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Knowledge Acquisition: Lessons from Local and Global Interaction in the Indonesian Consumer Electronics Sector

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***Abstract*:** Knowledge acquisition plays an important role for firms, particularly those in developing countries, helping them keep up with process and product innovation and also to effectively compete in the domestic and export markets. Foreign direct investment is often regarded as the major source of knowledge acquisition for local firms in developing countries. The global value chain (GVC) framework provides an analytical tool for understanding knowledge transfer and acquisition in the context of governance. Based on empirical evidence within the Indonesian consumer electronics sector, this paper explores knowledge transfer and acquisition in the context of governance of value chains in which Indonesian manufacturing firms are engaged. Different forms of GVC governance have an impact on knowledge transfer and learning mechanisms within the chains. In captive value chains, Indonesian firms acquire production knowledge and capability from global lead firms by satisfying product and process specifications imposed by the global lead firms. In hierarchical structures, Indonesian firms learn from their joint venture partners not only production capability, but also design and product engineering. Within market-based structures, Indonesian firms acquire production and non-production knowledge through their own efforts in accessing external knowledge sources other than global lead electronics firms.

Keywords: global value chain, governance structure, knowledge acquisition

JEL Classifications: *L68, O14, O33*

1. Introduction

Innovation and learning is the key to competitiveness and sustainable growth of firms or nations. In developing countries, foreign firms are regarded as the most important sources of knowledge. These external sources of knowledge affect

the processes of learning and innovation by local manufacturing firms through various channels. These channels include foreign direct investment (FDI), joint ventures, licensing, original equipment manufacture (OEM), and capital goods import (Hobday, 1995). The two often-cited channels of knowledge acquisition are FDI and capital goods import. Foreign direct investment is more crucial since the foreign firms bring not only capital goods, but also new knowledge and capabilities. A number of developing countries have policies that encourage FDI and in particular they attract foreign firms to invest in technology-intensive industrial sectors. Such preference for technology-intensive industry is based on the consideration that production and research activities undertaken by foreign affiliates will induce knowledge and capability spillovers to local firms and local economies. However many factors may restrict knowledge transfer from FDI, and empirical evidence of FDI spillover to local firms and economies shows mixed results. Some studies (Kokko, 1994; Blomstrom and Sjoholm, 1999; Takii, 2005) found a positive effect of FDI on local productivity, while others (Aitken and Harrison, 1999; Haddad and Harrison, 1993) did not find significant spillover effects in developing countries. Moreover, external sources may be an effective means of transferring the results of innovation, but not necessarily the innovative capability itself (Lall, 1996).

The emergence of the global value chains (GVC) framework brings about a different approach in understanding knowledge acquisition and learning processes within developing countries. The GVC framework focuses on relationships between firms from developing countries (local firms) and global lead firms from advanced economies to bring a product from conception to consumption. Using this framework, independent local firms are engaged in value chains by supplying inputs, outputs and services for global lead firms. In return, global lead firms are said to transfer knowledge and capabilities needed by local firms to meet the requirements set by global lead firms. Thus by inserting themselves into global value chains, local firms have opportunities to enhance processes of knowledge acquisition and learning. The extent of knowledge flow from global lead firms to learning processes of local firms depends on the governance structure of the relationships. Consequently it is important to understand how the governance structure is established.

This paper aims to understand knowledge acquisition by Indonesian consumer electronics manufacturing firms within global value chains. More specifically, the paper investigates the question: how do different forms of value chain governance affect the extent of knowledge acquisition by Indonesian manufacturing firms?

The paper is organised as follow: Section 2 reviews the development of global and Indonesian electronics industries. Section 3 examines the GVC framework with special attention to different types of knowledge flows and learning processes

within various forms of governance structures. Section 4 reviews the methods of data collection and analysis. Section 5 explores the empirical findings from the Indonesian consumer electronics sector. Section 6 concludes.

2. Development of the Global and Indonesian Electronics Sectors

This section provides an overview of the dynamic trends within the global and Indonesian electronics industries. The macro overview of the Indonesian electronics sector provides a snapshot of its insertion into domestic and export market. The insertion of Indonesian electronics industry into export market in a greater extent, are linked to FDI of global firms through the establishment of their foreign affiliates in Indonesia. However, the macro-level analysis does not reveal information about other forms of governance structures. The dynamics of global electronics value chains demonstrate that FDI does not provide the only means of participation of electronics firms from developing countries. Electronics manufacturing firms from developing countries including Indonesia may take up roles as suppliers to global lead electronics firms. Therefore within these governance structures, Indonesian electronics firms bring about a different approach in understanding knowledge acquisition and learning processes.

2.1 The Shifts of Global Electronics Value Chain

Most studies of the electronics industry concentrate on hardware, i.e. electronic equipment and components (Hobday, 1995; Kim, 1997; Dicken, 1998; Ernst *et al*., 1998; Belderbos and Zou, 2006), while others include software and information and communication services (Ernst, 2002; Grantham and Kaplinsky, 2005; Hess and Coe, 2006).

Table 1: Electronic Product Classification

Classification	Product and system
Consumer electronics	Compact disc, high definition TV, video cassette player and recorder, stereo system, camcorder, radio
Telecommunications	Exchange, telephone, radar, broadcast equipment, mobile base station, microwave, fibre optics, satellite earth station
Defence	Aircraft, missile control system, shipping navigation equipment, space vehicle and testing system
Computing	Internet infrastructure (e.g. super server), personal and mainframe computer, disk drive, optical disk, laser and other printer, terminal
Industrial equipment	Process control equipment, robot system, numerical control equipment, motor control
Semiconductors	Microprocessor, memory, transistor, flat panel display, standard logic circuit, application specific integrated circuit

Source: Adapted from Table 1 (Hobday, 2001: 14).

Electronic equipment is in itself a very broad term and can be classified into six categories – telecommunications, defence, consumer electronics, computing, industrial equipment and semiconductors. Advanced countries tend to concentrate on high-end electronic hardware and software (Hobday, 2001).

Table 2: Leading Exporters and Importers of Telecommunication Equipment, 2007 (in billion dollars and percentage)

	Value	Share in world	Annual percentage change	
	2007	2007	2000-07	2007
Exporters				
European Union (27)	174.1	31.1	7	-13
extra-EU (27)				
Exports	53.3	9.5	6	4
China a	146.3	26.1	33	18
Hong Kong, China	54.7	9.8	16	18
domestic exports	1.0	0.2	9	849
re-exports	53.7	9.6	16	16
Korea, Republic of	40.2	7.2	16	8
Mexico a	39.8	7.1	11	24
United States	38.6	6.9	2	12
Japan	34.7	6.2	2	3
Singapore	17.7	3.2	11	-1
domestic exports b	6.4	1.1	8	-13
re-exports b	11.3	2.0	14	6
Malaysia a	13.2	2.4	0	-8
Taipei, Chinese	11.6	2.1	8	1
Canada	8.6	1.5	-4	-1
United Arab Emirates b	8.4	1.5	36	14
Thailand	6.3	1.1	7	-2
Israel	4.0	0.7	-1	11
Indonesia	2.7	0.5	-4	-7
Above 15	547.1	97.6	-	-
Importers				
European Union (27)	221.6	37.7	10	-7
extra-EU (27)	105.0	17.9	14	18
Imports				
United States	124.7	21.2	8	7
Hong Kong, China	48.3	8.2	13	12
retained imports	...	...	...	...
China a, c	35.7	6.1	16	1
Japan	21.9	3.7	7	25
Mexico a, d	21.6	3.7	13	14
Singapore	15.8	2.7	13	-2
retained imports b	4.6	0.8	10	-19
Canada d	14.2	2.4	5	12
Russian Federation b, d	12.5	2.1	36	44
India	9.9	1.7	46	30
United Arab Emirates b	8.7	1.5	19	-7
Australia d	8.5	1.4	8	11
Korea, Republic of	8.2	1.4	5	9
Brazil	5.1	0.9	8	16

Malaysia a	4.9	0.8	5	8
Above 15 e	513.5	87.4	-	-

Source: Adapted from Table II.50 (WTO, 2008).
Notes:
a Includes significant shipments through processing zones
b Includes Secretariat estimates.
c In 2007, China reported imports of telecommunications equipment from China amounting to $13.4 billion. For further information, see the Metadata.
d Imports are valued f.o.b.
e Excludes retained imports of Hong Kong, China.

The electronics sector shows a production shift among countries, particularly in the East Asian region (Lall *et al*., 2004). The East Asian region has become a centre of global electronics production. For instance, China, Hong Kong, and the Republic of Korea are leading exporters of telecommunications equipment (Table 2). This is not only due to the division of labour in global production activities, but also a catching-up process over time. Thus these Asian countries are able to reduce the gap in terms of technology and productivity with advanced economies such as the European Union and the United States. Literature has identified some factors affecting the catch-up process of East Asian countries (Akamatsu, 1961, 1962; Kojima, 2000; Hobday, 1995; Lall, 1996; Kim, 1997; Ernst, 2000; Luthje, 2002).

Akamatsu (1961) described the catch up processes within developing countries in East Asia as a wild flying geese order that is based upon dynamic comparative advantages of East Asian economies. Industrial development of developing countries 'wild geese' is catching up with advanced countries that are flying ahead and leading the flock of wild geese. The main principle of catching up processes is based on import-import substitution production-export sequence activities of a particular product over time. Trade becomes the main channel for new products and technology introduction into developing countries. Trade facilitates technology transfer and knowledge flow through an acquisition of capital goods required to produce imported goods domestically. Thus the demonstration effect of trade is the main channel of technology transfer to the importing economies. Some scholars including Akamatsu (1962) and Kojima (2000) developed the original import-import substitution production-export sequence of a flying geese paradigm into multi sequential catching-up processes. They incorporated a product pattern (i.e. labour-intensive goods - capital-intensive goods - knowledge-intensive goods) and countries pattern (i.e. advanced countries - less advanced countries - least-advanced countries) into a production and trade pattern. Consequently, channels for knowledge and technology transfer to developing countries not only through trade linkage,

but also through FDI and other non-equity business relationships including licensing and sub-contracting (Kojima, 2000).

Hobday (1995) highlighted the accumulation of technological and marketing capabilities of firms through supplier roles for global firms under the OEM (original equipment manufacture) arrangement. Moreover he discussed different stages that firms have followed in the catch up process, from OEM to ODM (original design manufacture) and ultimately to OBM (own brand manufacture). Meanwhile Lüthje (2002) discussed the role of a global production network and outsourcing strategy in the catch up process. Global electronics firms are unlikely to possess the necessary capabilities to carry out the whole value chain effectively, thus firms need to specialize in particular activities and outsource others. Some firms are growing into global contract firms (CM) or electronic manufacturing service (EMS) providers.

The literature on the catch up process indicates that the most important factor is learning process and capability formation within local firms. Capability acquisition and accumulation enables firms to progress toward high-value, high-skill and high-tech activities. Technological capability acquisition and accumulation demands technological efforts by firms in terms of investment and learning process. Technology is not freely available from a known 'shelf' instead it requires efforts to decide on, to acquire, and to absorb the best technology. Technological capability is neither automatically nor efficiently acquired over time due simply to the cost of factors and it is often tacit or implicit, difficult to understand and costly to diffuse (Lall, 2001). Consequently, the effective knowledge transfer and capability acquisition at the firm level needs a learning process. Capability formation follows a similar trajectory– from process operative capabilities to process and product innovative capabilities. To accelerate learning process and capability formation, some scholars (Nelson and Rosenberg, 1993; Freeman, 1995; Lundvall, 2007) identify the importance of the network of interaction or the system in which firms are involved in the innovation processes with other firms (e.g. buyers, suppliers) and organizations (e.g. universities, research or training institutes).

2.2 Historical Trajectory of Indonesian Electronics Sector

The development of the Indonesian consumer electronics industry is linked to the role played by FDI, particularly from Japan and the East Asian Newly Industrialised Economies (NIEs). During the 1970s, Japanese electronics firms established joint ventures or technical cooperation agreements in Indonesia to access a protected Indonesian domestic market under an import substitution industrialization strategy. In the joint ventures, both the Japanese and the domestic investors established new firms, in which the domestic and foreign partners shared their contribution and control over the joint venture firms. This

is in contrast to the technical cooperation agreements, in which the domestic investors establish assembly facilities and controlled product distribution channels in the domestic market, while the foreign partners provide technical assistances in assembly operation and quality control and supply product design and specification, along with the parts and components. Therefore technical cooperation arrangements were much less rigid than joint ventures.

Later on, under an export-orientated industrialization strategy adopted in the mid-1980s, foreign electronics firms, particularly from South Korea, designated Indonesia as one of their export bases by exploiting low production cost advantages. Hence, export of Indonesian electronics increased rapidly during the early 1990s. Over time, several domestic investors terminated their technical cooperation with Japanese and Korean electronics firms, and moved out fully from supplier roles to become independent electronics firms on their own. In recent years, the technical cooperation arrangement has regained its popularity among some global consumer electronics firms, particularly from China, as a strategy to enter the Indonesian domestic market. Thus some Indonesian domestic-owned firms have established themselves as subcontractors for the Chinese lead firms.

2.2.1 Period 1970 – 1985: The Import Substitution Era

During the 1960s there were only radio assemblers in Indonesia, including *Philips* which was inherited from the Dutch colonial period (Elektronika Indonesia, 1996). The Asian Games in 1962 became a milestone for the Indonesian electronics industry, leading to a growth in demand for televisions. Indonesian firms began assembling the first black and white (B&W) televisions under a technical cooperation with Japanese firms.

The substantive development of Indonesian electronics started in 1970 when the Government of Indonesia (GOI) introduced import substitution policies to save foreign exchange. The foreign exchange was used to finance imported products including electronic products. In addition, the policies were aimed at encouraging domestic industrialization to produce manufactured products to fulfil domestic need. The GOI applied both tariff and non-tariff barriers to support import substitution industrialization effectively. In the electronics sector, the GOI prohibited importing radios and televisions in the form of finished goods (completely built-up/CBU) by imposing import tariffs on final products at 2-50 per cent. In addition, the GOI applied a negative import list, approved an importation and sole agency system (Thee and Pangestu, 1998). Foreign firms were encouraged to invest in the electronics industry directly by establishing joint ventures or technical cooperation with Indonesian partners.

As a result, foreign electronics firms, particularly those from Japan (e.g. *Panasonic, Toshiba, Sanyo* and *Sharp*), established assembly facilities in the 1970s. Consequently during the 1970s the Indonesian electronics industrial structure was dominated by foreign direct investment. For instance in 1974 foreign ownership within the Indonesian electronics industry accounted for 59 per cent while domestic private and government ownership contributed 40 per cent and 1 per cent respectively (Balasubramanyan, 1984). Furthermore, electronics firms which were established during the 1970s produced mostly consumer electronics including televisions and refrigerators. For instance in the mid-1980s, consumer electronics contributed to 54 per cent of the total electronics production (Thee and Pangestu, 1998: 225). The electronic products were mostly for supplying the domestic market thus the industry was not export oriented. In 1985, for instance, export of Indonesian electronics accounted for just 28 per cent of total production (Thee and Pangestu, 1998: 225). The GOI then established an export promotion scheme through bonded-warehouse status for particular electronics firms. Under the bonded warehouse status, firms received import tariff and tax incentives when they manufactured for exports. As a result, export of electronics products grew since the mid-1980s.

The import substitution policies from the 1970s to mid-1980s reduced imports of electronic finished goods however the policies were unable to reduce the sector's dependency on imported components. Under the joint venture or technical cooperation arrangement, electronics firms in Indonesia obtained components from their foreign principals. This problem got worse with the relocation of two US semiconductor firms, *Fairchild* and *National Semiconductor*, out of Indonesia in 1986. The local content of consumer electronics was only about 25-30 per cent in 1985 (Elektronika Indonesia, 1996).

2.2.2 Period 1985 – 1998: The Export Promotion Era

A new era of Indonesian electronics development started in 1985 in which the GOI replaced the import substitution policies with export oriented strategies. The GOI reduced import tariffs on electronic finished products from 20-60 per cent to 20-40 per cent and electronic components from 20-30 per cent to 0-5 per cent (Thee and Pangestu, 1998). In addition, the GOI developed an export processing zone (EPZ) and a bonded zone (BZ) and provided export processing entrepot (EPE) status[1] to promote exports. Batam Island in Riau Province became the first EPZ in Indonesia, established in the early 1970s to attract export-oriented FDI. Batam successfully attracted foreign investors mostly in the electronics sector due to its position as part of a 'growth triangle' alongside Malaysia and Singapore. Foreign investors directly invested in Batam to reap the benefit of abundant and inexpensive labour to undertake low-value low-tech activities in the production of electronics.

The GOI also gradually[2] eased restrictions on foreign ownership in its investment in Indonesia. This policy made it possible to have fully foreign-owned subsidiaries operating in Indonesia. The period of export-oriented industrialization in the electronics industry was indicated by an inflow of export-oriented foreign investment from Japan and East Asian NIEs particularly South Korea (e.g. *Samsung*, *LG*). These foreign electronics firms moved their low value production activities to Indonesia to exploit lower labour costs for supplying the export market.

Consequently production and export of electronics from Indonesia grew rapidly, particularly in the early 1990s. Export of electronics increased from US$118.3 million in 1985 to US$865.5 million in 1992, and accounted for 55 per cent of total electronics production (Thee and Pangestu, 1998: 225). In 1992, consumer electronics contributed 49 per cent of total production while industrial electronics and components accounted for 29 per cent and 22 per cent respectively. In addition, video recorders, radio/tapes recorders and car radios were the biggest contributor to consumer electronics export. The United States and the European Union became the main export destinations of consumer electronics while Singapore, Thailand and Taiwan were the main export destinations for components. Singapore played an important role in Indonesian electronics export due to its *entrepot* status in which most of the products were re-exported to third countries with or without further processing (Thee and Pangestu, 1998).

Table 3: Electronic Production and Export (US$ millions)

	1985		1992	
	Production	Export	Production	Export
Consumer electronics	224.7	39.0	779.6	377.3
Industrial electronics	87.9	0.2	454.5	197.3
Electronic components	104.2	79.0	344.0	290.8
Total	416.9	118.3	1,578.2	865.5

Source: Adapted from Table 5.6 (Thee and Pangestu, 1998: 225).

Aligning with tariff reduction under the export-oriented policies, import tariffs were cut further after the GOI signed the ASEAN Free Trade Area agreement (AFTA).[3] Import tariffs on electronic finished products traded among ASEAN was set at a maximum 5 per cent in 2003. By signing the agreement the Indonesian electronics industry was driven to improve its competitiveness, since foreign electronics firms might rationalize and restructure their affiliates and subsidiaries within the ASEAN region. Foreign electronics firms were likely to divide their product mix among ASEAN countries according to the comparative advantage of each particular country in order to achieve global scale economies.

2.2.3 The Post 1998 Era, and Recent Development

During the Asian Crisis in 1997/1998, some electronics firms in Indonesia closed down but most electronics firms were able to stay alive. This was because some were export-oriented firms that suffered less during the Crisis. In addition, most foreign affiliates in Indonesia obtained support from their parent companies, by taking over the domestic ownership of their joint ventures and transforming them into fully foreign-owned subsidiaries.

The emergence of China in global electronics production in the 1990s also affected the development of the Indonesian electronics sector. In contrast to Japanese or East Asian NIEs electronics firms, Chinese consumer electronics firms entered the Indonesian market by making products under Indonesian buyers' brand names. The manufacturing services offered by Chinese firms were mostly utilized by Indonesian distribution firms or retailers. Thus the Chinese electronics firms did not establish production facilities in Indonesia. Instead they exported unbranded products to Indonesia. The entry of made-in-China products led to a remarkable brand names expansion, but mostly under Indonesian private brand names.

As Indonesian macroeconomic conditions stabilized in the 2000s, and the electronics sector recovered, the implementation of AFTA in 2003 brought about a consolidation of global electronics establishments in the ASEAN region. Some global electronics firms moved their production facilities out of Indonesia (for example, *Sony Corporation* relocated to Malaysia in 2002). Most foreign electronics affiliates, however stayed on in Indonesia by restructuring their activities. Some foreign principals designated their affiliates in Indonesia as production centres for specific electronic products (e.g. refrigerators) based on Indonesian competitive advantages. Furthermore, China's influence on the Indonesian electronics industry entered a new phase since some Chinese electronics firms such as *TCL* and *Changhong* established technical cooperation arrangements with Indonesian domestic-owned firms. The domestic-owned consumer electronics firms assembled and distributed electronic products in Indonesia under the Chinese principals' brand names.

The current condition of the Indonesian consumer electronics industry was still dominated by large foreign affiliates and domestic-owned firms which were mostly established in the 1970s. During the period 2005-2007, electronics became the largest contributor to Indonesian manufactured exports. In 2007, export of electronics contributed 17.1 per cent of total manufactured exports. Furthermore the export of Indonesian electronics in 2007 was made up of 33 per cent consumer electronics, 19 per cent industrial electronics and 48 per cent electronic components (see Table 4). In consumer electronics, audio and video equipment (e.g. radios and televisions) are the largest contribution.

Table 4: Export and Import of Electronics and Manufactured Goods

	Export (US$ millions)			Import (US$ millions)		
	2005	2006	2007	2005	2006	2007
Consumer electronics	3,203.9	3,021.0	2,988.3	830.6	738.4	975.7
Industrial electronics	2,616.3	2,514.7	1,708.7	1,600.6	1,544.5	2,751.5
Electronic components	4,230.0	3,885.9	4,279.7	1,117.0	1,083.3	1,567.0
Subtotal electronics	10,050.2	9,421.6	8,976.7	3,548.2	3,366.2	5,294.2
Manufactured goods	42,759.0	47,882.0	52,557.1	32,303.0	33,252.7	40,485.2

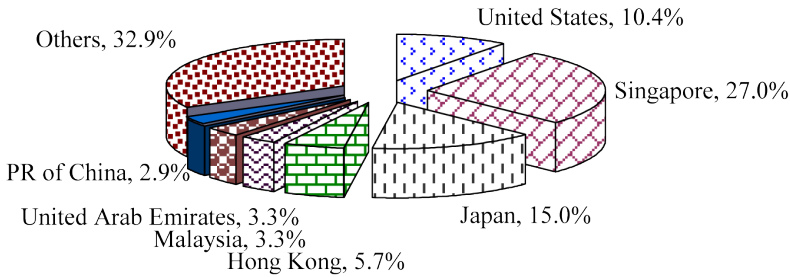
Source: Calculated from UN Comtrade (comtrade.un.org).

Although electronics became the largest contributor to Indonesian manufactured export, its share in global production and market was very tiny. In 2006, Indonesian electronics contribution to global production was 0.8 per cent, while its share in the global market was only 0.5 per cent (Reed Electronics Research, 2006). The very low contribution of Indonesian electronics in the global industry and trade indicates that the sector has low technological capability. The Indonesian electronics industry emerged around the same time as other South East Asian economies, however it lags behind countries such as Malaysia (Thee, 2006). Some scholars argue that the lack of available technology support services, particularly public metrology, standards, testing and quality support (MSTQ) (Thee, 2006) and the lack of high-tech infrastructure in research and development activities (Rasiah, 2005, 2009) restrict learning processes and capability formation within the Indonesian electronics sector. Consequently, most electronics firms in Indonesia have merely process operative capability to undertake production activities (Thee and Pangestu, 1998).

Major destinations of Indonesian electronics export were Singapore, Japan and the United States. Singapore kept playing an important role in the export of Indonesian electronics since the country acted as the port for re-exporting to third countries. Meanwhile Japan became the second main export destination, since the Japanese electronics firms imported mature consumer electronics from their affiliates in Indonesia. For instance, Panasonic's affiliate in Indonesia exported refrigerators to Japan.

Domestic markets are also important for the Indonesian consumer electronics industry. Data in 2007 indicated that the market value of consumer electronics in Indonesia reached Rp.15.3 trillion or US$1,605.5 million (US$1 = Rp.9,500) in which colour televisions, refrigerators, air conditioners and washing machines are the largest contributors.

Figure 1: Main Destination of Indonesian Electronics Export in 2007



Source: UN Comtrade (comtrade.un.org).

Table 5: Indonesian Consumer Electronics Market

Consumer electronics	2007		2008	
	Unit	Value (Rp millions)	Unit	Value (Rp millions)
Colour Television	4,108,785	6,437,777	4,679,362	6,757,766
Video player and camcorder	922,107	496,045	1,140,391	626,471
Radio cassette and Hifi	568,162	471,356	521,384	420,739
Refrigerator and freezer	2,126,199	3,133,119	2,325,424	3,599,892
Air conditioner	926,694	2,423,414	1,059,715	2,826,562
Washing machine	919,614	1,176,963	1,159,816	1,611,578
Water pump	1,782,846	510,254	1,801,463	546,728
Vacuum cleaner	43,858	27,647	59,047	36,382
Microwave oven	44,570	46,827	48,021	51,831
Rice cooker	1,461,874	236,064	1,266,736	235,197
Gas stove	386,263	103,874	154,389	50,251
Small appliances	998,702	188,534	902,186	208,789
Total		15,251,873		16,972,187

Source: Electronics Marketer Club, 2009.

The electronics industry in Indonesia is concentrated in Java and Batam Island. More specifically while consumer electronics firms mostly located in Java, particularly the Jabotabek region (Kuncoro, 2005) most electronics firms in Batam are specializing in electronic component and computer industries. Table 6 shows the distribution of industries located in Batam.

In Batam, electronics firms are mostly located in several industrial estates (e.g. Batamindo Industrial Park, Panbil Industrial Park, Commo Industrial Park and Bintang Industrial Park). There is indication that electronic firms in Batam are still engaged in low-value and low-tech activities with no upgrading trajectory toward high-value and high-tech activities (Rasiah, 2009).

Table 6: Distribution of Industries in Batam, 2007

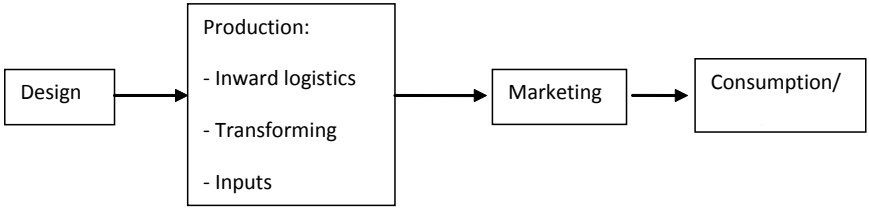
Industry	Per cent
Electronics	40
Precision Parts	18
Plastic Moulding	11
Electrical	10
Packaging	6
Pharmaceutical	4
Others	11

Source: Adapted from Table 3 (Sivananthiran, 2009: 9).

3. Global Value Chain Framework

Liberalization and deregulation of international trade and investment, and the rapid development of technologies – particularly in transport, communication and information – have led to the globalization of economic activities and geographical spread of firms. There is a new development in industrial organization in which FDI is augmented by the global production network system. In the production network system distinct value added activities are fragmented into a variety of discrete tasks carried out by different independent firms that are located in dispersed sites around the world (Ernst, 2001; Dicken, 1998). Therefore, a participation in the global production network is more necessary than ever, in order to keep up with rapid technology advancement. The global value chains (GVC) framework provides an analytical tool for understanding how fragmented and globally dispersed value added activities are organized. A concept of value chain refers to the sequence of activities which are required to bring products or services from a conception to a final consumption and even to a recycling process (Kaplinsky, 2005).

Figure 2: A Simple Value Chain



Source: Adapted from Figure (Kaplinsky, 2005: 101).

The concept of value chain acknowledges that the production process is merely one out of a number of value added activities. A single firm may carry out all value added activities or functions, however it is also a possibility that the firm only keeps some

particular activities in-house, while outsourcing other functions to other independent firms. Global firms increasingly outsource a number of value added activities which previously were carried out in-house. They keep only a few value added activities that are their core competence and provide high rents. Value added activities are then fragmented and dislocated across independent firms around the globe. A common characteristic in this globalization of value added activities is the fact that the global lead firms are frequently from advanced countries which get involved in coordinating and governing the value chains. The GVC framework highlights value chains governance to understand the relationships between actors within the value chains. A specific form of value chain governance is determined by three factors: (i) a complexity of information and knowledge required to sustain a particular transaction, particularly with respect to product and process specification (i.e. complexity of transactions); (ii) an extent of this information and knowledge can be codified and therefore transmitted efficiently and without transaction-specific investment between the parties to the transaction and (iii) capabilities of actual and potential suppliers to meet requirements of the transaction. Based on a combination of these determinant factors on a 'low/high' category, the GVC framework defines five distinct forms of value chain governance: (1) market, (2) modular, (3) relational, (4) captive and (5) hierarchy (Gereffi *et al*., 2005).

Table 7: Key Determinants of Value Chain Governance

Governance type	Complexity of transaction	Codifiability of information	Capabilities of supplier	Degree of explicit coordination and power asymmetry
Market	Low	High	High	Low
Modular	High	High	High	
Relational	High	Low	High	
Captive	High	High	Low	
Hierarchy	high	low	low	High

Source: Adapted from Table 1 (Gereffi *et al*., 2005: 87).

A market structure can be expected when transactions are easily codified, product specifications are relatively simple and suppliers have the capability to make the product. Because the complexity of information exchanged is relatively low, transactions can be governed with little explicit coordination.

Modular value chains will be expected, when the ability to codify specifications extends to complex products, and suppliers have the competence to supply full packages. Because of codification, complex information can be exchanged with little explicit coordination and the cost of switching to new partners remains low.

Relational value chains can be expected when product specification cannot be codified, transactions are complex and supplier capabilities are high. This is because tacit knowledge must be exchanged between buyer and supplier, and the exchange of complex tacit information is most often accomplished by frequent face to face interaction and governed by high levels of explicit coordination, and all of these make the costs of switching to new partners high.

The value chain governance will lean toward the captive type when the ability to codify and the complexity of product specifications are both high, but supplier capabilities are low. This condition requires a great deal of intervention and control, encouraging the build-up of transactional dependence in order to exclude others from reaping the benefits of their efforts. Captive value chains control opportunism through the dominance of lead firms, while at the same time providing enough resources and market access to the subordinate firms to exit an unattractive option. When product specifications cannot be codified, products are complex and highly competent suppliers cannot be found, lead firms will be forced to establish and manufacture products internally through a hierarchical structure (Gereffi, *et al*., 2005). This hierarchical structure is being represented by joint ventures and foreign subsidiaries.

The GVC framework highlights the role played by global lead firms in diffusing technology and knowledge to their suppliers within the chains instead of network relationships within a national system of innovation. Thus insertion into global value chains is a crucial means of accessing the global market and acquiring knowledge and technological capabilities required by local firms to compete in the domestic and global markets. Technology diffusion and knowledge flow from global lead firms depends on the structure of value chains governance. Consequently, acquisition and learning processes by local firms within this governance structure also differs. Pietrobelli and Rabellotti (2008) explored the knowledge flow and acquisition within different forms of global value chain governance.

In market-based structures, the main mechanism of knowledge flow and acquisition is through spillover and imitation. Global lead firms do not get directly involved in knowledge transfer since local firms have high capability to acquire knowledge by accessing global market requirements and standards. This knowledge is required by the local firms to bring products from conception to market and to compete effectively. Thus local firms have to learn and invest in design, production and marketing capabilities.

In modular chains, local firms learn how to produce components and modules which fully meet the technical standards to be used by the global firms. Compliance with the technical standards is an important learning mechanism within local firms. The global lead firms do not directly get involved in the knowledge transfer and learning processes but provide stimulus indirectly for local firms to keep up with technological advancement. Consequently, local firms rely more on their own learning efforts.

Within relational chains, global lead firms transfer the tacit knowledge to local firms through supply of product design and blueprint, face to face interaction, and new product and technology development. Local firms must have capabilities highly complementary to global lead firms to induce mutual learning.

In captive chains, global lead firms are actively involved in the learning processes of local firms that have low capabilities. Support from global lead firms is usually confined to assembly operation. Finally, within hierarchical structures global lead firms undertake direct ownership of some value added activities by establishing joint ventures or subsidiaries offshore. Knowledge flow and acquisition within hierarchical structures is analyzed in the literature on FDI, as transfer of management and training of local workforce.

Table 8: Knowledge Flow within Different Value Chain Governance

Type of governance	Knowledge flow and learning mechanism
Market	- Knowledge spillover - Imitation
Modular	- Learning through pressure to accomplish international standards - Transfer of knowledge embodied in standards, codes and technical definitions
Relational	Mutual learning from face to face interactions
Captive	Learning via deliberate knowledge transfer from lead firm confined to a narrow range of tasks e.g. simple assembly
Hierarchy	- Imitation - Turnover of skilled manager and workers - Training by foreign leader/owner - Knowledge spillovers

Source: Adapted from Table 1 (Pietrobelli and Rabellotti, 2008: 8).

4. Research Method

To obtain an empirical basis for the analysis, this paper collected both quantitative and qualitative data through surveys and in-depth interviews within the Indonesian consumer electronics sector. Since the objective of the paper is to provide an understanding of the process of knowledge acquisition at the firm-level in the context of value chains, this paper relied to a large extent on the strength of qualitative, rather than quantitative, analysis. This helps to

provide better and more in-depth insights into processes of knowledge transfer by global lead electronics firms and knowledge acquisition by Indonesian manufacturing firms.

The surveys assist in profiling distinct characteristics of the Indonesian consumer electronics sector. They were conducted to provide a profile of distinct characteristics of the Indonesian consumer electronics sector. From the surveys, a subset of firms was identified for in-depth interviews to obtain thorough insights. Therefore it was crucial that the paper investigated different forms of value chain governance structure in which consumer electronics firms in Indonesia were inserted. For this reason, the subset of firms was purposively selected to be interviewed more in-depth to obtain rich insights into the issue under investigation. The in-depth interviews were used to understand how consumer electronics manufacturing firms in Indonesia acquire different types of knowledge. This analysis was based on interpretation of interview results in which short quotations were selected to provide clear illustration to readers in addressing the issues under investigation. Data was gathered in Indonesia through field research conducted from January to April 2008.

4.1 Surveys

Surveys were aimed at identifying the forms of value chain governance and what Indonesian firms learn from global lead firms. They emphasized the perception of firms concerning their relationship, particularly with global value chain leaders, regarding issues of learning opportunity. Surveys were carried out through two different modes – electronic and postal. Electronic surveys utilized an automated Microsoft-Word form, sent as an email attachment. Postal surveys were administered in Jakarta, using a printed version of the same questionnaires sent to respondents, via special express mail delivery. The list of consumer electronics manufacturing firms in Indonesia was obtained from the Electronics Marketing Club (EMC), a trade association made up of major consumer electronics firms operating in Indonesia. There were 30 members of the EMC in 2007 and these firms were contacted (by phone or email) to gauge their interest in taking part in the survey, and those interested were then sent the questionnaire. The survey was designed particularly to include medium and large scale firms that have their production facilities in Indonesia. It was assumed that those firms have more resources and expertise to deal with global firms, and to acquire a full array of knowledge. Employee numbers were used as an indicator of firm size. The survey results are used merely to provide basic descriptive statistics rather than to support detailed analysis, results being summarized using Excel and SPSS software.

4.2 In-depth Interviews

In-depth interviews were conducted to acquire detailed insights about each firm's dynamics over time, with regard to knowledge acquisition and learning process, and their functional relationships. Interviews were arranged with the executives at director and manager level, from 12 consumer electronics firms. In addition, to ensure a complete and balanced description of the Indonesian consumer electronics sector, a range of interviews were also undertaken by the author with Indonesian scholars, government officers from Indonesia's Ministry of Industry and key informants from the Indonesian electronics trade association.

The interviews were guided by an open-ended questionnaire to make sure of the free flow of information and to represent the interviewees' perspectives. Each interview was carried out face-to-face for about 120 minutes on average, recorded and transcribed for analysis. The interviews were carried out mostly in *Bahasa Indonesia*. During the interviewing process some ethical issues including confidentiality were managed, protecting the identity of respondents by giving them a pseudonym.

5. Empirical findings and discussion

This section seeks to use micro level firm case study evidence to see first, how Indonesian electronics firms insert themselves into different forms of value chain governance at domestic and global level. And second, what are the implications of such insertion for their ability to acquire knowledge learn and innovate and thereby enhance their competitiveness.

5.1 Descriptive Overview

Although the EMC has 30 members, a significant number of these do not have manufacturing facilities in Indonesia and only act as sales and distribution offices of global consumer electronics firms. Only 17 of the 30 EMC members are actual firms. The assessment of characteristics of the Indonesian consumer electronics sector is mostly based on the information drawn from the survey results from 15 consumer electronics firms. This sample of 15 accounted for about 80 per cent of the total members of the EMC which had their production facilities in Indonesia (i.e. 17 firms). Hence the sample provides a good overview of the Indonesian consumer electronics industry as a whole.

As FDI continues to play an important role in the consumer electronics industry in Indonesia, further analysis of the sample is classified based on ownership patterns. From the total of 15 consumer electronics firms sampled: eight were 100 per cent domestic investment; four were 100 per cent foreign direct investment (i.e. subsidiaries); and three were joint ventures. Four out of

eight domestic-owned firms operated under subcontracting arrangements by supplying products for foreign electronics firms.

Although domestic-owned firms employed fewer workers than foreign affiliates, nevertheless the domestic-owned firms on average employed more than 1,000 workers, thus they can all be classified as large-sized firms. In addition, there was no difference in production capability, since domestic-owned firms and foreign affiliates utilized machineries of similar age. The domestic-owned firms (i.e. 4 out of 8) also implemented information and communication technologies (i.e. enterprise resource planning/ERP) to enhance production productivity and efficient distribution. In addition, most domestic-owned firms had also achieved ISO 9000 to enhance their quality management system. As a result, all firms were able to achieve product reject rate below the 5 per cent threshold.

However, it seems that the domestic-owned firms supplied more to domestic markets than to export markets. Therefore the export of consumer electronics from Indonesia was mostly contributed by foreign affiliates. Foreign affiliates gained more access to global markets than domestic-owned firms, due to the role played by their parent companies globally. By accessing both global and domestic markets, foreign affiliates achieved higher sales growth than domestic-owned firms.

In addition, the higher sales growth of foreign affiliates came from the type of electronic products. Foreign affiliates were able to sell more technology-intensive products (e.g. LCD and plasma televisions) than domestic-owned firms who tended to focus on mature consumer electronic products (e.g. CRT televisions). The sales of high-tech consumer electronic products particularly in the domestic market grew faster than mature products. In the previous section, it was shown that the sales of LCD and plasma televisions in the domestic market grew by 56.8 per cent while sales of CRT televisions fell by 24.0 per cent in 2008. In addition, it should be noted that the low sales growth of domestic-owned firms was highly influenced by the negative growth of a single surveyed manufacturer. The manufacturer downsized its electronics business deliberately to face the changing competition.

Figure 3 below illustrates the decision making process for several value added activities, in which the value 1 indicates that the decision on a particular aspect is made by global firms, while the value 4 denotes that the decision is made by Indonesian electronics firms independently. It appears that within the decision making process, domestic-owned electronics firms obtained greater control over value chains than foreign affiliates (i.e. joint ventures and foreign subsidiaries). This came from the fact that most of the domestic-owned firms did not have ties with global electronics firms, while foreign affiliates were highly dependent on their parent companies' global strategy. The parent companies

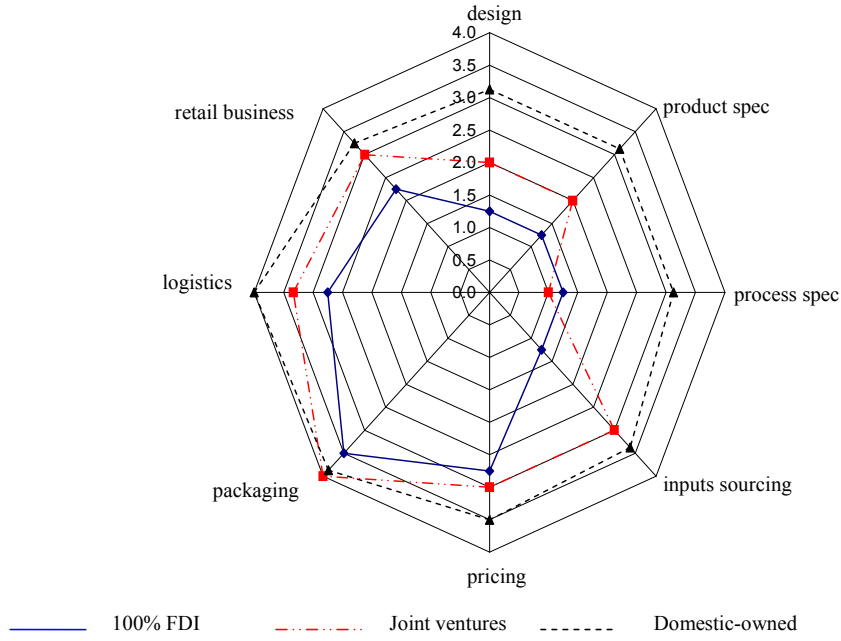
of foreign affiliates implement strict control over product design, product specification and production process specification. For other value added activities, including pricing, packaging and logistics, the parent companies involved their affiliates in the decision making. Consequently, domestic-owned firms had a greater opportunity to undertake design and marketing functions than foreign affiliates. The survey shows that 6 out of 8 domestic-owned firms conducted design activity, while only 2 out of 4 foreign subsidiaries designed their own products. Interestingly, joint ventures were different from foreign subsidiaries, since all of the surveyed joint ventures performed design activity. However, the interview results revealed that while foreign subsidiaries merely conducted minor adaptations, joint ventures conducted a major design change of particular products (e.g. small refrigerators) for supplying the domestic market.

Table 9: Indonesian Consumer Electronics Profile

Consumer electronics sector (total sample = 15 manufacturing firms)			
Descriptive	100% FDI	Joint Venture	100% Domestic
No. of firms	4	3	8
No. of employees (people, average)	1,605	1,883	1,288
Export share (%, average)	48	37	3
Dynamics			
Annual sales growth (%)	11-20	11-20	≤ 10
Global Value Chains			
Hierarchical structure (no. of firms)	4	3	0
Captive value chains (no. of firms)	0	0	4
Market structure (no. of firms)	0	0	4
Capabilities			
Age of machineries (years, average)	9	10	9
ISO 9000 certification (no. of firms)	4	3	7
ISO 14000 certification (no. of firms)	3	2	3
OHSAS 18001 certification (no. of firms)	1	0	1
Reject rate (%)*	< 5%	< 5%	< 5%
ERP application (no. of firms)	1	2	4
CAD usage (no. of firms)	4	3	7

Source: Author Own Survey, 2008.

Figure 3: Decision Making Process



Source: Reconstructed from Author interview results, 2008.

5.2 Form of Global Value Chain Governance

In light of other studies on global value chains, hierarchical structures are likely to be found within the Indonesian consumer electronics sector. In hierarchical structures, global electronics firms establish production facilities in Indonesia and have direct ownership over their Indonesian affiliates. Global firms designate their affiliates in Indonesia as production centres, to assemble electronic products to be sold in domestic and export markets under the global firms' brand names.

By designating production centres across several countries around the globe, global firms are able to simultaneously achieve economies of scale and scope to enhance their global competitiveness. Instead of producing a wide range of electronic products, foreign affiliates in Indonesia focus on mass production of particular products to be exchanged with global firms' affiliates in other countries. In regard to this, global electronics firms play a significant role in determining the development of Indonesian electronics through their decisions

on production location. Furthermore, for particular electronic products (i.e. refrigerator and cathode-ray tube/CRT televisions), some foreign affiliates in Indonesia are designated not only as the production centres, but also as product research and development centres. Consequently, these foreign affiliates are authorized to carry out not only production activities but also design and product development. These products are designed and developed particularly to adapt to the domestic market. By allowing foreign affiliates to adapt refrigerators and CRT televisions to the domestic market, global electronics firms are able to differentiate products and improve their competitiveness. As a representative from *Pusaka Elektrindo* (7 April 2008) responded:

> We have a product [research and] development [department]. We employ many engineers in that department. I can even say that we carry out not only minor changes [of product] but also make new products. Our parent company allowed us to do that. Of course we apply a certain quality system which is known as the 'passport system' thus a new product development stages are strictly controlled, in which the development stages have to be similar to what is conducted [by parent company] in Japan … our system is similar to the system which is applied in Japan, in order to achieve the similar level of quality, reliability and safety … We design our products. Our products [design] may differ from similar products which are produced globally, however we still keep the [original] design identity. Thus although our product design are different, customized for local market, but the general appearance of products still have the similar identity.

In captive value chains, Indonesian domestic-owned firms act as suppliers for global electronics firms. Domestic investors establish assembly facilities and manage product distribution for the domestic market, while the global firms provide technical supports in assembly operation and supply design and product specification, along with the parts and components. Thus in this relationship Indonesian supplier firms are often involved only in assembling operations to make finished products from electronic components and parts supplied by global lead firms. Global electronics firms focus on design and product development, supply chain management and marketing strategy. Although global firms do not have any ownership of Indonesian firms, the global firms have direct control over Indonesian manufacturing firms by setting product and process requirements to be met by Indonesian firms in terms of detailed product and process specifications. Global lead firms often place their expatriates in Indonesian suppliers' production facilities to monitor production processes. A representative from *Berdikari Elektrindo* (2 April 2008) described it this way:

> Our product design or specification is similar [to other lead firm's factory and affiliates] … Everything is determined from the principal HQ [headquarter]. Hence our factory is just assembling components into the finished products …

> We have to follow their requirements such as the thickness of the plastics to be used and so on. They set quality standard and product specification. Therefore the electronic products which are made in Mexico, China, Philippines, Vietnam, Thailand or Indonesia have similar quality standard … We have principal's representatives here, thus they can provide support. They are placing QC [quality control] person, since quality standard has to be similar all over the world.

Within market-based structures, Indonesian domestic-owned firms have no tie with global electronics firms. The firms carry out and control all value added activities. In this regard, the firms have greater flexibility to design, develop, produce and market electronic products. These firms are able to adapt products to fully meet with domestic customers' taste and need. They create not only original design, but also original product functionality. For instance, a domestic-owned firm (*Harapan Elektrindo*) makes audiovisual products that generate a specific powerful sound demanded by Indonesian customers. For this reason, the firm developed and patented a speaker technology which is able to generate the powerful sound. As another example, the firm also developed an antenna system for its televisions which can receive an electromagnetic signal from every direction to adapt to conditions of weak transmitters in Indonesia. The firm's respondent (23 January 2008) commented:

> … It is a matter of fact that we have more advantage [than global brand names] since we are able to adapt fully to Indonesian people's taste. This is why we can beat the multinational [consumer electronics firms]. They sell product worldwide thus they have to compromise [their product]. They do not have products which fully meet a particular country. The winning key of our brand name is that we provide products which has similar price with multinational competitors but with higher specification [adapt to domestic market], for instance a better sound quality …

5.3 Knowledge Flow and Learning Mechanisms

The nature of governance structures and extent of value added activities performed by Indonesian consumer electronics firms, affect knowledge flow and learning process within chains. Within hierarchical structures, global firms have direct ownership of foreign affiliates, thus most knowledge flows through the global electronics firms. In manufacturing activities, foreign affiliates (i.e. joint venture and subsidiaries) in Indonesia simply replicate the production system and management adopted by their global lead firms. By applying similar production systems and management, the foreign affiliates will achieve technical standards (e.g. safety, reliability, durability) globally. For instance a

Japanese joint venture in Indonesia applies a cell production system to replace a traditional conveyor-belt system which is also adopted by its lead firms.

> … For instance, in the past, people thought by minimising human involvement in the assembling process and replaced human operators by automatic machines, then production would be faster …. Nowadays, that production system has been forgotten, the new production system resumes the concept which relies on human involvement, including cell production system which is more productive … Machine is not always better [than human]. In the past, operators were waiting for the conveyor to bring the components to be assembled by them. Nowadays, the operators have to move to approach the components … that is the difference of cell production system. In cell production system, operators multitasks, the team [a group of operators] is responsible to make the product until it is finished. The system is faster and its productivity is better than the conveyor system.
>
> (*Pusaka Elektrindo*, 7 April 2008)

Furthermore, foreign affiliates in Indonesia also adopt the management philosophy of their lead firms. For instance most Japanese affiliates in Indonesia adopt *Kaizen* for continuous improvement of processes in manufacturing, engineering, supporting business processes, and management. Some firms implement a Toyota Production System while others apply an iterative plan-do-check-action (PDCA) four-step problem-solving process to improve their business process.

> … We apply PDCA or Plan-Do-Check-Action cycles for continuous improvement. We are used to undertake the cycles. For instance, we saw that our production line or its processes were unbalanced thus we decided that 1 operator handled 2 functions. We carry on this improvement from time to time. There were 10 operators [in production line], how to use 8 operators who can produce similar output for following year. Then in the next year we try to make how with 8 operators can produce higher output, for example 10 per cent. This improvement cycles becomes a must, otherwise how we can compete. Labour wage increases, thus we cannot compete if we produce similar amount of output. Thus accompanying with increasing wage, output has to be higher relatively to wage increase. Thus in our factory, we are talking about productivity improvement either productivity per operator or productivity per meter square area. We cannot enlarge working space but we have to use similar space size or even using smaller space. We will have a spare space for use in response to an increase quantity demanded.
>
> (*Pusaka Elektrindo*, 7 April 2008)

For the adoption of a similar production system and management, the local workforce of foreign affiliates in Indonesia obtains formal training provided by

the lead firms. The local staffs are sent to lead firms' training and production facilities in Japan particularly to learn production activities.

> ... We usually send our technician to Japan for 6 months or 1 year to learn. After they are back home, they will diffuse the knowledge to their colleagues in our firm. Alternatively, Japanese experts sometimes visit our firm and they provide training for our staff …
>
> (*Gama Elektrindo*, 9 April 2008)

Moreover, global lead firms tend to place expatriates in key management positions of foreign affiliates in Indonesia. Thus local workforces can also learn directly from these highly skilled personnel within a hierarchical structure where global lead firms are directly involved in the flow and acquisition of production know-how through informal and formal training of these workforces. Local workforces can learn production capability while implementing and using production equipment and systems similar to those adopted by global lead firms (i.e. learning by using) and producing goods that meet the requirements of global firms (i.e. learning by doing). In addition, local workforces acquire production knowledge through formal training (i.e. learning by training).

For particular consumer electronics (i.e. refrigerator and CRT televisions), global lead firms also transfer design and product engineering knowledge to local workforces. By acquiring the design knowledge and capability from lead firms, foreign affiliates in Indonesia are able to develop electronic products to adapt to the domestic market. To acquire design know-how, foreign affiliates invest in computer-aided design (CAD) systems that connect to those adopted by global lead firms to ease data sharing. Design and product development proposed by foreign affiliates still have to be approved by global lead firms. Thus local workforces learn design capability through a product development process guided by global lead firms.

Domestic-owned firms can acquire the knowledge from foreign affiliates in Indonesia through skilled personnel recruitment. These professionals are hired to provide their expertise for the firms.

> Our company's shareholders were once executive managers of Toshiba's joint venture in Indonesia. Therefore they actually had experiences in electronics business … They have knowledge on production and distribution [activities], thus they have known characteristics of electronics business … We also hire a Japanese expert who had retired from Toshiba to provide a know-how on product development and design. That is why our products are claimed as a Japanese technology which it is not only a marketing gimmick but in fact our products are designed and developed by a Japanese expert from 'Toshiba' from the beginning.
>
> (*Kencana Elektrindo*, 21 February 2008)

Alternatively, domestic-owned firms can imitate product and brand image of global lead firms that operate in Indonesia. One of the domestic-owned firms introduced its own-brand name to create an image of the Japanese product since Indonesian customers perceive Japanese consumer electronics as the best ones. Other firms copied a panel construction for its televisions from a foreign affiliate's product in the domestic market. By imitating the construction directly firms do not need to spend time and investment in designing it from scratch.

Knowledge flow within captive value chains refers to detailed requirements set by global lead firms. In the course of meeting all these requirements, Indonesian firms have opportunities to learn how to make internationally competitive consumer electronics. They learn from the bill of materials supplied by global lead firms. Indonesian firms also obtain assistance in manufacturing processes, supplied by the global lead firms to ensure that the local firms achieve standards applied by global lead firms (i.e. quality, durability, safety and health). Global lead firms often place their quality assurance personnel in Indonesian factories. They are responsible to make sure a certain level of quality is achieved during production process. Indonesian firms can acquire best practices of production activities through a direct interaction with expatriates placed by global lead firms.

> We have principal's representatives here thus they provide supports. They are placing QC [quality control] person, since quality standard has to be similar all over the world. We do not use brand name recklessly thus we have to follow their requirement such as how thick of plastics be used and so on. There are standardized specifications. Thus product made in Mexico, China, Philippines, Vietnam, Thailand or Indonesia has similar quality standard … They provide technical support since they do not want the [quality of] their product poor …
>
> (*Berdikari Elektrindo*, 2 April 2008)

Within the captive value chains, global lead firms are directly involved in the flow and acquisition of production knowledge and capability. However the global lead firms do not transfer design, product development and marketing capability to Indonesian firms since they kept these functions themselves. With regard to this, Indonesian firms may specialize in limited assembly activity without any opportunity to learn the design, product development and marketing know-how and the capabilities that are required to generate innovation.

Within a market-based structure, Indonesian domestic-owned firms have no relationship with global electronics firms. Thus the knowledge does not flow through global lead firms, instead it flows from other sources. Some domestic-owned firms acquired the assembly know-how from the global electronics firms they once had a technical cooperation with in the past. However the

global electronics firms did not transfer design and marketing know-how to Indonesian firms.

> Manufacturing know-how or assembly [knowledge] rather than product development was obtained from Japanese principal and we paid for it … The Japanese principal will not assist us to acquire the know-how in product development. Thus we learnt about product development slowly by establishing research and development [department] in 1986 …
>
> (*Buana Elektrindo*, 16 February 2008)

Other firms acquired the manufacturing know-how by purchasing equipment and electronic kits from global suppliers. By purchasing these, the manufacturer obtains technical support from the suppliers. For instance a domestic-owned firm spent almost 10 years (1977 – 1985) to excel only in televisions production by learning from different foreign suppliers as illustrated in Table 10.

Table 10: Learning Process and Capability Development of Harapan Elektrindo

Period	1977	1980	1984	1985	1986-Now
Product	Black & White TV	Large colour TV (i.e. 20, 26 inch)	Small colour TV (i.e. 14 inch)	Small colour TV (i.e. 14 inch)	A wide range of products
Knowledge Sources	Electronics kit supplier, Belgium	Electronics set maker, Finland	Electronics firm, Taiwan	Internal R&D, Input and technology suppliers	Internal R&D, Input and technology suppliers
Learning process	Staff training, input using	Staff training, equipment using	Staff training, input using	Self-learning	Self-learning
Capability	Assembly	Assembly	Assembly	Manufacturing, design	Design, marketing, manufacturing, linkage

Source: Reconstructed from Author's interview results.

To improve product quality and production efficiency, Indonesian firms obtain support mainly from consultancy agencies. For instance most of the domestic-owned firms adopt standards that are applied in the global market by achieving international certifications (e.g. ISO 9000) with support from consultancies and accredited certification institutions such as *SGS International Certification*, *TUV International Indonesia*, *Bureau Veritas Quality International*, *Sucofindo*.

To develop design and product development capability, Indonesian firms establish in-house research and development functions. They recruit designer and engineer graduates and develop their expertise, by sending these staff

regularly to visit electronics exhibitions domestically and abroad to search for information on product and process advancement.

> We get information from two sources. First, there are regular electronics component exhibitions in Indonesia in which global component makers introduce their new component or technology. They will offer components or technology which is required by us. Second, we are visiting exhibitions abroad to meet with component makers. We are mostly visiting exhibitions abroad in order to update with recent technology and obtain new [product] inspiration … We usually send our art work's staffs to international exhibitions in Japan, China, Hong Kong, Korea or Taiwan since the best electronics product exhibitions are likely to be held in Asia. By sending the staffs abroad, our main goal is to make their eyes used to see a good design …
>
> (*Harapan Elektrindo*, 23 January 2008)

They also purchase product samples to be dismantled to learn of their advantages and disadvantages. Based on these samples, Indonesian firms are able to create a new product design and functionality by improving the products.

> For instance if we want to make 'iPod' [portable multimedia player], there are about 12 brands that are producing 'iPod' and each brand produces 2 types or models, thus there are 24 types totally. We will buy all of the 24 types of product and bring them to our factory in Indonesia and we dismantle each product to look for its advantage and disadvantage, then we are trying to combine advantages that come from all of those products and we also seek our product's pricing strategy … and produce it. After producing, we will arrange a focus group discussion by asking people's opinion on our product … Thus as I said before we go abroad to buy electronics product samples and compare them. Then we divide our R&D staffs into 5 groups and ask each group to design and make new product. In addition, they compete not only on product design but also on pricing strategy. For this reason, when they are designing and making the product, they also have to know the price of cables or other components used … IC suppliers provide us with their application notes, thus we apply the note and will improve its deficiency. For example, since the beginning we aware that European TV had better picture quality than Japanese TV …. But European TV is not heat resistance … and its reception sensitivity is worse than Japanese TV. Thus one of our strategies, which was applied in the designing stage is by using IC for video processor, prompt IC, from Europe [i.e.] Philips, while for the reception tunnel we purchase it from Japan, thus we combine the technologies.
>
> (*Harapan Elektrindo*, 23 January 2008)

Table 11: Knowledge Acquisition and Learning Mechanisms of Indonesian Consumer Electronics Firms within Different Global Value Chains

Value chains	Production	Design & product development	Marketing
Hierarchical	- global lead firms transfer the knowledge through direct involvement in manufacturing activities (production equipment and management, expatriates, formal training)	- global lead firms transfer the knowledge through direct involvement in product design and development processes	- global lead firms transfer the knowledge through direct involvement in brand promotion and marketing strategy in domestic market
	- local partners learn by replicating production system and management of global lead firms	- local partners learn by creating new product design and functionality	- local partners learn by carrying out the strategy
Captive	- global lead firms transfer the knowledge through detailed process and product specifications and quality control	global lead firms are least likely to transfer the knowledge	- global lead firms are least likely to transfer the knowledge
	- local firms learn by satisfying product and process specifications imposed by global lead firms		
Market	- local firms access and acquire the knowledge from equipment and input suppliers (best practices and applications) and consultancy agencies	- local firms rely on their internal sources (design and development functions) to conduct reverse engineering, adaptive change	- local firms rely on their internal sources (marketing function) to develop brand and market
	- local firms learn by purchasing and using production equipment and inputs	- local firms learn by interacting with customers and searching original design and functionality	- local firm learn by interacting with customers

Source: Reconstructed from Author interview results, 2008.

Empirical findings demonstrate that global firms transfer knowledge and capability to Indonesian firms not only through FDI (i.e. hierarchical structure) but also through other modes. By engaging in captive value chains, Indonesian domestic-owned firms acquire the production knowledge and capability from global lead firms. Within captive value chains, global lead firms have an obligation to improve production capability of their suppliers in Indonesia to meet their requirements. Thus they transfer production knowledge and capability

to Indonesian firms. Global lead firms, on the contrary, are least likely to transfer design and product development know-how to Indonesian suppliers. They keep the knowledge and capability for themselves. By staying in captive value chains Indonesian firms are able to acquire the 'production system' but not the 'knowledge system' which is required to generate and manage innovative functions (Bell and Albu, 1999). Indonesian supplier firms will specialize in low-value and low-tech production function without any opportunity to progress toward high-value and medium- or high-tech activities (i.e. design, product development and marketing). Competitiveness of Indonesian consumer electronics firms is not based on low-value and low-tech activities but highly depends on innovative functions. Thus consumer electronics firms have to move up the technological capability ladder from operative production activities to innovative design and R&D functions to compete effectively in domestic and export markets.

Greater opportunity for innovation takes place within a market-based structure. To move from hierarchical and captive value chains toward market-based structures, Indonesian electronics firms have to upgrade their capabilities. In such a governance structure Indonesian firms have to actively acquire knowledge from sources other than global lead firms including suppliers and users and develop it into indigenous innovative capabilities.

Some domestic-owned consumer electronics firms in Indonesia indicate signs of utilization of process and product innovative capability through involvement in design and product development activities. However these innovative activities take place with little support from knowledge infrastructure including universities and public research institutes. The relationships between knowledge infrastructure and consumer electronics firms in Indonesia are very weak or even non-existent. Research output by knowledge infrastructures is often not relevant to what consumer electronics firms do and need. In some cases, the R&D facility of a university or public research institute is not always better than the R&D facility of consumer electronics firms.

> We have own R&D facility that for the moment is the largest and the best in Indonesia. In the past we might hear people say that R&D facility at the Diponegoro University was better (than us) but now our R&D facility is the best … our relationship with universities mostly to share our technology development with them. They gain more benefit from us …
>
> (*Harapan Elektrindo*, 23 January 2008)

The absence of institutional linkages between consumer electronics firms and domestic knowledge infrastructure drives electronics firms to search and acquire knowledge and capabilities from external sources by their own efforts. Thus

the extent of process and product innovative capabilities is highly dependent on firms' own resources and absorptive capacity. Consequently, while some individual consumer electronics firms experience technology catch up processes, the Indonesian consumer electronics sector as a whole continues to face competitive challenges. Thus this sector remains relatively laggard compared to their regional competitors in terms of raising value and skill as well as moving up the technological ladder.

6. Conclusion

Globalization of value chains brings about opportunity for firms in developing countries to access the international market and to acquire knowledge, technology advancement and innovations. The extent of knowledge flow between global lead firms and learning processes of local firms is highly dependent on the forms of governance structure regulating the relationships between the firms involved in the value chains. In hierarchical and captive value chains that are found within the Indonesian consumer electronics sector, global lead firms are directly involved in the learning processes of Indonesian firms through knowledge transfer. In contrast, global lead firms do not involve themselves in the learning processes of Indonesian firms engaged in market-based structures.

Global lead firms within hierarchical structures transfer production knowledge and capability through various channels, including a replication of production system and management, or a placement of expatriates in local management structures and formal training. In addition, global lead firms also transfer design knowledge and capability to their affiliates in Indonesia to carry out new development of particular products (e.g. refrigerators and CRT televisions). Design knowledge and capability is transferred particularly to augment the ability of their affiliates in Indonesia to learn from and adapt to domestic markets. By acquiring design and product development capability, foreign affiliates in Indonesia are able to compete effectively in the domestic market and generate profit contribution to their global firms. The diffusion of knowledge and capability from foreign affiliates to domestic-owned firms is through a recruitment of skilled personnel and product's and brand's imitation in the domestic market.

Meanwhile global lead firms within captive value chains transfer production knowledge in terms of detailed product and process specifications. Indonesian firms acquire production knowledge and capability by fulfilling these specifications, including product quality, durability and safety. These learning processes by Indonesian firms are supported directly by global lead firms, by placing quality controllers within the production facilities of Indonesian firms. The foreign skilled personnel are responsible to monitor production process and

maintain a direct contact with production workers. However, global lead firms are unlikely to transfer design, product development and marketing knowledge and capability to Indonesian firms. With regard to this, Indonesian firms within captive value chains have little opportunity to move from imitators to innovators by generating improved products.

Indonesian firms within market-based structures acquire production knowledge by establishing relationships with inputs and equipment suppliers as well as with consultancy agencies. By purchasing production equipment and inputs, Indonesian firms get the technical supports to learn the best practices of production operation. Consultancy agencies are required by Indonesian firms to improve product quality (e.g. implementation of ISO standards) and production efficiency (e.g. implementation of ERP). Design and product development knowledge is acquired through internal R&D function. Indonesian firms within market-based structures are able to move toward becoming innovators, by improving their product design and functionality through adaptive change.

Despite the success stories of some individual consumer electronics firms in moving up toward process and product innovative functions through internal R&D activities, the Indonesian electronics industry remains lagging behind competitors in the region. The absence of support from domestic knowledge infrastructure (e.g. universities) is detected as a main factor that restricts learning process and capability formation at the industry level.

Notes

[1] When a firm obtains the EPE status, the firm does not have to go through the custom office and pays import tariff for its imported inputs. Moreover, a firm can obtain the status without being located in existing bonded zones. The firm can also sell up to 25 per cent of its product to domestic market after paying tariff on the inputs and the value added tax on the product (Pangestu, 1997).

[2] In 1985–86, foreign-ownership restrictions and divestment requirements were relaxed for export-oriented investments and those located in bonded zones. In 1992, fully foreign ownership was allowed for investments greater than US$50 million and for those located in Eastern Indonesia and in bonded zones. In addition, to encourage small and medium-sized foreign investments in electronic components and parts, fully foreign ownership was extended to investments with a minimum investment of US$2 million in 1993. Finally in 1994, fully foreign ownership was allowed for most sectors and the divestment requirements were eliminated (Pangestu, 1997).

[3] In 1992, members of ASEAN agreed to implement AFTA by reducing import tariffs on manufactured and processed agricultural products to 0-5 per cent and eliminating non-tariff barriers to restrict trade among the members within 15 years (1993-2008). Electronic products among 15 products were included in a fast track scheme which was asked to lower its import tariff within 7-10 years

instead of 15 years. In response to the Crisis in 1997, the members agreed to bring forward the realization of the AFTA agreement to 2003 (www.aseansec.org).

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