The In Situ Upgrading of Japanese Electronics Firms in Malaysian Industrial Clusters

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Abstract

The ability of clusters generated by direct foreign investment (DFI) in emerging economies to generate sustained, value-added growth is a matter of controversy. This article assesses this debate with reference to the role of Japanese electronics multinational corporations (MNCs) in the development of clusters in Malaysia. Conceptually, we present a typology of DFI-generated industrial clusters that represent increasing degrees of commitment to local value creation and upgrading. Empirically, we conducted a survey of 10 Japanese firms in Malaysia that examined whether or not their factories increased technological upgrading, increasingly embedded their operations through using local skilled labor and supply firms, and responded positively to national policies and cluster-governance measures supporting the electronics industry. We found that Japanese firms had clearly moved beyond simple assembly-based to embedded clustering but had not progressed further to technology-intensive behavior because of the poor technological environment in Malaysia, as well as Japanese MNCs’ strategies that depend on technology from headquarters. Nonetheless, Japanese MNCs were sufficiently embedded in Malaysia to upgrade production to digital consumer products, and semiconductor assembly has flourished, warding off competition from China and low-cost locations in the Association of Southeast Asian Nations. At the end of the study period, Malaysia remained an attractive location for Japanese electronics MNCs.
In the past few years, there has been much debate among international business scholars and economic geographers over the contribution of multinational corporations (MNCs) to the development of industrial clusters in emerging economies (Buckley and Ghauri 2004; McCann and Mudami 2005; Scott and Garofoli 2007; Dunning 2009; Beugelsdijk, McCann, and Mudami 2010; Meyer, Mudami, and Narula 2011; Mudami and Swift 2012). That innovative, interactive production networks within industrial clusters play crucial roles as engines of economic growth in developing countries has been recognized (Kuroiwa and Heng 2008). Where clusters take root, they can generate valuable technological spillovers, promote innovation, and create the critical industrial mass for sustained growth (Yusuf, Nabeshima, and Yamashita 2008). Yet De Propris and Driffield (2006), Phelps (2008), and Giblin and Ryan (2012) observed that the role of MNCs in supporting their long-term progress, knowledge transfer, and increased innovation is often controversial. As Kuchiki and Tsuji (2011) suggested, because of their relative “newness,” there has been little systematic evaluation of the long-term trajectories of MNCs in the industrial clusters of countries that are experiencing rapid growth and, in particular, how these clusters renew themselves in the face of competition from other locations. This article addresses this research imperative by examining the influence of Japanese electronics MNCs on Malaysian industrial clusters over a 45-year period.

The organization of industrial clusters in developing countries varies, from those dominated by indigenous firms to those driven by direct foreign investment (DFI) (see e.g., Chaminade and Vang 2008). Conceptually, we elaborate the latter by distinguishing three ideal types of DFI-driven clusters—assembly based, production based, and technology based—that respectively involve increasing impacts by MNCs on local development. We argue that these impacts are indicated by the nature and extent of value-added activity or upgrading and through associated transformations in their links between DFI and labor markets and connections to local companies and with public-sector agencies that shape policies on clusters. Moreover, it is reasonable to expect that upgrading increases the commitment of MNCs to local clusters, reducing the likelihood of their disengagement over time in face of competition from other locations in the global economy. With specific reference to this study, Malaysia is a good case to explore...
relationships between MNCs and clusters in developing countries because of its long history of reliance on DFI. Furthermore, lacking a strong entrepreneurial pool it represents a different economic model from Taiwan, Korea, and China (Jomo 2007). The meteoric rise of China and India and the rapid pace of globalization have forced Malaysia to reinvent itself so that it can remain competitive and relevant (Meyanathan 2011; Rasiah 2011).

Our empirical analysis is based on the experience of major Japanese electronics firms that have set up large-scale factory production in Malaysia since the 1980s or earlier. This article extends earlier research on this group of firms conducted in 1999 that involved 18 interviews with companies and two interviews with expert commentators (see Edgington and Hayter 2001a, 2001b). For this article we analyzed changes in company operations over the 10 or so years since the Asian financial crisis of 1997–98, through interviews conducted in 2006–07 with a sample of 10 Japanese subsidiaries (controlling 15 local factories in total) and 3 officials located in the Japanese embassy in Kuala Lumpur, the Japan External Trade Organization (JETRO), and the Japanese Chamber of Commerce and Industry (JACTIM) in Malaysia. We also consulted company publications, including material from corporate websites. The aims of the interviews, which lasted 1 to 2 hours each, were to reveal perceptions of Malaysia’s vulnerability to competition with China and Vietnam, as well as Japanese MNCs’ continuing commitment to the country’s industrial clusters.1 Also, the period when we conducted our field research (2006–07) was critical for the long-term commitment of many Japanese firms to Malaysia because the firms were faced with the urgent need to upgrade their assembly operations from analog consumer items (e.g., traditional color television products) to digital products (e.g., flat-screen monitors), as well as to fend off intensive competition from low-cost production clusters in China and other locations in the Association of Southeast Asian Nations (ASEAN).

The following section deals theoretically with the development of clusters in Asia and the role of DFI, linkages, and the development of suppliers. The subsequent sections present our empirical case study of Japanese electronics companies in the major industrial clusters of Malaysia and the conclusion that positions the results within the theoretical literature and considers the ramifications for public policy.

Industrial Clusters in the Emerging Economies of Asia and MNCs

At a time when the dynamics of the world’s economy are increasingly influenced by developments in Asia, recent scholarship has addressed the “explosion” of clusters and policies on clusters throughout the region (Sonobe and Otsuka 2006; Yusuf et al. 2008; Kuroiwa and Heng 2008; Ganne and Lecler 2009; Kuchiki and Tsuji 2011). Four overlapping themes are evident in this work. First, Asian clusters differ in many dimensions, such as the type of products and services they offer, the location dynamics they are

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1 These typologies resonate with earlier classifications, such as that of Markusen (1996), who identified four categories: Marshallian, hub and spoke, satellite platform, and state anchored. In a similar vein, McCann and Mudami (2005) proposed a typology of clusters based on a transactions-cost perspective and identified three kinds of clusters according to the nature and intensity of the relations between firms: the classical model of pure agglomeration, the industrial complex model (comparable to Markusen’s hub and spoke type), and the social network model. At another level, clusters in Asia can be classified by the stage of development they have reached (emerging, potential, and mature), about which we have more to say later, as well as whether they incorporate MNCs and whether they are driven primarily by DFI (Yusuf 2008).
subject to, their stage of development, the nature of their organization, and the business environment that surrounds them. They include craft village clusters in Vietnam and agglomerations of specialized producers in China, some dating from the pre-1978 reform era. There are also major clusters in both China and Vietnam that focus on high-volume contract manufacturing of low-value footwear and clothing for the U.S. and European markets; complex product systems, such as automobile clusters in Thailand; and various high-technology zones situated in large cities and near university complexes like the Hsinchu Science Park in Taiwan (Chaminade and Vang 2008; Yeung, Liu, and Dicken 2006; Yeung 2008; Ganne and Lecler 2009). Indeed, various authors have proposed typologies, including the broad-scale categories developed for Thailand by Baron-Gutty, Figuiere, and Simon (2009): trade clusters of small- and medium-sized enterprises in traditional sectors; planiclusters promoted by public policy; and new clusters based on more advanced and internationally competitive products, characteristically involving internationally MNCs and their nearby suppliers. The third category underlines that clustering is not limited to local firms and that MNCs can be an effective entry point for fostering the upgrading of local suppliers and the labor force.

The second theme in the literature is related to the relative importance of the involvement of MNCs in the formation of clusters. A casual examination of Asian export-processing zones, new industrial estates, and science and technology parks shows that MNCs are widely present actors, often as flagship firms. Indeed, this has been a defining feature of many Asian emerging economies. Vang and Asheim (2006) noted that compared to well-functioning clusters in the developed countries, most rapidly industrializing clusters look to exogenous-, rather than endogenous-based, interactive learning and to foreign companies for technology, skills, and access to overseas markets. There are exceptions to the high degree of dependence on foreign firms in industrializing countries, and Taiwan and Korea, for example, have developed their manufacturing industries into significant global exporters, primarily by nurturing indigenous enterprises. A more controversial point concerns how MNCs are related to clusters in which they locate their activities and, more specifically, the role that these companies play in transferring knowledge and skills to local firms and the labor force. Phelps (2008) demonstrated that MNCs are unlikely to contribute to localized technology learning in clusters without active bargaining by national governments. In a similar vein, Felker (2003, 2004) argued that an overdependence on MNC-based industrialization in Southeast Asian countries, such as Singapore, Thailand, Malaysia, and the Philippines, has led to “contingent clusters,” in which foreign production rarely brings about localized externalities, such as the upgrading of skills and entrepreneurial supply firms.² By comparison, other scholars have shown that DFI can contribute to the formation of clusters (Manning 2008; Giblin and Ryan 2012). Thus, Asheim and Vang (2006) cited the increasing embeddedness of foreign MNCs in Shanghai, China, because of the city’s regional industrial profile, the role of the Chinese transnational community in the United States, and China’s importance as a growing market. Since the 1990s, the Shanghai regional government has targeted foreign investment in high-technology industries with some success, indicating the local availability of science and engineering talent and the ability of local companies to link with globally operating MNCs (see also Enright 2000; Zhou and Xin 2003).

² This viewpoint reflects many earlier debates on the role of MNCs in host-country economies and questions of dependence (Moran 1978), and, in the East Asian context, these concerns have centered on the dominant position of Japanese corporations and their investments in Asian countries under the “flying geese” pattern (Hatch and Yamamura 1996; Hayter and Edgington 2004).
The third theme of recent scholarship on clusters in developing countries recognizes that clusters evolve over time and focuses on the challenge of upgrading and innovation (Li, Bathelt, and Wang 2011). Although many studies have explored the formation stage of Asian clusters, there is still a great deal to learn about development issues from examining the long-term sustainability of clusters (Kuchiki and Tsuji 2011). Independent of the role of MNCs, the continual enlargement of clusters and external linkages can provide local suppliers and international firms with an important window for technological advancements and the expansion of markets in the global economy. Alternatively, the lack of innovation, together with cutthroat competition, may well influence the cluster’s development ability and lead to it withering away. Thus, globalization perspectives that emphasize traditional stereotypes of “placeless” MNCs suggest that if wage rates increase and tax breaks are reduced in a particular industrial cluster, firms will simply close down and move to other clusters where wages remain low and incentive packages are more generous (e.g., Friedman 2005; for a critique, see Dicken, Forsgren, and Malmsberg 1994). Indeed, numerous studies have illustrated that when MNCs use developing countries to locate labor-intensive mature industries, they often relocate footloose production facilities when the competitive advantages of clusters decline compared to elsewhere (Schmitz 2004). For example, since the 1997 Asian economic crisis, most first- and second-generation industrializing countries in the region have faced an increasing challenge from China and India, resulting in a repositioning of their industrial activities and the need to upgrade their production clusters (Nesadurai and Soedradjad Djiwandono 2011). Other studies have pointed to the increasing importance of research laboratories or institutes and their role in helping MNCs improve existing products or designs or introduce new products in Asia clusters. For instance, Basant (2008) identified the growing links formed between academia and foreign MNCs (as well as local firms) as the Bangalore software cluster in India moved up the capability ladder and began to service complex orders for its European and U.S. customers.

The fourth theme in the literature is the recognition that the evolution of DFI-dominated clusters is shaped by the home-country conditions and practices (or “nationality”) of the MNCs, as well as by the host-country policies (Stopford 1998; Mudambi and Swift 2012). In this regard, the international business and affiliated literature is replete with models of relationships between MNCs and host governments that explain technology transfer and learning as a result of interaction between a firm and a given host government over time. These models include the obsolescencing bargain model, applied originally as an explanation for the widespread expropriation and nationalization in the 1970s of MNCs’ natural-resources subsidiaries located in developing countries but tested later in relation to manufacturing activities. Kobrin (1987) found that if MNCs can supply host countries with a stream of new investments, the original bargain between the two sides need not obsolesce (see also Eden, Lenway, and Schuler 2005). In addition, following entry, MNCs are empowered by their increased understanding of local cultures and economies (Hayter 1997). The work done by Krugman (1991), Porter (2000), and others on clusters as drivers of innovation has stressed that host governments can help create more favorable business environments for foreign firms to promote a virtuous circle of industrial development. However, on the basis of an extensive review of the literature on economics and international business, Phelps (2008) argued that host countries typically find it difficult to capture the benefits of MNC activities and that sustained embeddedness by MNCs cannot be taken for granted, especially given the intense competition for new products among subsidiaries from parent companies (see Phelps and Fuller 2000). This challenge, of course, varies with the economic develop-
ment model pursued by governments. In the case of China, for instance, Liu and Dicken (2006) showed how MNC investments in the automobile industry were shaped to meet the host country’s objectives under conditions of “obligated embeddeness.” The national characteristics of the companies involved are also of consequence (see Phelps and Wu 2009). In this regard, Japanese companies have been among the longer committed foreign investors, compared to, say, U.S., European, and some other Asian investors, and have created distinct “hybrid” factories that have modified the practices of parent companies according to local conditions (Edgington and Hayter 2001a; Majek and Hayter 2008).

To bridge these themes, we propose a typology of DFI-dominated clusters advance three “ideal types” that we term assembly type clusters, embedded clusters, and technology clusters (see Figure 1). Each ideal type features particular characteristics and points to the kind of interactions that MNC have with emerging nations’ industrial clusters. These characteristics and interactions are shaped by host-country policies, especially in relation to economic development and innovation; by the “national” characteristics of MNCs; and by their competitive situation in relation to other host countries’ clusters. This typology emphasizes differences in DFI-dominated clusters, while, over time, the characteristics of clusters may stay the same or, possibly, move from one type to another. From a policy perspective, the assembly cluster is the easiest to attain, and the creation of technology clusters via DFI is especially problematic (Hayter and Edgington, 2004).

In the assembly type cluster, low labor costs and a range of investment incentives (e.g., generous export subsidies, free trade zones, and tax allowances) have perhaps been the

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**Figure 1. Conceptual framework: MNCs’ commitment to industrial clusters (external and internal factors).**
most popular motivation for assembly-based DFI in East Asia (and other parts of the world) during the past 50 years or so (Rasiah 1993). Embedded clusters occur when supporting supply industries emerge together with skilled labor and host governments can offer effective cluster environments beyond low-cost infrastructure and utilities (e.g., training facilities and upgrading services for small- to medium-sized enterprises, or SMEs). The more sophisticated technology clusters are likely to emerge only when MNCs are linked with local sources of technology (e.g., through joint ventures with local public research institutes, universities, and local technology firms; the acquisition of technologies of suppliers; learning from the technical specifications and feedback from buyers; and recruiting experienced scientists and engineers; see Figure 1). Often associated with the development of science parks, these types of industrial clusters have a strong innovative base that can be attractive to the location of industrial MNCs because it is easier to transfer technology to supply firms and engineers and to learn new technologies. Science parks have been an important part of industrial clustering and a central part of growth in economies such as Taiwan, Singapore, and South Korea (Yusuf 2003).

This typology ignores many nuanced features of technological innovation, differences between codified and tacit knowledge, and other characteristics of technology spillovers (see, e.g., Blien and Maier 2008). Nonetheless, differences among these three ideal types in large part shape the nature of competition among industrial clusters. For instance, assembly clusters compete primarily through lower labor and material costs, while embedded clusters and technology clusters retain a competitive advantage through sophisticated production and enterprise capabilities (Kuchiki and Tsuji 2004). Ferdows (1997) argued that the more that assembly clusters compete on low production costs, the more high volume manufacturing capability becomes a commodity. For example, with a buildup in volume production capabilities across East Asia, manufacturing plants are often in excess supply, intensifying the tendency of mass production to be commodified. Indeed, for MNC operations competing on the basis of higher value-added, rather than wages or material costs alone, the quality of human capital and the capacity of local firms to absorb new technology from overseas are critical to MNCs’ continuing commitment to particular industrial clusters (Vang and Asheim 2006). Adding value at subsidiary factories, training the workforce, investing in local management, and engaging in product design and research and development (R&D) in assembly or embedded clusters implies a greater likelihood of successfully resisting competition on the basis of only the cost of wages or materials.

In our typology, there is no guarantee that local clusters can evolve from assembly to technology clusters, and the evolutionary dynamics of moving from one type of cluster to another are problematic. Clusters face crises from time to time through globalization and competitive pressures from other industrial regions threatening their identity, structure, and cohesion. In addition, the past industrial policies of the host country related to clusters can outlive their usefulness (Zucchella 2006). Then again, there are reasons to expect some shifts over time as learning and experience by the host economy lead to more effective policies on clusters (Kichuki and Gokan 2011).

We use these ideal types of clusters to examine the position of Japanese electronics MNCs in Malaysia, where intensifying competition from MNCs elsewhere, the opening and remarkable expansion of the Chinese economy, and recessions and financial crises have been important impulses for such redefinitions in recent years (Aziz and Bakar 2006). We argue that this process is driven to an important degree by in situ changes made by MNC subsidiaries, together with changes in their relationships with suppliers and other external, locally based institutions. In situ changes, as they are related to size, function, and levels of technology, are shaped by conditions in the home country, MNCs’
decentralization strategies and propensity to localize authority, the political and economic nature of conditions in the host country, and governmental policies in regard to science and technology (see Figure 1). The success or otherwise of in situ upgrading will determine, in large part, how these clusters can renew themselves in the face of hyper-competition from other locations.

Japanese electronics MNCs display distinctive (and paradoxical) features that are important in understanding their position in Malaysian clusters. Thus, on the one hand, Japanese management requires close proximity and shared cultural values that inhibit the transfer of knowledge beyond the immediate work group (Nonaka and Konno 1998). Scholars have noted that Japanese companies have had a particularly difficult time making the transition to full “transnational status” in the sense used by Bartlett and Ghoshal (1989, 1998). Yoshihara (2005) argued that Japanese foreign subsidiaries are often dependent on Japanese parent companies and cannot survive without a continuous transfer of resources from the parent companies. On the other hand, the overseas production decisions of Japanese electronics firms are often weakly controlled at the headquarters level, relying instead on management and technology governance from a number of often-competing consumer and industrial divisions that participate in setting up branch factories overseas on an ad hoc basis (Edgington and Hayter 2012). At the time of our survey, a key issue revolved around whether these firms would undertake the necessary upgrading of their Malaysian factories into new value added production networks for flat-screen televisions and digital CD and DVD players. We now turn to a consideration of the role of Japanese electronics MNCs in the formation of industrial clusters in Malaysia.

Clustering and the Evolution of Japanese Electronics Firms in Malaysia, 1965–2010

Malaysia is an interesting host economy to study because of its role as a first mover in attracting DFI in Asia outside the first-tier Asian industrializing countries (such as Taiwan, Korea, and Singapore) during the 1970s and 1980s, followed by its explicit cluster-based Second Industrial Master Plan (1996–2005) (Arrifin and Bell 1999). Indeed, electronics specialization in Malaysia was made possible largely by foreign capital and the expertise of MNCs, initially from the United States. Then Japanese and finally Taiwanese MNCs outsourced their production workshops to Malaysia, particularly in Penang (De Micheau 2009). Malaysia contrasts with Korea and Taiwan in its lack of a strong local entrepreneurial culture and effectiveness in its bargaining stance regarding DFI. Thus, while the Malaysian federal government has had some success in persuading MNCs to upgrade their operations, progress in encouraging higher local content for assembly operations has been more limited, as has the development of the skills of local workers (see Hayter and Edgington 2004). Clusters as a formal governmental tool were adopted in Malaysia following the introduction of the Second Industrial Master Plan in 1996. However, the electronics clusters that can be traced in Malaysia were established much earlier, especially since the opening of various industrial estates run by state governments, together with federal export processing zones in 1972 (Rasiah 2005). Currently, cluster programs in Malaysia are further hampered by political tensions between federal and state levels of government, as well as the lack of synchronization between national and regional agencies. Thus, while federal government initiatives were critical for attracting Japanese and other foreign investment to Malaysia in the 1980s and 1990s, state institutions at the regional level have been instrumental in operationally influencing the quality of the development of clusters since then, for example, by
promoting interfirm linkages and training facilities and by establishing a supporting infrastructure (see Goh 2001; Best 2007). Generally, Penang state and, to some extent, neighboring Kedah, which harbors the country’s first science park, have initiated the most coherent programs for the development of clusters. Outside the Penang cluster, much less effort appears to have been made to upgrade the absorptive nature of local supporting firms and the local workforce (Best and Rasiah 2003; Best 2007).

Overall, Japanese DFI in Malaysia has been strongly clustered within Penang, Selangor (Klang Valley), and Johor states (see Figure 2). Similarly, the surveyed firms of 7 Japanese consumer and business appliance makers and three industrial parts makers were located in various industrial estates around the major clusters of Penang, Selangor (Klang Valley), and Johor. The reasons for their particular locations in Malaysia varied. For instance, Matsushita (Panasonic) established many operations in Selangor to be close to the federal government in Kuala Lumpur, while Sony set up one of its four factories in Penang, attracted by state government incentives. Mitsubishi Electric moved its consumer electronics operations from Singapore to adjoining Johor Baru at the end of the 1980s as wages and other costs in Singapore increased. Three factories were established in the 1970s, 11 factories in the 1980s, and just 1 in the early 1990s. While this forms only a small selection of the estimated 260 electronics firms in Malaysia during 2007, our sample includes most of the major companies and parts makers, which employed about

Figure 2. Location of Japanese factories in peninsula Malaysia’s major industrial districts, 2007. Source: Authors’ computations derived from data supplied by JACTIM.
25,000 personnel (see Table 1). In all cases except one, the products were made for export markets, including the United States, the European Union, and Japan, as well as ASEAN and other Asia-Pacific countries. In the case of Alps Electric, locally produced parts and equipment, such as television remote control mechanisms, were sold to other Japanese assembly factories in Malaysia. As with many other Asian subsidiaries of Japanese firms, only one factory had a Malaysian chief executive officer (Omron Malaysia). Japanese companies are the least “Malaysianized” in terms of the composition of top management, especially in contrast to American electronics MNCs, such as Motorola, Dell, and Intel (Ismail 1999). However, many assistant factory managers were hired locally in Malaysia.

All the surveyed electronics MNCs also had operations in other ASEAN countries and in China. Given that these firms had access to production in cheaper-wage Asian countries, to continue their operations in Malaysia required “compelling reasons.” To identify these “compelling reasons,” we asked our interviewees a series of questions, such as the nature of the parent company’s production network, the role played by the Malaysian factory within the parent manufacturing strategy, how this role had changed over time, and whether the local company’s strategy was affected by the headquarters’ sourcing strategies in East Asia. In addition we included questions on addressing other issues, such as the evolution of their factory systems and mix of products, their development of their employees’ skills; and links with local labor markets, supply firms, and perceptions of Malaysian industrial support policies and local cluster governance. We analyzed competition with China and other ASEAN industrial clusters from the perspective of the local Malaysian subsidiaries.

From Assembly to Embedded Clusters

The history of Japanese electronics firms in Malaysia and of Malaysian industrial policies has been well covered in the literature, and the background is summarized here only to highlight Japanese MNCs’ strategies together with their clustering outcomes. Table 2 indicates the major stages in the MNCs’ operations and links with local labor markets and supply firms and the government’s industrial policies from 1965 to 2010. Japanese electronics firms (and other MNCs) developed spatial clustering tendencies on the basis of the initial industrial estate and free trade zone programs established from the 1960s onward. They were lured by suitable cost and infrastructure factors and, significantly, by the externalities (skills, knowledge, logistics infrastructure) that were generated by each other’s presence (see Chen 1999; Ismail, 1999; Edgington and Hayter 2001a, 2001b). By 2000, the three major clusters of Penang, Selangor (Klang Valley), and Johor had collectively become important hubs of Japanese firms, testing and assembly of semiconductors, together with the assembly and design of televisions and video-cassette recorders (VCRs) (see Figure 2).

A general feature of Stages 1 to 3 of Table 2 was the shift by Japanese MNCs to higher levels of investment and production, as well as localization in terms of design engineering capacity, decision making over the procurement of parts, in-house training of factory personnel, and local sourcing of parts and materials, signaling a shift from their initial unsophisticated assembly production to operations that were more embedded in local clusters. This shift coincided with the goals of the Malaysian government’s Second Industrial Master Plan (1996–2000), guided by the key ideas of “cluster-based industrial development” and “manufacturing plus plus” (Felker and Jomo 2007). The latter aim was supported by the Economic Planning Unit’s Seventh Malaysia Plan and its goal of broadening the concept of industry to include local R&D capacity, regional logistics, the development of human skills, an upgraded infrastructure and technical institutions, and so
Table 1

Japanese Factories in the Authors’ 2006–2007 Survey

<table>
<thead>
<tr>
<th>Name and Location</th>
<th>Year Malaysian Factory Established and Location</th>
<th>Original Products</th>
<th>Major Products at the Time of the Survey</th>
<th>Peak and Current Labor Force</th>
<th>Additional Foreign Labor</th>
<th>Exports and Major Markets (%)</th>
<th>Source of Components: Local Content (%)</th>
<th>Recent Technology and Process Upgrading; Other Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Consumer Products</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>A1. Matsushita Electric Industrial (Panasonic)</td>
<td>1988, Selangor</td>
<td>CTV assembly</td>
<td>High-end CTV assembly</td>
<td>2,000 (1995); 1,600</td>
<td>63:35 ratio of full-time to part-time foreign contract labor</td>
<td>100 percent export markets</td>
<td>80 percent localized; CRT made in-house</td>
<td>Changed from assembly line to cell production and just-in-time (j-i-t) production; all product design for CRT done in-house</td>
</tr>
<tr>
<td>A2. Sony EMCS Malaysia</td>
<td>Four separate factories established during the 1980s in Penang and Selangor</td>
<td>Hi-fi set assembly, computer peripherals, VCRs</td>
<td>DVDs, CD-ROM, flat-screen TVs, audio products (e.g., CD, Walkman); components such as hard disk drives</td>
<td>15,000 (1995); 6,740</td>
<td>3,000</td>
<td>100 percent exports; United States (DVDs); CTVs (Japan, United States, and East Asia); HDD (United States), Walkman (Japan)</td>
<td>40–80 percent local, depending on the product</td>
<td>Largest single Japanese firm in Malaysia</td>
</tr>
<tr>
<td>A3. Sanyo PT Malaysia</td>
<td>1987, Johor</td>
<td>Hi-fi sets and cordless telephones</td>
<td>High-technology mobile phone</td>
<td>3,000 (1995); 1,700</td>
<td>Foreign: Malay workforce is 40:60</td>
<td>100 percent exported to the United States</td>
<td>50 percent localization; major ICs come from Japan</td>
<td>In-house task force set up to improve productivity</td>
</tr>
</tbody>
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<th>Recent Technology and Process Upgrading; Other Comments</th>
</tr>
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<tbody>
<tr>
<td><strong>A4. Sharp Electronics (Kedah, Kuala Lumpur and Johor)</strong></td>
<td>(1) SREC (1980, Johor)</td>
<td>(1) TV/CTV assembly, (2) VTR assembly, (3) transistor radio and cassette tape recorder assembly</td>
<td>(1) Wide-screen and HDTV assembly, (2) LCD flat-screen display monitors, (3) portable minidisk assembly, and optical pickups</td>
<td>8,500 (2000); 7,000 (total for four factories)</td>
<td>About 2,000</td>
<td>90 percent exported; Asia-Pacific, Middle East, Africa, and Russia; DVDs go to Japan</td>
<td>About 40 percent local, CPT (color picture tube) is local, high-end ICs from Japan, optical pickup for DVDs from Malaysia or China</td>
<td>SEM (Kuala Lumpur) 1999, is a dedicated R&amp;D and product engineering center, especially for TV production in Malaysia</td>
</tr>
<tr>
<td><strong>A5. Mitsubishi Electric Malaysia</strong></td>
<td>1989, Johor</td>
<td>VCRs</td>
<td>DVD recorders; printers</td>
<td>2,400 (1995); 830</td>
<td>14 percent</td>
<td>100 percent export market</td>
<td>Only 8 percent local content</td>
<td>Design and production engineering done in-house; shift to cell production system</td>
</tr>
<tr>
<td><strong>A6. JVC Video Malaysia</strong></td>
<td>1988, Selangor</td>
<td>VCR</td>
<td>Digital camcorder</td>
<td>1,500 (1996); 900</td>
<td>300</td>
<td>100 percent export; 58 percent to the United States, 35 percent to the European Union, 7 percent to Asia-Pacific</td>
<td>20 percent local content; IC and LCD display from Japan</td>
<td>Design and production engineering done in-house; adoption of cell type production and just-in-time (J-i-t)</td>
</tr>
<tr>
<td><strong>A7. Hitachi Electric Products Malaysia</strong></td>
<td>1988, Selangor</td>
<td>VCR</td>
<td>Optical data storage device</td>
<td>2,000 (1995); 1,200</td>
<td>400 (Indonesia)</td>
<td>100 percent export markets</td>
<td>80 percent localization; optical pickup comes from Japan</td>
<td>Cell production</td>
</tr>
</tbody>
</table>

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Table 1

Japanese Factories in the Authors’ 2006–2007 Survey (Continued)

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<th>Major Products at the Time of the Survey</th>
<th>Peak and Current Labor Force</th>
<th>Additional Foreign Labor</th>
<th>Exports and Major Markets (%)</th>
<th>Source of Components: Local Content (%)</th>
<th>Recent Technology and Process Upgrading; Other Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B. Industrial Products</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1. Toshiba Electronics Malaysia</td>
<td>1974, Kuala Langat (Selangor)</td>
<td>Assembly of low-value ICs</td>
<td>Assembly of medium-value custom-built ICs</td>
<td>2,500 (1993); 1,400</td>
<td>100</td>
<td>90 percent exports (60 percent of sales for China)</td>
<td>About 80 percent local; Localization of materials (plastic compounds, gold wires), silicon wafer comes from Japan</td>
<td>ISO 14001, ISO 9002; more emphasis placed on workforce training</td>
</tr>
<tr>
<td>B2. Alps Electric Malaysia</td>
<td>1989, Nilai (Kuala Lumpur)</td>
<td>Electric switch components</td>
<td>TV remote control, switches, and magnetic heads</td>
<td>4,000 (1995); 3,000</td>
<td>None</td>
<td>100 percent local assembly companies (usually Japanese) in Malaysia</td>
<td>About 80 percent local (depends on the product)</td>
<td>Two design divisions to adjust production to local customers; in-house training facility</td>
</tr>
<tr>
<td>B3. Omron Malaysia</td>
<td>Selangor, 1973</td>
<td>Electric components for home appliances (e.g., parts for washing machines)</td>
<td>Similar</td>
<td>1,500 (1991); 800</td>
<td>None</td>
<td>100 percent export (50 percent for European Union; 25 percent for the United States; 20 percent for Southeast Asia; 5 percent for Japan)</td>
<td>100 percent localized, e.g., dies and molds made in-house, together with many machines</td>
<td>80 percent automated; 20 percent semiautomated; local Malay managing director</td>
</tr>
</tbody>
</table>

Note: CRT = color picture tube, CTV = color television (analog system), VTR = video tape/cassette recorder.
Source: Fieldwork.
# Table 2

**Stages of Japanese Electronics Factory Operations in Malaysia**

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Reliance on low-wage labor</td>
<td>Establishment of “dependent” linkages with local supply companies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptance of the New Economic Policy and hiring of Malaysian (Bumiputra) labor</td>
<td>Increasing local sourcing of parts and materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 2 (1986–95): Rapid growth in new factories</td>
<td>Continued reliance on important parts from Japan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning of factory automation</td>
<td>Positive attitude to a range of investment incentives, such as generous export subsidies, tax and reinvestment allowances</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hiring of design engineers</td>
<td>Pioneer status incentives given under the Promotion of Investments Act, 1986</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some RHQ and logistics functions</td>
<td>SME Vendor Development Program, 1988</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid growth in new factories</td>
<td>Ditto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 4 (2001–05): Decline in new factory investment, together with the exit of some firms</td>
<td>Introduction of “cell” systems, rather than mass production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid growth in new factories</td>
<td>Ditto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 5 (2006–10): Upgrading of existing plants to digital assembly</td>
<td>Reduction of local sourcing of analog mechanical parts and components</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid growth in new factories</td>
<td>Third Industrial Master Plan 2006–10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid growth in new factories</td>
<td>“New Economic Model” 2010</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: Jomo (1994, 2007); Edgington and Hayter (2001a, 2001b); Hayter and Edgington (2004); fieldwork.
on. Accordingly, Japanese firms in the 1990s began to increase their own local capacity to develop and design products (Sim and Nor Othman 1999). For example, Sony’s CTV (color television) Asia Design Center in the Klang Valley carried out innovations in production in mechanical and electrical circuit design, as well as cosmetic and chassis work for the different markets in Asia, while its Electronics R&D center in Penang designed Sony Diskman products for manufacture in Malaysia and China (Sim and Nor Othman 1999). Other firms began to diversify their Malaysian operations beyond factory production, for example, by establishing an ASEAN regional headquarters in the case of Sharp Corporation and a logistics function and International Procurement Office in the case of Sony (Edgington and Hayter 2012). In 1994, Hitachi moved its entire regional VCR design and production division to Malaysia (Felker 2003).

Before the rise of Japanese DFI in China, Malaysia was the most important overseas production center for Japanese electronics firms in Asia (Edgington and Hayter 2000). Not only had Malaysian clusters become a strategic location for Japanese electronics firms, Japanese DFI was important for the entire Malaysian electronics industry, reaching about 80 percent in the case of consumer products (Capannelli 1999). Hence, any shift of Japanese firms from Malaysian to Chinese production clusters would be a serious blow.

Decline in the Number of Manufacturing Factories

Following 10 years of dramatic growth, Malaysia had to deal with a series of economic downturns beginning with the Asian financial crisis (1997–98) (Stage 3 in Table 2). Edgington and Hayter (2001a) remarked on the commitment of Japanese firms to their Malaysian (and ASEAN) operations at that time, unlike U.S. MNCs, which either withdrew many of their investments or engaged in speculative merger and acquisition activities. Immediately after the Asian financial crisis, Japanese electronics firms appeared largely positive about their prospects in Malaysia (Edgington and Hayter 2001b). However, the investment environment thereafter changed suddenly because of a slump in U.S. markets for consumer and industrial electronic products and the entry of China into the World Trade Organization (WTO) in 2001, together with the likelihood of an integrated ASEAN Free Trade Area, which eventuated in placing further competitive pressure on Malaysian factories in 2003 (The Nihon Keizai Shim bun 2003; Feng 2006; Plummer and Yue 2009). At the same time, Vietnam emerged as an important competitor for Japanese electronics DFI within ASEAN because of its lower production costs, rapid economic reform, and a growing consumer market (McCargo 2004; Tonishi 2005; Vind 2008) (Stage 4 in Table 2).4

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3 By 1993, Japanese televisions assembled in Malaysia accounted for about 19 percent of the total global production by Japanese firms. In 1994, Malaysian television production exceeded that of Japan. For Japanese-made VCRs, Malaysia accounted for a similar share of total global production. By 1995, Panasonic’s Malaysian operation accounted for 25 percent of its parent group’s overseas production and a similar proportion of its global (including Japan) production of air conditioners and televisions (Tanaka and Kenney 1996). On the basis of surveys by the Malaysian Industrial Development Authority, surveys, Japanese electronics MNCs accounted for 52 percent of total DFI during 2001, while U.S. DFI in the same sector amounted to only 7 percent. Moreover, Japanese companies supplied 110,620 jobs in that year, while U.S. firms (mainly in the semiconductor sector) provided 29,660 jobs (Aziz and Bakar 2006). Using data from the Japan Electronics Industry Association, Paprzcki (2005) recorded that at the end of 2001, there were 144 Japanese electronics production facilities in Malaysia, equivalent to slightly more than 10 percent of all overseas Japanese facilities in this sector, and behind only Japanese operations in the United States (160 facilities) and China (330 facilities).

4 In 2001, Malaysia saw the closure or downsizing of a number of high-profile U.S. semiconductor plants involving (among others) the Motorola and Seagate semiconductor companies in Penang (Hamid 2001). In the same year, Japanese audio electronics company Aiwa was involved in a major restructuring plan as part
As a result of these dramatic turns of events, Malaysia, with its relatively higher labor costs, was seen as vulnerable. For instance, the president of Matsushita Electric Co. (Malaysia) noted: “the wages of a factory worker in Malaysia total 300 dollars or more a month, while in Shanghai and Thailand they are closer to 200 dollars a month. Thus, production facilities continue to be moved in search of lower wages” (quoted in The Nihon Keizai Shimbun 2003). Not only were labor costs in China attractive to Japanese electronics firms, but the costs of materials and components were also cheaper than in Malaysia (Ms. A. Hashimoto, director, JETRO Kuala Lumpur, November 2006). In addition, the JETRO Economic Research Department recorded that 21.7 percent of Japanese companies that responded to its survey in 2001 had plans to move manufacturing to China from Malaysia and other parts of Asia, including Japan, during the 2001–04 period (cited in Kasuga et al. 2005).5

Our analysis of Japanese investment in Malaysia found that new flows of total DFI indeed plummeted after 2001, signaling a perceived decline in the competitiveness of the Malaysian economy (see Table 3). Changing numbers of Japanese electronics factories and Japanese companies in Malaysia are shown in Figure 3. After growing by an average of 10 percent per year from 1991 to 1998, the total number of Japanese affiliates in Malaysia leveled off and subsequently declined, according to data from JETRO. It peaked at 1,433 in 1998 and decreased by 7.7 percent during the subsequent 5-year period. In other words, by 2003, some 111 Japanese companies ceased operations in Malaysia. Data from the Japanese embassy (using different measurement criteria) point to a continuing decline during the 2000s. The number of Japanese citizens who were registered in Malaysia also fell by more than 20 percent in the 10 years from 2000 to 2009 (see Figure 3).

Table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>RM (in millions)</th>
<th>% of Total DFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>264.4</td>
<td>27.5</td>
</tr>
<tr>
<td>1997</td>
<td>2,164.3</td>
<td>18.9</td>
</tr>
<tr>
<td>1998</td>
<td>1,867.9</td>
<td>14.3</td>
</tr>
<tr>
<td>1999</td>
<td>1,006.9</td>
<td>8.1</td>
</tr>
<tr>
<td>2000</td>
<td>2,880.5</td>
<td>14.5</td>
</tr>
<tr>
<td>2001</td>
<td>3,366.1</td>
<td>17.8</td>
</tr>
<tr>
<td>2002</td>
<td>587.4</td>
<td>5.1</td>
</tr>
<tr>
<td>2003</td>
<td>1,295.8</td>
<td>8.3</td>
</tr>
<tr>
<td>2004</td>
<td>1,010.7</td>
<td>7.7</td>
</tr>
<tr>
<td>2005</td>
<td>3,671.7</td>
<td>20.5</td>
</tr>
<tr>
<td>2006</td>
<td>4,411.6</td>
<td>21.8</td>
</tr>
<tr>
<td>2007</td>
<td>6,522.7</td>
<td>19.5</td>
</tr>
<tr>
<td>2008</td>
<td>5,594.9</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Source: Data provided by the Malaysian Industrial Development Authority, contained in Malaysia Treasury (various years).

5 Belderbos and Zhou (2006) reported that during the early 2000s complete factories relocated from Malaysia to China (e.g., Casio calculators) as did product lines (e.g., Minolta cameras and Matsushita low-end air conditioners).
By the mid-2000s (Stage 4), there was a widely held view that Malaysian industrial growth had faltered (Henderson and Philips 2004). The electronics sector remained dominated by foreign MNCs, which continued to be major exporters, yet the internal value creation and the development of dynamic industrial clusters were less than the Second Industrial Master Plan anticipated. Meanwhile, the policy interest of the Malaysian government shifted from building linkages around firms in the electronics sector to the creation of innovative SMEs in sectors that were independent of MNCs. Commenting on this change in policy emphasis, Ohno (2010, 19) noted that “terms such as K-economy, ITC, e-commerce, biotech and branding were mentioned in the early 2000s,” rather than the electronics industry.

**Fighting Higher Labor Costs in Malaysian Industrial Clusters**

The managers in our survey affirmed that the rapid growth of Japanese (and other MNC) investment prior to the 2000s had put enormous pressures on Malaysia’s labor resources. Accordingly, wages increased rapidly, making further investments in highly labor-intensive operations difficult to justify and intensifying competition with other clusters in China and Vietnam, as we highlighted earlier. Yet rather than leave Malaysia, the surveyed Japanese MNCs upgraded their factories with increased automation and the manufacture of higher value-added items, together with the development of skills and other improvements in productivity.

**Local Upgrading Strategies**

Bearing in mind their long experience of production, the Malaysian factories that we surveyed all recorded an upgrading of assembly production in the form of more sophisticated products and the devolution of product design from headquarters. Table 2 indicates
the product specialization of factories in our survey and how it had changed since their initial operation. Our interviews revealed further information on in situ upgrading strategies carried out over the previous 10 years or so. First, as we noted earlier, Japanese export-oriented electronics production in Malaysia focused originally on the mass production of high-volume products, such as audio products, televisions, and VCRs. Following the late 1990s, however, many assembly factories shifted toward the production of a variety of high-end products in several production lines. This multifunctionality of production further stabilized the embeddedness of Japanese assembly factories in Malaysia despite wage competition with China and Vietnam. For example, the yearly changes in output levels of the JVC Video factory in the Selangor cluster between 1989 and 2006 indicate a progressive move away from analog VCRs toward the more sophisticated multifunctional production of both analog and digital camcorders after 2002 (see Figure 4).

Second, in conjunction with more sophisticated products came the further localization of design and engineering capacity. Thus, in the JVC Video factory, the local design of camcorders began with the so-called cosmetic design of camcorder cases from 2000 and then expanded to incorporate the design of electrical circuits in 2004. At the time of the interview, local engineering design included the development and design of printed circuit boards, as well as mechanical hardware and software design.

In 1988 all design changes were controlled by the Japanese mother factory for the design of VCRs, and later on for the camcorders. But in 2001 a design team for the camcorder was brought to Malaysia. Five Japanese design engineers spent three years teaching local engineers. While the quality of engineering may be better in Singapore, Malaysia is cheaper, and it is very important in the Japanese system to have design and development functions and production in the same location, and to get design engineers onto the factory floor. So it helps that JVC already has a relatively long history of manufacturing in Selangor in order to link both our design and production engineers here. (Mr. Shigenori Onaka, managing director, JVC Video Malaysia, Selangor, July 2006)

Figure 4. Production and Employment Indices in JVC Video Malaysia, 1989–2006
Notes: Analog production: VCR = video cassette recorder; VHSC = analog camcorder. Digital production: DVC = digital camcorder; HDD = hard disk drive; STB = set top box.
Source: Authors’ computations derived from data supplied by JVC Video Malaysia.
This apparently successful deepening of production operations in JVC Video Malaysia and other factories we visited helped sustain the factories’ operations in Malaysian industrial clusters following 2000. However, it was also apparent that it depended on the enthusiasm of local managers in attracting new products from Japanese headquarters. Indeed, recognizing that technological power resided in headquarter “mother” factories and not in Malaysia, managers of local subsidiaries faced challenges in attracting more value-added products to their operations than elsewhere, including China and other ASEAN countries. Thus, allied to the seeming commitment by headquarters to shift new products into their Malaysian operations was the effort required by local Japanese managers to champion their Malaysian factories in the past 10 years or so. The tension between local managers and their headquarters regarding the introduction of more sophisticated products is captured in this comment by a local Matsushita Electric Industries [hereafter Panasonic] manager, who, at the time of our interview, was struggling to obtain a mandate for digital LCD (liquid crystal display) television assembly because the corporate headquarters had already decided to stop producing traditional analog televisions (see Perton 2006).

We must try to get more advanced products from the head office. We cannot survive in the future by just producing conventional TVs for the Asian market. So now we are endeavoring to change our production systems to further reduce waste and to bring costs down. We must move to a lean production approach. We would like to get a mandate to produce LCD flat-screen monitors and small LCD screens for cell phones. Our Selangor factory is already the ASEAN “hub” factory for our company’s CTV production in Indonesia and Vietnam, and we also design some subassembly kits, such as TV chassis, for overseas markets. But it is up to the HQ in Osaka to decide whether or not to bring in new items for production to Malaysia. (Mr. Jamaludin Bin Ahmad, assistant manager, Auto Insertion Department, Panasonic AVC Networks, Kuala Lumpur Malaysia, Selangor, July 2007).

Some months after our interview, Panasonic announced it would begin making LCD televisions in its Malaysian television factory for the ASEAN market (Guide2LCDTV.com 2008). During 2007, Hitachi also stated it would make plasma flat-screen televisions in Malaysia to meet the demand in Australia and Southeast Asia. Toshiba Corporation and Sony Corporation also upgraded their television production in Malaysia to meet the demand as consumers opted to replace bulky conventional models with flat-panel screens (Alpeyev 2007; Gabriel 2009). In addition, Sharp Corporation chose both Malaysia and China for the production of their LCD television models in Asia (Ohara 2007).

In sum, after the mid-2000s, four major Japanese consumer electronics firms in Malaysia upgraded from producing analog technology items, such as VCRs and cathode ray tubes, to digital equipment, in part because of the previous shift of design and production engineering to Malaysian factories, coupled with the development of innovative products in Japan (Stage 5 in Table 1). However, the managers also stressed that whether further upgrading could be successful would depend on the skills of the local workforce, the quality of local suppliers, and support from federal and state governments, a point to which we return later.

Labor and Training

Apart from upgrading factories through more complex production and improving the design and development capacities, Japanese subsidiary managers implemented a number of changes in workplace practices over the 2000s to compete with assembly
factories in China and other ASEAN countries. First, the overall levels of the factories’ workforces were drastically reduced by consumer assembly firms, and parts makers had drastically cut their factory employment since their peak levels in the mid-1990s, typically by between 20 percent and 40 percent (see Table 2). This downsizing of jobs coincided with the restructuring of Malaysian electronics production toward the medium-scale production of higher-value products. Indeed, many headquarters required their Malaysian operations to reduce their workforces when Japanese products faced stiffer price competition from Korean, Taiwanese, and Chinese competitors in the early 2000s and the growth in their export sales either fell or remained steady (Mr. Masayoshi Otake, the Japanese Chamber of Trade and Industry, Malaysia, Kuala Lumpur, November 2006). For example, the restructuring of Mitsubishi Electric’s factory in Johor from the 1990s to 2006 combined job loss with a shift to higher valued-added products (see Figure 5).

We used to have a 2,400 strong workforce at the peak in 1995, mainly for our VCR business, which at that time was very labor-intensive. The output levels were very high, but due to labor cost increases there was very little profit. It is this type of production that has gone to China. The current workforce in our Johor factory is around 800, with just 6 executives from Japan. We now function as a medium-output assembler of products with higher per unit profits, such as time-lapse security recorders and printers for video products. (Mr. Akira Sano, managing director, Mitsubishi Electric (Malaysia), Johor Baru, November 2006)

The second trend was the greater use of foreign contract labor from surrounding South and Southeast Asian countries. Because of the rapid rise in the establishment of new

![Figure 5. Changes in Production and Employment, Mitsubishi Electric Malaysia, 1991–2006.](image)

Notes: (1) Analog production: PTV-projection TV; VCR-video cassette recorder; DM-display monitor; (2) Digital production: TL-time lapse VCR; DVD-digital video recorder; VCP-video copy processor (medical uses); (3) Other workers: GA-general affairs; CAD-computer assisted design engineers.

Source: Authors’ computations derived from data supplied by Mitsubishi Electric Malaysia.
large-scale factories in the 1990s, the Malaysian government became cognizant of the country’s overall labor force shortages in the industrial sector and consequently relaxed regulations over hiring foreign workers. After restructuring in the early 2000s, Japanese electronics MNCs tended to keep their permanent employment levels stable but increased their use of foreign workers at times of expansion. Table 1 indicates that all assembly plants in our survey were dependent on foreign labor from about 10 percent to 40 percent of their total workforce.

The third change in workforce practices was the implementation of improvements in productivity on the factory floor by adopting best practices from Japan in the organization of production lines to achieve flexible production that could easily change when new models were handed down from headquarters. Thus, in line with Japanese practices elsewhere, all firms in our survey reported a heavy investment in on-the-job training of workers and encouraged their staffs on the factory floor to think about continuous improvement. An earlier study of Malaysian consumer electronics plants by Wilkinson et al. (2001, 687) noted that “quality circles, kaizen teams and the like—for which the Japanese are famous” were not so effective or used in Malaysia. However, in recent years, Japanese assembly factories appeared to make more use of these approaches, especially in conjunction with redesigned production machinery organized into small cells or “U-line” production systems, rather than traditional mass production systems (see Isa and Tsuru 2002). The newer multiproduct nature of factories in Malaysia since 2000 meant frequent job changes and significant multitasking and employee input to various processes.

We have recombined assembly tasks into cellular production and small-lot batch production, where “the person moves and not the belt.” The shift to multiskill manual assembly from mechanical conveyor lines and automated parts assembly was an attempt to develop a more flexible response to the rapid introduction of new models by our parent company in Japan. Operators now have more opportunity to make decisions, since each cell is considered an autonomous and self-sufficient unit possessing a high degree of authority to complete the wide range of work tasks assigned. (Mr. Zainal Rhamat, senior factory manager, Hitachi Electronic Products (M), Selangor, July 2007).

Apart from these workplace innovations, managers also reported that since 2005 or so they faced reduced rates of increases in labor costs in Malaysia compared with the 1990s, which helped keep their production operations competitive. This perception was borne out by data compiled as part of a World Bank study of East Asia, indicating that while the growth in real wages in the Malaysian electronics industry had surged by an average of 6.2 percent from 1994 to 1997, this growth had slowed to just 1.9 percent in the 1998–2007 period (reported in Hunt 2009). Indeed, over the 2000s, the increase in Chinese factory wages outpaced those in Malaysia and, by the end of the decade, had almost caught up with those in Kuala Lumpur. Although these figures take no account of relative labor productivity, it would appear that by the end of our study period, labor costs were no longer the major component of competition between the Malaysian and Chinese industrial clusters. Indeed, for complex electronics manufacturing, such as silicon chips and flat-panel television screens, labor costs made up as little as 2–3 percent of the total costs (Brown 2011). More important factors for MNCs in their decision

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6 Data from the International Labor Office (2010) showed that China’s fast industrial growth and surge in international factory investment had increased wages there at over 12 percent per year since 2000, while those in Malaysia increased less than 5 percent annually for the same period.
whether to upgrade their Malaysian factories to even further levels of added value were access to skilled labor and sophisticated supply companies (see Figure 1).

Are Technology Clusters Possible in Malaysia?

The managers in our sample of firms were asked to discuss the potential of their operations to manufacture technology-based products in Malaysia itself, rather than in Japan, and if not, what major constraints were operating within their industrial cluster.

Problems Obtaining Skilled Labor

The Japanese managers complained of shortages of skills at all levels, particularly in the high-technology engineering and other technical fields. In the surveyed firms, 10 percent to 15 percent of the employees worked as engineers. A high turnover of mid-level engineers was perceived as a major shortcoming that adversely affected the effectiveness of introducing new products, both by increasing the cost of technology transfer and lowering local absorptive capacity, as well as by hindering advanced design, quality control, and obtaining certification from the International Organization for Standardization (ISO). All the surveyed companies faced these problems to a lesser or greater extent, and staff turnover rates of 5 percent to 10 percent per year (at the technical level) were common. While much cluster infrastructure and support were provided by state governments, in this case, MNCs had to call on the federal Malaysian government to relax immigration controls involving skilled labor, yet the official policy was to reduce dependence on foreign technicians (unlike unskilled workers) and give more opportunities to Malay (Bumiputera) people (Mr. Kazufumi Koya, plant general manager, Toshiba Electronics Malaysia, Selangor, Kuala Lumpur, November 2006).

Local Suppliers

The overall local content for the surveyed factories was relatively high, in many cases approaching 80 percent of nonlabor costs (see Table 2). Supplies that still came from Japan during the mid-2000s included sophisticated integrated circuits for VCRs and CTVs, wafers for the local assembly of silicon chips, and customized parts that could be produced only by domestic Japanese factories. Although these data suggest the significant localization of supplies, there are two serious qualifications. The first is that many core components were made in-house by the assembly factories themselves or closely affiliated Japanese companies based in Malaysian clusters. These components included compressors for air conditioning units; cathode ray tubes for CTVs; and many mechanical devices, such as heads and drums for VCRs. Together with the critical molds and dies for their production, these types of components were typically shifted from Japan to the Malaysian subsidiaries during the 1990s as part of earlier cost-reduction programs.

Second, in many cases, the Malaysian content, such as printed circuit boards, tuners, and diodes, came from the local subsidiaries of other Japanese companies or Korean- and Taiwanese-owned companies. The actual procurement programs of the firms varied according to the particular electronic products (e.g., air conditioners, camcorders, and DVDs), and even Korean and Taiwanese suppliers might produce various parts in China and Indonesia, rather than in Malaysia. For example, the distribution of parts and materials used by the Mitsubishi Electric factory in Johor by country of origin reveals a reduction in its share of inputs from Malaysian suppliers about one-third by value to under one-tenth between 2002 and 2005 (see Table 4). The percentage value from China, Thailand, and other countries (mainly Taiwan and Korea) increased dramatically.

Third, in terms of the types of parts that were supplied, local Malaysian-owned firms tended to provide only lower-end technology parts made from plastic, rubber, and metal,
together with paper packaging. In sum, Malaysian firms were not important sources of technology. Rather, they supplied simple unprocessed or only semiprocessed materials, such as wiring, packing materials, plastic parts, rubber supplies, dyes, inks and paints, masking sheets, and films. Although the factory managers reported that they used many Malaysian suppliers, the value of their contribution often amounted to only about 5 percent. In sum, the difference between Japanese firms and local Malay firms was due to the fact that just a few expensive parts, either made in-house or supplied from Japan, accounted for a large share of the total nonlabor costs. Our findings confirm earlier research by Arrifin and Bell (1999), Wilkinson et al. (2001), and Paprzycki (2005) that high-value parts were supplied by other Japanese companies and that Malaysian suppliers relied greatly on their Japanese buyers for sources of technology, for example, using dies and molds for metal forging and plastic moldings. The technological backwardness of many local suppliers was also pointed out by the Japanese parts makers, such as Omron, which reported that they often purchased even metal wire and other similar parts from other Japanese or European factories in Malaysia to ensure the quality of steel and copper products (Mr. Danny The Tiang Hua, department head, Production Control, Omron Malaysia, Selangor, July 2007).

Other comments from local managers captured a number of important trends in sourcing supplies over the previous decade. First, because of the need to reduce costs, many parts and components, such as transistors and diodes used for printer circuit boards, were sourced increasingly from other ASEAN countries like Thailand and Vietnam, as well as China. For instance, the key component for Sharp Corporation’s DVD machines was the optic pickup, which came from the parent company’s factories in either Malaysia or China, indicating competition between industrial clusters for the supply of parts as well as low-wage labor (Mr. D. M. Fujiki, chairman and chief executive officer of Asian Operations, Sharp Electronics (M), Kuala Lumpur, November 2006). Second, the procurement practices of Japanese subsidiaries had moved away from the use of firm-specific components, developed internally or within affiliated subcontractor systems, toward the open purchase of standard components (see Ernst 1997). This behavior had evolved in conjunction with the shift from analog to the introduction of digital systems for audio high-fidelity systems and televisions, as well as cameras (Paprzycki 2005). As a result, local supply companies, including Japanese parts firms in Malaysia, were affected. “Our supply chain shifted as we moved from analog to digital production and from VCR to DVD technology. In fact, our factory’s local content fell from about 27.5 percent in 2001 to just 7.8 percent today, and the value of electronic

<table>
<thead>
<tr>
<th>Country</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>47.0</td>
<td>38.3</td>
<td>32.7</td>
<td>21.7</td>
</tr>
<tr>
<td>Malaysia</td>
<td>31.2</td>
<td>34.8</td>
<td>27.7</td>
<td>7.7</td>
</tr>
<tr>
<td>China</td>
<td>6.4</td>
<td>9.6</td>
<td>20.2</td>
<td>31.9</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.9</td>
<td>6.5</td>
<td>7.4</td>
<td>9.9</td>
</tr>
<tr>
<td>Other (e.g., Korea and Taiwan)</td>
<td>11.5</td>
<td>10.8</td>
<td>12.0</td>
<td>28.8</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Derived from data supplied by Mitsubishi Electric Malaysia.
components coming from Japan increased from 12.9 percent to 42.9 percent by value, mainly because of the optic pickup. The hard disk drive for DVDs comes from both China and Thailand. But overall, China’s portion of our supply chain has increased, as have parts from Korea and Taiwan” (Mr. Akio Sano, managing director, Mitsubishi Electric (Malaysia), July 2006).

Cluster Governance and Industry Policy

Cluster governance signifies the collective actions of various stakeholders (including universities and research institutes, large and small companies, governments, and other supporting agencies) to advance the cluster and develop a sustainable competitive advantage (see Visser and de Langen 2006). In our study, we asked how local Japanese factories interacted with Malaysian industrial policies and local governance in each of the three clusters. Overall, the managers reflected that it was disappointing that so little attention was given by public agencies to upgrading the technological level of Malaysian SMEs so that they could supply Japanese assembly MNCs with more value-added products. “The major restraint to further technology transfer and higher value-added products is the lack of local engineering production at the very highest level. In the United States and Europe there are local high technology companies. But apart from one or two firms, such as the local ‘ENG company’ [based in Penang] there is nothing” (Mr. Shigenori Onaka, managing director, JVC Video Malaysia, July 2006, words in brackets added). By comparison with the lack of innovative Malaysian firms, we found that the Japanese parts supplier Alps Malaysia generated a range of new products in its Nilai factory located close to Kuala Lumpur for the burgeoning car industry in Malaysia and Thailand (Mr. S.W. Lam, Section Manager, Sales Department, Alps Electric (Malaysia) Sdn. Bhd, Nilai, 18th November, 2006). Conversely, the JACTIM official noted that the Malaysian suppliers’ primary criticism of Japanese assembly firms focused on what were perceived, to be excessively strict standards and the unilateral imposition of prices (Mr. Masayoshi Otake, the Japanese Chamber of trade and Industry, Malaysia, Kuala Lumpur, November 2006).

Other comments in our interviews revolved around the lack of effective education and training institutes in the Klang Valley cluster (Kuala Lumpur and Selangor), even though the Klang Valley had the largest concentration of Malaysian universities. “Only a few Malaysian universities concentrate on engineering. Many lack competitiveness. Most Chinese families want to send their children to the UK, United States, or Australia for education. Sometimes the Chinese students want to stay rather than return to Malaysia. Only Malaysian children can obtain free education at Malaysian universities. Some Japanese firms have complained that the Malaysian universities are at the same level as Japanese high schools” (Mr. Osafumi Kio, second secretary and commercial attache, Embassy of Japan, Kuala Lumpur, November 2006). In a similar vein, the Japanese electronics firms reported that they enjoyed little collaborative links with research institutes or universities. The shortage of scientists and engineers in Malaysia and restrictive immigration policies for technical experts (with the exception of the software-oriented Multimedia Super Corridor) had undermined the capacity of Malaysia’s clusters to develop technological linkages with Japanese MNCs.

Conclusion

It has been suggested in the literature that DFI-generated clusters in emerging economies have often proved to be fragile and short term and that MNCs will not embed themselves locally but simply relocate if economic conditions change (De Propris and
In this article, we have argued that MNCs may, if conditions are appropriate, grow in clusters by in situ upgrading. Overall, our research on Japanese electronics firms in Malaysia suggests that DFI can not only instigate a clustering process, but can contribute to long-term growth that is beneficial to regional and national economies. However, this process takes time and may face limits. Much depends on the enthusiasm of local factory managers and the technology strategies of headquarters, as well as public policy in promoting skilled labor, sophisticated SMEs, and local technology centers. Figure 6 summarizes the major connections with local Malaysian clusters, as recorded in our interviews. The Japanese MNCs reported that most technological ties were back to the production divisions of headquarters and “mother” or focal factories based in Japan, components were made either in-house or supplied by non-Malaysian local firms or from elsewhere in Asia, and in-house training compensated for the lack of training opportunities outside the firm. This approach could be further elaborated by comparative analyses that compare the subsidiary companies of Japanese MNCs in Malaysia with those from the United States and other countries.

In general, Japanese firms have moved from using Malaysian industrial clusters as sources of low-cost labor to more embedded activities involving sophisticated products, design, and factory development. This trend was aided, in part, by painstaking in-house training and a reliance on Japanese parts firms plus substantial in-house production, together with technical links with R&D carried out by headquarters factories. However,
the weakness of cluster governance (other than at Penang), the shortage of skilled labor, and the disappointing upgrading of local supply firms have constrained further technological development. In this regard, the role of Malaysia in the overseas production of Japanese electronics companies in 2009 reveals the substantial production of cathode ray tubes, as well as flat-screen television, video recorders and players, audio sets for cars, digital cameras, mobile phones, and hard disk and DVD drives (see Table 5).7 Significantly, local factories were not selected to manufacture personal or notebook computers; yet overall the data demonstrate that Malaysia’s clusters remained important and attractive locations for Japanese electronics MNCs.

Conversely, it can be argued that the survival of the 3 Malaysian industrial clusters depends on the continued presence of these (and other) foreign investors in the region. There have been closures in the past 10 years or so, mostly in the few years following China’s entry into the WTO. Nevertheless, these closures appear to have stabilized, and, recently, Malaysia has benefited from fresh rounds of restructuring to digital consumer products. Still, there are a number of threats to its current role. For instance, electronics MNCs, such as Pioneer, have retreated entirely from the production of flat-screen televisions (Ogg 2009), and in 2009 Hitachi closed its Malaysian television operation and outsourced its production to Taiwanese firms (Chuang 2009). Moreover, as revealed in our study, the shift to value-added digital production paradoxically led to reduced opportunities for local supply firms. The scarcity of skilled labor in particular continues to be a formidable constraint to higher levels of technology.

While the Malaysian government is aware of these challenges, its current Industrial Plan (called the “New Economic Model”) appears wrongheaded in its focus on leapfrogging economic development into sectors, such as biotechnology and resource industries, even though electronics continues to be the largest contributor to manufactured exports (Khoon and Chong 2009; Chieh 2011). Despite these and other criticisms of the new policies, Malaysia has experienced a large increase in competitive performances in recent years (Business Times [Malaysia] 2010), which has encouraged new rounds of DFI from Japan after 2006 (see Table 3). In the future, the impending China and ASEAN free trade agreement will encourage Japanese firms to concentrate clustering in each country along specialized business lines. Although the implementation of the ASEAN free trade agreement will bring more competition, Malaysia’s industrial clusters could emerge as regional technology hubs in electronics, bringing both labor and parts from other Southeast Asian countries, while producing for regional markets. Under these circumstances, the next phase of development on which policymakers should focus is promoting the capacity and capabilities of local firms. A more balanced approach would bolster existing electronics clusters with appropriate institutional infrastructure for technology-intensive manufacturing, including standards and testing laboratories, quality control centers, and so on, building on the cumulative success of past policies (Ohno 2010; Rasiah 2011).

7 It may be argued that the transition from the production of cathode ray tube televisions to flat-screen televisions production (i.e., from analog to digital technology) represents the start of a new product cycle, rather than technological upgrading. Even so, this is a change in production that involves more demanding technical standards in the assembly process. Indeed, the demise of the production of cathode ray tubes by Japanese MNCs had not yet occurred in Asia by 2009 (see Table 5), mainly because of the strong local market demand for these lower-cost products. Outside of production by Japanese firms, televisions with cathode ray tubes were not surpassed by the more expensive LCD monitors until the end of 2007, owing largely to the extensive assembly of cathode ray tubes at factories in China by Chinese original equipment manufacturer firms (Zhang 2009). Korea’s Samsung persisted with its production of cathode ray tubes in Malaysia until 2012, while continuing its production in China (Invest Korea 2012).
Table 5
Production of Electronics in Japanese MNCs’ Overseas Factories, by Asian Country, 2009 ('000 sets)

<table>
<thead>
<tr>
<th>Country</th>
<th>CTVs</th>
<th>Flat Panel TVs</th>
<th>Video Record Players</th>
<th>Car Audio</th>
<th>Car Navigation Systems</th>
<th>Digital Cameras</th>
<th>Mobile Phones</th>
<th>Personal Computers (Including Notebooks)</th>
<th>HDDs and DVD Drives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>768</td>
<td>4,191</td>
<td>9,365</td>
<td>4,890</td>
<td>30</td>
<td>3,860</td>
<td>3,333</td>
<td>—</td>
<td>31,800</td>
</tr>
<tr>
<td>China</td>
<td>543</td>
<td>10,218</td>
<td>24,572</td>
<td>16,518</td>
<td>490</td>
<td>27,530</td>
<td>11,020</td>
<td>2,480</td>
<td>165,210</td>
</tr>
<tr>
<td>Taiwan</td>
<td>—</td>
<td>150</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>South Korea</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2,000</td>
</tr>
<tr>
<td>(Other ASEAN)</td>
<td>(3,150)</td>
<td>(3,143)</td>
<td>(1,800)</td>
<td>(17,378)</td>
<td>(60)</td>
<td>(15,870)</td>
<td>—</td>
<td>—</td>
<td>(176,312)</td>
</tr>
<tr>
<td>Singapore</td>
<td>—</td>
<td>340</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>17,400</td>
</tr>
<tr>
<td>Thailand</td>
<td>982</td>
<td>2,242</td>
<td>1,800</td>
<td>12,023</td>
<td>60</td>
<td>3,370</td>
<td>—</td>
<td>—</td>
<td>63,712</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2,003</td>
<td>561</td>
<td>—</td>
<td>4,100</td>
<td>—</td>
<td>8,000</td>
<td>—</td>
<td>—</td>
<td>24,200</td>
</tr>
<tr>
<td>Philippines</td>
<td>165</td>
<td>—</td>
<td>—</td>
<td>1,255</td>
<td>—</td>
<td>320</td>
<td>—</td>
<td>—</td>
<td>71,000</td>
</tr>
<tr>
<td>Vietnam</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>4,180</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Other Asia</td>
<td>540</td>
<td>250</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5,001</td>
<td>18,252</td>
<td>35,737</td>
<td>75,062</td>
<td>47,260</td>
<td>14,433</td>
<td>66,272</td>
<td>375,322</td>
<td></td>
</tr>
</tbody>
</table>

Source: Derived from JEITA (2011).


Invest Korea. 4 April 2012. Samsung SDF halts CRT production in Malaysia plant. Available online: http://www.investkorea.or.kr/InvestKoreaWar/work/ik/eng/nr/nr_01_read.jsp?no=608300001&l_unit=90202&bno=204040004&page=21&sort_num=5391


