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Malaysia's development challenges for moving up the value chain:
Analysis of cluster development policy

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ABSTRACT

In an effort to become a high-income country, Malaysia has been pursuing development of clusters as a key policy for productivity growth since 1990s. However, Malaysia has not moved up the value chain and remains a middle-income country. This paper aims to identify key challenges for Malaysia and analyzes the government policy towards cluster development. In order to examine the nature of clusters, the analysis focuses on electrical and electronics, particularly semiconductors. The electrical and electronics industry, with semiconductor cluster at its core, is the most developed industry in Malaysia in terms of value added, employment, export, and FDI. After analyzing the government policies for cluster development, the paper concludes that further coordination of stakeholders and continuous effort to develop human resource and science and technology over years are keys for Malaysia's further economic development.

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1. Introduction of Malaysia's industry development policy towards high-income country

1.1 Growth slowdown after decades of growth

Malaysia has consistently achieved high economic growth since its independence in 1957. The GNI per capita has increased from $300 in 1962 to $10,430 in 2013, making Malaysia an upper middle income country[1]. The average GDP per capita growth rate during the same period was 3.8 percent. Unlike other natural resource rich countries, Malaysia has diversified its economic structure. The GDP share of mining and quarrying and agriculture dropped from 24 percent to 8 percent and 26 percent to 7 percent respectively between 1971 and 2013, while manufacturing increased its share from 12 percent to 25 percent[2]. The export-oriented manufacturing development policy with the opening of Free Trade Zones in 1971, combined with efforts to attract FDI, has promoted manufacturing sector growth, particularly in the electrical and electronics industry (E&E). The export value of goods and services as a percentage of GDP increased from 41 percent in 1970 and 93 percent in 2010 respectively[3]. The top three export items changed from crude rubber 33.4 percent, tin 19.5 percent, and wood products 12.5 percent in 1970, to electrical machinery and apparatus 12.8 percent, office machines 11.4 percent, and natural and manufactured gas 7.3 percent in 2009[4]. E&E became the largest contributor to GDP with 25 percent of manufacturing sector value added followed by refined petroleum 16

[1] According to United Nations and World Bank, countries have been classified based on gross national income (GNI) per capita and grouped as high-income (GNI more than $12,746), upper middle income (GNI between $4,126 and $12,745, lower middle income (GNI between $1,046 and $4,125), and low-income countries (GNI below $1045) based on atlas method (current US$)."Country and Lending Groups," World Bank, accessed April 20, 2015, http://data.worldbank.org/about/country-and-lending-groups; United Nations, "World Economic Situation and Prospects 2015: The Global Economic Outlook", United Nations, New York, 2015.

[2] Bank Negara Malaysia, Annual Report various issues.

[3] "World Development Indicator," World Bank, accessed April 20, 2015, http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS.

[4] The items are based on SITC (Standard International Trade Classification) three digit category: crude rubber 231, tin 687, wood products 242, electrical machinery and apparatus 729, petroleum 331, telecommunications apparatus 724, office machines 714, natural and manufactured gas 341. "UN Comtrade Database", United Nations, accessed April 20, 2015, http://comtrade.un.org/data/.

percent and chemical products 11 percent in 2013[5]. This remarkable growth is connected with foreign direct investment (FDI) by multinational companies (MNCs). Net FDI inflow increased from $ 94 million to $11,582 million between 1970 and 2013[6]. The share of foreign firms in capital investment has grown 39 percent during 1981-1990, 53 percent during 1991-2000, and 60 percent during 2001-2011[7]. E&E accounts for 11 percent, 22 percent and 30 percent of total capital investment during 1981-1990, 1991-2000, and 2001-2011 respectively[8]. The share of foreign firm's investment in E&E increased from 39 percent to 56 percent and 85 percent during the same period[9].

Despite remarkable economic development over the last five decades, Malaysia has been struggling to achieve its national goal of reaching high-income country status by 2020. The average GDP per capita growth rate decreased from 4.6 percent during 1991-2000 to 2.7 percent during 2001-2010. In fact, the government expressed their concern in the latest development vision, which is called New Economic Model (NEM) in 2010:

> *The progress we have made over the past half-century has slowed and economic growth prospects have weakened considerably. We are caught in a middle income trap – we are not amongst the top performing global economies. Amid changes in the external environment, many of the policies and strategies we used to achieve the current state of development are now inadequate to take us to the next stage. (…) We urgently need a radical change in our approach to economic development which will be sustainable over the long-term, will reach everyone in the country and will enable Malaysia to reach high income status*[10].

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[5] Malaysian Productivity Corporation, Productivity Report 2013-2014, 2014, p.73, accessed March 5, 2015, http://www.mpc.gov.my/home/?kod1=k&kod2=announcement&item=000165&sstr_lang=en&t=3.
[6] "World Development Indicator," World Bank, accessed April 20, 2015, http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD.
[7] "Malaysia Investment Development Authority (MIDA) Approved Projects by Industry," Malaysia Economic Planning Unit, accessed March 5, www.epu.gov.my/epu-theme
[8] Ibid.
[9] Ibid.
[10] National Economic Advisory Council, "New Economic Model", Kuala Lumpur: Percetakan Nasional Malaysia Berhad, 2010, pp.3-4.

As highlighted in this statement, many middle income countries have experienced economic growth slowdown like Malaysia and failed to become high income countries, which is called the middle income trap. For example, the World Bank estimated that among 101 middle-income economies in 1960, only 13 became high income by 2008[11]. A common explanation of the cause of the middle income trap is productivity growth slowdown due to the changing nature of growth factor between low and middle income countries and high income countries[12]. Low income countries typically achieve productivity growth by reallocating labor and capital resource from agriculture to manufacturing, but middle income countries have exhausted such labor surplus in rural areas. Moreover, middle income countries lose competitiveness in labor-intensive products due to high wage compared to lower income countries. Therefore, middle income countries need to increase productivity through innovation rather than using imported technologies, but many of them have not achieved such a transition.

The Malaysian government already recognized main challenges for middle income countries in the early 1990s. In 1991, the government set the goal to reach high income country status by 2020 in the national development strategy paper, Vision 2020. In order to set out quantitative terms and the major targets of this strategy, the government formulated the Outline Perspective Plan 1991-2000 (OPP2) and 2001-2010 (OPP3). OPP2 states that productivity improvement is the key for further economic growth and stressed the importance of human resource development and science and technology:

[11] The 13 countries are Equatorial Guinea, Greece, Hong Kong, Ireland, Israel, Japan, Mauritius, Portugal, Puerto Rico, the Republic of Korea, Singapore, Spain, and Taiwan. World Bank and the Development Research Center of the State Council, P. R. China, China 2030: Building a Modern, Harmonious, and Creative Society. Washington, DC: World Bank, 2013, p.12.
[12] Ibid.

1.12. Sustained growth will require not only high levels of investment in physical capital but also higher quality of human resource inputs from labour, management and entrepreneurship. Human resource development must therefore be accelerated to enhance the prospects for growth. With natural resources becoming less plentiful and labour becoming more scarce, the contribution to growth must increasingly come from improvements in productivity and efficiency. Human resource development plays a vital role in raising productivity and providing the professional, management and technical skills needed for the growth of the economy particularly in the process of transformation towards becoming an industrialized nation. (…)

1.80. New and emerging technologies will have a major impact on productivity and competitiveness as the economy accelerates its industrialization drive. In addition, a structural shift in the production sector to higher value-added products using new technologies is anticipated. Malaysia will have to diversify its export base into products which will exploit new and emerging technologies. In this regard, the Government will invest in science and technology (S&T) infrastructure, particularly in the new and emerging areas of technology.

OPP3 reiterates that productivity growth is the key to economic growth and emphasizes the role of skills upgrading and science and technology:

Forward by the Prime Minister: (…) The OPP3 focuses on some key strategic thrusts to achieve sustainable growth. To a great extent, our competitive position will be determined by the speed with which we increase the knowledge content of our activities as well as strengthen our capability to develop indigenous technology and create new products. We will need to adopt modern production systems and technology to raise our productivity and value added.(…)

1.54 Productivity improvement is central to Malaysia's economic growth and competitiveness. To raise productivity, greater efforts will be made to upgrade skills, adopt better management and organizational techniques, upgrade Research and Development (R&D) and S&T as well as produce high quality and customized goods.

More short-term five-year Malaysian plans have been used to allocate funds to achieve the objectives and commitments of the visions and OPPs. Moreover, the government has formulated policy strategy focusing on manufacturing and service industry development since 1986, namely the Industrial Master Plans of 1986-1995 (IMP1), 1996-2005 (IMP2), and 2006-2020 (IMP3). However, the five-year plans show that growth rate of the manufacturing sector has continuously dropped from 13.3 to 1.3 percent between 1991 and 2010 while service sector has maintained relatively constant growth (Figure1). Manufacturing has also failed to achieve growth target since 1996 except for the period of 2001-2005.

Figure1: GDP growth rate by sector during each Five-Year Malaysian plan

	6th plan 1991-1995	7th plan 1996-2000	8th plan 2001-2005	9th plan 2006-2010	10th plan 2010-2015	GDP share (2010)
GDP total	8.7% (8.1%)	4.7% (8.0%)	4.5% (4.2%)	4.2% (6.0%)	(6.0%)	100%
Manufacturing	13.3% (12.2%)	9.1% (10.7%)	4.1% (4.0%)	1.3% (6.7%)	(5.7%)	26.7%
Service	9.3% (9.1%)	5.2% (8.4%)	6.1% (5.2%)	6.8% (6.5%)	(7.2%)	53.1%
Agriculture	2.0% (2.1%)	1.2% (2.4%)	3.0% (2.0%)	3.0% (5.0%)	(3.3%)	7.5%

Note: Numbers in parentheses show targeted growth rates in each five-year plan. Mining and construction are excluded.

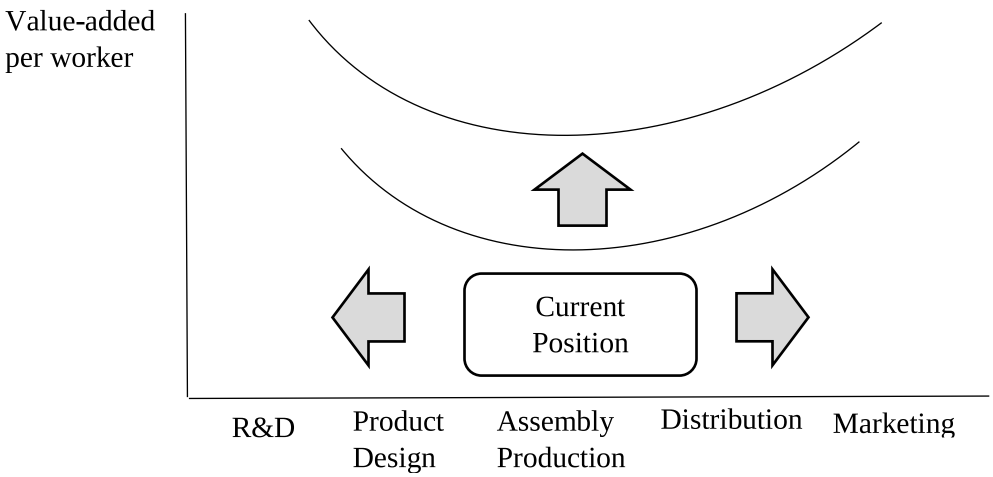
Source: Five-Year Malaysian plan various issues, Malaysia Economic Planning Unit; National Accounting Statistics, Malaysia Department of Statistics.

1.2 Cluster development as a key industry development policy

Recognizing the need to upgrade skills, R&D and S&T for productivity growth, the government formulated its industry development strategy in IMP2. The main pillar of IMP2 is the combination of the "Manufacturing ++" approach and cluster development. The "Manufacturing ++" approach aims to increase value added activities of the value chain, namely

R&D, product design, distribution, and marketing activities with development of integrated supporting industries (Figure2)[13]. This strategy also places emphasis on labor productivity growth - higher value-added per employee - at all levels of the value chain[14].

Figure 2: Manufacturing ++ policy



Source: Malaysia's Ministry of International Trade and Industry (MITI), Second Industry Master Plan 1996-2005; Ohno (2013)

In order to realize the objective of "Manufacturing ++", IMP2 emphasizes the need for cluster development and categorizes eight Malaysian industrial groups into clusters including E&E[15]. IMP2 defines a cluster as follows:

> *The defining characteristic of a cluster is the high degree of connectivity (…) A cluster is an agglomeration of inter-linked or related activities comprising industries, suppliers, critical supporting business services, requisite infrastructure and institutions (...) The existence of a*

[13] Ministry of International Trade and Industry, Second Industrial Master Plan 1996-2005, Kuala Lumpur: Ministry of International Trade and Industry, 1996, p.3.
[14] Ibid, p.31.
[15] Other clusters are Transportation Industry, Chemicals Industry, Textiles and Apparel Industry, Resource-Based Industry, Materials and Advanced Materials Industry, Agro-Based and Food Products Industry, and Machinery and Equipment Industry. Ibid, pp. 32-3.

mature cluster requires the development of ancillary industries and economic foundations in support of the core industry[16].

This approach is also adopted in IMP3. IMP3 specifies five strategic thrusts for the greater development of the manufacturing sector: (1) accelerating transition towards higher value-added products and activities; (2) facilitating and accelerating the development of domestic and regional clusters; (3) further integrating domestic industries into global supply chains; (4) promoting knowledge-based activities, including R&D and design and development (D&D), and supporting the application of leading edge technologies by industry; and (5) encouraging mergers and acquisitions (M&As), consolidations and strategic partnerships among industries to strengthen their capabilities and competitiveness[17].

However, Malaysia has not yet achieved these policy objectives. The productivity level of the industry sector ($40,676) is still far below Singapore ($85,866), South Korea ($73,487) and Taiwan ($68,393) and slightly above Thailand ($36,271) in 2010[18].With regard to activities of value chain, Malaysia increased R&D expenditure as percentage of GDP, but the level is still far below high income countries' average and slightly below upper middle income countries' average (Figure 3).

Figure 3: R&D expenditure as percent of GDP

	1996	2000	2006	2010
Malaysia	0.2	0.5	0.6	1.1
Upper middle countries average	-	0.7	0.9	1.3
High income countries average	2.2	2.4	2.3	2.4

Source: World Bank, World Development Indicator

[16] Ibid, pp. 23-25.
[17] Ministry of International Trade and Industry, Third Industrial Master Plan 2006-2020, Kuala Lumpur: Ministry of International Trade and Industry, 2006, p.71.
[18] Productivity of industry means GDP (PPP) per person employed in industry. Industry includes manufacturing, mining, construction, electricity, gas and water. Economic Planning Unit, Prime Minister's Department, The Malaysian Economy in Figures 2013 (Updated Edition), accessed March 5, 2015, http://www.epu.gov.my/documents/10124/2257e64f-b08d-41b7-bed0-b6e6498c38a3.

With respect to specific industries, E&E has been playing an important role in leading industry development. E&E has been one of the national priority industries and the sole non-resource-based industry consistently nominated as a growth target area since the introduction of IMP1 1986 (Figure 4). E&E remains the leading export industry, representing 42.4 percent of total exports[19]. It is the largest contributor to the manufacturing sector value added accounting for 26.1 percent and employer with more than 40 percent of manufacturing labor in 2010[20]. Its productivity level (80,000 RM) is slightly above the manufacturing sector average (74,000 RM)[21]. However, A survey conducted by Khazanah National – the Malaysian government investment fund - shows that Malaysian E&E firms engagement in R&D, particularly mature R&D, is extremely low as of 2007 (Figure5). Semiconductor firms form the core of E&E technology, accounting for the largest number of granted patent both in Malaysia as well as U.S. patent granted to Malaysia origin[22]. However, the same survey reveals that even semiconductor firms engaged in up to early R&D not matured R&D phase (Figure 6)[23]. As stated in the government productivity report:

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[19] Malaysian Productivity Corporation, "Productivity Report 2010/2011", accessed March 5, 2015,http://bpap.mpc.gov.my/elearn/APR/APR2010.pdf

[20] Ibid.

[21] Ibid.

[22] During 2006-2010, semiconductor represents 6 percent of total patent granted in Malaysia. During 2010-2014, Active Solid-State Devices (i.e. a sort of semiconductor) represents 14 percent of total Malaysia origin patent granted in U.S., followed by Semiconductor Device Manufacturing Process 8 percent, and Computer-Aided Design and Analysis of Circuits and Semiconductor Masks 3 percent respectively. WIPO," WIPO statistics database, Indicator 5 - Patent grants by technology," accessed April 20, http://ipstats.wipo.int/ipstatv2/?lang=en; U.S. Patent and Trademark Office, "Patenting By Geographic Region (State and Country), Breakout By Technology Class, Count of 2010 - 2014 Utility Patent Grants, As Distributed By Calendar Year of Grant," accessed April 20, http://www.uspto.gov/web/offices/ac/ido/oeip/taf/stctec/myxstcl_gd.htm.

[23] Early R&D refers to the state that hiring of engineers for product development activities, separate specialized training activities in human resources; process development in layouts, machinery and equipment, materials and processes; product development capability with some firms developing an original design manufacturing (ODM) capability. Mature R&D refers to the state that hiring of specialized R&D scientists and engineers wholly engaged in new product research in human resources; process R&D to devise new layouts, machinery and equipment prototypes, materials and processes; new product development capability with some firms developing an original brand manufacturing (OBM) capability. Rajah Rasiah, "Is Malaysia's electronics industry moving up the value chain?" in Malaysia's Development Challenge: Graduating from the middle, ed. Hal Hill, Tham Siew Yean and, Ragayah Haji Mat Zin, New York: Routledge 2012, p.199-203.

> "*Malaysia [E&E industry] can no longer rely on assembly-based and lower value-added segments but should move towards higher value-added activities in design and manufacturing as well as research and development.*[24]"

The next section reviews the literature on the role of clusters to promote productivity and value chain upgrading, the process of cluster development, and characteristics of competitive cluster and policy frameworks for competitive cluster development. The following section analyzes Malaysian government policies to develop competitive clusters. In order to examine the nature of specific clusters, particular attention is placed on the E&E and semiconductor industries.

[24] [ ] is added by the author. Malaysia Productivity Corporation, supra note 19, p.81.

Figure 4: Targeted growth areas in Malaysia's industry development policy

Prioritized industry	IMP1 1986-1995	IMP2 1996-2005	IMP3 2006-2020	ETP 2010-2020
Non-resource-based industries				
Electrical and electronics	+	+	+	+
Transport equipment	+	+	+	
Machinery and engineering products	+	+	+	
Ferrous metal[25]	+	+	+	
Textiles and apparel	+	+	+	
Healthcare[26]			+	+
Wholesale and retail				+
Communications content and infrastructure				+
Business service				+
Financial services				+
Education				+
Tourism				+
Greater Kuala Lumpur / Kian Valley				
Resource-based industries				
Food processing	+	+	+	
Rubber	+	+	+	+
Palm-oil	+	+	+	+
Wood-based	+	+	+	
Chemical and petrochemical	+	+	+	
Non-ferrous metal products	+	+		
Non-metallic mineral products	+	+		
Pharmaceuticals			+	
Oil and gas				+
Agriculture				+

Note: ETP stands for Economic Transformation Program based on New Economic Model 2010.
Source: IMP 1-3, Malaysia Ministry of International Trade and Industry (MITI); Economic Transformation Program, Malaysia Performance Management & Delivery Unit.

[25] Named as Metals Industry in IMP3.
[26] Named as Medical Device in IMP3.

Figure 5: The number of E&E firm by knowledge depth level of activities (2007)

Knowledge depth of activity	Human Resources	Process Technology	Product Technology
Level 1: Simple activities	103	103	103
Level 2: Minor improvements	103	103	73
Level 3: Major improvements	85	85	66
Level 4: Engineering	69	69	57
Level 5: Early R&D	35	35	11
Level 6: Mature R&D	1	1	1

Note: The total population of survey is 103.
Source: Rasiah (2012)

Figure 6: The number of semiconductor firm by knowledge depth level of activities (2007)

Knowledge depth of activity	Human Resources	Process Technology	Product Technology
Level 4: Engineering	12 (10)	12 (10)	10 (-)
Level 5: Early R&D	9 (9)	9 (9)	7 (-)
Level 6: Mature R&D	0	0	0

Note: no information is available on distinction between foreign and domestic firm in product technology
Source: Rasiah (2012)

2. Cluster literature review for analytic framework

2.1 Rationale behind cluster development for firm productivity growth

The performance of firms differs even in the same industry in a given location, partly because of the difference in firms' strategy and operation efficiency. At the same time, firms have little influence over most of their business costs, which are largely determined by the quality of business environment such as physical infrastructure and institutions in a given location[27]. Previous research recognizes that cluster promotes firm productivity and innovation possibilities through lower transaction costs and entry barriers, development of skilled labor market, and greater knowledge spillover within clusters, although empirical evidence is mixed[28].

First of all, clusters reduce transaction costs among firms located in a cluster, which facilitate productivity improvement through the division of labor among firms[29]. Transaction costs arise from moral hazard, adverse selection, and hold-up problems, but they tend to be low in the industrial cluster because transaction parties need to maintain reputation in a cluster where information flows easily[30]. A buyer and a seller need to incur cost of monitoring behavior of

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[27] Justin Yifu Lin and Célestin Monga, "Comparative Advantage: The Silver Bullet of Industrial Policy", in The Industrial Policy Revolution I: The Role of Government Beyond Ideology, ed. Joseph E. Stiglitz and Justin Yifu Lin, Hampshire and New York: Palgrave Macmillan, 2013, p.23.

[28] For example, Marshall observed three types of agglomeration economy: information spillover, division of labor, and labor pool. Alfred Marshall, "Principles of Economics," 8th ed. London: Macmillan, 1920. Many econometric studies have confirmed that spatial concentrations of establishments and workers offer great productivity advantages which *e*stimates the productivity increase form a doubling in the size of an agglomeration range between 2 and 8 percent, depending on the sector and details of the estimation procedure. Henry G. Overman and Diego Puga, "Labor Pooling as a Source of Agglomeration" in Agglomeration Economics, ed. Edward L. Glaeser, Chicago: The University of Chicago Press, 2007; Stuart S. Rosenthale and William C. Strange, "Evidence on the nature and sources of agglomeration economics" in Handbook of Regional and Urban Economics, Volume 4, ed. J V Henderson and J.FE Thisse. Elsevier, 2004.

[29] Transport cost refer to a great variety of diverse costs involved in the movement of goods, services, people, money and capital, as well as information, knowledge and technology. In the literature of economic geography, "transport cost" is used as a synonym of transaction cost. It is important to distinguish the usual costs for the transportation of goods and persons from the costs related to the transfer of information through various modes of communication. Masahisa Fujita, "Formation and Growth of Economic Agglomerations and Industrial Clusters: A Theoretical Framework from the Viewpoint of Spatial Economics," in The Flowchart Approach to Industrial Cluster Policy, ed.Akifumi Kuchiki and Masatsugu Tsuji, Hampshire and New York: Palgrave Macmillan, 2008, p.31.

[30] Testushi Sonobe and Keijiro Otsuka, "Cluster-Based Industrial Development: An East Asian Model," Hampshire and New York: Palgrave Macmillan, 2006, p.5.

each other for the fear of loss due to imperfect information about the goods and services subject to the transaction, but within a cluster, information about their technological capacities, marketing behaviors, and the conduct and personality of enterprise managers is public knowledge owing to the geographical proximity of firms[31]. If a firm cheats, it will quickly and widely be known by firms in the cluster, which reduces the firm's reputation as well as future business opportunities[32]. Moreover, the existence of ongoing personal relationships and community ties fosters trust which also facilitates lower transaction costs. The role of cluster to facilitate information flow and reduce uncertainty becomes important as products become more complex since the knowledge gap between parties increases. With lower transaction cost, firms are likely to specialize in their strength and outsource other activities. As Adam Smith observed, the division of labor leads to simplification of the production process which creates opportunities for improvement of production[33].

Second, clusters foster favorable environments for new business entry[34]. Since many parts and components can be purchased from other firms in a cluster, outsourcing saves significant amounts of initial capital investment[35]. In the early stage of industrial development, firms with low skills and technologies can enter the market by imitating the production methods and products of the incumbents[36]. New business entry further facilitates deeper and broader development of the cluster.

[31] Ibid, p.3.
[32] Ibid.
[33] Adam Smith, "An inquiry into the nature and causes of the wealth of nations," MetaLibri, 2007, pp.8-14, accessed April 10, 2015, http://www.ibiblio.org/ml/libri/s/SmithA_WealthNations_p.pdf.
[34] Empirical research reveals that industries located in regions strong clusters experience higher growth in new business formation in U.S. Mercedes Delgado, Michael E. Porter and Scott Stern, "Clusters and Entrepreneurship, Center for Economic Studies", National Bureau of Economic Research, Working Paper 18250, 2010, accessed Janurary 30 2015, http://www/nber.org/papers/w18250.
[35] Sonobe and Otuska, supra note 30, pp.11-12.
[36] Ibid.

Third, cluster facilitates the development of skilled labor markets. The division of labor encourages specialization of workers. A larger labor market due to firm agglomeration provides better matching opportunities for high skilled workers with firms, which allows them to further specialize in a narrower set of tasks and become more productive. Another benefit the pool of skilled workers generates is greater potential for skill transmission through labor turnover and spin-offs[37].

Fourth, a cluster enhances innovation possibilities because of knowledge spillovers. Tacit knowledge is relatively easier to be shared among firms since the locational proximity allows frequent direct face-to-face contact between individuals[38]. Furthermore, diverse industries agglomeration in a cluster, often realized in large cities, foster innovative ideas through face-to-face interactions of experts of various types with favorable access to many kinds of goods, services, and skills[39].

2.2 Cluster development process

In theory, a cluster grows when agglomeration economies outweighs congestion costs. A number of factors encourage agglomeration of firms such as heterogeneity in goods, increasing return to scale, transport cost, migration of workers and consumers, natural conditions (e.g. the presence of natural ports, natural resources) and catalysts (historical conditions, accidents, and various public policies)[40]. Heterogeneity in goods allows suppliers to locate in proximity without involving severe price competition, while consumers or users can enjoy the complementarity of such heterogeneous goods by locating close to their suppliers. Increasing

[37] Sonobe and Otuska, supra note 30, p.5.
[38] Marshall, supra note 28.
[39] Jane Jacobs, "Cities and the Wealth of Nations: Principles of Economic Life," New York: Random House, 1984
[40] Fujita, supra note 29, pp.27-28.

return to scale means that firms located in densely populated regions can save fixed costs relative to overall output by concentrating production in smaller number of plant[41]. The presence of transport costs can be saved by locating near a large market. On the other hand, as economic activities concentrate in a specific location, wage rates and land costs there increase, which tend to raise other costs such as housing costs as well as prices of non-traded goods and services[42]. When these congestion costs rise disproportionately as new entry increases while additional firms add few advantages to the cluster, the industries located in the cluster start to decline[43].

Otsuka and Sonobe illustrate three phases of cluster-based industrial development based on case studies of East Asia and African countries[44]. At first, in the initial phase of cluster formation, products are relatively similar and simple and their values are self-evident for customers (i.e. low heterogeneity) as they are usually light industry product. Therefore, elementary and secondary education is enough to sell such products and the leading entrepreneurs are not highly educated[45]. Once production process and technology is standardized, the entry of new firms based on product imitation becomes active (i.e. migration of workers)[46]. At this quantitative expansion phase, merchants play an important role in developing distribution systems as a supplier of raw materials and intermediate inputs as well as distributor of products to large distant markets. As a result, the marketplace relieves producers from the burden of searching for a source of procurement and marketing channels (i.e. lower transport costs)[47]. With a number of firms, entry, prices and profit rates tend to go down. Firms at this stage need to improve their product and/or

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[41] Paul Krugman, "Increasing returns and economic geography," Journal of Political Economy, vol. 99 (June), pp. 483-99.
[42] Fujita, supra note 29, p.34.
[43] G.M.Peter Swann, "Towards a model of clustering in high-technology industries," in The Dynamics of Industrial Clustering, ed. G.M. Peter Swann, M. Prevezer and D. Stout, Oxford: Oxford University Press, 1998, p.54.
[44] Sonobe Testushi and Keijiro Otsuka, "Cluster-Based Industrial Development: A Comparative Study of Asia and Africa," Hampshire and New York: Palgrave Macmillan, 2010, pp.4-7.
[45] Sonobe and Otsuka, supra note 30, p.187.
[46] Sonobe and Otsuka, supra note 30, pp.187-188.
[47] Sonobe and Otsuka, supra note 30, p.188.

service quality in order to earn profits. This transition from quantity expansion phase to the quality improvement phase needs to be accompanied by the establishment of a brand name and the development of a firm's own marketing channels such as a network of exclusive sales agencies and its own retail shops (i.e. high heterogeneity). While product improvement itself may be easily achieved by employing a number of engineers and designers, the improved product cannot set a high price and generate profit unless customers recognize its difference from the inferior products of other firms. To achieve a series of innovations, entrepreneurs have to make decisions over a variety of issues with which they are unfamiliar and innovators in this phase must be highly educated.

2.3 Policy steps to develop competitive cluster

In reality, the economic performance of clusters differs from one another. In some clusters, firms move up higher value added activities, whereas many others lack the internal and external growth dynamic and remain in the same product category and value chain position production[48]. Michael Porter analyzed ten countries and proposed framework to analyze business environment that promotes clusters of competitive industries. The framework explains four major components of competitive location: the nation’s position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industry; the nature of home-market demand for the industry’s product or service; the presence or absence in the nation of supplier industries and other related industries that are internationally competitive; the conditions in the nation governing how companies are created, organized, and managed, as well as the nature of domestic rivalry (Figure 7).

[48] Michael H. Best, “New Competitive Advantage,” Oxford: Oxford University Press, 2001, p.87.

Porter's approach on locational competitive advantage suggests that the government prioritizes resources into location of clusters including: investment in cluster-related resources and infrastructure, training and education, establishment of cluster-oriented special economic zone (such as free trade zones, industrial parks and science parks), promotion of export and inward foreign investment around cluster, efforts to promote information flow and to generate social capital among cluster participants (such as forums to bring them together, and product certification)[49].

Porter observes that specialized factors in a cluster, especially those for innovation and upgrading, tend to be less tradable or available from outside the cluster. Therefore, the more decisive aspects of the business environment are often cluster specific in advanced economies while economy wide constraints are prevalent in developing countries[50].

Figure 7: Sources of locational competitive advantage (Cluster Diamond framework)

Factor (Input) Quantity and Cost: Natural resources, human resources, capital resources, physical infrastructure, administrative infrastructure, information infrastructure, scientific and technological infrastructure (e.g. university and research institute)
Related and Supporting Industries: Capable locally-based suppliers, competitive related industries
Local Rivalry: Competition among locally-based rivals, local context that encourages appropriate forms of investment and sustained upgrading (e.g. tax, corporate governance system, labor market policies, intellectual property rules, openness to trade and foreign investment, government ownership, licensing rules, antitrust policy, corruption)
Demand Conditions: Sophisticated and demanding local customers, unusual local demand in specialized segments that can be served globally, customer needs that anticipate those elsewhere

Source: Porter (2008)

[49] Michael E. Porter, On Competition, Boston: Harvard Business School Publishing Corporation, 2008, pp.262-269.
[50] Ibid, pp.226-227.

Building on Porter's work, Akifumi Kuchiki proposes a framework to prioritize policy steps for cluster development with focus on manufacturing[51]. The framework offers sequencing of measures which is divided into two major steps: industrial agglomeration (step1) and innovative activities (step2) (Figure 8).

Step 1: industrial agglomeration means that related firms are located in the same region. It starts with the establishment of industrial zones such as export processing zone, then is followed by capacity building in which physical infrastructure development, institutions building such as tax system and one-stop administrative service, human resource development mainly literate unskilled labor, and living conditions improvement for foreign investors. The core of this step is capacity building for attracting anchor firms, in particular MNCs[52]. Once anchor firm is attracted, related firm would follow.

Step 2: innovative activities refer to active innovation efforts by the agglomerated firms. This requires the presence of universities and/or research institutes. The key factors of capacity building are information transmitting linkages and absorptive capacity of local firms to fully utilize information related to upgrading and innovation[53]. Concerning human resource development, a cluster sometimes faces a shortage of skilled labor, requiring the presence of universities and on-the-job training centers for innovation in order to sustain the development of the cluster[54]. The conditions for innovation hold if this second type of capacity is built up and if anchor persons come. In East Asia, the channels transferring information on technologies as well

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[51] This flow chart approach framework cannot be applied to the biotechnology or information technology industry, partly because those industries do not use a large number of parts and components in manufacturing process and thus not subject to economies of scale. Akifumi Kuchiki and Masatsugu Tsuji, Introduction, in The Flowchart Approach to Industrial Cluster Policy, ed.Akifumi Kuchiki and Masatsugu Tsuji, Hampshire and New York: Palgrave Macmillan, 2008, pp.4-6, 12.

[52] Akifumi Kuchiki and Masatsugu Tsuji, "Introduction", in "Industrial Clusters, Upgrading and Innovation in East Asia," ed.Akifumi Kuchiki and Masatsugu Tsuji, Cheltenham and Northampton: Edward Elgar, 2011, p.5.

[53] Ibid, p.6.

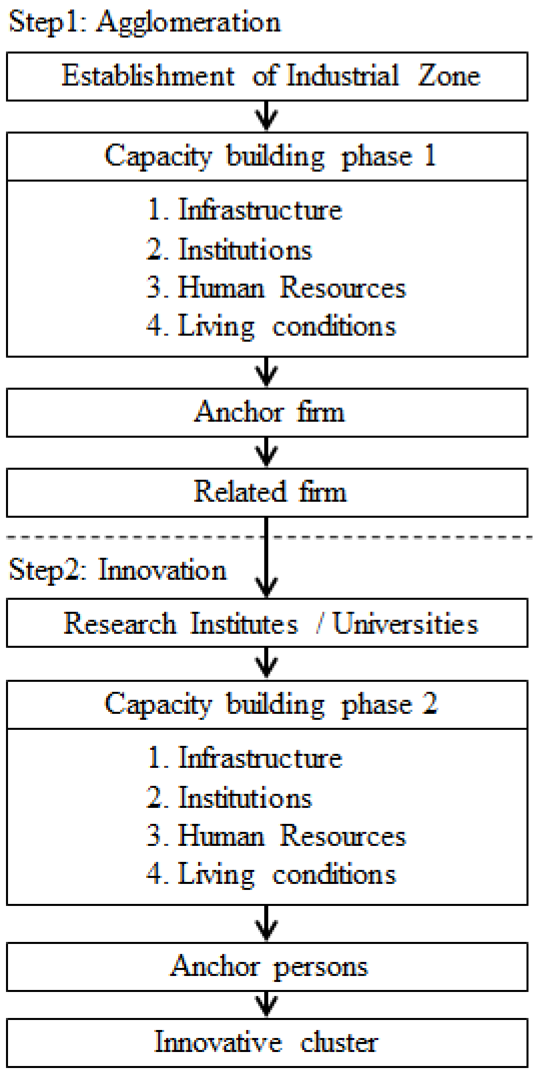
[54] Kuchiki, supra note 51, p.9.

as managerial know-how via MNCs have appeared to stronger than via local entities such as research institute. The endogenous innovation process is not yet established. The key policy was identified as the formation of local platform that fosters flows of information and strengthens various linkages[55].

Kuchiki emphasizes the need to identify actors responsible for building various types of capacity for cluster development throughout the process[56]. On top of that, cluster literature underlines nature of interaction among stakeholders. While physical proximity to key infrastructure, natural resources, and market (i.e. cities and major settlements) creates latent conditions for cluster emergence, nature of interaction among firms is essential to realize cluster. The social network in the cluster, such as personal relationships, network and a sense of common interest, plays an important role since many of cluster advantage depend on the free flow of information, the discovery of value-adding exchanges, the willingness to align agendas and to work across organizations, and strong motivation for improvement[57]. Ongoing collaboration to fulfill transactional requirements and demands increases awareness of capacities and activities among firms which fosters mutual trust within a group[58]. With this regard, knowledge centers, such as university, research center and business associations, could facilitate collaboration among firms through sharing market specific and specialist knowledge[59].

[55] Kuchiki, supra note 52, p.6
[56] Kuchiki, supra note 51, p.12.
[57] Porter, supra note 49, p.241.
[58] Andrew Atherton and Andrew Johnston, “Clusters formation from the bottom-up: a process perspective”, in handbook of research on cluster theory, ed. Charlie Karlsson, Cheltenham and Northampton: Edward Elgar, 2008, pp.99-100.
[59] Ibid, p.98.

Figure 8: Cluster development flowchart approach



Source: Kuchiki (2008)

3. Analysis of key policies for cluster development in Malaysia

3.1 The state of cluster development

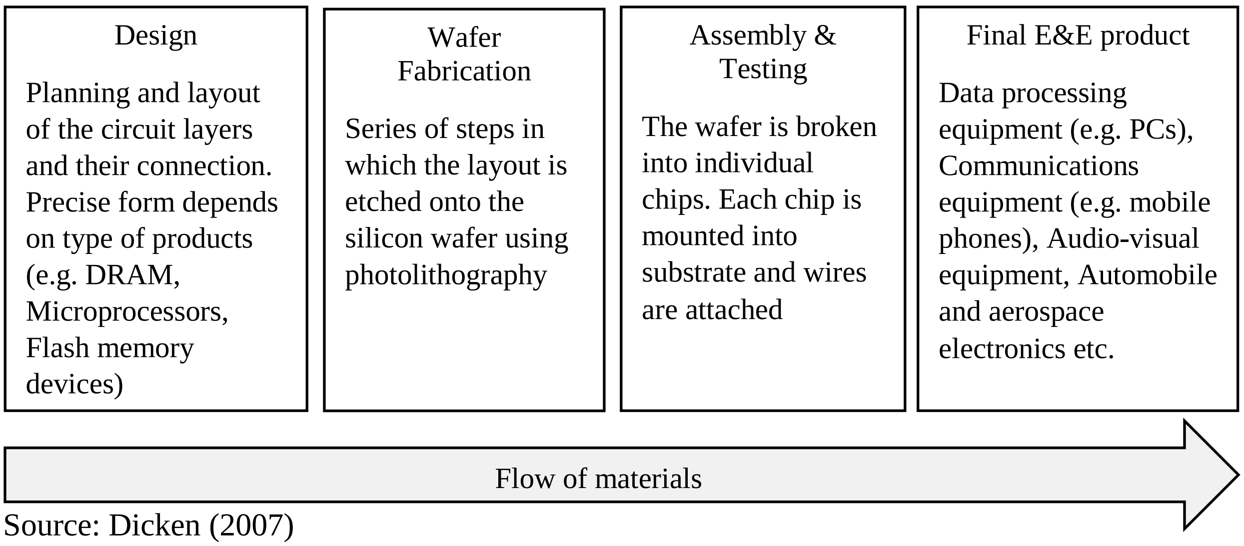
Malaysia has already entered into quality development phase and been in the transition from the agglomeration phase to the innovation phase based on Kuchiki's framework (Figure 9). Since the opening of the first Free Trade Zone in 1972, Malaysia has provided good infrastructure and streamlined administrative procedures within the zones and later across the country. A survey conducted by the World Economic Forum for corporate executives ranked Malaysia's infrastructure quality 20th among 144 economies, better than high income countries such as South Korea 23th, U.K 27th, and Norway 28th[60]. Similarly, the Doing Business survey conducted by the World Bank ranks Malaysia 18th among 189 countries, better than high income countries including Switzerland 20th, Netherlands 27th, and France 31th[61]. In terms of human resources, Malaysia has a sufficient literate labor force as the primary enrollment became universal in 1990s and the literacy rate was 93 percent in 2010. Malaysia has attracted many anchor firms including AMD, Dell, Hewlett-Packard, Intel, Motorola, Panasonic, Toshiba to name a few in E&E industry. The number of related firms in the E&E industry dramatically increased from 4 to nearly 1,700 between 1970 and 2006[62].

In order to illustrate the nature of a cluster, the analysis refers to the semiconductor cluster. The value chain of semiconductors consists of integrated circuit (IC) design, wafer fabrication, assembly and testing, and final E&E products (Figure 9). Design and wafer fabrication are the higher value-added segment and final E&E product is generally manufactured by non-

[60] World Economic Forum, Global Competitiveness Index 2014-2015.
[61] The World Bank, Doing Business ranking as of June 2014.
[62] Malaysia Investment Development Authority (MIDA), Performance of the Manufacturing and Services sectors 2006.

semiconductor firms. The dominant segment in Malaysia is assembly and testing and the government has been trying to expand firms' activity into design and wafer fabrication.

Figure 9: Value chain of semiconductor



Source: Dicken (2007)

There are 28 companies engaging in IC design, 5 companies in wafer fabrication, and 28 companies in assembly and testing as of 2008[63]. While some spin-off local companies from MNCs successfully developed businesses, the majority are foreign-owned companies as foreign equity accounts for 96.3 percent in 2007[64]. Among five wafer fabrication companies, two are Malaysian government-affiliated entities (Silterra and MIMOS[65]). The location of firms is concentrated on Penang and Kelang Valley region. The government has promoted both regions; for example, MIMOS wafer fabrication plants are located in Kuala Lumpur near Klang Valley while Silterra's plant is located in Kulim Hi-Tech Park in Penang region, but a number of research findings indicate that Penang has developed stronger clusters in terms of technological

[63] MIGHT, Understanding the Malaysian Electronic Industry Issues, 2009.
[64] For example, Globetronics, Altera, Dominant Semiconductor, Carsem, Unisem & AIC Semiconductor.
[65] The government created a wafer fabrication company Silterra in 1995. Now, Silterra provides complete IC design service for global fabless design and product companies. MIMOS is established by the government in 1985.

capability and inter-firm linkages[66]. This gap is mainly because of the difference in local government activity. Penang State government established Penang Development Corporation (PDC) in 1969 and extensively promoted inward FDI by export-oriented MNCs. It has also promoted linkages between local firms and MNCs and provided skill upgrading programs for local firms with the establishment of Penang Skills Development Center in 1989. While Knag Valley regional government also established State Economic Development Corporation in 1964 and Selangor Human Resource Development Center in 1992, the State government played a minor role in coordinating local firm capacity development and promoting linkages[67].

The following section examines challenges for value chain upgrading with the dominance of foreign MNCs and then analyzes Malaysian government policies based on steps proposed in the Kuchiki's framework to develop innovation-oriented cluster.

3.2 Challenges for value chain upgrading with FDI

Malaysia has benefited from massive inward FDI by MNCs since the 1970s. The Malaysian Investment Development Authority (MIDA), established in 1967, has played an important role in attracting FDI. MIDA offers one-stop service to foreign investors for various applications and incentives, including manufacturing licenses, tax incentives, expatriate posts, duty exemptions on raw materials and components, and duty exemptions on machinery and equipment for the agricultural sector and selected services sector. The priority areas of FDI shifted from labor-intensive to capital-intensive industry over time. For example, E&E accounts for 11 percent, 22 percent and 30 percent of total capital investment during 1981-1990, 1991-2000, and 2001-2011

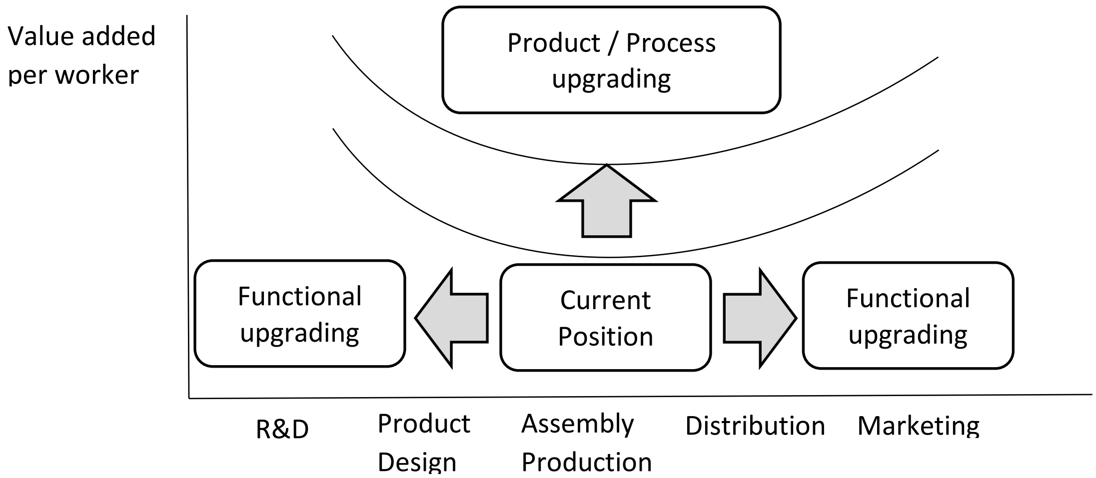
[66] Rajah Rasiah, "Fostering Clusters in the Malaysian Electronics Industry," paper presented at the second annual meeting Latin America and Asia: Strategic policies for global competition, 2005, pp.18-44; United Nations Conference on Trade and Development, "Creating Business Linkages: A Policy Perspective," United Nations, 2010, pp.87-94.
[67] Ibid, UNCTAD, pp.92-93.

respectively[68]. The share of foreign firm's investment in E&E increased from 39 percent to 56 percent and 85 percent during the same period[69].

In general, inward FDI has several potential positive impacts on the local economy, including better access to international production network, technology transfer, human resource training, and firm management development[70]. However, previous studies about value chain upgrading in MNCs' international production network argue that MNCs often provide support for process and product upgrading, but not functional upgrading in the value chain (Figure10)[71]. The process upgrading refers to improving the production efficiency through more inventory turnover, less scrap, more frequent and on-time deliveries etc. The product upgrading means better quality, lower priced and more differentiated products, as well as shorter times to market for new products. The functional upgrading means acquisition of new functions in the value chain to increase the overall skill content of activities, for example, extension from contract manufacturing to design and marketing within the contracted work.

[68] "Malaysia Investment Development Authority (MIDA) Approved Projects by Industry," Malaysia Economic Planning Unit, accessed March 5, www.epu.gov.my/epu-theme
[69] Ibid.
[70] Dirk Willem te Velde, "Foreign Direct Investment and Development: An Historical Perspective," Overseas Development Institute, 2006, accessed January 10, 2015, http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/850.pdf.
[71] John Humphrey and Hubert Schmitz, "Chain governance and upgrading: taking stock," in Local Enterprises in the Global Economy: Issues of governance and upgrading, ed. Hubert Schmitz, 2004, p.352-360; United Nations Industrial Development Organization, Industrial Development Report 2002/2003, United Nations, p.105; Jacques H. Trienekens and Meine Pieter van Dijk, "Upgrading of value chains in developing countries," in Global Value Chains, Linking local producers from developing countries to international markets, ed. Meine Pieter van Dijk and Jacques Trienekens, Amsterdam University Press, 2012, pp.239-241.

Figure 10: Typology of upgrading



Source: Author

In fact, upper middle income and middle income countries have a higher ratio of high-technology exports in manufactured exports (19.8 percent) than high income countries (16.3 percent) in 2012[72]. By contrast, the level of R&D expenditure as percent of GDP in high income countries (2.45 percent) is almost as twice high as that in upper middle income countries (1.35 percent) in 2011[73].

First of all, functional upgrading of local firm (i.e. supplier) often conflicts with MNCs' strategy because the latter considers non-assembly functions as their core competence and focus their investment on such function, including R&D, marketing, branding, and coordination of inter-firm relations. This is particularly true for marketing and branding activity, while R&D activity can be divided and allocated into multiple locations based on products.

Furthermore, required R&D and capital investment for functional upgrading is generally much larger than those for process and product upgrading. This is particularly true in

[72] "World Development Indicator," World Bank, accessed April 20, 2015, http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS.
[73] "World Development Indicator," World Bank, accessed April 20, 2015, http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS.

semiconductor industry. The world largest semiconductor firm Intel alone spent $6,576 million more than Malaysia's gross domestic R&D expenditure $4,902 million and the second largest firm Samsung, third largest STMicroelectronics, and the fourth largest Renesas spent more than $2,000 million for R&D in 2011[74]. U.S. semiconductor firms' R&D expenditures as a percent of sales has risen at from 10 percent range to 20 percent range between 1993 and 2013 which is almost unprecedented among major manufacturing sectors of the U.S[75]. Total investment per employee (measured by combined R&D and new gross plant and equipment) of U.S. semiconductor firms has increased from $40,000 to $120,000 between 1993 and 2013[76]. Given the rapid pace of technological change, R&D expenditures are essential to be competitive in semiconductor industry.

Local firms cannot expect automatic participation in higher value added activities of MNCs because such opportunity is subject to MNCs' strategy. Local firms need to take larger risks without support from MNCs if they pursue functional upgrading. The performance of firms differ from each other even in the same industry in a given location, partly because of differences in firms' strategy and operation efficiency. In fact, previous studies found that the strategy to move up higher technology varies by local firms[77]. At the same time, firms have little influence over most of their business costs, which are largely determined by the quality of business environment such as physical infrastructure and human capital in a given location[78]. Given those challenges, the Malaysian government has improved the business environment for innovation

[74] United Nations Educational, Scientific, and Cultural Organization (UNESCO), Statistics, accessed April 20, 2015, http://www.uis.unesco.org/ScienceTechnology/Pages/default.aspx; IC insights, Research Bulletin, September 4, 2012.
[75] Ibid, IC insights, p.18.
[76] Semiconductor Industry Association, The U.S. Semiconductor Industry Factbook 2014, accessed March 5, 2015, p.16, http://www.semiconductors.org/clientuploads/Industry%20Statistics/2014%20Factbook%202.0%20-%2002032015.pdf.
[77] Momoko Kawakami and Timothy J. Sturgeon ed., "The dynamics of local learning in global value chain: experience form East Asia," Hampshire and New York: Palgrave Macmillan, 2011.
[78] Line and Monga Supra note 27, p.23.

with the establishment of research and technology development institutions as well as specialized infrastructures. The government has undertaken capital intensive R&D projects through its own research institutes. Furthermore, the government has promoted R&D and skill upgrading of indigenous firms and including spin-off from research institutes with a variety of financial incentives. For example, the government established the Small and Medium Industries Development Corporation (SMIDEC) in 1996 and later transformed it into Small and Medium Enterprise Corporation Malaysia (SME Corp) for better coordinating inter-government organizations in 2009. Both SMIDEC and SME Corp have provided SMEs with infrastructure facilities, financial assistance, advisory services, market access and other support programs. In order to encourage linkages between SMEs and MNCs, the government launched Industrial Linkage Program (ILP) in 1997. To encourage MNCs to participate, 100 percent of expenditures were declared deductible from income tax if they are spent in training employees, developing and testing local products, improving the quality of local inputs or innovating the facilities of local SME partners. To encourage SMEs to upgrade and meet world class standards in terms of price, quality and production capacity, the government introduced the pioneer status in which eligible SMEs were entitled to a tax exemption of 100 per cent of statutory income for a period of ten years and to an investment tax allowance of 60 per cent (or 100 per cent in industrial sites) on the capital expenditure incurred within a period of five years[79]. ILP also provided SMEs with supply of parts and components on a long-term basis. Between 1997 and 2000, a total of 128 SMEs benefited with a turnover of RM111.6 million[80]. In addition, the government established the Malaysia Venture Capital Management Berhad (MAVCAP) in 2001. MAVCAP is the country's largest venture capital company with investments in the ICT sector and other high-

[79] UNCTAD, supra note 66, p.87.
[80] 8th Malaysian Plan, p.245.

growth industries as of 2015. The following sections illustrate government measures to promote innovation, mainly R&D, by local firms and institutions.

3.3 The establishment of research and technology development institutions

Malaysia has a number of research institutes and universities covering broad areas including E&E. With respect to the E&E industry, the Malaysian Institute of Microelectronic Systems (MIMOS), established in 1985, has led national flagship R&D projects. For example, MIMOS commissioned a new industrial-class wafer fabrications plant, 0.5 micron digital CMOS technology, 8-inch, 3,000 wafers per month. Moreover, MIMOS provides local firms with essential facilities for manufacturing, testing and packaging E&E products. MIMOS has encouraged skill development of local firm. For example, the Semiconductor Technology Program was designed to develop skilled personnel with expertise in technology and product development in wafer fabrication and integrated circuit design[81]. MIMOS has also encouraged creation of spin-off companies with its facilities and R&D activities. In 2006, MIMOS CEO announced that MIMOS gradually shift focus from National IT Policy and Development and Business Development to R&D for commercialization towards national competitiveness. IN 2010, MIMOS created a business market funnel of innovations worth RM1.092 billion for commercialization by Malaysian companies.

Aiming to promote indigenous local firm technology upgrading, the government launched new institutions in the early 1990s. In 1992, the government established the Malaysian Technology Development Corporation (MTDC) in order to stimulate upgrading in the manufacturing sector. MTDC has provided early stage financing to potential start-up companies involved in high-technology activities. MTDC established technology centers located in five

[81] 8th Malaysian plan, p.249.

partnership universities in which MTDC provides firms with office and lab facilities as well as business promotion service. The government also established the Malaysia Industry Government High Technology (MIGHT) in 1993. As a think tank, MIGHT has conducted research and plays a consensus building role. It has also managed programs to strengthen linkages among members.

3.4 Infrastructure development for innovation

The government established infrastructure for R&D in the late 1990s. Among the significant infrastructure, the government opened its first Hi-Tech Park, the Kulim Hi-Tech Park (KHTP), in Penang area in 1996. As of 2015, KHTP covers an area of approximately 4,000 acres and the R&D zone comprises a 91.5-acre parcel earmarked for R & D activities that includes Techno Centre, which is equipped with facilities for electronics testing, human resource development, biotechnology and industrial collaboration network. MIMOS and SIRIM (government-owned research and technology development entity) set up branch in KHTP. In the same year, Technology Park Malaysia was also established with approximately 700 acres land in Selangor area. As of 2015, the park is home to more than 150 technology companies employing 10,000 knowledge workers[82].

Another flagship project is the Multimedia Super Corridor (MSC) established in 1997. MSC is a zone that encompasses Kuala Lumpur and five key infrastructure projects: Putrajaya (new government administrative capital), Cyberjaya (intelligent research and development city), KL Tower, Petronas Twin Towers, and Technology Park Malaysia[83]. It is a strategic project to attract organizations by providing the infrastructure to draw in Information Technology (IT) and electronics projects. The government has set up the Multimedia Development Corporation

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[82] Technology Park Malaysia website, accessed April 20, 2015, http://www.tpm.com.my/about/ab.php.
[83] UNCTAD, supra note 66, p.84.

(MDC) and has introduced a number of special incentives for firms that qualify for MSC status. Many infrastructure projects, such as MSC, Cyberjaya, and Kulim Hi-Tech Park, emphasize the promotion of E&E industry.

3.5 Improvement of incentives and institutions for innovation

The government has expanded a variety of fiscal and financial incentives to strengthen R&D capacity of indigenous firms and linkages between firms and research institutes since 1996 (Figure 11). Before 1996, R&D activities were mainly aimed towards generating new knowledge and little attention were given to commercialization of the researches[84]. A survey of 5,232 projects implemented by public research institutions and universities during the 1986-1995 revealed that 14.1 per cent of these projects were identified as potential candidates for commercialization while only 5.1 per cent was commercialized. A notable example is the Intensification of Research in Priority Areas (IRPA) program launched in 1988. An evaluation of R&D Projects funded under the IRPA program during the 1996-2000, revealed that only 3.4 per cent of the projects were commercialized during 2001-2005[85].

During 1996-2000, several new grants had been set up to attract more researchers to conduct market-driven type of research; namely Technology Acquisition Fund (TAF) in 1997, Commercialization of R&D Funds (CRDF) in 1997, Multimedia Super Corridor R&D Grant Scheme (MGS) in 1998, Demonstrator Application Grant Scheme (DAGS) in 1998 and Industry Grant Scheme (IGS) in 1997. Moreover, public R&D grants under MOSTI were no longer

[84] Ahmad Zafarullah Abdul Jalil1, Noor Al-Huda Abdul Karim, Sallahuddin Hassan, “Assessing the socio-economic benefits of public R&D activities in Malaysia,” presented at “The Third International Conference on International Studies, 1st-2nd December 2010, p.3.
[85] 9th Malaysian Plan, p.226.

confined to public universities and research institutes. Private entities became eligible to apply for these grants.

The TAF, managed by MTDC, complemented the various technology incentive programs by assisting SMEs in the acquisition of strategic foreign technology through the purchase of high technology machinery and equipment, technology licensing and technical training. A total of 69 projects with a value of RM75.3 million were approved by 2000[86]. As of 2015, SMEs, owned at least 51 percent by Malaysian, is eligible to receive partial grants with a maximum of RM2 million or 50% of the eligible expenses (whichever is lower) up to two years. The eligibility criteria include; the proposed technology acquisition must be from one of the Priority Technology Clusters identified by MOSTI excluding ICT; the technology to be acquired must be a registered Intellectual Property (Patent/Copyright/Industrial Design) with proven and significant sales volume; the technology provider must not hold any equity in the applicant's company; and the proposed project must be tangible in nature.

The CRDF, also managed by MTDC, focused on the commercialization of R&D findings undertaken by local universities and research institutions as well as companies and individual researchers and inventors. Between 1997 and 2000, a total of 38 projects amounting to RM32 million was approved. As of 2015, CRDF has four different categories based on target group. First, the commercialization of R&D output from public and private University (PPU) or Government Research Institute (GRI) by a spin-off company, owned by PPU or GRI, is eligible to receive partial grants with a maximum of RM500,000 or 90% of the eligible expenses (whichever is lower)[87]. Second, a start-up company, not owned by PPU or GRI, is eligible to receive partial grants with a maximum of RM500,000 or 70% of the eligible expenses

[86] 8th Malaysian Plan, p.248
[87] MTDC website, accessed April 20, http://www.mtdc.com.my/crdf-1.php.

(whichever is lower)[88]. Third, SMEs is eligible to receive partial grants with a maximum of RM4,000,000 or 70% of the eligible expenses (whichever is lower) for its commercialization of any local R&D[89]. Fourth, non-SMEs is eligible to partial grants with a maximum of RM4,000,000 or 50% of the eligible expenses (whichever is lower) for the commercialization of public sector R&D[90]. All four categories grants require that the company must be at least 51% owned by Malaysian; the proposed technology to be commercialized must be from one of the Priority Technology Clusters identified by MOSTI excluding ICT; the R&D must have been completed successfully and commercial-ready prototype is available; and the proposed project must be tangible in nature. Eligible expenses up to two years includes; cost of the purchase of equipment for Quality Control and Production, cost of technology, consultation, training, cost of advertisement and promotion, cost of IP registration and protection, cost of product testing and standards; cost of registration of certification.

MGS has provided funding for 50 percent of the project cost relating to research over a two-year period. MSC-status companies with at least 51 per cent Malaysian ownership were eligible to apply for this grant. The funding was primarily meant for SME electronics firms to conduct research. Between 1998 and 2000, a total of 19 projects with a value of RM38 million was approved[91]. The projects involved the development of software for electronic payment, computer telephony integration, fingerprint identification product and new tools for the production of a newer generation of semiconductor equipment.

The DAGS aimed to promote widespread usage of ICT among Malaysians. Between 1998 and 2000, a total of 37 projects valued at RM48 million was approved for projects to create

[88] MTDC website, accessed April 20, http://www.mtdc.com.my/crdf-2.php
[89] MTDC website, accessed April 20, http://www.mtdc.com.my/crdf-3.php
[90] MTDC website, accessed April 20, http://www.mtdc.com.my/crdf-3.php
[91] 8th Malaysian Plan, p.344.

software and contents that were indigenous in design, local in content, and customized to the needs of the local community[92]. The program was terminated during 2006-2010.

The IGS aimed to foster collaboration among private sector companies, universities and research institutes applying for the grant assistance. By the end of 2000, a total of 58 projects valued at RM138 million were approved, which included adapting existing technologies and the creation of new products and processes[93]. The program was terminated during 2006-2010.

In terms of fiscal incentives, the government has provided various measures including; full income tax exemption to companies granted pioneer status, an investment tax allowance of 100 per cent in respect of the qualifying capital expenditure incurred, double deductions for R&D expenditure, capital allowance, import duty exemption and industry building allowance[94].

Techno fund supports pre-commercialization stage projects with potential of technological innovation and commercialization with RM1,500,000 – RM 3,000,000 grant for SMEs and research and higher education institutions up to 30 months. Similarly to TAF and CRDF, the scheme covers the acquisition of technology, the up-scaling of laboratory-scale prototype or the development of commercial ready prototype; and clinical testing and field trials. The project must fall into scope of the research priority area including: life sciences, computer sciences and information and communication technology, agriculture sciences and engineering, environmental sciences, advanced materials science, chemical sciences, physical and mathematical sciences, engineering, medical and health sciences, and social sciences and humanities.

Another new fund scheme is the Inno fund which supports individuals, SMEs (Enterprise inno fund) and community groups (Community inno fund) for their effort to commercialize technological innovation and improvement of the socio-economic situation of the community

[92] 8th Malaysian Plan, p.345.
[93] 8th Malaysian Plan, p.334.
[94] 8th Malaysian Plan, p.247; 9th Malaysian Plan, p.267.

through products, processes or services development. The enterprise inno fund provides grant with maximum of RM 50,000 for individuals and RM 500,000 for small and micro companies up to 12 months. The community inno fund provides maximum of RM 500,000 for community group up to 18 months.

Figure 11: Government R&D grant implemented under Five-Year Malaysia Plan

5th and 6th 1986-1995	7th 1996-2000	8th 2001-2005	9th 2006-1020
1. Intensification Research Priority Area (IRPA)	1.IRPA 2.Industrial Grant Scheme (IGS) 3. Demonstration Application Grant (DAGs) 4. MSC Malaysia R&D Grant Scheme(MGS) 5. Commercialization of R&D Fund (CRDF) 6. Technology Acquisition Fund(TAF) 7. Technology Acquisition Fund Women (TAFW)	1.IRPA 2.IGS 3. DAGs 4. MGS 5.CRDF 6.TAF 7.TAFW 8.R&D Biotechnology 9. National Oceanography Directorate (NOD)	1. DAGs (Roll Out) 2. MGS 3. CRDF 4. TAF 5. NOD 6.Techno Fund 7.Inno Fund 8.Science Fund 9. Human Capital Development 10.Technopreneur Development 11.STI Policy Study 12.Strategic Funding for ICT 13.E-Content Industry Development Fund 14.Agro Biotek R&D Initiatives 15.Genomics&Molecular Biology R&D Initiatives 16.Pharmaceutical Nutracetical R&D Initiatives 17.Brain Grain 18.Biotehnology Commercialization Grant 19. Biotehnology Acquisition Grant

Source: Adopted from Jalil1, Karim, Hassan (2010) based on Malaysian Ministry of Science, Technology and Innovation (MOSTI)

The comparison of budget allocation and expenditure during 7th and 8th Five-Year Malaysian plan shows that expenditure fell short of the allocated budget (Figure 12). Malaysia's absolute value and level of R&D as percent of GDP is lower than high income countries, but it would not be feasible to expand expenditure unless the volume of technology- and R&D-oriented firms increases. On top of that, the additional benefit from new program would be limited in such a situation. The availability of high-skilled human resource constrains the number of such firms. The next section reviews the trend of human resource development.

Figure 12: Government budget expenditure and allocation for science and technology

Unit RM million

Program		7th 1996-2000		8th 2001-2005		9th 2006-2010
		Allocation	Expenditure	Allocation	Expenditure	Allocation
R&D Grant (includes IRPA)		848	793	1000	927	-
Science Fund/Fundamental Research		-	-	-	-	1582
Technology Acquisition Fund (TAF)		118	118	250	71	143
Commercialization of Technology		208	204	610	268	1843
	Industrial R&D Grant Scheme (IGS)	50	46	200	197	-
	Commercialization of R&D Fund (CRDF)	63	63	110	31	115
	Demonstrator Applications Grant Scheme (DAGS)	30	30	100	-	-
	MSC R&D Grant Scheme (MGS)	65	65	200	-	-
	Technology Development and Incubator Program (includes MTDC and MDC program)	-	-	-	40	228
	Techno Fund	-	-	-	-	1500
S&T Human Resource Development and Awareness		-	-	-	123	651
S&T Infrastructure		2413	1497	2819	1950	1035
Total		3588	2611	4709	3338	5253

Source: 8th and 9th Five-Year Malaysian Plan

3.6 High-skilled human resource development

The Malaysian government has made effort to increase the supply of skilled worker by expanding capacity in education and training institutions. During 1995-2005, the number of student in secondary school rose approximately 30 percent - 465,973 students – with a total of 16,744 new classrooms[95]. The students enrolling in post-secondary level surged approximately 150 percent with 119,556 additional students during the same period[96]. The government boosted capacity of tertiary education between 2000 and 2005. The number of public tertiary education institutions expanded from 22 to 71[97]. In addition, with the liberalization of education sector, private university and university collage increased from 5 to 22. Furthermore, the government expanded funding of the National Higher Education Fund (NHEF) by RM1 billion to RM2.3 billion. This financial assistance was extended to students in private institutions which benefited 29,000 students in 2000[98]. Still, the enrollment rate in secondary school (67 percent) is below the upper middle income countries average (87 percent) in 2011 since other countries boosted the capacity more than Malaysia (Figure 13). Tertiary school enrollment (36 percent) exceeds upper middle income average (32 percent), but still far below high income countries average (75 percent) in 2011 (Figure 14). These data suggest that the expansion of students' enrollment needs to be continued to catch up high income countries.

Concerning the areas of study in tertiary education, several data suggest that science and technology field increased its proportion. For example, the enrolment in science and technical courses at the first degree level increased from 30,823 persons (41 percent) in 1995 to 88,880 (52

[95] The number of students increased from 1,627,874 (1995) to 2,093,847 (2005), 8th Malaysian Plan, p.99; 9th Malaysian Plan, p.243.
[96] The number of students increased from 80,080 (1995) to 199,636 (2005), 8th Malaysian Plan, p.99; 9th Malaysian Plan, p.243.
[97] The increase for University from 11 to 11, University College from 0 to 6, Polytechnic from 11to 20, community college from 0 to 34 respectively. 9th Malaysian Plan, p.244.
[98] 8th Malaysian Plan, p.103.

percent) in 2000[99]. At the post-graduate level, enrolment in science and technology-related programs increased from 12,602 to 18,910 during 2000-2005[100]. As a result, the number of researchers engaging in R&D surged from 89 per million people to 1643 per million people between 1996 and 2011 outpacing upper middle income countries average (Figure 15). For industries with strong scientific base, such as electrical engineering, computer science, and chemical engineering, advanced training in technologies has become a prerequisite for ability to understand and engage in production process[101]. Therefore, the Malaysian government needs to facilitate supply of engineers and scientists through sponsoring science and technology education. For example, Taiwanese government promoted student enrollment in science and engineering programs so that these field accounted for half of all students in the late 1980s (64% of Master-level students and 48% of doctoral students)[102]. With this regard, the Malaysian government has provided funding for post-graduate researchers. For example, the National Science Fellowship (NSF) awarded 298 scholarships to graduates in science, engineering and technology to pursue post-graduate studies by research in the identified priority areas during 1996-2000[103]. Between 2001 and 2005, a total of RM116 million was allocated to NSF and another RM61 million was allocated to public higher education institutions to fund post-graduate students in key technology areas[104].

[99] 8th Malaysian Plan, p.104.
[100] 9th Malaysian Plan, p.244.
[101] Roberto Mazzoleni and Richard R. Nelson, "The Roles of Research at Universities and Public Labs in Economic Catch-up" in Industrial Policy and Development: The Political Economy of Capabilities Accumulation, ed. Mario Cimoli, Giovanni Dosi and Joseph E. Stiglitz, Oxford: Oxford University Press, 2009, pp.383-384.
[102] Ibid, p.385.
[103] 8th Malaysian Plan, p.350.
[104] 9th Malaysian Plan, p.269.

Figure 13: Secondary school enrollment (percent)

	1996	2000	2006	2011
Malaysia	57	66	68	67
Upper middle income countries average	63	68	74	87
High income countries average	98	98	97	100

Note: Gross enrolment ratio in all secondary programs, regardless of age, expressed as a percentage of the population of official secondary education age.
Source: World Bank, World Development Indicator

Figure 14: Tertiary school enrollment rate (percent)

	1995	2000	2006	2011
Malaysia	11	26	29	36
Upper middle income countries average	10	15	25	32
High income countries average	51	56	67	75

Note: Total is the total enrollment in tertiary education, regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.
Source: World Bank, World Development Indicator

Figure 15: Researchers in R&D activity (per million people)

	1996	2000	2006	2011
Malaysia	89	274	368	1643
Upper middle income countries average	413	503	793	897
High income countries average	2996	3171	3610	3864

Note: Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students engaged in R&D are included.
Source: World Bank, World Development Indicator

In addition to the education enrollment expansion, the government promoted skill training programs. The output of skilled manpower from these institutions increased from 27,910 in 1995 to 44,490 in 2000 and 71,876 in 2005, of which 33 percent was in the electrical engineering and 30 percent was in mechanical engineering field in 2005[105].

[105] 8th Malaysian Plan, p.107; 9th Malaysian Plan, p.243.

Moreover, the government has promoted skills upgrading of SMEs. Human Development Fund (HRDF) was introduced in 1993 in which SMEs that contributed to HRDF were eligible to claim for an additional 45 per cent of the training fees from the fund. During 1996-2000, among disbursed RM488 million, 80.8 percent accounted for in-house employee training rather than training offered by external training providers[106]. Another example of SME upgrading support is the Skills Upgrading Program, introduced in 1997, which provides grant of 70 percent on the training fees for SMEs, aiming at enhancing the skills and capabilities of employees of SMEs in the technical and managerial levels, particularly in critical areas such as the electrical and electronics, information technology, industrial design and engineering fields[107].

The amount of expenditures for education and training increased beyond initial budget allocations at least since 1996 (Figure 16), but a recent survey conducted by the Talent Corp, a Malaysian government agency, and the World Bank in 2014 found that 90 percent of companies surveyed think that universities should provide students with more practical training, while 80 percent think that universities should consider reforming university curricula to reflect the current realities of the labor market[108]. The collaboration between educational institutions and companies needs to be improved in order to generate greater impacts and to promote linkages among stakeholder in clusters. According to the same survey conducted by the Talent Corp and the World Bank, only 3 percent of companies had participated in the classroom as adjunct

[106] 8th Malaysian Plan, p.110.
[107] 70 percent grant rate is as of 2015.
[108] The survey covered 200 companies that employ around 245,000 workers. Most respondents were foreign multinationals (43 percent), followed by nonfinancial public enterprises (including government-linked companies), large domestic enterprises (both listed and unlisted) and SMEs. Other institutions comprised of several government/not-for-profit bodies. With respect to sectors of activity, respondents represented over 14 NKEAs, notably education (18 percent), manufacturing (15 percent) and agriculture (13 percent). World Bank, “Malaysia economic monitor,” June 2014, p.24.

professors and 34 percent of them had never approached universities to recruit candidates, nor been approached by universities to place their graduates into entry-level positions[109].

Figure 16: Government budget expenditure and allocation for human resource development

Program		7th 1996-2000		8th 2001-2005		9th 2006-2010
		Allocation	Expenditure	Allocation	Expenditure	Allocation
Education		17,949	17,542	18,660	37,992	40,357
	Pre-school	124	108	147	216	807
	Primary Education	2,632	2,632	2,750	5,369	4,837
	Secondary Education	5,330	5,318	4,863	8,748	6,793
	Tertiary Education	5,362	5,005	8,900	13,404	16,069
	Teacher Education	350	333	300	1,368	578
	Others	4,150	4,148	1,700	8,817	11,272
Training		2,237	2,182	4,000	4,451	4,793
	Industrial	1,876	1,827	3,760	3,931	4,104
	Commercial	71	71	100	159	180
	Management	290	284	140	362	510
Total		20,186	19,724	22,660	42,373	45,149

Source: 8th and 9th Five-Year Malaysian Plan

4. Malaysia's challenges in cluster development for moving up the value chain

Malaysia has implemented various policies needed for cluster development since 1990s. The government established and improved science and technology institutes and infrastructure. It has also expanded R&D promotion programs as well as series of measures for high-skill human resource development. However, the policy objective on cluster development and value chain upgrading has not yet been achieved.

Even in Penang region, the location of most developed E&E and semiconductor cluster, research found that insufficient synergy is generated among E&E industry stakeholders, such as

[109] Ibid, p.26.

Integrated Circuit design firms, wafer fabricators, packaging and assembly firms[110]. This situation suggests that national level government measures alone cannot sufficiently upgrade cluster. The collaboration among firms, research institutes and the local and national government needs to be coordinated by a specific actor. In other words, government policy incentives do not themselves produce inter-firm collaboration. A positive example is that MIMOS and the Semiconductor Fabrication Association of Malaysia (SFAM) launched the Talent Development Program in order to overcome the severe shortage of skilled semiconductor engineers locally in 2013. This initiative consolidates training resources in one center to undertake upskilling and training of new engineers. This kinds of collaborative coordination needs to be accelerated.

Furthermore, it takes years of effort to develop technologies and high-skilled human resources. Having a domestic base of skilled-worker such as scientists provides the basis for breaking into the international networks where new technologies are being hatched[111]. The Malaysian government has been promoting return of skilled-Malaysian origin people through incentives such as tax exemption and permanent residence status granting, but it is not clear that those experts could play an anchor person role or coordinate stakeholders[112].

The policies analyzed in this paper show that the Malaysian government has been encouraging value chain upgrading and linkage strengthening through financial incentives, but little is shown that the national government improve business condition of specific location such as Penang and Klang Valley other than infrastructure development. The local government plays an important role in coordinating stakeholders as observed in Penang, but coordination between local and central government is little known from previous research. The impact of each

[110] MIGHT, Innovation audit on semiconductor and electronics industry 2008; the Industry Research Task Force of Penang (under Penang State Development Corporation), the Technology Roadmap for the E&E industry of Penang 2007.
[111] Roberto Mazzoleni and Richard R. Nelson, supra note 101, pp.383-384.
[112] For example, returning expert program (REP) by the Talent Corp.

government program and complimentary effects with other policies needs to be examined more detail for further investigation of government policies.

Malaysia has successfully attracted MNCs since the establishment of Free Trade Zones and achieved remarkable economic development. The Malaysia needs to cultivate sources of technology, management and knowledge upgrading in addition to MNCs. This paper show that it takes more than decades to develop such capability and coordination among stakeholder, particularly inter-firm, firms and research and educational institutions, local and central government, is critical for Malaysia to achieve further economic development towards high-income country.

BIBLIOGRAPHY

Best, Michael H., New Competitive Advantage, Oxford: Oxford University Press, 2001.

Cimoli, Mario, Dosi, Giovannni, and Stiglitz, Joseph E. ed., Industrial Policy and Development -The Political Economy of Capabilities Accumulation-, Oxford University Press, 2009.

Clark, Gordon L., Feldman, Maryann P., Gertler, Meric S. ed., The Oxford Handbook of Economic Geography, Oxford: Oxford University Press, 2001.

Delgado, Mercedes, Porter, Michael E. and Stern, Scott, Clusters and Entrepreneurship, Center for Economic Studies, National Bureau of Economic Research, Working Paper 18250, 2010.

Dicken, Peter, Global Shift (5th edition), The Guilford Press, 2007

Dijk, Meine Pieter van and Trienekens, Jacques, ed., Global Value Chains, Linking local producers from developing countries to international markets, Amsterdam University Press, 2012.

Economic Planning Unit, Prime Minister's Department, The Malaysian Economy in Figures 2013 (Updated Edition)

Economic Planning Unit, Prime Minister's Department, Five-Year Malaysian Plan various issues

Economic Planning Unit, Prime Minister's Department, Malaysia Outline Perspective Plan 1991-2000 (OPP2) and 2001-2010 (OPP3).

Hill, Hall and Socorro Gochoco-Bautista, Maria ed., Asia Rising – growth and resilience in an uncertain global economy –, Asia Development Bank and Edward Elgar, 2013

Hill, Hal, Yean, Tham Siew and Haji Mat Zin, Ragayah, ed., Malaysia’s Development Challenge: Graduating from the middle, New York: Routledge 2012

Jacobs, Jane, Cities and the Wealth of Nations: Principles of Economic Life, New York: Random House, 1984

Jalil1, Ahmad Zafarullah Abdul, Karim, Noor Al-Huda Abdul, Hassan, Sallahuddin, Assessing the socio-economic benefits of public R&D activities in Malaysia, 2010

Joseph E. Stiglitz and Justin Yifu Lin ed., The Industrial Policy Revolution I: The Role of Government Beyond Ideology, Hampshire and New York: Palgrave Macmillan, 2013.

Karlsson, Charlie, ed., Handbook of research on cluster theory, Cheltenham and Northampton: Edward Elgar, 2008,

Kawakami, Momoko and Sturgeon, Timothy J. ed., The dynamics of local learning in global value chain: experience form East Asia, Hampshire and New York: Palgrave Macmillan, 2011.

Kuchiki, Akifumi and Tsuji, Masatsugu ed., The Flowchart Approach to Industrial Cluster Policy, Hampshire and New York: Palgrave Macmillan, 2008.

Kuchiki, Akifumi and Tsuji, Masatsugu ed., Industrial Clusters, Upgrading and Innovation in East Asia, Cheltenham and Northampton: Edward Elgar, 2011, p

Malaysian Productivity Corporation, "Productivity Report 2010/2011, 2013-2014

Malaysia Investment Development Authority (MIDA), Performance of the Manufacturing and Services sectors 2006.

Marshall, Alfred, Principles of Economics, 8th edition. London: Macmillan, 1920.

Ministry of International Trade and Industry, Second Industrial Master Plan 1996-2005, Kuala Lumpur: Ministry of International Trade and Industry, 1996.

Ministry of International Trade and Industry, Third Industrial Master Plan 2006-2020, Kuala Lumpur: Ministry of International Trade and Industry, 2006.

National Economic Advisory Council, New Economic Model, Kuala Lumpur: Percetakan Nasional Malaysia Berhad, 2010

Overman, Henry G. and Puga, Diego, Labor Pooling as a Source of Agglomeration In Agglomeration Economics, edited by L. Glaeser, Edward, Chicago: The University of Chicago Press, 2007;

Perkins, Dwight H., Radelet, Steven, L.Lindauer, David, and Block, Steven A., Economics of Development (7th edition), W.W. Norton & Company, 2013.

Porter, Michael E., On Competition, Boston: Harvard Business School Publishing Corporation, 2008.

Rosenthale, Stuart S. and Strange, William C., Evidence on the nature and sources of agglomeration economics In Handbook of Regional and Urban Economics, Volume 4, edited by Henderson, J V and Thisse, J.FE. Elsevier, 2004.

Schaffner, Julie , Development Economics, Wiley, 2014.

Schmitz, Hubert, ed., Local Enterprises in the Global Economy: Issues of governance and upgrading, 2004

Semiconductor Industry Association, The U.S. Semiconductor Industry Factbook 2014

Smith, Adam, An inquiry into the nature and causes of the wealth of nations, MetaLibri, 2007.

Sonobe, Testushi and Otsuka, Keijiro, Cluster-Based Industrial Development: An East Asian Model, Hampshire and New York: Palgrave Macmillan, 2006.

Sonobe, Testushi and Otsuka, Keijiro, "Cluster-Based Industrial Development: A Comparative Study of Asia and Africa," Hampshire and New York: Palgrave Macmillan, 2010

Swann, G.M.Peter, Towards a model of clustering in high-technology industries, In The Dynamics of Industrial Clustering, edited by Swann, G.M. Peter, Prevezer, M. and Stout, D., Oxford: Oxford University Press, 1998.

United Nations Industrial Development Organization, Industrial Development Report 2002/2003, United Nations

United Nations Conference on Trade and Development, World Investment Report 2013, United Nations

Velde, Dirk Willem te, Foreign Direct Investment and Development: An Historical Perspective, Overseas Development Institute, 2006

World Bank, Malaysian Economic Monitor: Boosting Trade Competitiveness, Washington, DC: World Bank, 2014.

World Bank and the Development Research Center of the State Council, P. R. China, China 2030: Building a Modern, Harmonious, and Creative Society, Washington, DC: World Bank, 2013.