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GLOBAL COMMODITY CHAINS AND PRODUCTION NETWORKS

**Understanding uneven development in the
global economy**

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RICHARD PHILLIPS, JEFFREY HENDERSON

**Global production networks and industrial upgrading:
negative lessons from Malaysian electronics¹**

1. Introduction

Much debate over industrial and economic development has focused on the use of linkages stimulated by foreign direct investment (FDI) to fast-track industrial upgrading and integrate economies into higher-value positions in global production networks (GPNs). In this context, we have often been told that the basis of FDI-led industrialisation is a process where domestic firms ‘learn from global buyers’ and, over time, gradually acquire the capability to move into higher value segments of GPNs (e.g. Humphrey/Schmitz 2002; Schmitz/Knorriga 2000). This process of ‘moving up the value chain’ has generally been viewed as a shift from manufacturing to product development and associated research, design and marketing activities.

Within the GPN and related literatures (see, for instance, Gereffi/Kaplinsky 2001; Henderson et al. 2002; Czaban/Henderson 2003), the concept of industrial ‘upgrading’ straddles both ends of the structure-agency divide. On the one hand, it refers to the competitive strategies that economic agents pursue, such as increasing firm competencies in producing goods or specialising in competencies that meet niche markets. On the other hand, the concept is rooted in the structural premise that such strategies are responses to the increasing competitive pressures that firms, particularly in developing countries, face as national economies become integrated into global markets and industries. Thus for Humphrey and Schmitz (2002: 1018), “the deepening integration of developing countries into global markets, [results in] firms in these countries [...] [facing] increasing competitive pressure. For producers to maintain or increase incomes in the face of

this pressure, they must either increase the skill content of their activities and/or move into market niches which have entry barriers and are therefore insulated to some extent from these pressures. We refer to such shifts in activities as upgrading”.

Strategies for industrial upgrading, then, arise from competitive pressures affecting firms, and are contingent on their positions within a hierarchical system of value-added activities. From this vantage point, the central question for research on upgrading must be the nature of the *constraints* affecting the ability of firms to both participate in, and move into, more valuable positions within these activity systems. However, work on the constraints posed by GPNs has been rather selective in current programmes of research.

One main strand of research has focussed on differentiating the structures of ‘governance’ of industrial relationships (e.g. Gereffi et al. 2005). The principal claim here is that the ability of firms to participate in, and upgrade within, GPNs is dependent on the organisation of activities by dominant firms and the mechanisms by which those latter firms co-ordinate and control value within the chain. Such mechanisms, in turn, can be differentiated into types of control based on ownership, standards setting, or access to key markets or other strategic ‘resources’.

A second strand of work has focussed on cataloguing the different types of upgrading. All attempts to upgrade seek to change the nature and configuration of industrial activities. Consequently, upgrading strategies imply some reconfiguration of existing industrial processes. As change can threaten the existing configurations maintained by lead firms, upgrading by local firms can be contested affairs. These contestations can arise in different ways, such as when firms attempt to change production processes and products (‘process’ and ‘product’ upgrading), or change the mix of functional activities that occur inside firms (‘functional upgrading’). Whether firms attempt to upgrade by these means, or by leaving a particular network in search of more profitable ones (‘network’ or ‘chain’ upgrading), the claim here is that upgrading dynamics (and thus the success factors) differ depending on the route taken to upgrade the firm’s position and role (Kaplinsky/Morris 2001).

While the theory of upgrading is a work in progress, research has been hindered by an ontological assumption about the nature of GPNs. That is,

GPNs are generally regarded as ‘positive’, or at worst ‘neutral’, forces with regard to industrial upgrading. Such assumptions affect how one interprets the strategic behaviour and intent of industrial agents and focuses research on the upgrading impact of GPNs. This pre-occupation with affirmation, however, can lead researchers to ignore the possibility that lead firms, or even whole production networks (regardless of type) might be subject to historical dynamics that constrain, from the outset, the possibilities for local upgrading.

Via a study of the Malaysian experience, this paper critically examines the role GPNs play in industrial upgrading. Retracing some key features in the development of the Malaysian electronics industry, we argue that the possibilities for industrial upgrading must be treated as contingent upon the prevailing dynamics within the GPNs themselves. This has two important implications for theorising upgrading processes. Firstly, GPNs are not ‘drivers’ of upgrading but rather only provide ‘windows of opportunity’ that must be exploited by national systems of economic governance. Secondly, GPNs are not always ‘positive’ forces for economic development, but can work against local upgrading by ‘locking’ domestic firms into lower-value operational modes.

2. The Malaysian situation

Electronics firms from the US and Japan began to be attracted to Malaysia in the early 1970s (Henderson 1989: 51). By the early 1990s, some of the US semiconductor subsidiaries (Intel in particular) had become the source of Malaysian-owned, ‘spin-off’ companies (Eng Teknologi and UNICO in particular) that subsequently achieved modest industrial upgrading. The upgrading of these and other Malaysian electronics companies, however, seems not to have been sustained. Let us consider some of the relevant data.

To make a significant contribution to economic development, industrial upgrading needs to be grounded in rising technological capacities. A *sine qua non* for the latter is a significant pool of scientists and engineers. Unfortunately, Malaysia has fared relatively poorly on this score. From the data in Table 1, it seems that Malaysia has the lowest proportion of science

and technology students and the second lowest of trained scientists and engineers relative to a number of its East Asian competitors. As a consequence, Malaysia has tended to import many of its senior professional, technical and engineering personnel from abroad (Ernst 2003, 2004). This situation is often interpreted as a ‘skills gap’ that needs to be filled. However, the more relevant issue may be whether firms (domestic and foreign) in Malaysia actually want to hire such personnel.

Table 1: Technology indicators for selected East and Southeast Asian countries

Country	R&D (% of GDP)	High-tech exports (% of manufactured exports), 2001	Scientists and engineers per million capita	Tertiary science and engineering students (% of population), 1998
Hong Kong	0.45 (2000)	19.5	n/a	0.49
Korea	2.68 (2000)	29.1	2,319 (2000)	1.65
Taiwan	2.3 (2000)	35.0 (1998)	2,980 (1998)	1.06
Japan	2.98 (2000)	26.0	5,095 (2000)	0.64
Singapore	1.88 (2000)	59.7	4,140 (2000)	0.47
Thailand	0.1 (1997)	31.1	142 (1997)	0.19
Indonesia	0.1 (1994)	13.4	206 (1998)	0.23
Malaysia	0.5 (2000)	56.9	159 (1998)	0.13
Philippines	0.2 (1999)	70.2	179 (1996)	0.55

Source: Ritchie (2005: 753)

While little evidence is available on this question, a recent World Bank (2005) study found that 24% of firms in Malaysia's electronics sector reported skills shortages as a major obstacle. This study, however, suggested that, relative to other sectors, electronics had little to gain (in terms of estimated percentage increases in sales) from a reduction in skills shortages. Such findings imply that the 'skills gap' problem in Malaysian electronics may have been exaggerated. At the very least, those who attribute Malaysia's limited upgrading in electronics to a supposed lack of skills and thus to failures in education policy (e.g. Rasiah 2005) may be underestimating the principal reasons for the problem.

Findings such as these beg the question as to why, after more than 35 years of participating in GPNs, Malaysian electronics firms have not moved far enough up the value chain for there to be a greater demand for engineers, technicians and other highly skilled workers from firms operating in the country. To gauge the situation better, it is instructive to take a broader look at the labour demands of electronic firms in Malaysia.

Any attempt to understand the human capabilities needed to maintain Malaysia's current export position in electronics requires an examination of the situation in Penang. This is because Penang is universally regarded in the literature – as well as by the Malaysian Government's industrial development agency, MIDA – as the most significant and most 'advanced' electronics complex in the country. Taking Penang as a 'best case' proxy for the Malaysian situation as a whole, then, is highly appropriate.

As of December 2003, about 17% of all production workers in the electronics sector in Penang were classified as unskilled, while 80% of production workers in the sector were classified as skilled or semi-skilled (PDC 2004). However, some experts on the industry in Penang estimate that about half of all employees in electronics there may still be performing low-value assembly activities (interview with PDC analysts, June 2004). These findings are consistent with two longstanding historical features of manufacturing (long dominated by electronics) in Penang. Firstly, 74.3% of all manufacturing employees there were engaged in production work in 1990 (nearly 20 years after electronics FDI created a significant manufacturing cluster in the region). By 1998, there had only been a modest improvement, with 67.1% of employees involved in production work (Ong 2000). Secondly, these findings are reflected in the modest changes in the skills of employees

of US electronics multinationals (traditionally the major foreign investor in Penang's electronics cluster), not simply in Penang but in Malaysia as a whole. Whereas in 1977, 74% (about 19,000 workers) of employees in US electronics subsidiaries were unskilled production workers, by 1994, this category had declined by only 2%, to 72% (about 33,100 workers) of total employment (Slaughter 2002). Extrapolating the Penang employment data to the country as a whole, it seems that the majority of Malaysian electronics production is tied to a low-cost, labour-intensive form of integration into GPNs.

This pattern can be seen in national employment data. With the extent of the demand for highly skilled personnel in doubt, demand at the other end of the spectrum seems unmistakable. Henderson and Phillips (2007), for instance, show that a continued reliance on lower skilled labour activities in electronics has been complemented by an increasing reliance on foreign migrants. In absolute terms, migrant workers in the electrical and electronics sector mushroomed from 1,024 in 1990 to 46,470 in 1996, reaching 10.7% of all employment in the sector (Department of Statistics, Malaysia Manufacturing Census, cited in Henderson/Philips 2007: 92). Unpublished data from the Malaysian Government's Ministry of International Trade and Industry suggest this trend has continued, almost unabated, through to the present day.

Other studies have corroborated this concern over the nature of Malaysia's role in GPNs. Ernst (2003, 2004) presents a similar assessment of the industry, arguing that Malaysia never developed a deep, multi-tiered industrial supply structure in electronics. Rather, with the exception of a small number of companies, the contribution of indigenous firms to export performance continues to be dominated by small and medium-sized enterprises (SMEs) disproportionately engaged in low-value 'lower tier' assembly activities. The relative lack of local suppliers in higher-tier supply positions consequently implies a shallow level of industrial specialisation and thus a 'thin' range of domestic supply capabilities. Consistent with this reading of the situation, an authoritative report on the technological state of Malaysia's electronics SMEs makes for depressing reading. Commissioned by the Penang Development Corporation in 2001, the report notes that there is: "A sense of crisis regarding a possible decline of local industrial activities [...]"

[and] that the development of the capability of local companies to supply parts to MNCs is an urgent necessity” (JICA 2001: 1-1).

So pessimistic is this report that it is worth quoting two of its other observations. “[T]here is a general shortage of such SI (supporting industries) as parts and processing service industries (precision machining, precision stamping, precision plastic processing, heat treatment, electrical and electronic parts and plating), materials industries (resin, metal and chemicals) and other industries (industrial waste treatment, jigs, press dies, plastic dies and automation machinery) to support the operation of MNCs” (JICA 2001: 2). “[T]he ratio of SMIs (small and medium industries) which have reached the level (excellent) required by MNCs is quite low, ie. 24% in terms of processing, 14% in terms of production control and 15% in terms of management control out of the 103 SMIs diagnosed [...]” (JICA 2001: S-3).

Taken together, such findings suggest that the supposed ‘skills gap’ in Malaysia is actually a reflection of the true nature of demand for human capabilities by electronics companies; demand that, in turn, is a function of various efforts (conscious or otherwise) to maintain Malaysia’s longstanding position as a low-cost, labour-intensive base for GPN activities. This, in turn, begs another question. Why is this situation being reinforced at the expense of efforts to promote industrial upgrading?

While the nature of government policy has certainly been part of the story (see Rasiah 2005; Henderson/Phillips 2007), equally important for understanding Malaysia’s predicament are the strategic interests and models of GPN integration that are being imported into the country by foreign firms. Below, we assess changes in the strategic intent underlying FDI in Malaysian electronics. Our argument is that Malaysia’s predicament is a function of the nature of investment from (a) East Asian companies and particularly from Taiwanese ‘original equipment manufacturers’ (OEMs), and (b) a new ‘breed’ of electronics company: the ‘contract electronics manufacturers’ (CEMs).

3. Multinationals and industrial upgrading: understanding strategic intent

Some of the benefits of FDI in electronics are likely to depend upon the type of multinational that invests in the given country. This is not simply a question of the national origin of FDI. Rather, it is a question of the broader competitive dynamics and pressures within which multinationals are situated and to which they respond when choosing to invest in a particular country or region (Czaban/Henderson 1998). Two developments in the composition of FDI in Malaysian electronics are critical to understanding the intent behind the GPN dynamics that have worked to 'stall' industrial upgrading in the sector.

3.1 GPN consolidation and East Asian supply bases

Firstly, we must recognise that much of the growth in FDI in Malaysia, particularly over the last two decades, has come from East Asian firms (principally from Japan and Taiwan). Beginning in the 1980s, East Asian investment began to outstrip US investment. For instance, between 1970 and 1985, one study found that 27 Japanese electronics factories had been established in Malaysia. After the dramatic appreciation of the Yen (following the 'Plaza Accord' of 1985), 96 more electronics factories were established there between 1986 and 1991 (Edgington/Hayter 2000). During this same period, Japanese investment in Malaysia increased from \$1.2 billion to \$2.3 billion (World Bank 1995). Taiwanese investment increased from \$167 million in 1986-1989 to \$783 million in 1990-1992. Between 1988 and 1995, Japanese firms invested in total about \$8.1 billion in Malaysia with Taiwanese firms close behind with \$8 billion. US investment in Malaysia, during the same period, was more than 70% less than Japanese and Taiwanese investment combined (Ariff/Ng 1998).

The strategic intent of East Asian firms is widely recognised as providing little scope for domestic upgrading as their networks are generally closed to outsider participation (Aoyama 2000; Belderbos et al. 2001; Borrus et al. 2000; Dore 1986; Lim/Pang 1991; Taylor 1995; Yamamura/Hatch 1997). Consequently, much evidence suggests that the transfer of knowledge and technology from East Asian subsidiaries in Southeast Asia has been limited to processes that enable firms to establish market positions based on lower-

level, labour intensive production activities (Yamashita 1991; UNDP 1994; Taylor 1995). Our own interviews (in 2004 and 2007) confirmed the general perception that Taiwanese production networks in particular, and to a lesser extent those of Japanese companies, tend to be closed to outsourcing relationships with local electronics firms, except in low value-added activities.

The limited linkage possibilities offered by East Asian GPNs, however, does not mean these networks are 'neutral' with regard to domestic upgrading. On the contrary, in many branches of the sector, East Asian 'first tier' suppliers have become the preferred intermediaries in the consolidation of GPN supply bases for leading US and Japanese firms (Sturgeon/Lester 2004). With global 'flagship' firms increasingly consolidating their supplies in this way, the routes for local Malaysian firms to move out of low-level assembly are, in effect, being increasingly constrained.

This should not be taken to mean that 'US' firms promote upgrading while 'East Asian' firms do not. It is widely recognised, however, that, in general, US multinationals have offered the most outsourcing opportunities for local firms in Malaysia, as they also have in other countries (see Hobday 2001). The general reason for this has been the longstanding strategic interest of US manufacturing firms in outsourcing manufacturing capabilities to foreign supply bases. This interest has culminated in an 'industrial model' in the US that is based on a desire to make products and production processes more 'modular'. The high degree of formal codification of technical interactions in the production system that results from modularisation, enables components and subassemblies to be externalised (Sturgeon 2003; Gereffi et al. 2005). In the Malaysian context, this disposition has provided much of the drive for the local upgrading that has occurred. For instance, recent surveys by the Malaysian-American Chamber of Commerce show that the local outsourcing of goods and services by (US) member companies more than doubled from RM6.7 billion in 2000 to RM13.8 billion in 2003 (www.amcham.com.my). The most successful examples of local firms reaching higher-tier supply positions have been those linked to US multinationals in Penang. Indeed, one of Malaysia's premier industrial linkage programmes, Penang's Global Supplier Programme, was largely driven by US multinationals, and its success, reportedly, was based on the genuine commitment by their managers (some of whom were Malaysian nationals) to local upgrading.²

3.2 Changes in US FDI

FDI is a product of the strategic intentions of firms and therefore the developmental impacts of foreign investment cannot be divorced from the interests that firms (extrapolated through their GPNs) bring with them when they invest in a particular country. In recent years the strategic intentions of some electronics companies have been changing as the emergence of a new breed of global supplier – the ‘contract electronic manufacturer’ (CEM) – has led to an increasing consolidation of supply positions within the electronics production network.³ While seeking to evaluate the impact of these changes on Malaysia, we must recognise that the emergence of CEM firms does not imply anything about the ‘type’ of firm involved. Rather, the issue is the way firm-based processes are changing GPN configurations and thus the roles played by local firms, workers and institutions.

FDI has tended to be viewed positively as a vehicle for local industrial development. Signs that this may not necessarily have been the case have often been ignored. Some electronics firms, for instance, have been less interested in developing local capabilities and more interested in exploiting the pre-established functions performed by local firms and their workers. This seems to have been the case in Malaysia where the strategic intent of a significant group of companies – the CEMs – has not been associated with outsourcing capabilities to local suppliers (and working with the local suppliers to improve them). Rather, the intentions of the CEMs have been associated with the internalisation of capabilities that can be standardised to fit with the global production services strategies that are now important elements within GPN dynamics. To understand these changes and their import requires some contextualisation.

CEM firms are a type of sub-contractor to which lead firms can outsource subassembly and product design functions. Unlike traditional subcontractors who perform original equipment manufacturing (OEM) or original design manufacturing (ODM) on behalf of lead (brand name) companies, the new breed of CEM firms have actively sought to broaden the range of production services that could be offered. One of their basic aims was to provide a ‘one-stop shop’ for manufacturing services by offering a greater range of integrated manufacturing capabilities that could be standardised and opened up to a variety of brand name electronics producers. These services include not only the more traditional core of OEM/ODM

manufacturing such as product design, component subassembly, final assembly and product configuration, but also include a range of supply-chain management functions such as component purchasing, logistics management and after-sales services such as product repair. Additionally, alongside their attempts to vertically re-integrate various production stages, CEMs have been concerned to offer such services globally by co-locating their operations alongside those of their major customers.

CEMs are not simply a new type of firm. Rather, they are an emergent form of production organisation that represents a contemporary solution to an old problem. Since its inception in the US in the late 1940s, one of the critical problems faced by the electronics industry has been the massive fixed costs of production facilities coupled with the high costs of 'in-house' product development. Both activities entail increasingly large 'sunk costs', generating a basic business problem that firms have had to devise ways of overcoming in order to generate returns. Global production networks and the underlying desire to facilitate the outsourcing of manufacturing capabilities has always represented one of the basic strategies for dealing with this problem. Pioneered by US firms as far back as the 1950s, an active interest in developing foreign capabilities and diversifying offshore supply bases was a critical way of externalising the risks of investing in electronics manufacturing. Initially, these networks were based on ownership relations between parent and subsidiary companies (explored, for instance, in Henderson 1989) with international production systems dominated initially by US electronics firms and followed later by their Japanese competitors. By the 1970s and 1980s both US and Japanese companies had begun to make significant use of independent firms to perform lower-level assembly functions. This came to be known as the OEM system of production, a contractual system that helped to uncouple a dependence upon manufacturing capabilities from the balance sheets of those (brand name) companies developing new products.

The OEM system is a form of sub-contracting where buyers – the leading brand name firms that design and market the products – contract out manufacturing functions to firms that produce products under arrangements specified by the buyer (a given set of products, quality standards, packaging and labelling requirements, etc.). The outcome is an end product that looks to consumers as though it was produced by the brand name firm.

By the late 1960s, many of the electronic exports from East Asia were OEM produced. Former OEM firms from Japan and later Korea began to overtake formerly dominant US and European firms in a number of product markets. A critical element in the success of Japanese consumer electronics firms was the dramatic cost reductions facilitated by their extensive use of OEMs that had emerged elsewhere in East Asia (Ernst 1998).

With consumer electronics increasingly dominated by East Asian firms, the mainstay of US electronics became the computer industry; this was particularly so with regard to the production of semiconductors and 'peripherals' such as hard disk drives. US semiconductor firms had historically pursued international production via equity-controlled subsidiaries, in part to limit the leakage of proprietary technologies (Henderson 1989). However, over the 1980s and 1990s prevailing supply arrangements began to be disrupted by several exogenous developments.

Firstly, the US dollar had appreciated and raised the cost of components imported from offshore subsidiaries. Furthermore, a wave of 'bust-up' mergers and acquisitions had engulfed US manufacturing. Across the board, leading *Fortune 500* firms were targeted by Wall Street 'raiders' who profited from dismantling large manufacturing firms unable to match their Asian competitors (cf. Best 1990; O'Sullivan 2000). In this context, vulnerable US semiconductor firms began to follow international production strategies formerly developed by the highly cost-conscious consumer electronics firms, gradually moving to continuously upgrade their existing subsidiaries, as well as expanding their outsourcing activities with East Asian suppliers. GPN dynamics, such as these, provided an important international context for the emergence of Malaysia's domestically-owned electronics companies in the 1990s.

Secondly, changes in the organisation of mass production operations were afoot. The new breed of US-based CEM firms began to emerge in the late 1970s. Most of them were initially small manufacturers, often detached from the supply relationships that US lead firms had with East Asian OEMs. Many of them emerged from the opportunities offered by the component design, but 'fabless'⁴ high-tech start-ups in Silicon Valley, for which they provided wafer fabrication and other manufacturing services (Sturgeon 2003). During the 1990s, however, US CEMs expanded far more

rapidly than East Asian OEMs and began to occupy higher value-added positions in GPNs, with a broader global reach.

The growth of CEM firms coincided with moves by some Asian producers to abandon their OEM operations in favour of higher value-added design functions ('original design manufacturing' ODM) and, occasionally, own-brand manufacture ('original brand manufacturing' OBM). As the Asian OEM producers began to compete directly with US and European (brand name) electronics companies, the latter began to switch their supply strategies from OEM-associated GPNs to the emerging CEM producers. The basic reason for this shift stemmed from the fact that CEM outputs did not compete with their own branded products (cf. Hobday 2001; Sturgeon/Lester 2004). Rather, CEM firms concentrated on re-organising global supply chains to service the manufacturing needs of the leading electronics firms. Thus, the CEM growth strategy was based not on competition for branded products, but on the consolidation of global production services.

While CEMs emerged in the 1980s, it was not until the early 1990s that the boom in the US stock market gave them the 'combination currency' with which to finance the acquisition of manufacturing operations. For US CEMs, growth was based on a strategy of acquiring the unprofitable production facilities of firms specialising in particular segments of the computer industry. Through 'turn-key' contracts, they then supplied components back to the factory's original owners. For instance, in 1996, Apple sold off its largest production facility (in Colorado) to an emerging CEM firm, SCI. SCI then refocused that facility to service not only Apple's production demands, but those of a range of other customers as well (Sturgeon 2002). This decoupling of ownership of design and innovation activities from production, a hallmark of Apple since its inception, proved to be a symbolic moment in the rise of CEM operations.

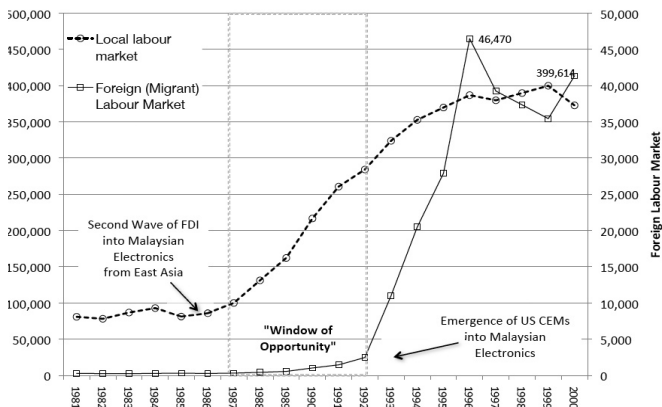
These developments were not limited to sites in the US. East Asian investment by US CEMs provided a major source of their growth in the 1990s. In Asia, CEMs were actively engaged in the consolidation business, providing manufacturers around the world with the possibility of selling off their struggling manufacturing operations. The Malaysian experience provides a vehicle for understanding how such changes in supply dynamics

and the intentions of foreign investors impact on local processes of industrial development. This is a discussion to which we now turn.

4. GPN evolution and Malaysian industrialisation

As major electronics firms from the US, Japan and, increasingly, Taiwan, began a new round of investment in Malaysia following the Plaza Accord of 1985 and the liberalisation of the Malaysian economy from the late 1980s, a brief window of opportunity emerged for local suppliers. Figure 1, based on the employment of local and migrant workers in the electronics sector (see subsequent discussion for an explanation) locates this window between roughly the mid 1980s and early 1990s. Unfortunately for Malaysia, it was a window that CEM firms began to close as they internationalised, looking to co-locate their supply services alongside prospective customers that had already established operations in Malaysia and other East Asian centres of electronics production (see Felker 2003 for a broader discussion of co-location dynamics).

Figure 1: Employment in electric/electronics sector in Malaysia, 1981–2000



Source: *Malaysia Manufacturing Census, Department of Statistics, Malaysian Government.*

The ability of CEM firms to internationalise needs to be understood in context. As part of the 'new economy', the movement of CEM firms into Malaysia coincided with the growing bubble in the US stock market. This provided US CEM firms with critical financial resources with which to grow by acquisition (cf. Carpenter et al. 2003; O'Sullivan 2000; Sturgeon 2002). Riding the stock market boom of the 1990s allowed CEMs to expand in East Asia through the acquisition of existing production facilities. Between 1995 and 2002, the five largest CEMs⁵, most with headquarters in North America, saw a compound annual growth in revenues of 47%. Roughly 67% of this revenue growth stemmed from acquisitions made over the previous three years (Sturgeon/Lester 2004).

Growth via acquisition, combined with the reorganisation of the supply chain that inevitably followed CEM acquisitions, changed the governance structure of electronics GPNs and thus the ways in which local firms in Malaysia could participate in them. Malaysia's few higher-tier suppliers were now competing with cash-rich CEMs for the outsourcing business of major brand-name customers. In these circumstances, some of the Malaysian companies themselves became acquisition targets of the expanding CEMs. UNICO, a spin-off from Intel Malaysia in the early 1990s, was a case in point. In 2003 it had been rendered bankrupt, as a result of Intel's decision to switch to a Chinese company for its motherboard supplies, and was acquired in 2004 – at a knock-down price – by the US CEM, Three Five Systems (TFS). Though in business for over ten years, UNICO's reliance on Intel had failed to assist the upgrading of its operations. Once cheaper sources for the labour-intensive production of motherboards were available, UNICO was in trouble. Acquisition by TFS, however, is unlikely to lead to upgrading either. That is not a result that can normally be expected from involvement in the GPNs of CEM firms. The reasons are as follows.

While variations are evident, depending on the firm in question, a number of traits are common to the CEM business model. CEMs compete for supply contracts largely on the basis of lower costs. Relative to established OEM suppliers in countries like Taiwan, CEMs are thought to be able to undercut their rivals by at least 15% on costs. In 2000, the operating margins for the top twelve CEMs were only 2.6% of revenues (www.custeiconsulting.com). The ability of the CEMs to operate under these conditions stems from their growth model: the acquisition and standardisation

of manufacturing capacities globally. By providing major customers with a channel to sell off struggling in-house manufacturing facilities, the global expansion of CEMs has been driven by their ability to manage the financial risks of modern manufacturing by pooling production capacities from a range of specialist manufacturers (such as Apple) and creating a more standardised, generic and 'merchant' form of manufacturing capacity. Such a broad base provides CEMs with greater economies of scale and scope in the sourcing of components. Their purchasing power underwrites both their ability to offer lower costs and encourages their greater use as consolidated global supply-chain managers, leaving lead firms free to concentrate on product innovation.

Underlying this model is a particular use of labour, which is instructive for understanding the limited demand for higher value capabilities and the continuing demand for low skilled labour, especially in the form of migrant and other sources of temporary labour. Some CEM firms have been found to employ 50% or more of their workers on temporary contracts (Sturgeon 2003). Demand for such workers reflects the fact that CEMs employ a high degree of standardisation to service common manufacturing procedures such as assembly, warehousing and logistics; their reliance on unskilled labour reflects their 'McDonald's' approach to manufacturing (Lüthje 2002).

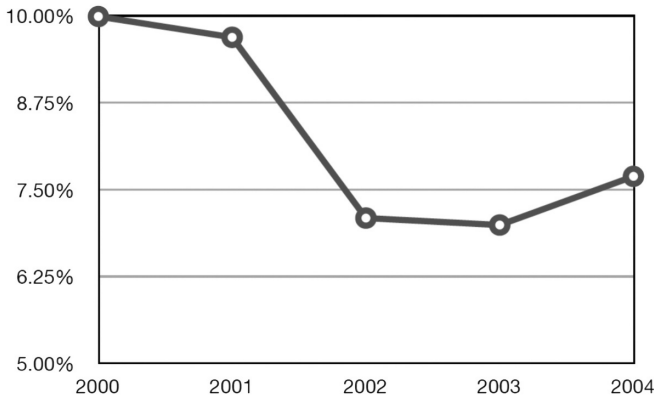
Although no firm-level evidence for the increasing reliance on migrant workers exists for the Malaysian case, it can be inferred from two features underlying the available evidence: (a) the coincidence of CEM investment in Malaysia and the growth in foreign migrant workers on temporary contracts ⁶, and (b) the near perfect mirroring of market shifts in the US with the use of migrant labour between 2001 and 2004.

Firstly, US CEM firms began moving into Malaysia in the early 1990s. Prior to this point, the use of migrant labour in electronics had been negligible. However, in the early 1990s, CEMs, alongside other manufacturers, were reportedly vociferous in lobbying the Malaysian government to liberalise its markets for imported labour (interviews with MIDA, Kuala Lumpur, June 2004). This partly helps to account for the dramatic step change in the demand for migrant labour between 1992 and 1997 after more than a decade of virtually no employment of migrants in the electronics industry (see Figure 1).

Secondly, the role of CEMs can be inferred from the coincidence between changes in market demand for electronic products (e.g. computers, peripherals and many electronics components) in the US and the demand for migrant labour in Malaysia. While signs of a slowdown in US electronics markets had emerged over the late 1990s (as did a variable demand for migrant labour in Malaysia following the Asian economic crisis of 1997), the interrelations between these two markets is clearly demonstrated by the drastic decline in US electronics demand that followed the September 11th 2001 attacks. As the principal market for Malaysian electronics, slowdown in US demand inevitably impacted on employment patterns in Malaysia.

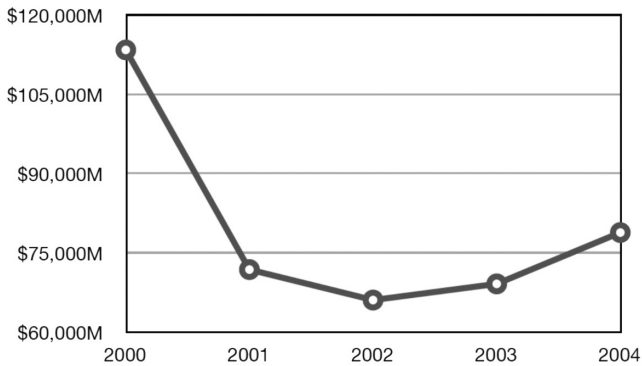
For CEMs, migrant labour in countries such as Malaysia is not simply a replacement for local labour; it is a form of labour market flexibility that buffers firms in times of market volatility. Thus, reductions in the employment of migrant workers are to be expected as CEMs lay-off their 'slack human resources' to protect themselves from declining demand. Similarly, indications of a resumption in market demand tend to lead to increases in the demand for flexible (and thus often migrant) labour. This is precisely what appears to have happened in Malaysia between 2001 and 2004 (Figures 2 and 3).

Figure 2: Percentage of migrant workers in Malaysian electronics, 2000–2004



Source: Phillips/Henderson (2008: 608, Figure 1)

Figure 3: US market for semiconductors and related devices, 2000–2004



Source: Phillips/Henderson (2008: 609, Figure 2)

5. Conclusions

Several studies affirm that technology transfer and upgrading of manufacturing processes had occurred in Malaysia by the end of the 1990s (e.g. Haggard et al. 1998; Jomo et al. 1999; Rasiah 1995). The examples on which they draw, however, do not serve to moderate the serious structural limitations – derived from the nature of GPNs – that Malaysian electronics industries now confront. Electronics industries there continue to be dependent on the import of intermediate components and to a greater extent than was the case with the earlier East Asian industrialisers. In the late 1980s, for instance, 43% of Malaysia’s final product exports were based on intermediate imports, compared with 37% of Korean exports (Takeuchi 1997, referenced in Ernst 2003). Such figures worsened during the 1990s as the domestic supply system continued to be unable to meet the changing component needs of multinational exporters. Recent estimates place the value of intermediate imports at over half that of all electronics exports. Thus in 2003, 73.1% of all electronic imports were of intermediate components used in the production of finished and semi-finished exports⁷. This is equivalent to over

54% of the total value of electronics exports during that same year. While the value of local content was thus the equivalent of 46% of electronics exports, the vast majority of this stemmed from the operations of foreign affiliates in Malaysia, rather than local suppliers.

Our analysis yields two conclusions. Firstly, the Malaysian case demonstrates that theories of upgrading should regard GPNs as providing only ‘windows of opportunity’ to be exploited by domestic agents. In Malaysia, the period in question seems to have been from only about the mid-1980s to the early 1990s. This is when most of Malaysia’s more successful SMEs emerged. However, these success stories were few in number and were based largely on the entrepreneurial aspirations of particular ‘intrapreneurs’⁸ in the context of opportunities that momentarily arose from the outsourcing pressures that US multinationals, at that time, were under. Times change, however, and with them the strategic intent of multinationals.

While it is important not to overstate the significance of the CEM ‘revolution’ for GPN architectures, the problem with regard to Malaysian upgrading was that the ‘waves’ of investment by both US CEMs and East Asian OEMs hit the Malaysian electronics industry at a time when federal government policy had only just begun to reflect the need to move the local supply base away from its traditional position as a low-value assembler of imported components. More was not made of this ‘window of opportunity’, in part because government industrial policy with regard to the electronics industry was more reactive than ‘market-leading’. Pro-active initiatives did not begin until the late 1980s and reforms aimed at promoting linkages between foreign and local firms emerged only around 1993 (Henderson/Phillips 2007). Unfortunately, such initiatives were too little and too late, as by then the GPNs within which Malaysian companies were absorbed were themselves in transition. This leads to our second conclusion. When ‘windows of opportunity’ are missed, GPNs can have a negative impact on industrial upgrading, generating lock-in effects that can trap domestic firms within established – and increasingly counterproductive – modes of operation from which they cannot easily be released.

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- 2) By the early 1990s, Matsushita (Japanese) had nine factories in Malaysia, but no Malaysians as senior managers. Intel (US), however, with two factories, had not a single expatriate in its senior management team (JH fieldwork notes, Malaysia, 1992).
- 3) Contract manufacturing is often referred to as 'product service companies', 'electronics manufacturing services' or 'electronics contract manufacturing services'.
- 4) Companies without their own wafer fabrication facilities.
- 5) Respectively, the largest CEM firms were: Flextronics (Singapore), Solectron (USA), Sanmina-SCI (USA), Celestica (Canada), Jabil Circuit (USA).
- 6) In the mid 1990s, the World Bank was recommending policy-makers in Malaysia to relax tight immigration policies and promote the inflow of foreign workers (World Bank 1995).
- 7) Figures provided by Ramli Othman, Director of the Electronics Industry Division of the Malaysian Industrial Development Authority (Seminar on Opportunities in the Electronics Industry, Penang, 15 June 2004).
- 8) That is, entrepreneurs emerging from employment in the Malaysian subsidiaries of major foreign-owned companies.

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Abstracts

Many argue that foreign direct investment can promote industrialisation when firms 'learn from global buyers' and move into higher value activities in global production networks (GPNs). We find that global linkages may also trap domestic firms within lower value positions and thus problematise further opportunities for robust economic development. Through a study of Malaysian electronics, we argue that industrial upgrading is historically contingent upon the interactions between shifting GPN architectures and local institutional dynamics. This qualification suggests that, far from being a panacea, GPNs offer only 'windows of opportunity'. If these are not grasped, GPNs can have negative impacts in the sense that they may begin to erode the possibilities for industrial upgrading in developing countries.

Es wird vielfach argumentiert, dass ausländische Direktinvestitionen Industrialisierung fördern, wenn Firmen „von *global buyers* lernen“ und

höherwertige Arbeitsschritte in globalen Produktionsnetzwerken (GPN) übernehmen. Die Autoren stellen in ihrer Untersuchung hingegen fest, dass globale *linkages* inländische Firmen auch in einer untergeordneten Position festhalten können. Dadurch wird eine stabile wirtschaftliche Entwicklung erschwert. Anhand einer Studie der malayischen Elektronikindustrie argumentieren sie, dass *industrial upgrading* hinsichtlich der Interaktionen zwischen sich verändernden GPN-Architekturen und lokalen institutionellen Dynamiken historisch umkämpft und veränderbar ist. Dieser Befund deutet darauf hin, dass GPN kein Patentrezept darstellen, sondern lediglich „Zeitfenster“ bieten. Wenn diese nicht genutzt werden, können GPN negative Auswirkungen haben, weil sie die Möglichkeiten für ein industrielles *upgrading* in Entwicklungsländern untergraben.

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