriving network of local suppliers of parts and services’. Indeed, he claims that Taiwanese entrepreneurs ‘eventually [made] the TNCs dependent on their manufacturing skills and their highly productive engineering talent. Hundreds of local companies learned to innovate by clustering around the TNCs’ (Hobday 1995a, p. 109). Further, out of these ‘hundreds’ of small firms, larger, innovative ‘latecomer firms’, such as Acer and Tatung, emerged in Taiwan, to help solidify dense domestic inter-firm networks within Taiwan’s electronic industry (Henderson 1997). As a result of rising wages, Sanyo and other Japanese MNCs ceased to expand in Taiwan.
<table>
<thead>
<tr>
<th>Japanese company</th>
<th>Taiwanese partner</th>
<th>Operations (date ‘Established’/period of contract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hitachi (61.5%)</td>
<td>Taiwan Hitachi</td>
<td>Manufacturing of air conditioners for local Market (1964)</td>
</tr>
<tr>
<td>Hitachi (20.0%)</td>
<td>Yung Tay Engineering</td>
<td>Manufacture of lifts and escalators for local Market (1968)</td>
</tr>
<tr>
<td>Matsushita Electric</td>
<td>Taimatsu Industrial</td>
<td>Assembly of radios and record players parts from Matsushita (1966)</td>
</tr>
<tr>
<td>Mitsubishi Electric</td>
<td>China Electric</td>
<td>Manufacture of fluorescent lamps (technical assistance from Mitsubishi Electric) (1962)</td>
</tr>
<tr>
<td>Mitsubishi Electric</td>
<td>China Ryoden</td>
<td>Installation of lifts (1968)</td>
</tr>
<tr>
<td>Oki Electric Industry</td>
<td>Fareastern Electric Industry</td>
<td>Manufacturing of telephone sets and switching systems (1958)</td>
</tr>
<tr>
<td>Sharp (11.0%)</td>
<td>Sanpo Corporation</td>
<td>Manufacturing of household appliances with Sharp’s brand for local market (1971)</td>
</tr>
<tr>
<td>Toshiba (12.5%)</td>
<td>Tatung</td>
<td>Manufacturing of electric equipment e.g. fans and refrigerators (1961)</td>
</tr>
</tbody>
</table>

**B. Technology licencing arrangements**

<table>
<thead>
<tr>
<th>Japanese company</th>
<th>Taiwanese partner</th>
<th>Technology licencing arrangements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuji Electric</td>
<td>Chan Shing Electric</td>
<td>Technology for electronic transformers (1970)</td>
</tr>
<tr>
<td>Hitachi</td>
<td>New Asia Electric</td>
<td>Technology for fluorescent lights (1970–75)</td>
</tr>
<tr>
<td>Hitachi</td>
<td>Prince Electronic</td>
<td>Technology for colour TV set transistors (1970–75)</td>
</tr>
<tr>
<td>Hitachi</td>
<td>Taigene Electric Machinery</td>
<td>Technology for automobile engines (1970)</td>
</tr>
<tr>
<td>Mitsubishi Electric</td>
<td>Shihlin Electric and Engineering</td>
<td>Technology for transformers and other electronic parts (1962–74)</td>
</tr>
<tr>
<td>Mitsubishi Electric</td>
<td>Chung Hsin Electric and Machinery</td>
<td>Technology for colour TV sets (1970–80)</td>
</tr>
<tr>
<td>Sharp Corporation</td>
<td>Sanpo Corporation</td>
<td>Technical assistance for refrigerator factory (1968–78)</td>
</tr>
<tr>
<td>Toshiba</td>
<td>Tatung</td>
<td>Use of Toshiba’s patent on wattmeter (1954)</td>
</tr>
<tr>
<td>Toshiba</td>
<td>Tatung</td>
<td>Use of Toshiba’s patent on magnets (1964–74)</td>
</tr>
<tr>
<td>Toshiba</td>
<td>Tatung</td>
<td>Use of Toshiba’s patent on electric refrigerators (1964–74)</td>
</tr>
<tr>
<td>Toshiba</td>
<td>Tatung</td>
<td>Use of Toshiba’s patent on electric Motors (1969–74)</td>
</tr>
<tr>
<td>Toshiba</td>
<td>Tatung</td>
<td>Use of Toshiba’s patent on colour TV sets (1969–79)</td>
</tr>
</tbody>
</table>

*Source: adapted from Dodwell Marketing Consultants (1974).*
itself after the late-1970s. Still, Taiwanese firms continued to develop, free from dependence on Japanese DFI, by joining in international subcontracting arrangements (OEMs), mainly with US retail firms, but also with the giant Japanese sogo shosha (trading companies). Technology was also acquired by Taiwanese firms following the original Japanese template, that is by copying, reverse engineering, foreign licencing, rigorous local training combined with overseas education. Japanese MNCs, therefore, had a significant impact on the development of consumer electronics in Taiwan during the 1970s, especially by offering tacit knowledge embodied in human capital and the start of new firms. Taiwanese firms such as Tatung sent engineers to Japan for training and became a source of technology and entrepreneurs in Taiwan, in part attracted by government incentives and the lure of high rewards.

In the 1970s Taiwanese electronics exports were confined largely to parts and components. But these evolved gradually into more added-value products and Stage II (Figure 1) operations, such as customisation, product design, and production technology (Ernst, 2000b). The rise of the Japanese yen in 1985 further increased Japanese MNC purchases of Taiwanese-made keyboards, TV monitors, printed circuit boards and printers, even as Japanese electronics firms shifted their own (post-endaka) assembly plants into Southeast Asian countries. A few companies, such as Acer and Tatung, had also invested in R&D by the end of the 1990s while the government’s main technology institute, The Industrial and Technological Research Institute (ITRI), had spun-off successful exporting firms (Wade 1990). Admittedly, Ernst (2000b) and Hobday (1995a, 1997) noted difficulties for Taiwanese firms wishing to move into the technology intensive Stage III (Figure 1), mainly because of a lack of capital for R&D.

Yet, the reverse product cycle model expects increased difficulty as firms seek more sophisticated technological capability and notwithstanding such difficulties Taiwanese firms (and South Korean firms) have moved substantially down this road. A crude indicator of this movement is provided by US patent data. Thus, with respect to all patents granted by the United States, in 1988 Taiwanese inventors accounted for just 0.59 per cent in 1988 but this share has steadily grown reaching 3.23 per cent in 2001. For the same period, South Korea’s share grew from 0.12 per cent to 2.13 per cent (Figures calculated from US Patent and Trademark Office 2002). Specifically with respect to electronic goods, Taiwan’s share of US patents increased from 3.95 per cent in 1997 to 7.96 per cent in 2001 while South Korea’s share remained steady (4.56 per cent and 4.36 per cent) in the same period (Table 4).

Indeed, in 2001 Taiwan accounted for 18.73 per cent of the foreign patents in electronics products patented in the US. Korea’s share amounts 10.23 per cent and, on this basis, both countries, but especially Taiwan, can claim to be global contributors to innovation in electronics. Ernst (2001), using patent data for the early 1990s, has noted that the increasingly superior patenting record of Taiwanese over South Korean firms relates to excessive corporate concentration, specifically domination of just four chaebol firms in South Korea and problems with their innovation management. He notes: ‘the organization of innovation within these firms follows an outdated centralized R&D model, in contrast to the progressive decentralization of R&D typical today for Japanese, US and European firms’ (Ernst 2001, p. 151). Interestingly, Taiwan’s insistence on a strong role for the social division of labour echoes the Japanese domestic model of industrialisation.

Malaysia, meanwhile, has remained a virtual non-player in US patent activity.

**JAPANESE FLYING GEESE IN ASIA II: SOUTHEAST ASIA**

As with South Korea and Taiwan, Southeast Asia’s electronics industry has been among the largest overall contributor to export growth over the past 15 years (Hobday 1995a, p. 20) and Japanese MNCs have been attracted to the region’s lower labour costs and markets (Lim & Pang 1991; Ernst 2000b). However, unlike Northeast Asia, local firms have so far made few contributions to the electronics industry. As noted by Hobday (2001, p. 23), Malaysia and Thailand in particular present a radical contrast to both South Korea and Taiwan. Together with Singapore, they have followed a markedly successful strategy of attracting MNCs into export-led consumer and industrial electronics sectors.
which has resulted in a steady, impressive performance in the accumulation of technology within MNC subsidiaries. Conversely, countries such as Singapore, Malaysia and Thailand have lacked the domestic entrepreneurs found in abundance in South Korea and Taiwan. Evidence from Singapore (Hobday 1994b) and Malaysia (see following section) indicates that learning has occurred along the reverse product cycle model (Figure 1). However, this learning has taken place within Japanese (and other MNCs), rather than more broadly across Malaysia (Guyton 1994; Narayanan & Lai 1994; Rasiah 1995, 2002; Ariffin & Bell 1999; Jomo et al. 1999). Next to Singapore, Japanese DFI has had the most impact in Malaysia among Pacific Asian countries in relation to employment and exports (Lim & Pang 1991). In addition, in the early 1980s Prime Minister Mahatir Mohamad of Malaysia set up a ‘Look East’ policy that hoped to ‘learn from Japan’ (Jomo 1994), an initiative the following discussion addresses on the basis of secondary sources and the authors’ 1999 survey of 20 Japanese electronics MNCs (Edgington & Hayter 2001b).

**Malaysia** – The first generation of Japanese electronics DFI took place in Malaysia during the 1960s. This inflow was based on traditional import substitution objectives in the face of high Malaysian tariffs on imported consumer items such as televisions and refrigerators (Lim & Ping 1983, 1991). Japanese MNCs, such as Sony and Matsushita, set up joint venture subsidiaries at that time with only medium-scale capacity to produce consumer electronics for local markets. In the 1970s, Japanese MNCs also established parts and components companies. In addition, export-oriented integrated circuit assembly by companies such as Hitachi and NEC (Piei 1990) then grew rapidly. However, in contrast to South Korea and Taiwan, studies conducted in Malaysia in this early period (Period 1 in Table 1) typically reported few

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**Table 4. Patents awarded in the US electronics’ industries by country of origin.**

<table>
<thead>
<tr>
<th>Source countries</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>1,397</td>
<td>7,070</td>
<td>7,878</td>
<td>8,461</td>
<td>9,322</td>
<td>37,128</td>
</tr>
<tr>
<td>Japan</td>
<td>1,887</td>
<td>2,571</td>
<td>2,768</td>
<td>2,662</td>
<td>3,009</td>
<td>12,897</td>
</tr>
<tr>
<td>South Korea</td>
<td>353</td>
<td>569</td>
<td>685</td>
<td>665</td>
<td>707</td>
<td>2,979</td>
</tr>
<tr>
<td>Taiwan</td>
<td>306</td>
<td>461</td>
<td>704</td>
<td>1,045</td>
<td>1,290</td>
<td>3,806</td>
</tr>
<tr>
<td>– share of foreign patents</td>
<td>9.15%</td>
<td>9.61%</td>
<td>12.73%</td>
<td>17.71%</td>
<td>18.73%</td>
<td>14.39%</td>
</tr>
<tr>
<td>– share of total patents</td>
<td>3.95%</td>
<td>3.89%</td>
<td>5.25%</td>
<td>7.28%</td>
<td>7.96%</td>
<td>5.99%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Singapore</td>
<td>35</td>
<td>27</td>
<td>34</td>
<td>73</td>
<td>112</td>
<td>281</td>
</tr>
<tr>
<td>China, Hong Kong S.A.R.</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>11</td>
<td>12</td>
<td>38</td>
</tr>
<tr>
<td>CHINA P.R.</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Total foreign</td>
<td>3,343</td>
<td>4,795</td>
<td>5,529</td>
<td>5,899</td>
<td>6,886</td>
<td>26,452</td>
</tr>
<tr>
<td>Total</td>
<td>7,740</td>
<td>11,865</td>
<td>13,407</td>
<td>14,360</td>
<td>16,208</td>
<td>63,580</td>
</tr>
</tbody>
</table>

**Note:** The electronics industries are defined by the following selected classifications: Class 062, Refrigeration; Class 136, Batteries: Thermoelectric and Photovoltaic; Class 219, Electric Heating; Class 348, Television; Class 438, Semiconductor Device Manufacturing: Process; Class 438, Semiconductor Device Manufacturing: Process; Class 702, DP: Measuring, Calibrating, or Testing (Data Processing); Class 707, DP: Database and File Management, Data Structures, Or Document Processing (Data Processing); Class 708, Arithmetic Processing and Calculating (Electrical Computers); Class 709, Multiple Computer or Process Coordinating (Electrical Computers and Digital Processing Systems); Class 710, Input/Output (Electrical Computers and Digital Processing Systems); Class 711, Memory (Electrical Computers and Digital Processing Systems); Class 712, Processing Architectures and Instruction Processing, e.g., Processors (Electrical Computers and Digital Processing Systems); Class 713, Support (Electrical Computers and Digital Processing Systems); Class 716, DP: Design and Analysis of Circuit or Semiconductor Mask (Data Processing)

**Source:** US Patent and Trademark Office 2002.
linkages with local subcontractors, few examples of local design and development activities, and limited promotion and autonomy for Malay staff or engineers (Fong 1990; Onn 1990; Aoki 1992). Joint venture partners were typically of the ‘ali baba’ kind, a cynical reference to Malaysian ‘sleeping partners’ in politically arranged joint operations who showed no interest in unlocking the secrets of Japanese technology through reverse engineering. Despite attempts by the Malaysian government to bargain for better joint venture deals, head offices in Japan used and controlled their Malaysian joint ventures as branch plants (Piei 1990). The small scale of the local market, together with the lack of suitable supply companies in Malaysia also resulted in minimal development of Japanese assembly factories in this early period (Piei 1990; Anazawa 1994).

Following the rise of the yen in 1985 a ‘new wave’ of large-scale assembly production took place aimed at overseas exports markets, especially involving colour television and video cassette recorder (VCR) production. These occurred in the states of Penang, Selangor (the Klang Valley) and Johor Bahru (Ikuta 1997; Edgington & Hayter 2000). At the same time, changes in Malaysian investment promotion attracted further inward DFI, creating a ‘bandwagon’ effect among Japan’s electronic companies (Anazawa 1994). By 1987, due mainly to Japanese (and US) assembly plants, Malaysia had become one of the world’s largest exporters of semiconductors and third largest producer of VCRs after Japan and the United States. The local factories of Matsushita Electronics Industries Corporation alone were estimated in the early 1990s to account for around four per cent of Malaysia’s GDP (The Economist 1993).

During the late 1980s and early 1990s, without a pool of appropriate indigenous firms, Japanese small- and medium-scale suppliers increased their DFI into Malaysia, aiming to manufacture components (e.g. hi-fi speakers and motors) for local assemblers as well as for export. Moreover, a general move to higher levels of investment and sophistication in the industry led to increased levels of localisation in terms of design engineering capacity, but strictly within Japanese-controlled assembly firms. For instance, the Matsushita Air-conditioning Group (MACG) in Malaysia made much progress in localising its activities. From its initial set-up as a production base for products designed in Japan, MACG used its facilities as a base for local product design development of air conditioners exported to the United States, China and Japan (Craig 1997). During the same time, the Malaysian government under its Sixth Malaysia Plan (1991–95) began to follow the policies of nearby Singapore and encouraged MNCs to shift their operations from labour-intensive DFI to more technology-intensive industries. Eventually, Japanese MNCs started to commit themselves to the higher value-added production that the Malaysian government sought. By way of illustration, Fuji Electric makes computer disk substrates for the hard disk drive industry and Sharp Corporation is assembling sophisticated consumer products such as camcorders. Certain companies, such as Hitachi and Matsushita Electronic Industries, have added R&D centres focusing on product design adaptations for Asian markets. However, with respect to the localisation of management or suppliers there has been little progression. Thus, at the end of the 1990s, component inputs tended to involve either keiretsu (in-house) links with a new generation of Japanese parts supply companies, or the local operations of South Korean and Taiwanese MNCs, rather than local Malaysian firms (authors’ interviews, 1999; Guyton 1995; Capanenelli 1998; Linden 2000).

From the early 1990s, however, some indigenous Malaysian components’ makers began to respond generally to the growing number of Japanese assembly investments, especially in the electronic sector (Aoki 1992). A more recent survey of local procurement behaviour by Japanese firms (Ling & Young 1997) suggested that critical changes were made following the ‘second endaka’ of 1993. These involved the greater use of non-Japanese local firms who specialised in a range of generic parts, such as resistors, diodes, capacitors, transformers, power supplies, coils and filters and loudspeakers. In part, this development was due to further cost cutting by Japanese firms, but in part it is explained by the introduction of a more aggressive ‘vendor-development program’ during 1993 by the Malaysian government in order to promote Malay small and medium enterprises. Buyer firms in government-approved schemes were eligible for tax breaks in return for local
procurement. The vendors were often SMEs registered with Malaysia’s MITI (Ministry of International Trade and Industry) subcontracting network under the payang or umbrella concept, designed to build linkages between large MNCs and local SMEs. Examples of local Malaysian inputs bought by Japanese electronics firms included moulded compounds for plastic casings, silicon wafer packaging materials, solder for joints, spare parts, supportive tools, industrial chemicals, lubricants, ancillary materials and final packaging, and shipping materials (authors’ survey 1999). While these inputs were all low-to-medium value-added, Japanese firms expressed considerable interest in further domestic sourcing as more materials and components of high standard became available locally.

Jomo and Chen (1997) argue that Malaysian local content rules for export-credit incentives aimed at MNCs encouraged higher local content for assembly operations. Thus, firms such as Hitachi closely co-operated with the government’s programme for promoting domestic industries in Penang’s integrated circuit production complex by participating in the Skill Development Centre of the Penang Free Export Zone. Jomo and Chen (1997) also note that Malaysian politics, which work in favour of bumiputra (indigenous Malay) enterprises, operate against localisation and a viable local parts industry by actively discriminating against entrepreneurial Chinese-Malaysian firms. This partisan support for Malay-only businesses on ethnicity grounds reflects an overall strategy implemented since 1970 to carry out the government’s NEP (New Economic Policy) redistribution objectives, particularly those aimed at increasing the share of Malay ownership in the economy. Consequently, Ling and Yong (1997) consider that developing a network of high quality local vendors would likely take a long time.

With regard to the development of local worker skills, Smith (1994) notes that during the 1970s local Japanese managers ‘idealised’ the traditional Japanese work system, with its emphasis on firm loyalty, teamwork and dedication to work. While many Japanese MNCs introduced some aspects of Japanese workplaces, including quality control groups and kaizen (continuous improvement), other features, notably seniority principles, could not be so easily transferred to local factories. For instance, seniority principles were rejected, she argues, because Malay people believe that those workers with higher ability and motivation should advance more quickly than the group as a whole. Indeed, Smith (1994) portrays Japanese managers as ‘culturally inept’ in relating to indigenous workers as well as the overall society in Malaysia. Because of an inability to assess local staff according to strict Japanese corporate norms, human resource issues below the management level have been generally left to indigenous Malay or Chinese directors and managers. Nonetheless, formal training and ‘on-the-job’ learning increased over the period since 1985 (Stage II, Table 1) (authors’ 1999 survey).

During the mid 1990s (Stage III, Table 1) Japanese firms retained a traditional Japanese management style and control in their assembly plants, but have had to increase the facilities offered to employees to compete for increasingly scarce factory labour (e.g. gyms, rest rooms during Ramadan when Muslims fast during the day). ‘Job hopping’ by both Chinese and Malay engineers and assembly workers has undermined Japanese interest in long-term training programmes. While labour mobility appears endemic in Malaysian culture, it has declined since the Asian financial crisis of 1997. While larger companies (e.g. Hitachi) had opened locally-based training institutions for their engineers and operatives, commitment to long-term R&D by Japanese electronics firms was still lacking.

By the end of the 1990s Japanese MNCs in Malaysia had committed themselves to higher value-added production and, overall, engaged in upgrading their operations according to the schema of Table 1. But Dobson (1993) and Linden (2000) argue that Japanese firms have continually functioned in more restricted ways than US electronics firms in Malaysia (and more widely throughout Southeast Asia), with less technology spill-over effects. They especially emphasise the Japanese firms’ protracted reliance upon Japanese ex-patriot managers, Japanese-style human-resource management, and a deep-seated general aversion towards non-Japanese suppliers, especially for high technology parts and products. Moreover, Malaysia has not yet generated an array of
locally-based electronics majors. Accordingly, whether Malaysia can follow South Korea and Taiwan and travel further backward along the reverse product-life cycle (from Stage II to Stage III, Figure 1), progressively learning how to shift innovation towards the technology frontier, is uncertain. As Morris-Suzuki (1992) notes, for Southeast Asian countries, such as Malaysia, with little post-war experience in local industry, it may be difficult to derive useful lessons from the Japanese experience of technology acquisition.

CONCLUSION

This paper has critically interrogated the flying geese model of Japanese DFI as a model of industrial learning in Asia. Japanese industrialisation itself featured production systems created from a comprehensive and systematic approach to endogenous learning. When applied to Asia, however, the flying geese model anticipates that late developers will catch up with the technological capabilities of advanced countries by reliance on DFI from Japan (Figure 1 and Table 1). In the electronics sector, the technological impacts of Japanese DFI have varied. The main differences in the interactions between Japan, Northeast Asia and Southeast Asia are summarised in Figure 2.

During the 1960s, linkages with Japanese MNCs played a critical part in South Korean and Taiwanese technology absorption and export market growth. The start-up, joint venture phase (up to the early 1970s) corresponds roughly to the passive capacity stage described in the reverse product cycle model (Stage I, Figure 1). In this stage OEM, licencing and subcontracting arrangements were more important here than DFI per se and provided a different kind of ‘training school’ for South Korean and Taiwanese firms’ engineers and managers. Their firms attained economies of scale by accessing large volume international markets. Firms such as Samsung and Acer, who began as junior partners in Japanese joint ventures, moved on to licencing, once sufficient in-house technology had been acquired (roughly Stage II in Figure 1). Following endaka in 1985, the level of in-house technology took a further jump as South Korean and Taiwanese firms obtained advantage from reduced Japanese competitiveness. In the post-1993 phase, the larger firms moved to in-house R&D efforts, the purchase of overseas companies and joint partnership with Japanese MNCs themselves.

Figure 2. Major interactions between Japan and other Pacific Asia countries in the electronics industry, 1960–2000.

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Indeed, there were few opportunities for Japanese DFI to expand in Taiwan and South Korea, in contrast to Southeast Asia, but Japanese MNCs used South Korean and Taiwanese firms as sources for components at their own assembly plants in Southeast Asia, and also China. Still, the latter failed to establish sufficient R&D capabilities to enable them to compete with Japanese leaders at the technology frontier (Stage III in Figure 1) over a wide range of products. Thus both South Korea and Taiwan had a negative trade balance in electronics with Japan throughout the 1990s, usually balanced out by a trade surplus with the United States and Europe (Guerrieri 2000).

DFI by Japanese MNCs offered Southeast Asian countries an alternative route to technology acquisition and participation in international production networks. Japanese branch plants have moved back along the product cycle, but stopped short of investing in long-term R&D or focal factories (as predicted by Stage III, Figure 1). Further, as wages rose in Malaysia, China has increasingly considered a more desirable location for electronics assembly operations and parts production (Mukoyama 1994). Consequently, at the end of the 1990s it was unclear how Malaysia and other southeast Asian countries would emerge and stake out a position in the evolving regional division of labour, and how their Japanese subsidiaries would be positioned along the Pan-Asian value-added production chain.

The overall conclusion for Southeast Asian countries, therefore, is that despite the relatively ‘seamless’ promise offered by the flying geese metaphor, too much reliance on Japanese MNCs for technological transfer misreads the Japanese model of how to industrialise. This model emphasises a ‘do-it-yourself’ or reverse engineering ethic that counsels against reliance on DFI. To move further back along the product cycle, Southeast Asian countries may have to develop their own systems of innovation and forms of R&D based around Hobday’s (1995b) ideas about indigenous latecomer firms. In different ways, South Korea and Taiwan have already moved along this path. Singapore remains the region’s high-tech and financial fulcrum, and the regional headquarters of Japanese MNCs prefer to locate there. Nonetheless, little mainstream product design or R&D is carried out in this location (see Perry et al. 1997). The Malaysian government had ambitious technology-driven plans (the ‘high-tech media corridor’) drawing upon Japanese and South Korean/Taiwanese Science City models. However, much more policy assistance is needed to encourage the development of fundamental engineering skills and design-competent SMEs in order to attract higher local content and technological deepening from Japanese MNCs (Narayanan and Wah 2000). Other Southeast Asian countries (e.g. Indonesia, the Philippines and Thailand) are unlikely to develop past Stage I assembly operations due to poorly designed government policies to support local industry and their poorly educated workforces (authors’ interviews in Japan with electronic firms’ head-offices during 1998 and 1999). It could be argued that the forces of ‘globalisation’, however defined, undermine strong local initiatives. But is the global context of indigenous-based industrialisation any more or less daunting than the situation that faced the Japanese in 1868 or 1945?

In the near future, how Japanese electronics firms arrange their operations in mainland China will provide further insight into the relevance of the flying geese model for development in Asia. Japanese electronics firms began to sell in China soon after the country opened up to overseas trade and DFI in the late 1970s. In the 1980s the Chinese market was lucrative for Japanese electronics consumer and industrial products, but conditions changed in the late 1980s as the Chinese government imposed import restrictions to offset ballooning balance of trade deficits (Cheung & Wong 2000). Consequently, Japanese electronics firms were forced to engage in some kind of local operations, often in joint venture arrangements, in order to sell into the Chinese market. During the early 1990s Japanese firms, such as Matsushita, Sanyo and Sharp, set up a wide range of consumer electronics factories, but in most cases these were aimed at securing sources of low-cost labour and materials for production aimed at Japan and other global markets, rather than China itself. Indeed, compared with much larger investments by European and North American electronics companies (e.g. Nokia and Motorola), Japanese firms to date have been loathe to commit large-scale production
and distribution networks in China. This hesitancy reflects their perception of the high risk of business in China (interview with S. Amano, Assistant Director, China and North Asia Division, Overseas Research Department, Japan External Trade Organisation, Tokyo, August, 2002). However, after 2000, when China first began negotiations to enter the World Trade Organisation (WTO), many Japanese changed their strategy towards China, and planned more extensive networks there in order to localise their production and other operations. There is a perception in Japan that the once highly-regulated Chinese market will become increasingly open under stringent WTO rules. There is also awareness that because China remains socialist it will require a special type of commitment (through DFI and technology transfer) compared with other parts of Asia (Interview with Kenichi Takayasu, Senior Economist, Centre for Pacific Business Studies, The Japan Research Institute Limited, Tokyo, July 2002).

To what degree the Chinese government and local enterprises will be able to broker agreements involving technology transfer between Japanese and Chinese firms (leading to shifts in local production along the reverse product cycle model in Figure 1) remains to be seen.

Notes

1. Despite the economic recession of the 1990s, Japanese electronics companies have generated a wide array of new products, including the digital still cameras, minidisk players and flat-screen televisions (Karatsu 1999).

2. Without debating the precise boundaries of Pacific Asia, the major countries of the region conventionally comprise Japan, the four Asian newly industrialising economies (NIEs) of South Korea, Singapore, Taiwan, and Hong Kong SAR, the ASEAN countries (i.e. Association of Southeast Asian Nations, including Thailand, Malaysia, Indonesia and the Philippines), China, Laos, Myanmar, Vietnam, Cambodia and Brunei.

3. Under the original formulation by Akamatsu (1962) the flying geese are industrial sectors (textiles, steel, chemicals, cars and electronics) that pushed Japan’s industrial development to technically more sophisticated levels, inevitably relying on high levels of exports, including those to Asia. In this framework each ‘lead’ industry (and products within each industry) ‘flies’ through various stages of import, domestic production (import substitution) and export, eventually to be replaced by another lead industry (Yamazawa 1990; Kwan 1994). In this view, local technical know-how and capital goods also eventually evolve, again in accordance with flying geese principles, providing the basis for the establishment of ‘homogenous’ industries. As such this model reflects the deep commitment within Japan to a philosophy of reverse engineering and the nation’s desire to catch-up and overtake the world’s technological leaders. Subsequently, as Japan emerged as a major source of DFI in Asia, the flying geese became a metaphor for the behaviour of Japanese MNCs in the region. For its origins as a sectoral model of industrial transformation as well as creating a Pacific Asia division of labour (Yamazawa 1990; Kwan 1994; Ozawa 1999; Edgington and Hayter 2000).

4. For the purposes of this paper the term electronics industry includes consumer goods, semiconductor components, computer and telecommunications equipment and other hardware. During the 1960s, Japan emerged as the world leader in consumer electronics technology and production. In the 1970s, Japanese computer manufacturers caught up with IBM in hardware design and production. By the 1980s, the Japanese semiconductor manufacturers had established per-eminence in world markets for the most advanced microelectronics devices. Gregory (1986) notes that although rapid and sustaining technological advance was manifest in the post-war period over a wide spectrum of Japanese industries, the ascendancy of Japanese electronics technology was perhaps most far reaching in its consequences. Not the least of its effects was to give impetus to the rapid diffusion of electronic technology throughout the Pacific Asian region. The remarkable growth of electronics industries has been a prime mover of economic development (Johnstone 1998).

5. For instance, the training programme in Malaysia’s Japanese car production (Mitsubishi Motor’s ‘Proton’ joint venture plant) has been ‘large and ambitious’ (Jomo 1994, p. 286).

6. The importance of promoting links between subsidiaries of MNCs and domestic firms in developing countries has been recently reviewed by the United Nations Conference on Trade and Development (2001).
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