Building Dynamic Industrial Agglomerations in ASEAN: Connectivity to Build Up Innovative Capability

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Introduction

The economies of the Association of Southeast Asian Nations (ASEAN) Member States (AMS) have followed a unique development path that has involved aggressively utilising global value chains (GVCs). It has been manufacturing-led economic development with massive introduction of foreign direct investment. The utilisation of GVCs has been steadily upgraded from simple and slow international industrial linkages to participation in quick and time-sensitive production networks, and further to the formation of industrial agglomerations with thick connection to GVCs. Participation in production networks has so far been achieved by only a limited number of least developed countries (LDCs) in the world, including most of the AMS, China, several Central and Eastern European countries, and a few Latin American countries such as Mexico and Costa Rica. The formation of industrial agglomerations with international production networks has been observed in just a few countries including Singapore, Malaysia, Thailand, China, and perhaps Mexico.

Participation in production networks has already been highlighted in both the academic and non-academic literature. The fragmentation theory (Jones and Kiezkowski, 1990) and the concept of the second unbundling (Baldwin, 2011) have convinced people about qualitative differences between simple and slow links. The formation of industrial agglomerations, however, has so far not attracted much attention. Perhaps industrial

agglomeration in LDCs is still regarded as an old phenomenon under the infant industry protection or the import-substituting development strategies. The authors believe that the formation of industrial agglomerations with fragmentation is a novel and important step in economic development for the current LDCs. As Baldwin claims, the information and communications technology revolution removes the 'glue' that used to keep all production processes and tasks together in one place and unleashes production blocks for the fragmentation of production. However, we still have some glue that demands geographical proximity for some of the activities. What we have observed is the simultaneous development of fragmentation and agglomeration in production. Our view is that the formation of efficient industrial agglomerations is the key for LDCs, particularly AMS, to moving up from simple production fragmentation to thicker domestic and international industrial linkages, as is nurturing innovative capabilities to move up to the full development stage.

This chapter focuses on two important elements in the formation of industrial agglomerations: connectivity and innovation. Connectivity is regarded as a necessary condition for production networks, and the importance of both physical and institutional connectivity is emphasised by the Master Plan on ASEAN Connectivity (ASEAN Secretariat, 2010; 2016). Discussion about connectivity in ASEAN sometimes over-emphasises middle- to long-distance connectivity and tends not to attribute sufficient importance to connectivity in geographical proximity, i.e. within an industrial agglomeration, which is also crucial. To take advantage of positive agglomeration effects and limit congestion, industrial agglomerations should be grown up to a certain size with proper infrastructure in a metropolitan area. Middle- to long-distance connectivity must also support a tight link of industrial agglomerations to GVCs.

Innovation deeply depends on industrial agglomerations (Carlino and Kerr, 2014). Production networks include not only the flow of goods but also the flow of knowledge and ideas. Production networks are designed and operated mainly by multinational enterprises (MNEs), and technology and managerial know-how partially move through foreign direct investment and outsourcing from developed countries to LDCs. But there are large technological gaps between MNEs and local firms in LDCs. One of the main channels for local firms to get access to modern technology and managerial know-how is the interaction with MNEs in industrial agglomerations. Geographical proximity provides opportunities for local firms to participate in production networks run by MNEs, which triggers a chain reaction of technology transfer and spillovers. Furthermore, industrial agglomerations should eventually turn into innovation hubs to move up to the last stage of economic development.

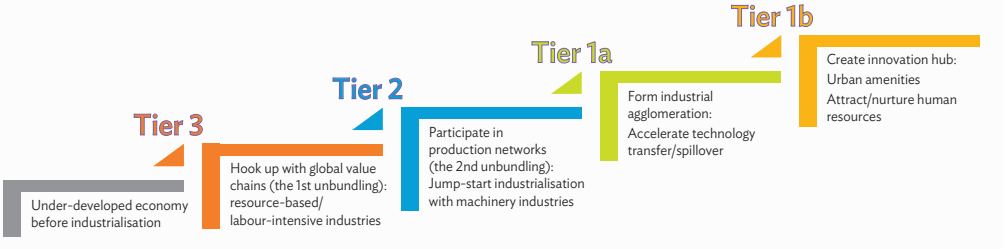
A key claim of this chapter is about the importance of industrial agglomerations in development strategies through aggressive use of GVCs. Connectivity enables countries to build up efficient industrial agglomerations, and innovation is generated and upgraded in industrial agglomerations.

The chapter plan is as follows: the next section presents the tier structure of utilising GVCs in AMS and shows how the improvement of connectivity allows countries to move up the stages of development. The third section argues that industrial agglomeration generates process and product innovation. The last section concludes.

The Tier Structure in Utilising GVCs and Connectivity

AMS have aggressively utilised GVCs in their economic development. Figure 1 illustrates the tier structure of utilising GVCs.[1] In most developing economies, the connection to GVCs is still like in Tier 3 where a country simply hooks up with a relatively slow value chain in the international industrial linkage. In AMS, some industries such as garment, footwear, and natural-resource-based industries still conduct Tier 3 type operations while the modern manufacturing sector, particularly machinery industries, has successfully moved up to Tier 2 where quick and time-sensitive value chains are designed and operated in the form of the second unbundling. Furthermore, forerunners in AMS start forming industrial agglomerations (Tier 1a). Some advanced countries start thinking of Tier 1b, where an innovation hub must be created and highly educated people should be attracted by appealing urban amenities, to move up to a fully developed economy.

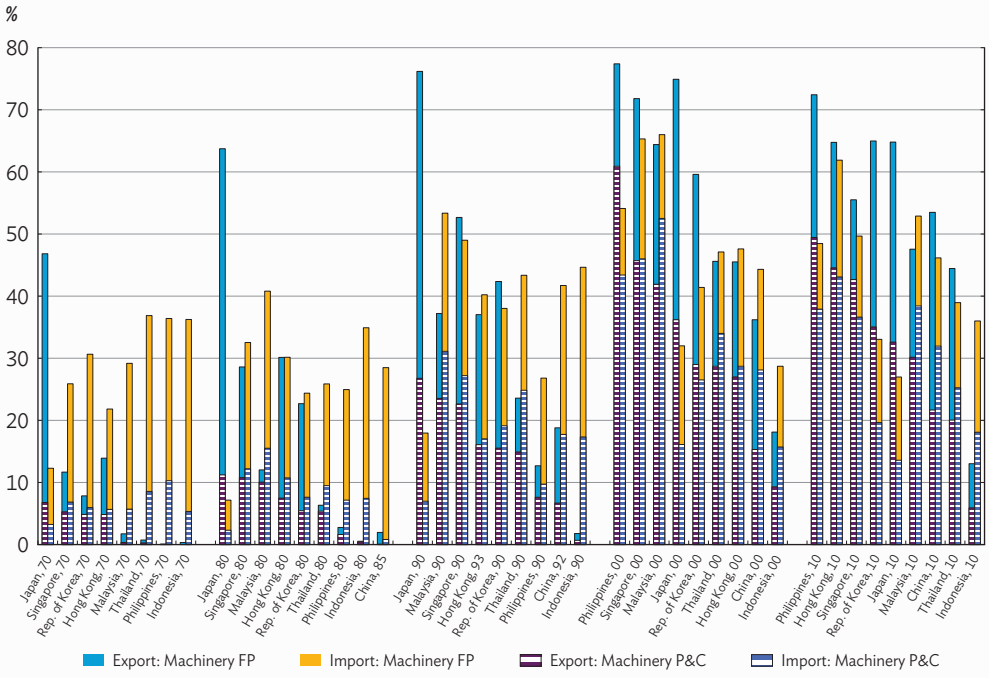
Figure 1: The Tier Structure of Utilising Global Value Chains



Source: ERIA (2015).

[1] The original version of the Comprehensive Asia Development Plan (CADP) (ERIA, 2010) conceptualises three-tiered development stages. The CADP 2.0 (ERIA, 2015) updates the tier structure by introducing two separate steps, Tier 1a and Tier 1b, in the last step of economic development.

Figure 2: Shares of Machinery Final Products, and Parts in Total Exports/Imports in East Asian Economies, 1970–2010



FP = final products; P&C = parts and components.

Note: Data for 1970 and 1980 are based on Standard International Trade Classification while those for 1900, 2000, and 2010 are based on the Harmonized System of tariff nomenclature. The detailed commodity codes are available upon request.

Source: United Nations Comtrade and World Trade Atlas (by Mitsuyo Ando).

Such a tier structure is observed only after the 1980s, and AMS and China are pioneers in applying it to their development strategies. Figure 2 shows the shares of machinery final products (FP) and parts and components (P&C) in total exports/imports in East Asian economies from 1970–2010. Machinery industries, which include general machinery, electric machinery, transport equipment, and precision machinery, are major manufacturing sectors in the second unbundling, and the trade pattern of FP and P&C reveals the degree of participation in international production networks. The second unbundling is detected in the form of back-and-forth transactions of machinery P&C. The figure indicates that machinery P&C transactions were small in 1970 and 1980, which means that the second unbundling was not dominant in the international division of labour. The trade pattern changed dramatically in 1990 and 2000. A very large portion of exports and imports in a number of East Asian economies was occupied by machinery P&C. This corresponds to Tier 2 and Tier 1a. In Tier 2, countries are

connected to quick and time-sensitive international production networks, but the link to GVCs is relatively thin, as can be seen in largely enclave export processing zones. As Tier 1 type operations come in, the international link becomes thick together with sophisticated vertical division of labour in industrial agglomerations. The recent trade data analysis on extensive margins, i.e. the number of exported machinery P&C, also provides evidence that the thickness of international linkages backed up by industrial agglomerations is about to be prepared in AMS (Obashi and Kimura, 2016).

Tier 1a type operations lead to the industrialisation of the whole economy and provide a certain level of stability in industrial structure. At the same time, once the vertical division of labour is developed within industrial agglomerations, a large amount of employment is created in the manufacturing and surrounding services sectors. A smooth movement of labour from rural/traditional/informal sectors to urban/modern/formal sectors is important for continuous industrialisation as well as poverty alleviation (Kimura and Chang, 2017).

Connectivity is a key element for a country to move up the ladder of the tier structure. Required levels of connectivity differ with each tier (Table 1). From Tier 3 to Tier 2, connectivity must be upgraded to cater for quick and time-sensitive operations. Jones and Kierzkowski (1990) called the connections between production blocks service links, the cost of which must be low enough to make production fragmentation economically viable. The cost includes not only a monetary cost but also a time cost and the reliability of logistics links. As for physical connectivity, Tier 3 needs just medium-grade transport infrastructure while Tier 2 requires high-grade transport infrastructure. As for institutional connectivity, although Tier 3 just needs minimal trade liberalisation such as a generalised system of preferences (GSP), Tier 2 must be supported by tariff removal and trade facilitation, at least for machinery industries.

Connectivity enhancement to move up from Tier 2 to Tier 1a calls for further efforts. In Tier 2, links with international production networks are relatively thin, and thus we need to provide connectivity only for limited industrial estates and in specified areas. On the other hand, in Tier 1a production networks expand to multiple industrial estates as well as factories outside specified estates and start covering a number of industries for deeper industrial linkages. Industrial agglomeration must generate positive agglomeration effects while keeping negative agglomeration, i.e. congestion, minimal. Therefore, thick connectivity with international production networks and short-distance within-agglomeration connectivity are required. As for physical connectivity, a large-scale port and airport are essential to connect to international production networks. Within industrial agglomerations, an efficient metropolitan transport system must be constructed. For institutional connectivity, overall trade liberalisation and facilitation

must be aimed for to cater for complicated industrial linkages. GVC-supporting services such as finance, telecommunication, transport, distribution, and professional services should be liberalised and strengthened. In Tier 1b, even higher connectivity would be required to nurture an innovation hub and urban amenities to attract highly educated people.

Table 1: The Tier Structure of Utilising GVCs and Required Connectivity

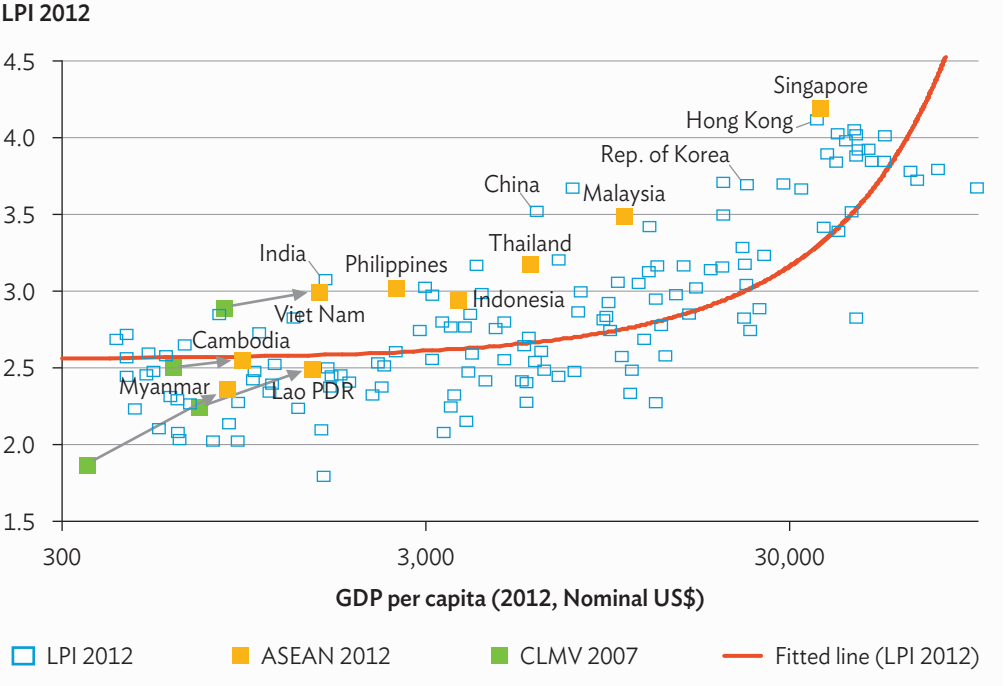
	Tier 3: Hook up with GVCs	Tier 2: Participate in production networks	Tier 1a: Form industrial agglomeration	Tier 1b: Create an innovation hub
Physical connectivity and infrastructure	– Transport infrastructure development (medium grade)	– Economic infrastructure services (for SEZs and others) – Transport infrastructure development (high grade, especially medium distance)	– Economic infrastructure services (metropolitan development, mass/stable supplies, and others) – Transport services development (turnpike quality, metropolitan transport network, full-scale port/airport)	– Urban amenities: (1) Varieties of consumption (services, consumption goods), (2) Aesthetics and physical setting (culture/art, smart city), (3) Public policy (education, security), (4) Speed (urban transport, international exchange)
Institutional connectivity	– Usage of generalised system of preferences (GSP)	– Tariff removal (especially machineries) – Trade facilitation (e-customs, customs clearance, trucks across borders, and others) – Investment liberalisation (especially machineries)	– Tariff removal – NTB removal (TBT and others) – Trade/transport facilitation (single windows and others) – Services liberalization (especially production-supporting services) – Investment liberalisation (especially manufacturing in general, production-supporting services) – Movement of natural persons (especially businessman) – Legal system and economic institutions (reducing transaction costs)	– NTB removal (SPS, standard and conformance, and others) – Services liberalisation (general) – Investment liberalisation (general) – Movement of natural persons (highly educated) – IPR protection – Competition policy – SOE reform

GVCs = global value chains; IPR = intellectual property; NTB = non-tariff barrier; SEZs = special economic zones; SOE = state-owned enterprise; SPS = sanitary and phytosanitary measures; TBT = Technical Barriers to Trade.

Source: Authors.

AMS have made tremendous efforts to enhance connectivity. As for physical connectivity, AMS have steadily invested in logistics and other economic infrastructure. The World Bank's World Development Indicators show that world gross capital formation remained at the level of 20% of gross domestic product (GDP) from 1970 to 2010. However, the ASEAN-5 invested 30% or a higher portion of their GDP in capital formation, except for the Philippines, and a certain proportion of the investment was allocated to infrastructure development. In history, a large share of official development assistance has also targeted the development of logistics infrastructure. As for institutional connectivity, clean tariff removals as well as various forms of trade facilitation under the ASEAN Economic Community (AEC) initiative have helped AMS upgrade the utilisation of GVCs though some parts of liberalisation including services are delayed. In the end, the logistics performance indices compiled by the World Bank are relatively high in AMS, except for some latecomers, after controlling for income levels, which has obviously supported AMS' participation in GVCs (Figure 3). Forerunners have largely achieved the level of connectivity for Tier 2 type operations while latecomers follow suit.

Figure 3: The Logistics Performance Index and GDP per capita



ASEAN = Association of Southeast Asian Nations; CLMV = Cambodia, Lao PDR, Myanmar, and Viet Nam; GDP = gross domestic product; Lao PDR = Lao People's Democratic Republic; LPI = Logistics Performance Index.

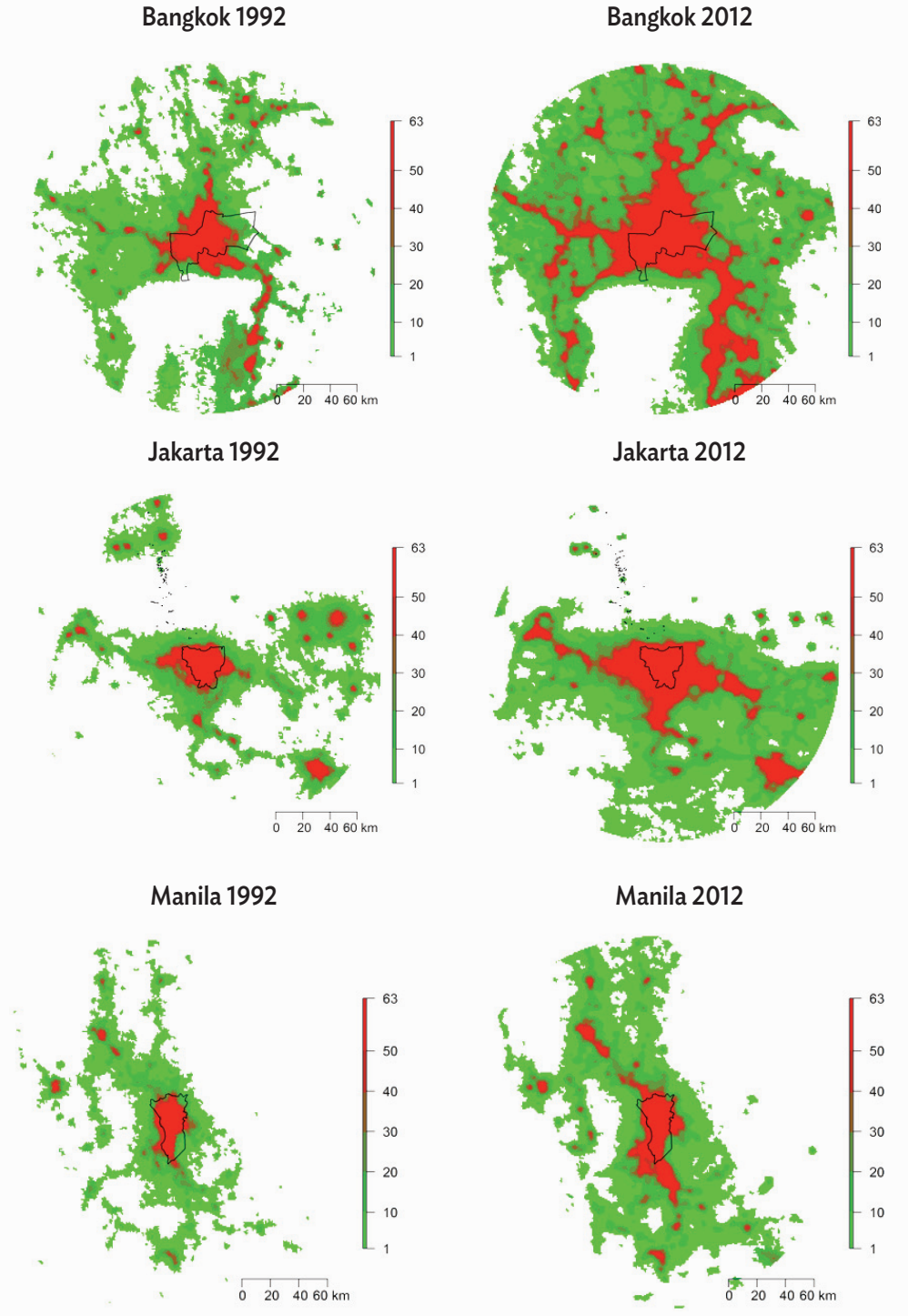
Source: ERIA (2015). LPI is from the World Bank website.

However, some forerunners still struggle with establishing proper connectivity for Tier 1a. Figure 4 presents satellite pictures of night-time lights for Bangkok, Jakarta, and Manila in 1992 and 2012.[2] The colours in 63 grades represent the brightness, and each map covers an area with a diameter of 130 kilometres. Although all show rapid growth of urban and suburban areas in 20 years, the spatial structure indicates that the efficiency of industrial agglomerations differs widely. The Bangkok metropolitan area is largely well designed. Forty industrial estates are scattered over a wide metropolitan area, connected with the highway system. Large-scale ports and airports secure the connection with international production networks. Just-in-time production systems with less-than-2-hour inventory stocks can work. On the other hand, in Jakarta and Manila, factories are located in narrow areas, and negative agglomeration effects – such as congestion – are obvious. The establishment of efficient industrial agglomerations is still a challenge for some AMS. Furthermore, connectivity for Tier 1b will be an important issue in the near future for AMS that will reach upper middle-income levels. Although the construction and operation of subways and urban transport have just started in some of the AMS, it will take some time to achieve 'speed' for creating charming urban amenities.

ASEAN and surrounding East Asia are well connected. Figure 5 presents a simulation result of the Geographical Simulation Model developed by the Institute of Developing Economies in cooperation with ERIA.[3] The simulation scenario includes three different types of trade and transport facilitation measures: (i) development and improvement of hard infrastructure such as roads, railways, sea routes, ports, airports, and border posts; (ii) special economic zones (SEZ) development in the 'CLMV countries' – Cambodia, the Lao PDR, Myanmar, and Viet Nam – which raises the productivity parameter of the specific region in the model; and (iii) non-tariff barrier reduction. Economic effects are shown in terms of cumulative gains in real GDP in 2021–2030 as a percentage of real GDP in 2010.[4] The result indicates that the further enhancement of connectivity will bring large economic gains not only for countries and regions with projects but also for countries connected with international production networks.

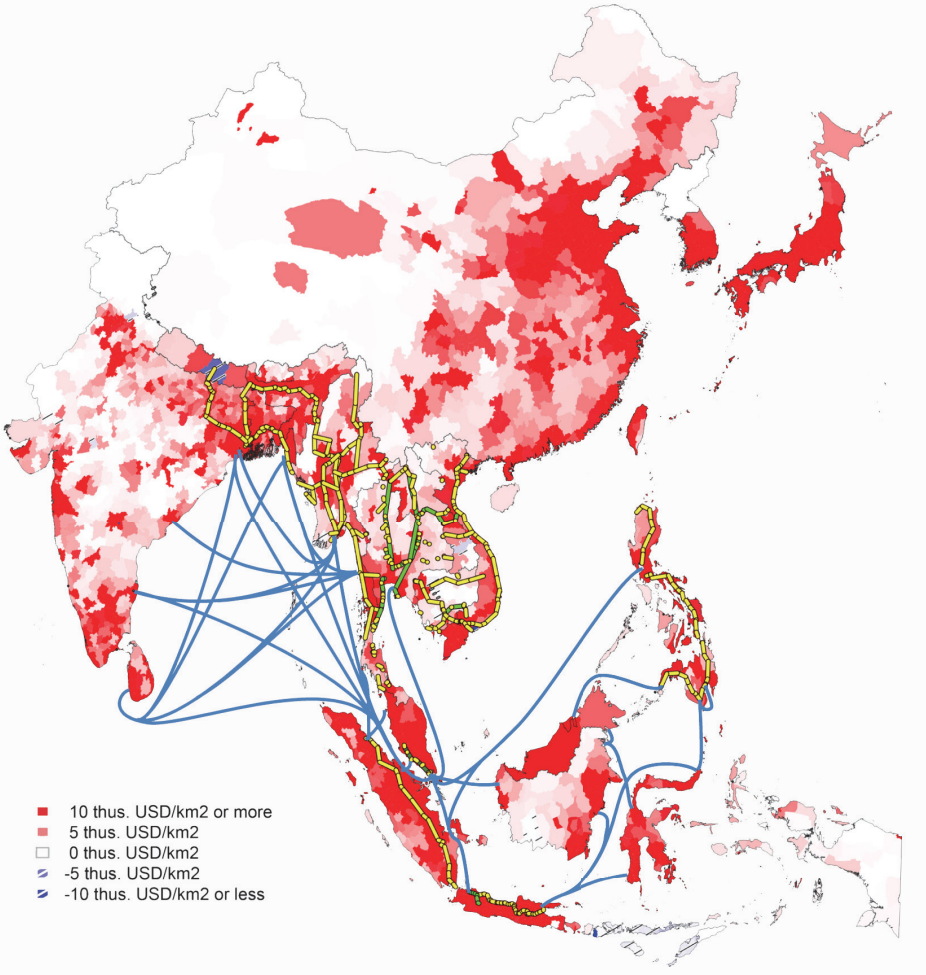
2 On the academic use of nightlight information, see Keola, Andersson, and Hall (2015).
3 Chapter 4 of ERIA (2010), Kumagai and Isono (2011), and Kumagai, Isono, Ishida, Gokan, Souknilanh, and Hayakawa (2015) provide more details on the IDE/ERIA GSM.
4 For more details on the IDE/ERIA GSM and simulation results, see Chapter 6 in CADP 2.0 (ERIA, 2015).

Figure 4: City Size with Night-time Light from Satellite



Source: ERIA (2015) by Keola Souknilanh.

Figure 5: Economic Impacts of All – All Improvements (2030, Impact Density)



km^2 = square kilometre; thus. = thousand; US$ = United States dollar.

Source: ERIA (2015) by Institute of Developing Economies/ERIA Geographical Simulation Model Team.

Industrial Agglomeration, Urban Development, and Innovation

Although development strategies that utilise GVCs have been proven to accelerate industrialisation, heavy dependency on MNEs and a lack of national champions in the economic scene may remain features of AMS for quite some time. This is one of the important differences with Japan, the Republic of Korea, or Taiwan, where slow

nurturing of local firms was possible in the pre-globalisation era. However, in the latter half of industrialisation, innovation is going to be crucial. MNEs are not necessarily motivated to bring innovative capabilities into LDCs. How to create innovation capabilities by utilising GVCs is a big challenge for AMS. Here again, industrial agglomeration is going to be important.

In Tier 1a, we observe that process innovation would be accelerated in industrial agglomerations. Outsourcing or subcontracting is a form of production fragmentation in which local firms have opportunities to participate in production networks within industrial agglomerations. Local firms may subcontract/outsource material processing, component and product assembly, and other tasks to outside suppliers. Subcontracting by MNEs provides opportunities for local firms to obtain from MNEs advanced knowledge about products, production process, and management techniques, and achieve innovation.

Knowledge transfer in the GVCs is realised through various forms of informal and formal relationships between buyers and suppliers (Crone and Roper, 2001; Giroud, 2007). More formal is a licensing agreement between buyers and subcontractor suppliers. Other forms of knowledge transfer are product drawings/specifications and manuals that are necessary for suppliers to fulfil buyer's requirements, comply with product and production-related regulations, and satisfy social responsibilities and market demands. Regular supplier audits, in which buyers evaluate performances of their suppliers, provide a periodic opportunity for suppliers to receive feedback from their buyers. Suppliers also communicate and cooperate with their buyers on a daily or as-needed basis, which involves knowledge transfer. Suppliers' established long-term relationships with their buyers increase their credibility and opportunities for knowledge transfer. In addition to such cooperative buyer–supplier relationships, competitive pressures motivate suppliers in the GVCs to achieve innovations.

However, the vast majority of local SMEs in ASEAN and other developing countries cannot succeed in establishing buyer–supplier relationships with MNEs. It is necessary for local firms to satisfy buyers' minimal criteria in supplier selection. Buyers evaluate in their screening process potential suppliers' financial status, production capacity, adoption of ISO (International Organization for Standardization) and other management systems, and their ability to meet corporate social responsibilities and comply with buyer specifications (i.e. quality, cost, and delivery – QCD). In particular, local firms do not have sufficient capabilities and resources to satisfy such criteria, especially in terms of quality control. Local firms that adopt quality management methods are more likely to receive technical assistance from buyers (Machikita, Tsuji, and Ueki, 2016). There are some successful cases in which the public and private sectors jointly developed supplier

development programmes, such as the Penang Skills Development Centre in Malaysia (Mohan, 2010) and the Technology Promotion Association (Thailand–Japan) in Thailand (Intarakumnerd, Gerdsri, and Teekasap, 2012).

Knowledge transfer enforces agglomeration forces when the flow of knowledge depends on distance. Face-to-face communication is effective in transferring tacit knowledge (Machikita and Ueki, 2013; Norasingh, Machikita, and Ueki, 2015). Distance affects trip time and the frequency of the movement of people. Intra- and inter-firm knowledge transfers are associated with physical proximity between buyers and suppliers in ASEAN, whereas technology transfers from outside are also important sources of technological information (Kimura, Machikita, and Ueki, 2016). Proximity enables firms to communicate face-to-face more frequently, share more knowledge and experiences, and interact to create new knowledge.

Knowledge can be transferred beyond the boundaries of a firm or a single value chain. People employed by a firm have opportunities to communicate with various people even without business relationships. Knowledge of a firm embodied in its employees is transferred to other firms when the employees leave the firm to work for other firms often located within the same commutable area. Knowledge transfer also occurs when employees establish their own firms. Full-size industrial agglomerations and urban areas provide better business environments for manufacturing and services that accumulate and generate a wide variety of knowledge and innovative activities (Audretsch and Feldman, 2004).

How about the prospects for upgrading innovation in Tier 1b? In most of the AMS, national innovation systems are under-developed, and ratios of research and development expenditure to GDP are still very low. However, there have already been some notable trials.

Some AMS introduce policies for promoting industrial upgrading, value-added services, and science and technology that are closely linked with urban development. Singapore released its IT2000 Plan in 1992 with the aim of transforming the city-state into an intelligent island where information technologies are utilised to enhance the quality of life and keep national competitiveness as a regional hub. Malaysia launched the initiative of the Multimedia Super Corridor (MSC) in 1996 to attract knowledge-based industries in the corridor stretching from Kuala Lumpur City Centre (KLCC) to Kuala Lumpur International Airport (KLIA) and accomplish Vision 2020, which aims to transform Malaysia into a fully developed country by the year 2020 (Yamada, 2003). In 2006, Malaysia launched the development of Iskandar on the shore opposite to Singapore to take over talents and value-added business activities from Singapore.

AMS have gradually built up the innovative capacity over time. The number of patents filed in the United States Patent and Trademark Office by inventors in some AMS has increased considerably (Table 2). The number of patents by inventors in Singapore rose sharply from 232 in 1990–1994 to 5,219 in 2010–2014, and in Malaysia and Thailand they increased from 91 to 1,561 and from 43 to 646, respectively. Singapore also experienced a sharp increase in the number of patents by assignees in Singapore from 73 to 5,077 during the same period. However, the increase in the number of patents by assignee in Malaysia and Thailand was moderate: from 28 to 321 for Malaysian assignees and from 14 to 142 for Thai assignees. The gaps between the number of patents by inventors' country and by assignee country indicate that more resident inventors in AMS are involved in international collaborations, although domestic firms need to develop the capacity to play leading roles in achieving inventions.

Table 2: The Number of United States Patents

(1) By Inventors' Country

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
1990–1994	34	91	39	232	43	0
1995–1999	57	175	98	725	126	7
2000–2004	107	474	175	2,373	298	16
2005–2009	127	1,002	187	2,793	277	22
2010–2014	120	1,561	330	5,219	646	62
2015	36	382	86	1,368	178	24

(2) By Assignee Country

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
1990–1994	7	28	2	73	14	0
1995–1999	23	18	0	327	52	0
2000–2004	52	109	5	1,246	53	1
2005–2009	44	184	13	2,699	69	1
2010–2014	18	321	35	5,077	142	7
2015	7	80	17	1,624	36	6

Source: United States Patent and Trademark Office.

In the globalisation era, we may need to consider development strategies for innovation that are different from those that have been adopted by existing developed economies. Corporate activities are extended beyond national borders, and human resources, particularly highly educated people, can also move internationally. Although strong

agglomeration forces may dictate path-breaking innovation in the world, 'networks' of innovation at satellites for research outsourcing and local application seem to work to some extent from the European experience (Meijers, Burger, and Hoogerbrugge, 2016). Capital cities in AMS must become such windows open to worldwide innovation.

The expected urbanisation in AMS will provide necessary conditions for promoting innovation. Urban areas with more than 5 million people (i.e. the size of Singapore) can be considered to have a high potential of growing into full-sized agglomerations. In 2030, such large populated places will be in Indonesia (Jakarta), Malaysia (Kuala Lumpur), Myanmar (Yangon), the Philippines (Manila), Singapore, Thailand (Bangkok), and Viet Nam (Hanoi, Ho Chi Minh City) (United Nations, 2015). In addition to these mega cities, major urban areas will be developed not only on the continent of ASEAN but also on islands outside metropolitan regions in Indonesia and the Philippines. However, policy efforts are needed to generate positive agglomeration forces and reduce negative ones to develop national and local innovation systems and transform these urban areas into innovation hubs.

Considering the mobility of highly educated people in the globalisation era, urban amenities will surely become important in building up a critical mass of human capital in a city. The large amount of human resources indigenous to the country now resides abroad; we would like some of them to come back and contribute to local innovation. Foreigners are also mobile to an increasing extent; we must provide comfortable urban environments for them to stay long for innovation. A seminal work by Glaeser, Kolko, and Saiz (2001) proposed four elements of urban amenities to attract highly educated people for innovation: (i) the presence of a rich variety of services and consumer goods available for consumption, (ii) aesthetics and physical setting, (iii) good public services, and (iv) speed. Ultimately, human capital creates innovation. How to attract human capital will be a very important part of the policy agenda for AMS.

Conclusion

ASEAN, together with China, has been a pioneer in applying development strategies of aggressively utilising GVCs and has had considerable success in terms of rapid and sustained economic growth as well as quick and steady poverty alleviation. In the process of industrialisation, the role of industrial agglomerations has also been crucial. Tight connection with GVCs is certainly important, but the role of industrial agglomerations in taking advantage of globalisation must also be emphasised. Particularly in Tiers 1a and 1b, the construction of efficient industrial agglomerations and urban development are essential, and strong policy effort is needed.

Studies on urban development in the context of LDCs used to apply a rather passive approach, focusing on the clearance of slums, the reduction of traffic congestion and pollution, etc. Urban development should now adopt a more positive approach. Efficient industrial agglomerations that are tightly linked to GVCs are essential to development strategies we applied in AMS. Urban amenities to attract human capital for innovation will become a key issue soon. These are uncharted areas in development economics. ASEAN should take a lead in writing up the latter half of its development strategies.

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