Chapter 3

Evaluation on Fragmentation and Relocation of Electronics Industries to CLMV Countries: Viewpoints from Malaysia

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CHAPTER 3

EVALUATION ON FRAGMENTATION AND RELOCATION OF ELECTRONICS INDUSTRIES TO CLMV COUNTRIES: VIEWPOINTS FROM MALAYSIA

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Abstract

This is a Malaysian case study on the possibility of fragmentation and relocation of the electronics industries to the CLMV countries. An overview and historical sketch of the structure of the electronics industry in Malaysia is described. Its key feature is the GPN or global production networks, which accounts for the distributed nature of the firms throughout the world. A survey of firms was also undertaken identifying key features and rationalizing their presence in Malaysia. The firms' perceptions were used as a basis for examining the key issues in terms of relocating to CLMV countries. A set of approaches were discussed with respect to improving their attractiveness, correcting their weaknesses, and taking advantage of the strategic orientation of the GPNs of the electronic industry.

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INTRODUCTION

This chapter is the Malaysian case study of ERIA on upgrading infrastructure in the CLMV countries. The main subsections include a discussion on the industrial structure, history, current situation of key electronic subsectors and industries, possibility of fragmentation and challenges for CLMV countries, and policy recommendations based on perspectives of advanced ASEAN countries.

1. STRUCTURE OF THE ELECTRONICS INDUSTRY IN MALAYSIA

Malaysia is a middle income country in 2010. With a population of 28 million, it has Gross Domestic Product or GDP estimated at US$222 billion in 2008 and a per capita GDP of US$8,000[2]. In terms of industrial structure, the manufacturing sector comprised 32 percent of Malaysia's economy (i.e., value added)[3]. Within the manufacturing sector, electronics has the most contribution to total exports being 45 percent. Its 2008 performance posted a 55 percent of Electrical & Electronics or E&E exports among the other manufactured products for exports.

The electronics industry in Malaysia started in the early 1970s when the Government adopted an export-oriented strategy to promote industrial development. The late 1960s and the early 1970s coincided with the first wave of multinational firms

[2] International Monetary Fund (http://www.imf.org/external/pubs/ft/scr/2009/cr09253.pdf, accessed 20 February 2010).

[3] Ninth Malaysia Plan 2006-2010, page 50.

moving their operations to Asia[4]. Texas Instruments set up their first plant in Singapore in 1967. Penang's first foreign direct investment in 1972 was from the US and Europe, i.e. Clarion, National Semiconductor, Robert Bosch, Microsystem International and Litronix (now Osram). Subsequently, the Plaza Accord of 1985 saw another round of firms from Japan and Korea, moving investments offshore.

The electronics industry in Malaysia can be classified into three broad categories and the details are shown in Table 1:

a) Electronic components;

b) Consumer electronics; and

c) Industrial electronics

Table 1: Major Electronic Products Made and/or Assembled in Malaysia

Semiconductor Devices	Other Electronic Components	Consumer and Industrial Electronic Equipment
• Linear and digital ICs; • Memories and microprocessors; • Opto-electronics; • Discrete devices; • Hybrids; • Arrays; • High-reliability military products	• Capacitors, relays, switches, resistors; • Quartz crystals/oscillators; • Connectors, wire harnesses transformers, lead frames disk-drive parts; • Audio and videocassette mechanisms; • Magnetic heads, coils ferrite; • Micro-motors; • Printed circuit boards (PCBs)	• Colour TV receivers; • Audio products; • DVD players & recorders and home theatre systems, blue ray, mini disc, electronic games consoles and digital cameras; • Paging systems, walkie talkies, telephone sets; • Digital transmission equipment, satellite receivers; • Personal computers disk-drives, monitors, CD-ROM drives, keyboard and printers; • Telecommunication systems, public telephone exchanges

Source: MITI 1998 updated 2009 (http://www.mida.gov.my/en_v2/index.php?page=ee).

[4] Penang Development Corporation. Penang: Looking Back, Looking Ahead, 20 Years of Progress (circa 1990).

There are more than 1,695 E&E companies operating in Malaysia with US$24.5 billion worth of investments. Employment includes more than 596,000 persons or 37.8 per cent of the total employment in the manufacturing sector in 2006.[5] Table 2 shows the growth of the electronics industry over the past 20 years by output, employment, and exports. Output of the electronics sector reached about US$48 billion with an export value of US$67 billion in 2008. Almost 300,000 persons were employed in the sector. Table 3 shows its export performance by subsectors (components, consumer, and industrial). Since 1990, the dominance of the components (mainly semiconductors) had reduced, with industrial electronic products having top share.

The electronic components subsector mainly comprised of semiconductor devices and passive components. Malaysia is a base for many leading semiconductor companies

Table 2: Performance of the Electronics Industry, 1990-2008

Year	Output		Employment		Exports		Imports	
	US$ (bil)	% growth	No.	% growth	US$ (bil)	% growth	US$ (bil)	% growth
1990	7.5	27.7	144,000	17.1	8.6	28.5	-	-
1995	27.9	25.9	313,000	12.6	33.5	28.0	25.1	29.9
2000	44.0	31.0	423,600	10.9	56.0	18.4	37.7	30.6
2003	38.7	7.7	360,048	4.2	48.2	-2.8	36.4	-0.2
2008	48.3		296,870		67.5		-	
AAGR 2003-08	-	23.2	-	13.4	-	25.1	-	24.0

*Source:*http://moeaitc.tier.org.tw/idic/mgz_topic.nsf/6258d3c9832b5df548256a8e001ffa63/cdcc4bc550022b30482567820021da98?OpenDocument, and MIDA (2007). Business Opportunities in Malaysia's Electronics Industry and MIDA website (http://www.mida.gov.my/en_v2/index.php?page=ee) accessed 24 Oct 2009.

[5] Source: MIDA (2007), *Electronics Manufacturing Services*, MIDA; 90% comprise of electronics.

Table 3: Export-Import Performance of the Electronics Industry by Sub-sector

(US$ billion)

Year	Electronic components		Consumer electronics		Industrial electronics		Total	
	Export	Import	Export	Import	Export	Import	Export	Import
1990	4.7	4.6	2.0	0.1	1.8	1.8	8.6	6.6
1995	14.3	18.4	8.4	0.3	10.7	6.4	33.4	25.1
2000	22.1	29.4	7.0	0.2	26.7	7.9	55.8	37.5
2005	26.6	31.9	6.0	0.5	30.5	14.4	63.1	46.9
2008	28.3	33.2	6.2	0.7	33.0	15.4	67.5	49.3

Source: MIDA, 1998, IMP3 and http://digitalibrary.mida.gov.my/equip-mida/custom/p_presentation/Electronics/2009/Statusperformanceofelectronicsindustry2008.pdf.

from the USA (Intel, AMD, and Spansion), Asia (Toshiba, NEC, and ASE) and Europe (Infineon, Qimonda, and STMicroelectronics). For 2008, exports of semiconductor devices amounted to US$28 billion accounting for 38.6 percent of the total electronics exports for the period. Interestingly, there are more imports of components than exports, and they become inputs to the consumer and industrial electronics subsectors.

Semiconductor companies continue to expand and diversify their products in the country. Beginning with the simple packages such as CERDIP, PDIP and later moving on to more advanced packages (flip chip, ball grid array, chip scale packages, multilevel packages and system-on-chip), to meet the growing demand of the multifunctional products. The packaging technology has also moved from micron level to nanotechnology. Some of these companies are now using 45nm technology in the production process and undertaking R&D on 32nm technology.

The Malaysian electronics industry has moved from low-wage, labour-intensive manufacturing to low-cost, rapid ramp up, high volume, and increasingly automated

manufacturing industries, with special capabilities in assembly, testing and packaging of semiconductors and hard disk drives (Best 2007). Many of the world's top electronics companies have set up their assembly plants in Asia in the early years of the development of electronics industry. Malaysia has become a significant production base where the MNCs manage to enjoy good relative infrastructure, bureaucratic quickness when dealing with MNCs, political stability, muzzled labour organization and an English speaking labour force (Rasiah 2003).

As Penang was the first location to woo foreign direct investment or FDI in this area, it has developed into the semiconductor hub for the region and has the relevant infrastructure and resources in place to spur investment in the industry. However, it is important to note that there is no room for complacency. In order to maintain the industry's competitiveness, the Malaysian Government has identified the 'widening and deepening of semiconductor value chain' as one of the strategic thrusts under its Third Industrial Master Plan (IMP3)[6]. A total of 35 semiconductor projects with investments amounting to US$4.53 billion were approved during the first three years of the IMP3 period (2006-2008). Table 4 shows the number of projects that were approved for the electronics sector between 1985 and 2008.

In 2008, a total of 39 projects were approved in the electronic subsector with investments amounting to US$1.5 billion. The projects approved were for the production of semiconductor devices, printed circuit boards, substrates, passive components and high brightness light emitting diodes (HBLED).

[6] Industrial Master Plan 3: 2006-2010, chapter 8 (Electrical and Electronics)

Table 4: Number of Electronics Projects Approved by Sub-sector 1985-2008

Year	Electronic Components		Consumer Electronics		Industrial Electronics		Total	
	No.	Capital Investment (US$ mil.)	No.	Capital Investment (US$ mil.)	No.	Capital Investment (US$ mil.)	No.	Capital Investment (US$ mil.)
1985	17	43.1	9	1.9	11	8.9	37	53.9
1990	143	1,029.8	25	419.6	38	210.3	206	1,659.7
1995	95	371.4	29	79.8	50	764.5	174	1,215.7
2000	75	3,010.8	45	142.6	87	1,392.2	207	4,545.6
2005	n/a	2,142.9	n/a	59.3	n/a	1,269.8	n/a	3,472.0
2007	44	3,228.5	15	589.1	31	231.5	90	4,049.1
2008	39	1,511.7	7	45.4	40	996.1	86	2,553.2
2009	32	858.5	7	119.3	25	117.8	64	1,095.5

Source: MIDA, 1998 and Various Issues of MIDA Performance.

Also, seven other projects were approved in the consumer electronics subsector with US$45.4 million in investments. Two of these were new projects amounting to US$40.94 million (90.1%) and five were expansion/diversification projects of US$4.47 million (9.9%).

For industrial electronics, 40 projects were approved with a total investment of US$996 million, a three-fold increase compared to 2007. The development of the Electronics & Electrical (E&E) industry in Malaysia is mainly due to FDI and is very much a part of the global production network (GPN) of multinational companies (MNCs). This phenomenon has been analysed in the literature by various economists. In particular, Ernst (2001) argued that the GPN was much broader than merely production. He disclosed that these MNCs controlled all stages of the value chain. Their flagships dominate over the network resources as well as decision making and used knowledge diffusion to keep the networks growing.

Table 5 summarises the typology of electronics production networks in Asia since the early days of the electronics industry. US companies produced more sophisticated industrial electronics especially involved in the manufacture of hard disc drives (HDDs), PCs, printers, and telecommunications products. The Japanese and Korean owned companies in Asia mostly produce consumer electronics and components with a closed, centralised, long-term and stable cross-border production networks. The Taiwanese-owned electronic companies have become more heavily specialised in PCs

Table 5: Typology of Electronics Production Networks in Asia

Characteristics	**US owned**	**Japanese Owned**	**Taiwanese Owned**	**Korean Owned**	**Singapore Owned**
Production Mix	Sophisticated industrial electronics	Consumer and low-end components, commodity industrial	PC electronics	Consumer, some components	Disk drive and PC electronics
Accessibility	Open	Closed	Open	Closed	Open
Permanence	Fluid	Long-term	Fluid	Long term	Long term
Ability to adjust to market/tech shifts	Fast	Slow	Moderate and fast	Slow	Moderate
Governance	Decentralised	Centralised	Centralised	Centralised	Centralised
Supply base preference	Anyone meeting price, quality, delivery constraints	Domestic and local affiliated	Domestic and local Chinese	Domestic	Local Chinese
Exploitation of intra-Asia value-added	Maximises local Asian value-added	Maximises Japanese value-added at home and locally; minimises rest of Asia value-added	Maximises Taiwanese value-added but exploits local Chinese value-added where necessary	Maximises domestic Korean value-added	Maximises high domestic and low local Asian value-added

Source: Borrus, M., D. Ernst and S. Haggard, 2000, "*Cross-Border. Production Networks and the Industrial Integration of the Asia-. Pacific Region*".

and its components. Singapore-owned companies manufacture computer peripherals and some high-end products of these categories.

The GPNs comprise of flagships which are considered the heart of the network. They command use of resources and direct strategic decisions of the network. These include the following: (1) Original Equipment Manufacturers (OEMs) and (2) Contract Manufacturers (CMs) or Electronic Manufacturing Services (EMS). It should be noted that the EMS are more typical of the US-based system, whereas the Asian electronics manufacturers are known to have their own set of supplier firms.

Ernst (2001) posited that GPNs had multi-tier network of networks. At the first level, the OEMs and the EMS have a global network of operations. In addition, within each location they also have built up a network of suppliers and service providers who can provide local services and support (second level). It is also important to note that this network is not confined to one location but extends to the region (third level). Wong (1999) documented that for the hard disk drive industry in Singapore, the network extended to Penang, Thailand and others. Key observers of the industry interviewed for this project claimed that components are still supplied from Singapore.

The local players within the GPN, such as the service providers and suppliers, provide various services ranging from contract chip assembly to design and manufacturing to post-manufacturing services.[7] The higher-tier suppliers have capabilities such as new product introduction (NPI), embedded software (system on chip), system integration and in the management of network resources, supply chain and customer relations. They are the intermediaries between the flagships and the second

[7] Source: http://www.mida.gov.my.

lower-tier suppliers.

The lower-tier suppliers are usually the Asians, which are identified as the weakest link in the GPNs. They specialised in automation, plastics, precision engineering and metal work, chemical products and packaging of various kinds. Their main competitive advantage is low cost, speed, and flexibility in delivery. They are usually the most vulnerable to abrupt changes in markets and financial crises.

All elements of the GPN are visible in Penang, but the GPN have clearly evolved in tandem with the industry and global-regional changes taking place.

The electronics industry started in Penang, a small state in the northern part of Peninsular Malaysia, since 1971. The island became highly industrialised when it was able to attract the first wave of electronics firms from the US, Japan, and Germany. Over the years Penang has attracted more than 200 MNCs high-tech electronic plants. The flagship OEM firms include Dell, Intel, AMD, Altera, Motorola, Agilent, Hitachi, Osram, Bosch, Fairchild, and Seagate. These are located within the Bayan Lepas Free Industrial Zone.

Electronic Manufacturing Services (EMS) companies have established in Penang as part of a global trend. The larger EMS companies such as Flextronics (which bought over Selectron) and SCI-Sanmina have been in Penang for several years. There are also the smaller EMS companies such as Jabil, Venture, Plexus (all in Penang), and Celestica (in Kulim). The larger EMS companies focus on volume production, earning 2-3 per cent margins. The smaller EMS companies get 6-8 per cent margins as they take on smaller customized jobs. The major concerns for the EMS companies are the supply chain as this is where they make their profits, while their business model is volume and low price.

An important strategy that has supported the GPNs of the electronics industry has been the development of the industrial cluster. When the first MNCs set up in Penang, they were very much having self-contained operations, in so far as the production aspect was concerned. Due to various changes in the industry, particularly the decentralisation of procurement responsibilities to individual establishments in the mid-1980s, local suppliers flourished. The Malaysian government also promoted the development of the industrial cluster in the Second Industrial Master Plan (1995-2005). In Penang, more than 1,200 local support industries have sprung up within and around the Bayan Lepas area. The Penang Automation Cluster that was formed in 2005 comprises over 50 local firms that provide automation support and services, from production to communications and networking to the MNCs[8]. Such cluster helped keep Penang competitive.

The electronics industry is extremely dynamic because it is based largely on technology, which is a major driver of change. These changes also characterised the pattern of industrial development in Penang. Its electronics industry started with consumer electronics and semiconductor assembly, packaging, and test. Disk drive manufacturers had set up in the late 1980s but could not survive the competitive nature of the industry. With the Asian financial crisis of the late 1990s, electronic firms have relocated the lower value parts of the business from Penang to China, Thailand, and Vietnam. Since the mid-1990s, some flagship manufacturing firms have started to divest their manufacturing operations to the EMS. In recent years, many EMS firms have considered shifting out of Malaysia after their initial contracts expired. This trend continues. Since the late 1990s, Penang has been experiencing a gradual decline of FDIs

[8] Penang Economic Monthly, Volume 8 Issue 7, July 2006, also available at (accessed 20 Feb 2010) http://www2.seri.com.my/Economic%20Briefing%20-%20Pg%20Econ%20Rept/EconBrief2006-07.pdf.

due to factors like cheaper labour costs in China, India, Thailand, and Vietnam.

Due to the nature of the electronics industry, the OEMs and EMS companies in Penang have also established their investments in other locations. For instance, INTEL Inc., an OEM, has been operating in 48 countries. Their operation includes fabrication, test, and assembly facilities. Renesas Technology Corporation (formerly Hitachi), a Japanese OEM semiconductor manufacturer, is engaged in manufacturing, design, and sales operations in 20 countries with a global workforce of 25,000. Jabil Inc., an EMS company, has 59 facilities in 22 countries with 85,000 employees. Flextronics, an EMS company in Singapore is present in 30 countries. Hence, it is not surprising that many of their suppliers are also found in these locations. Even the larger local-based suppliers in Penang have started operations elsewhere (e.g., Eng Teknologi has operations in the Philippines, Thailand, and China). However, most of the local suppliers opted to remain in Penang, although they have seen the disruptive changes in the industry and in some cases were even invited to move with the other OEMs and the EMS.

Many of the world's top electronics companies have set up their assembly plants in Asia in the early years of the development of electronics industry. Malaysia has become a significant production base where the MNCs manage to enjoy good infrastructure, bureaucratic quickness when dealing with MNCs, political stability, muzzled labour organization, and an English speaking labour force (Rasiah 2003).

2. POSSIBILITY OF FRAGMENTATION AND CHALLENGES FOR CLMV COUNTRIES

Although the electronics industry in Malaysia is part of a multi-tiered network of GPNs,

it is not clear whether firms would choose to stay or move to other locations that offer more competitive environments. It is clear that the OEMs and EMS companies in Malaysia are continually searching for locations that would reduce their risks and lower production cost. To understand how decisions are made, a survey was conducted among firms in the electronics industry in Penang. This section describes their characteristics and conditions of their continued operation. The next section discusses their responses to the attractiveness of the CLMV countries.

2.1. Characteristics of Electronics Firms that were interviewed

Two major types of data gathering were undertaken. First, 15 institutions were selected for formal interviews using a semi-structured questionnaire that was standardised across the countries. Second, informal interviews were also conducted among key respondents with insights in the industry, especially those who recently retired from the major firms. Table 6 shows the firms that were formally interviewed.

Nine of the firms had 100 percent foreign owned capital (Table 7). Out of nine foreign investors, five are EMS companies and four are OEMs. Of the foreign

Table 6: Number of Firms by Industry Category

Industry Category	Number of firms	%
EMS companies	5	33
OEMs	5	33
Tooling Shop	3	20
Institutional	2	13
Grand Total	15	100

Source: Survey results.

Table 7: Number of Firms by Capital Structure and Industry Category

Industry Category	Capital Structure			
	100% Local	100% Foreign	Joint Venture	Total
EMS companies	-	5 (100%)	-	5 (100%)
OEMs	1 (20%)	4 (80%)	-	5 (100%)
Tooling Shop	3 (100%)	-	-	3 (100%)
Total	4 (31%)	9 (69%)	-	13 (100%)

Source : Survey results.

Table 8: Nationality of Major Foreign Investor(s)

Country	Canada	German	Singapore	US	Total
EMS companies	1	1	1	2	5
OEMs	-	2	-	1	3
Total	1	3	1	3	8

Note: One missing case.
Source : Survey results.

shareholders, German (n=3), United States (n=3), Singapore (n=1) and Canada (n=1) emerged as the largest owners (Table 8).

Table 9 shows the distribution of firms by factory location. Out of the 13 firms interviewed, about 54 percent of the firms were located in the export processing zones (EPZ[9]) and 46 percent were located in industrial estate. Firms that are located in industrial estates are EMS companies (n=2), OEMs (n=1) and Tooling Shop (n=3). Of those firms located in SEZ or in EPZ, three are EMS companies and four are OEMs. The major difference between EPZ and Industrial Estate is that the latter is in the

[9] In Malaysia, they are known as Free Industrial Zones (FIZs).

Table 9: Number of Firms by Factory Location

Industry Category	Factory Location			
	In Ind. Estate	In EPZ	Outside of EPZ	Total
EMS companies	2 (40%)	3 (30%)	-	5 (100%)
OEMs	1 (20%)	4 (80%)	-	5 (100%)
Tooling Shop	3 (100%)	-	-	3 (100%)
Total	6 (46%)	7 (54%)	-	13 (100%)

Source : Survey results.

principal customs area, and is therefore subjected to import duties and taxes.

In terms of size, their annual sales value and employment size were good indicators. About 20 percent of the firms (n=2) had annual sales exceeding US$289 million, one firm had annual sales of US$144 million to US$289 million, two firms claimed that their annual sales ranged from US$28.9 million to US$144 million,

Table 10: Share of Firms by Annual Sales

Annual sales	EMS Companies	OEMs	Tooling Shop	Total
Less than US$7.2 mil *(Less than RM 25 mil)*	0	1 (20%)	1 (100%)	2 (20%)
US$7.2 mil to US$28.9 mil (*RM25 mil to RM100 mil*)	0	3 (60%)	0	3 (30%)
US$28.9 mil to US$144 mil (*RM100.1 mil to RM500 mil*)	1 (25%)	1 (20%)	0	2 (20%)
US$144 mil to US$289 mil (*RM500.1 mil to RM1 bil*)	1 (25%)	0	0	1 (10%)
More than US$289 mil (*More than RM1 bil*)	2 (50%)	0	0	2 (20%)
Total	4 (100%)	5 (100%)	1 (100%)	10 (100%)

Note: 3 missing cases.
Source : Survey results.

whereas 3 firms have US$7.2 to US$28.9 million annual sales, and two firms indicated that their annual sales are less than US$7.2 million (Table 10).

Table 11 shows the share of firms by number of full time employees. The number of full times employees of the companies surveyed ranged from 30 to 8,000. About 9 percent of the firms interviewed have between 5 and 50 full-time employees categorized as small firms[10]. Two firms have 51 to 150 full time employees, and 3 firms claimed that their workers are in the range of 151 to 500 persons. The total employment of the respondent firms was 20,344. Foreign firms account for 20,130 workers.

Table 12 shows the share of firms by export ratio of manufactured goods. All EMS companies interviewed (n=5) and one tooling shop reported 100 percent export ratio for their manufactured goods respectively. Sixty percent of the OEMs interviewed have indicated 100 percent export ratio. One OEM firm exported 90 percent of their manufactured goods and another OEM only exported 40 percent of its product.

Table 11: Share of Firms by Number of Full Time Employees

Number of full time employees	EMS Companies	OEMs	Tooling Shop	Total
Between 5 and 50 *(Small Enterprise)*	0	1 (20%)	0	1 (9%)
Between 51 and 150 *(Medium Enterprise)*	0	1 (20%)	1 (100%)	2 (18%)
Between 151-500	1 (20%)	2 (40%)	0	3 (27%)
More than 500	4 (80%)	1 (20%)	0	5 (45%)
Total	5 (100%)	5 (100%)	1 (100%)	11 (100%)

Note: 2 missing cases.
Source : Survey results.

[10] Small enterprise refers to a company with sales turnover between RM250,000 and less than RM10 million or with full time employees between 5 and 50; medium enterprise is company with sales turnover between RM10 million and RM25 million or having full time employees between 51 and 150.

Table 12: Share of Firms by Export Ratio for the Manufactured Goods

Export Ratio	EMS	OEMs	Tooling Shop	Total
40 per cent	0	1 (20%)	0	1 (9%)
90 per cent	0	1 (20%)	0	1 (9%)
100 per cent	5 (100%)	3 (60%)	1 (100%)	9 (82%)
Total	5 (100%)	5 (100%)	1 (100%)	11 (100%)

Note: 2 missing cases.
Source : Survey results.

Table 13: Number of Firms by Export Market

Export Market	EMS	OEMs	Tooling Shop	Total
US	4	2	1	7
EU	5	2	1	8
Australia	1	2	1	4
China	1	2	1	4
ASEAN, esp.Thai	3	2	2	7
Japan	0	2	0	2
Vietnam	0	0	1	1
Asia Pacific	0	0	1	1
Total	14	12	8	34

Note: This is a multiple response answers with 34 valid cases.
Source : Survey results.

The major export markets are United States (n=7), Europe (n=7), Australia (n=4), China (n=4), and Thailand (n=4). The details are summarised in Table 13.

2.2. Characteristics of Operations

The attractiveness of a particular location depends on the efficiency in the firms' operations. This section discusses various aspects of efficiency.

Table 14: Lead Time of Electronics Firms (period between a customer's order and delivery of products)

Lead Time	EMS Companies	OEMs	Tooling Shop	Total
Less than 2 weeks	2	4	0	6
2 weeks to a month	2	1	0	3
More than a month	1	0	3	4
Total	5	5	3	13

Source : Survey results.

An important aspect of any GPN operation is the ability to respond to customer's order and organise production to meet those orders. Table 14 shows the lead time to fulfil customer's orders. Out of the 13 firms interviewed, six OEMs and EMS companies are able to meet the targets in less than two weeks while three finished within a month. Three tooling shops and only one EMS made it after more than one month.

The lead time of their suppliers is less tight. In general, the OEMs have tighter deadlines than the other two types. Two EMS companies said that orders were fulfilled within a month but the rest were almost five months. It is important to note that these results fit with the understanding that EMS companies are not that flexible as their strength is high volume and low margins. Thus, the entire production process requires time to set up and produce. Tooling shops reported supplier's lead time was less than two months (Table 15).

Table 16 shows the transport mode of the firms. Majority of them (92%) used multimodal transport mode, which is important not to over-emphasize on any one mode.

Table 15: Lead Time of Supplier Firms (period between respondent's order for import materials and its delivery)

Lead Time	EMS Companies	OEMs	Tooling Shop	Total
Within 2 weeks	0	1	0	1
2 weeks to 1 month	2	1	0	3
1-2 months	0	2	3	5
3 months	0	1	0	1
>3 months	3	0	0	3
Total	5	5	3	13

Source : Survey results.

Table 16: Share of Firms by Transport Mode

Transport mode	EMS	OEM	Tooling Shop	Total
Airplane	0	1 (20%)	0	1 (8%)
Multi modals	5 (100%)	4 (80%)	3 (100%)	12 (92%)
Total	5	5	3	13

Source : Survey results

In terms of time consumed for customs clearance, two firms indicated that it took them less than 2 hours to bring out their container of goods from port or at the airport. Another 2 firms reported that it took them about 2 days to process customs clearance. Table 17 shows the details of the time required for exports customs clearance by different unit quantities.

With regard to the time consumed for import customs clearance, three firms indicated that about one to two days were spent processing. Six firms reported between two to four hours, and one firm experienced around 72 hours to clear their imported goods per one bill of lading (Table 18).

Table 17: Number of Firms by Time Consumed for Export Customs Clearance

Time (hours)	EMS	OEM	Tooling Shop	Total
Per Container				
0.5 hours	0	1	0	1
2 hours	1	0	0	1
2 days	0	2	0	2
Per Carton				
1 hour	1	0	0	1
3 hours	1	2	2	5
4 hours	1	0	0	1
1 hour per machine	0	0	1	1
8 hours per shipment	1	0	0	1

Source : Survey results.

Table 18: Number of Firms by Time Consumed for Import Customs Clearance

Time consumed for customs clearance	EMS	OEM	Tooling Shop	Total
Per Container				
2 hours	1	0	0	1
24 hours	0	1	0	1
48 hours	0	2	0	2
Per carton				
1 hour	1	0	0	1
3 hours	1	1	0	2
4 hours	1	1	2	4
2 hours per machine	0	0	1	1
72 hours per one bill of landing	1	0	0	1

Source : Survey results.

The average monthly wages or salaries of employees comprised the following: (1) workers US$196; (2) middle managers US$1,783; and (3) engineers US$882. As seen in Table 19, OEMs give higher wages to their employees compared to EMS companies

Table 19: Average Monthly Wages and Salary by Type of Employees (US$)

(US$/Month)	EMS	OEMs	Tooling Shop	Mean
Workers	178	217	191	196
Middle Managers	1,267	2,286	1,809	1,783
Engineers	750	1,029	857	882

Source : Survey results.

Table 20: Number of Firms by Educational Background and Type of Employees

Educational Background	EMS	OEMs	Tooling Shop	Total
Workers				
Almost 100% High School	3 (60%)	2 (40%)	1 (33%)	6 (46%)
81-85% High School	1 (20%)	2 (40%)	2 (67%)	5 (38%)
<80% High School	1 (20%)	1 (20%)	0	2 (16%)
Middle Managers				
98-100% College/university	4 (80%)	5 (100%)	3 (100%)	12 (92%)
95% College/university,	1 (20%)	0	0	1 (8%)
Engineers				
100% College/university	5 (100%)	5 (100%)	3 (100%)	13 (100%)

Source : Survey results.

and Tooling Shops.

Table 20 shows the employees' educational background by industry type. About 85 percent of firms interviewed (n=11) reported that more than 80% of their workers received high school education. Among the middle managers of the firms, 92 percent of the firms interviewed (n=12) reported that 98% of their middle managers had attended college or university. Only one EMS firm responded that 95% of their middle managers received college or university education and 5% from vocational school. All engineers of the firms graduated from college or university. Thus, the general education level of

the workers appears to be fairly high.

Table 21 summarises the firm's labour turnover ratio for 2008. About 62 percent of the firms interviewed (n=8) had labour turnover of 1-5%. Two OEMs reported labour turnover of 6-10% and 11 percent to 15%. One firm reported a labour turnover of 20 per cent. This is possible if there was a change in migrant labour.

An average of 54 days takes a new worker to become productive. Table 22 shows the various response times for a new worker to be productive. Workers of an EMS firm

Table 21: Share of Firms by Labour Turnover Ratio

Turnover Ratio	EMS	OEMs	Tooling Shop	Total
1% to 5%	2 (40%)	3 (60%)	3 (100%)	8 (62%)
6% to 10%	0	1 (20%)	0	1 (8%)
11% to 15%	0	1 (20%)	0	1 (8%)
Above 15%	3 (60%)	0	0	3 (23%)
Total	5 (100%)	5 (100%)	3 (100%)	13 (100%)

Note: Labour turnover ratio= number of workers who left the firm/total number of workers in 2008.

Source : Survey results.

Table 22: Time Required for a New Worker to Become Productive

Average Days	EMS	OEM	Tooling Shop	Total
Less than 2 weeks	1 (20%)	1 (25%)	0	2 (17%)
2 weeks to One month	3 (60%)	2 (50%)	0	5 (42%)
One month to 2 Months	0	1 (25%)	2 (67%)	3 (25%)
More than 2 months	1 (20%)	0	1 (33%)	2 (17%)
Total	**5**	**4**	**3**	**12**
Total Average days	*41*	*27*	*113*	*54*

Note: 1 missing case.

Source : Survey results.

Table 23: Share of Firms by Frequency of Black-Out

Black-out Frequency	EMS	OEM	Tooling Shop	Total
Have not experienced in a year	4 (80%)	5 (100%)	3 (100%)	12 (92%)

Source : Survey results.

need 41 days, an OEM firm 27 days, and tooling shop 113 days. Most firms (58%) reported that a new worker needs less than a month to become productive, whereas about 25 percent of the firms indicated that it takes one to two months. However, there are two firms which reported that their new workers need at least 3 months and above to become productive.

About 92 percent of the interviewed firms reported that they have not experienced black-out in a year. Only one EMS firm claimed that it happened once or a few times in a month, which could be due to a situation where there was confusion in response (Table 23).

In summary, Penang as a location has attained a certain level of operational efficiency. Firms are able to respond to customer's order relatively quick (within 2 months). The logistical conditions are good, less time incurred in customs clearing process, and with flexibility in transport modes. Workers are relatively well-educated and can become productive within a short period of time although their wage levels are higher than those of the CLMV countries.

3. CHALLENGES FOR CLMV COUNTRIES: AN EVALUATION OF THEIR INVESTMENT CLIMATE

This part of the report evaluates the perception of firms on the CLMV countries based on investment climate elements such as land price, wages, utilities cost, distance to ports , workers educational level, tax incentives among others.

Among the 13 firms interviewed, only three firms had experienced factory relocation. One OEM had relocated from US/Taiwan to Penang because its operation cost is much cheaper and the competency in product transfer is high. One EMS company expanded in Vietnam due to lower operational cost. One tooling shop relocated from Penang to Bangkok to provide better service to their customers.

Most of the firms interviewed considered the following reasons in factory relocation— provision of infrastructure (nearer to the port) and logistical systems, lower operational cost, opportunity to create new customers (customer driven), availability of tax incentives, availability of unskilled and skilled labour and cost associated with utilities and transport.

Table 24 summarises the weighted scores of investment climate elements by ranking the level of importance. An analysis of the weighted scores revealed that the most important element is the workers' educational level, followed by wage level, access to port and market, and price of energy or electricity. In addition, incentives like tax holiday, price of water for industrial use, and land price for owning or leasing are moderately important elements.

Table 25 shows the perception of the firms interviewed on CLMV countries. Majority of them (85%) indicated that they know CLMV countries well.

Table 24: Importance of the Investment Climate Elements

Investment Climate Elements	Total Scores
Educational level of workers	89
Wage level for workers	83
Access to port & markets	75
Price of energy or electricity	72
Incentives like tax holidays	56
Price of water for industrial use	54
Land price for owning or leasing	53

Note: Total Scores =Sum of Weighted Scores, Weighted scores for most important=9, second most important=8, third important =7; ……. and least most important=1.

Source: Survey results.

Table 25: Perception on CLMV Countries

Do you know CLMV countries well?	EMS	OEM	Tooling Shop	Total
Yes	4 (80%)	4 (80%)	3 (100%)	11 (85%)
No	1 (20%)	1 (20%)	0	2 (15%)
Total	5	5	3	13

Source: Survey results.

Table 26 shows the firm's evaluation of the investment climate in CLMV countries. Most firms (85%) gave Vietnam a "good" rating. Same percentage of firms (85%) gave Laos and Myanmar a "bad" rating. Cambodia was rated "bad" by some 69 percent of the firms while 31percent rated it as "fair." As can be seen, there is a two-tier assessment, with Vietnam standing out as the first tier, and then the others as not being attractive.

About 69 percent of the firms interviewed (n=9) indicated that they would not consider investing or operating in CLMV countries. Only one haven't decided a rating.

Table 26: Firms Evaluation of the Investment in CLMV Countries

Investment in CLMV countries	Good	Fair	Bad	Total
Cambodia	0	4 (31%)	9 (69%)	13 (100%)
Laos	0	2 (15%)	11 (85%)	13 (100%)
Myanmar	0	2 (15%)	11 (85%)	13 (100%)
Vietnam	11 (85%)	2 (15%)	0	13 (100%)

Source: Survey results.

Table 27: Share of Firm in Considering Investing or Operate in CLMV Countries

Whether would consider investing or can operate in CLMV countries.	Frequency	%
Yes	3	23
No	9	69
Not yet	1	8
Total	13	100

Source: Survey results.

The rest have already considered investing in Vietnam (Table 27).

Table 28 summarises the advantages and disadvantages of investing in CLMV countries. The common advantages are labour availability, lower labour cost, availability of cheap labour, while the common disadvantages are poor infrastructure, poor supply chain, and low educational level. In terms of specific advantages for Vietnam are educational level, incentives and proximity to China and its local market. The firms said that Laos has high logistic cost and Myanmar as having risks in political stability.

It is interesting to note that respondents had emphasized all the efficiency criteria, e.g. labour cost, education, infrastructure, logistics, bureaucracy, and incentives. None

Table 28: Advantages and Disadvantages of CLMV Countries

	Advantages	Disadvantages
Cambodia	• Labour availability • Lower labour cost • Availability of cheap labour	• Poor infrastructure • Poor supply chain • Low educational level
Laos	• Lower labour cost • Availability of cheap labour • No exposure to hi tech industry	• Poor infrastructure • Poor supply chain • Low educational level • High Logistic Cost
Myanmar	• Labour availability • Lower labour cost • Availability of cheap labour • No exposure to hi tech industry	• Poor infrastructure • Poor supply chain • Low educational level • Political concern
Vietnam	• Labour availability • Lower labour cost • Availability of cheap labour • No exposure to hi tech industry • Educational Level • Incentives • Proximity to China • Local market	• Poor infrastructure • Bureaucratic inefficiency • Lack of supporting services • Poor supply chain • Availability of skilled labour and managerial staffs • Discipline of workers • Low educational level • Expensive land

Source: Survey results.

have mentioned markets or resources (other than labour), which is the other main consideration of firms opting to relocate. In this regard, one can conclude that firms seek to be cost efficient.

Table 29 shows the perception on other countries in comparison with CLMV countries. About 92 percent of the firms interviewed indicated that China is better than CLMV countries as a potential location for investment. All firms interviewed agreed that Bangladesh and Pakistan are worse than the CLMV countries. In comparing India with CLMV countries, 54 percent indicated that India is worse than the CLMV

Table 29: Perception on Other Countries in Comparison with CLMV Countries (as a potential location for investment)

	Better	Same as Vietnam	Worse	Uncertain	Total
China	12 (92%)	0	1 (8%)	0	13 (100%)
India	4 (31%)	1 (8%)	7 (54%)	1 (8%)	13 (100%)
Bangladesh	0	0	13 (100%)	0	13 (100%)
Pakistan	0	0	13 (100%)	0	13 (100%)

Source: Survey results.

countries, 31 percent responded that India is better and only one firm agreed that India is same as Vietnam being a potential location for investment.

Presumably, the MNCs in Malaysia measure the total cost of production (not just labour). However, as labour is likely to be the most attractive feature of the CLMV countries, there is a need to investigate whether the total cost of production is lower in Malaysia or CLMV, and secondly, how important is the labour component. For example, if direct labour cost is only 10 percent, and CLMV countries have a 50 percent lower labour cost, then their advantage is only 5 percent lower cost of production. Would this translate into MNCs shifting out to these CLMV countries? If the risks of establishing in the countries have not been evaluated yet, then it is not likely that there is enough information to suggest a relocation potential.

4. CONCLUSION AND POLICY RECOMMENDATIONS

What lessons can be learned from the Malaysian experience? The following observations are pertinent. First, the GPNs are deeply entrenched in the electronics industry. Many of the OEMs and EMS companies have worldwide production. Since 2000, they have been expanding their Asian operations, hence, here lies the opportunity. It is also important to note that Malaysian investments were made in some CLMV countries since the mid-1990s. These investment areas include textile and garment manufacturing, hotels and resorts, infrastructure upgrading and development. Hence, investing in CLMV countries is not new to Malaysian bas11ed firms.

Second, in order to attract firms, a stable, conducive investment climate must be in place. Investors need to be assured that they can take advantage of the "attractiveness" of the country whether it is the cost of labour, availability of supplier firms or a cluster of manufacturing sub-contractors, supply chain and logistics opportunities, or even the incentives, etc. that add to a good investment climate. Hence, countries should work on reducing their weaknesses.

Third, the competitiveness of the country must respond to the needs of the investors, if this development strategy is the desired path. In this regard, a 2007 study in Penang found that electronic firms saw Malaysia's strengths in its infrastructures—physical information, and financial as well as tax incentives, supplier base, and employees' skills. Hence, Malaysia's operational excellence appeals to them. However, when asked for the key drivers to their continued investment, their top 3 responses are: tax incentives, overall production cost, and skills. It can be concluded that such firms take operational excellence for granted, and they are looking for the icing on the cake

(incentives and overall production cost). Countries should work on their strengths in order to make it attractive to investors (Penang Skills Development Centre, 2007).

There is no certainty that the electronics industry would remain in Malaysia forever. In fact, several studies have shown that there are major weaknesses in Malaysia (Ernst, 2001 and Best, 2007). For instance, Malaysia is no longer a low-wage economy and labour scarcity has emerged—an estimated 1 million foreign workers. A good understanding of the weaknesses of the country, like trying to understand how investors see their country, is a major step to getting a list of priorities on what to do about the perceived problems.

Hence, the strengths of CLMV countries seem to be the availability of labour. However, low skill manufacturing has already exited Malaysia in the late 1990s. It seems that the approach to be taken is to upgrade skills and training, to develop a pool of technical and professional workers that have the capacity to work in a multinational environment. This is one approach that all countries must try to do. Investing in human resource development (engineers, technicians, and even scientists) has been the approach taken by many of the advanced ASEAN countries.

There are various paths of attracting FDIs. One can try to make a pitch that the markets in CLMV are large enough for OEM firms to consider a strategic investment. In this regard, INTEL Corporation could have taken a strategic position in HCMC. The same can be said of Jabil Inc. A second approach could be to try to attract a cluster of certain types of firms such as precision metals and engineering or firms making specialised motors (e.g. Nidec). Some Japanese firms have recently made investments in Vietnam. Indeed, targeting which firms to attract is important for countries to bring along their network of supplier firms and services. A third approach could be to examine

the possibility of opening up a corridor to link various industrial clusters or agglomeration centres. There are several opportunities for linking with Myanmar, Laos, Cambodia, and also toward southern Vietnam (through Bavet).

A common approach in many other countries is to improve the operational capacity of the country to manage FDI. In Malaysia, investors rated this factor as very high. To do this well takes not just infrastructure investments, it also requires to ensure that these infrastructures operate and perform efficiently. Thus, while it is necessary to develop sufficient power for manufacturing, but the key factor that most firms look for is the ability to ensure that there are no blackouts or brownouts. To do this well in the CLMV countries will require both focus and investment which also takes time to get a good level of performance.

Other types of operational infrastructure that Malaysia has are free industrial zones or FIZs and licensed manufacturing warehouses (LMWs) have been established to attract FDIs over the years. Such infrastructure are important in the major towns but they could also be good in the less urban areas, especially when utility facilities are poor, and economic processing zones (EPZs) can ensure that sufficient power is available. These facilities can act to develop a cluster or at least be a centre for agglomeration of industrial activities that could be linked up with the industrial corridors.

Communications and service links must be improved considerably as these are the elements that attract the attention of potential investors. In this regard, the airline and port facilities must be improved together with the shipping and airline services in the CLMV countries. These elements drive cost of relocation down and improve the overall attractiveness of the CLMV countries.

In conclusion, there are opportunities for CLMV countries to take advantage of

attracting the electronics industry. They will need to work on rectifying their weaknesses and improving more their strengths as well as take advantage of the GPNs continuing search for low cost production sites.

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