Chapter 2

Infrastructure for Connectivity and Innovation: The Conceptual Framework

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Chapter 2
Infrastructure for Connectivity and Innovation: The Conceptual Framework

This chapter discusses the theoretical background and the conceptual framework for CADP 2.0. The original CADP (ERIA, 2010) placed the fragmentation theory and new economic geography at the centre of the analytical approach. CADP 2.0 follows the same path and at the same time further extends it to reflect recent changes in the development stages of ASEAN and East Asia as well as the advancement of economic research at ERIA. CADP 2.0 proposes the direction of infrastructure development not only for connectivity but also for innovation.

The chapter plan is as follows: the first and second sections review and expand the framework of the fragmentation theory and new economic geography. The third section discusses innovation in industrial agglomeration as the microeconomic source of productivity growth. The fourth section argues the implication of our development strategy for the narrowing of geographical and industrial development gaps. The fifth section links the conceptual framework to infrastructure development for connectivity and innovation.

2-1. The Fragmentation Theory

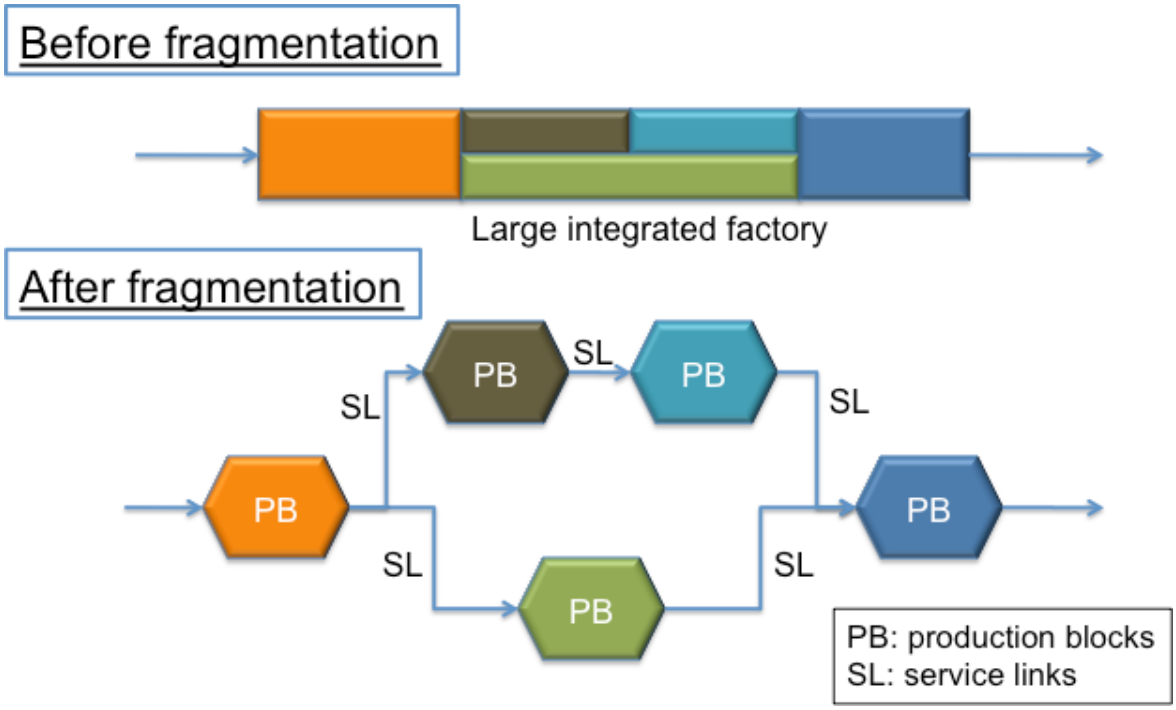
2-1-1. Fragmentation and the second unbundling

Since the mid-1980s, the world economy has started using a new type of international division of labour in production processes or tasks, instead of depending on the traditional industry-by-industry division of labour. The fragmentation theory (Jones and Kierzkowski, 1990) and the second unbundling (Baldwin, 2011) provide a conceptual framework to understand the mechanics.

Figure 2.1 illustrates the fragmentation theory. Suppose that before the fragmentation of production, a large factory took care of all production activities from upstream to downstream. It was a factory, for example, in the electronics industry, which was capital-intensive or human-capital-intensive so that it was located in a developed country, following the traditional comparative advantage theory. If we carefully looked at

the factory, however, it included diversified production processes that used different inputs and different technologies. Therefore, if we can separate some of the production processes into production blocks and place them in appropriate locations, we may save on total production cost. This is so-called fragmentation of production.

Figure 2.1. The Fragmentation Theory



Source: ERIA CADP research team.

Whether such fragmentation of production works depends on two conditions. First, the savings in production costs in a fragmented production block should be large enough. Second, costs of the service link that connects remotely located production blocks must not be too high. Fragmentation is a powerful tool to exploit differences in location advantages, particularly between countries/regions at different development stages. It can be much more flexible and articulate than the traditional industry-wise division of labour in taking advantage of gaps in factor prices, resource availability, logistics arrangements, policy environments, and others. On the other hand, it must at least partially overcome geographical distance by reducing service link costs, which include transport costs in terms of monetary and time dimension, telecommunication costs, and various coordination costs between production blocks.

The concept of the second unbundling further examines differences between fragmented production and traditional industry-by-industry division of labour. The first unbundling is the separation of production and consumption across national borders. It started at the end of the 19th century with the introduction of the mass transport system, such as steam ships and railways, and became a landmark for the formation of the world economy dominated by the industry-by-industry international division of labour based on comparative advantage. On the other hand, the second unbundling refers to the international division of labour in terms of production processes and tasks. It was initiated in the 1980s when the information and communications technology revolution drastically reduced coordination costs in distance. Fundamental differences between the first and the second unbundling reside in the way of dividing jobs/tasks with tight coordination rather than differences across industries or between finished products and parts and components. In the second unbundling, we have two-way flows of goods, ideas, technology, capital, and technicians between remotely placed production blocks. This requires a 'trade–investment–services nexus' supported by physical and institutional connectivity. For the second unbundling, connectivity by logistics infrastructure must be at a higher technical grade than for the first unbundling, which should take care of not only monetary transport costs but also time costs and the reliability of logistic links.

As we will review in detail in Chapter 4, ASEAN and East Asia have been forerunners in aggressively utilising the new international division of labour in their development strategies. In particular, machinery industries are major players in extending production networks. Machines consist of a large number of parts and components that are produced by using diversified materials and technologies. The industry thus has a sophisticated division of labour by nature and can be a natural forerunner of taking advantage of production networks. We, of course, observe the development of production networks or the second unbundling in other industries such as garment, food processing, cut flowers, software, and others. However, most of these industries are still in the traditional industry-by-industry international division of labour or the first unbundling. The concept of global value chains has recently been popular (Elms and Low, 2013) but we have to be careful that the concept includes both the first and the second unbundling. Production networks and the second unbundling are characterised by fast, high-frequency, and synchronised transactions rather than slow, low-frequency, and less

coordinated transactions in a simplistic international input–output structure. The development of production networks in machinery industries is actually a good indicator for assessing the degree of participation in production networks by each country; that is, because once the economic and policy environment allows machinery industries to extend production networks, other industries can also do so.

2-1-2. Policies to reduce three kinds of costs

For a developing country to participate in production networks, it needs to find a bottleneck. To join production networks, three kinds of costs need to be reduced: (i) network set-up costs, (ii) service link costs, and (iii) production costs per se in production blocks. If a country or a region has difficulty in joining production networks, some of these costs are likely to be too high. That is the bottleneck. Then policymakers would like to resolve the bottleneck by implementing necessary policies.

The government can reduce network set-up costs by policies to reduce investment costs, such as the enhancement of stability, transparency, and predictability of investment-related policies as well as the improvement of investment facilitation/promotion services provided by foreign direct investment–hosted agencies and industrial estates. Reduced service link costs may be achieved by a series of hard and soft connectivity policies to overcome geographical distance and border effects, which include the construction/operation of logistics infrastructure and trade liberalisation/facilitation. Reduced production costs per se are realised by policies that strengthen location advantages, which include, among others, enhancing and stabilising supplies of economic infrastructure services for electricity and other utility supplies, as well as industrial estate services.

2-1-3. Fragmentation and agglomeration

As a country or a region successfully participates in production networks and accumulates a number of production blocks, industrial agglomerations will start to form. Production networks in the world other than those in ASEAN and East Asia have barely reached the stage of forming industrial agglomerations, and thus the parallel development of fragmentation and agglomeration is not yet well recognised in the

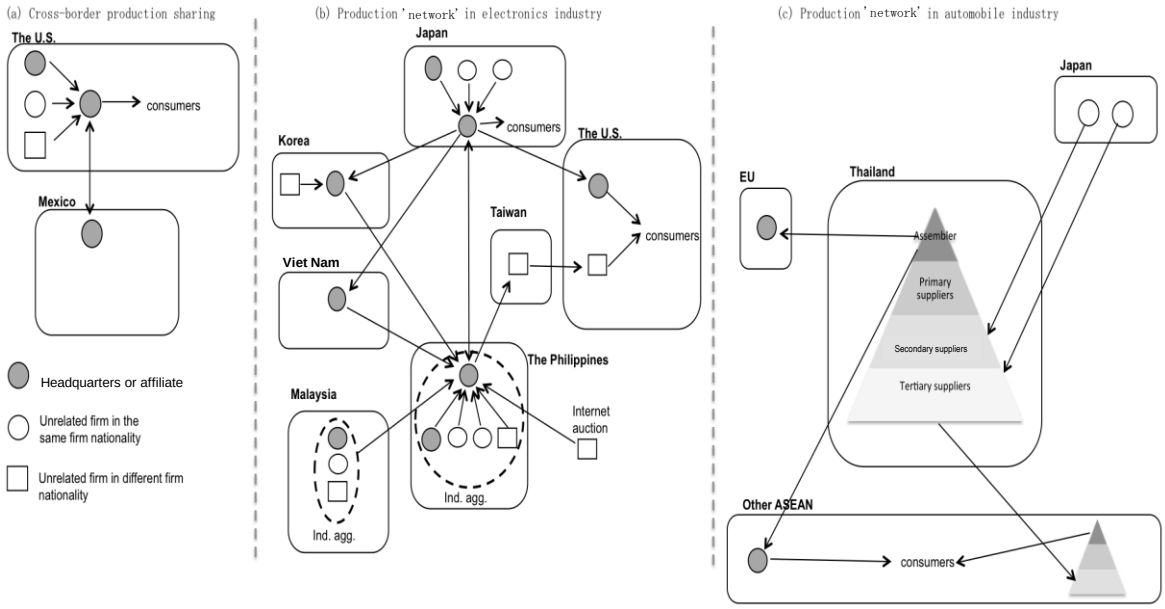
academic literature. However, this is important, and the seemingly paradoxical phenomenon can lucidly be explained by the extension of the fragmentation theory.

Kimura and Ando (2005) expand the fragmentation theory to two dimensions: fragmentation in the geographical distance and fragmentation in the disintegration. The new dimension, disintegration, means that fragmentation of production may occur in the context of intra-firm or arm's-length (inter-firm) division of labour. Arm's-length division of labour takes various forms of vertical linkages and outsourcing between unrelated firms. Compared with intra-firm fragmentation, arm's-length fragmentation is sensitive to geographical distance. In particular, one side of a transaction is a local firm or a small or medium enterprise in developing countries; the transaction is almost always in geographical proximity to save on distance-sensitive transaction costs.

This is a dominant economic logic in forming agglomerations in ASEAN and East Asia, which is quite different from typical cases in developed countries where industries with high transport costs are attracted to the most immobile element, people.

Figure 2.2 illustrates the evolution of production networks. Production networks typically start with a simplistic prototype as illustrated in Figure 2.2(a). This is just the intra-firm fragmentation of production across national borders with back-and-forth transactions between the United States (US) and Mexico, which is called cross-border production sharing. Similar forms of production networks were observed in many places at the beginning of the second unbundling era; examples are the semiconductor assembly in Penang, Malaysia and garment operations between Hong Kong and Guangdong. As production networks are extended and become sophisticated, fragmentation and agglomeration start evolving at the same time. Figure 2.2(b) is the case of hard disk drive production where geographical fragmentation dominates while industrial agglomeration with arm's-length transactions is initiated. Figure 2.2(c), on the other hand, is the case of the automobile industry where the logic of industrial agglomeration dominates though the formation is supported by parts and components supplies from abroad through production networks.

Figure 2.2. The Evolution of Production Networks: Illustrations



Source: Ando and Kimura (2010), modified.

A firm in production networks actually combines four layers of transactions (Table 2.1). Layer 1 is a transaction within an industrial agglomeration where a just-in-time system is literally operated. Layer 2 is a transaction within a subregion such as ASEAN that is connected with middle-distance transportation, still sensitive to time costs. Layers 3 and 4 are transactions on a regional basis, such as in East Asia, and on a global basis, which cannot be very time-sensitive anymore in most cases. The choice of four layers typically depends on the elements presented in Table 2.2. Weights of four layers depend on the economic and policy environment as well as industrial characteristics and corporate strategies. In the case of the electronics industry, more weights are placed in long-distance transactions because service link costs are low and arm's-length transactions go with relatively high credibility, balanced power, and are modular. On the other hand, the automobile industry typically prefers short-distance transactions, particularly under a corporate strategy like Toyota's, because service link costs are typically high and arm's-length transactions go with relatively low credibility, unbalanced power, and total integration.[2]

[2] This view seems to be particularly applicable in the case of Toyota. On the other hand, some other automobile assemblers such as Volkswagen and Hyundai may apply more module interface as well as communised parts and components worldwide so that a system close to complete knockdown may apply. This issue has been investigated in the series of automobile industry studies by ERIA and Research Institute Auto Parts Industries, Waseda University (2014).

Table 2.1. Four Layers of Transactions in Production Networks

	Layer 1 (Within ind. agg.)	Layer 2 (Within sub-region)	Layer 3 (Within region)	Layer 4 (Global)
Lead time	Within 2.5 hours	1 to 7 days	1 to 2 weeks	2 weeks to 2 months
Typical transaction frequency	More than once in a day	More than once a week	One a week	Less than once a week
Major transport mode	Track	Track/ship/airplane	Ship/airplane	Ship/airplane
Trip length	Within 100km	100-1,500km	1,500-6,000km	More than 6,000km

Source: Originally in Kimura (2009), modified.

Table 2.2. Determinants of the Transaction Layer Choice

	Layer 1	Layer 2	Layer 3	Layer 4
<Fragmentation (geographical)>				
Network set-up costs (e.g., cost to invite upstream firms)	small ⟷ large			
Service link costs (e.g., transport costs)	large ⟷ small			
Location advantages (e.g., wages, economics of scale)	small ⟷ large			
<Fragmentation (disintegration)>				
Intra-firm vs. arm's length (inter-firm)	Arm's length (inter-firm) ⟷ Intra-firm			
In cases of intra-firm transactions:				
Trust	weak ⟷ strong			
Power balance	unbalanced ⟷ balanced			
Architecture of firm-to-firm interface				
Modular vs. total integration	integration ⟷ modular			

Source: Originally in Kimura (2009), modified.

The formation of industrial agglomerations calls for a new set of hard and soft infrastructure—hard infrastructure for industrial agglomeration, and soft infrastructure for reducing transaction costs in arm's-length transactions.

2-2. New Economic Geography

2-2-1. Agglomeration and dispersion forces

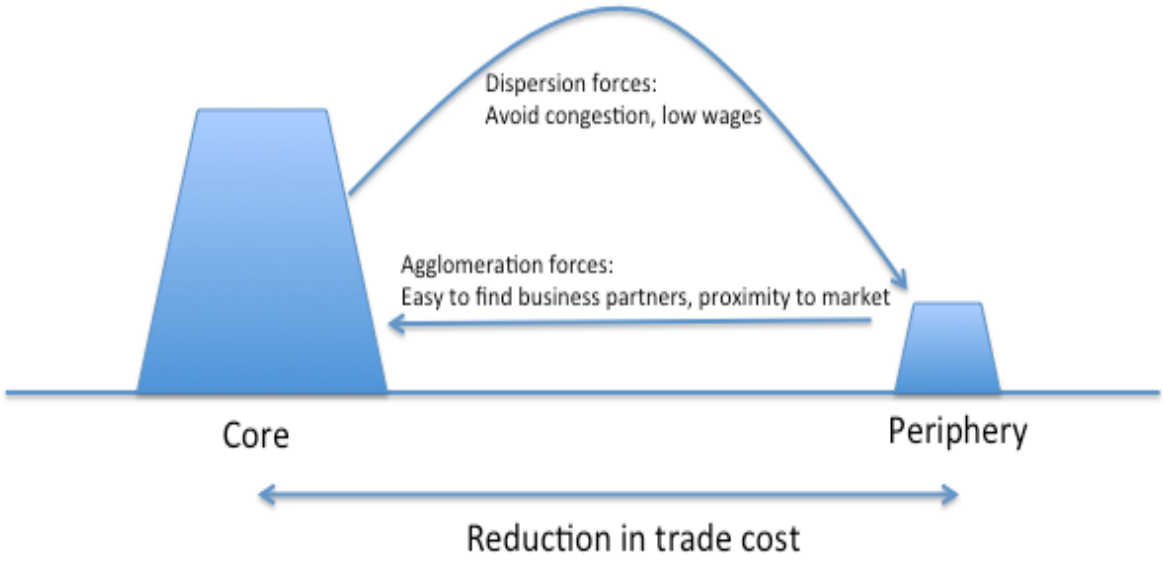
New economic geography (Fujita, Krugman, and Venables, 1999; Baldwin, Forslid, Martin, Ottaviano, and Robert-Nicoud, 2003) is another pillar of our conceptual framework. It complements the fragmentation theory, particularly in considering ways of participating in production networks. While the fragmentation theory inclines toward individual firms' decision-making, new economic geography looks at agglomeration forces and dispersion forces generated by production–consumption interactions in both internal

and external economies. In addition, new economic geography can think of a situation where not only economic activities but also people (or labour) can move.

Figure 2.3 depicts the essence of new economic geography. Suppose we have a core and a periphery in geographical distance. If trade costs between the core and the periphery go down, both agglomeration forces and dispersion forces are generated. Agglomeration forces mean that economic activities, people, and others are attracted to the core where positive agglomeration effects are found in the form of the easiness of finding business partners, the proximity to the market, and others. Positive agglomeration effects are often formalised as a sort of economies of scale external to individual firms that work within a certain geographical boundary. However, economies of scale internal to individual firms may also work as a benefit from moving to the core. On the other hand, dispersion forces generate movements of economic activities, people, and others from the core to the periphery. One source of dispersion forces is negative agglomeration effects or 'congestion' in the core, which includes wage increases, land price hikes, traffic congestion, environmental pollution, and others. Some economic activities or people do not like such congestion and may move from the core to the periphery. Another source of dispersion forces is a difference in location advantages such as differences in wages and others though this could also be interpreted as an element generated by 'congestion'. In contrast to a typical setting in Western Europe or the US where factor prices and other location advantages do not differ much, the core and the periphery in ASEAN and East Asia tend to have a large gap in development stages, factor prices, and others. We can thus expect dispersion forces of considerable magnitude in our region in contrast to situations in developed economies where agglomeration forces are almost always dominant.

The fragmentation theory may naively recommend a reduction in service link costs in order to participate in production networks. On the other hand, new economic geography poses a caveat that a reduction in trade costs may generate both agglomeration forces and dispersion forces; thus, we should properly control the two forces to achieve a balanced growth between the core and the periphery.

Figure 2.3. New Economic Geography: Agglomeration Forces and Dispersion Forces



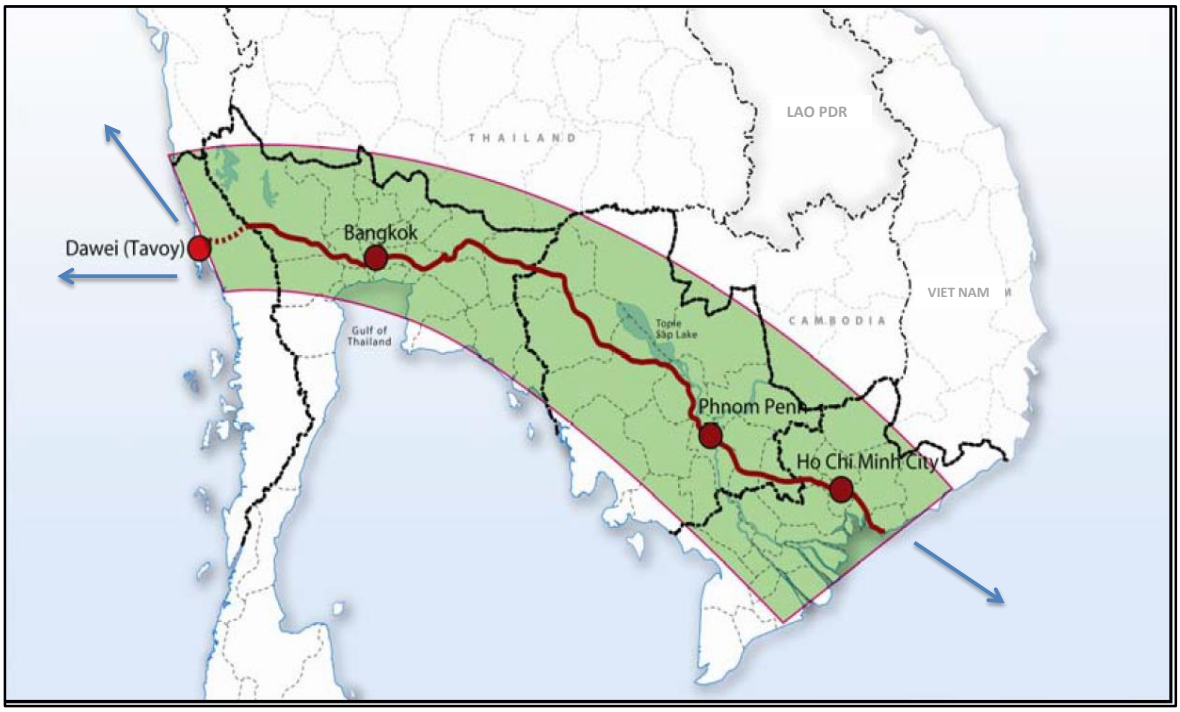
Source: ERIA CADP research team.

2-2-2. Supplementary policy package to control the two forces

How can we control the magnitude of agglomeration forces and dispersion forces? In particular, when latecomers would like to join production networks, a certain magnitude of dispersion forces must be generated, together with a reduction in trade costs. The answer is to properly plan and implement supplementary policy package together.

While the fragmentation theory also claims the necessity of enhancing location advantages, the strength of new economic geography is its ability to consider both agglomeration forces and dispersion forces as well as possible mobility of multiple elements. Let us use the Mekong–India Economic Corridor (MIEC) for thought experiments (Figure 2.4). MIEC is an economic corridor that connects Ho Chi Minh City, Phnom Penh, Bangkok Metropolitan Area, and Dawei. It has great potential for being a major manufacturing corridor in the near future. Think of the case of industrial development in Phnom Penh and in Dawei.

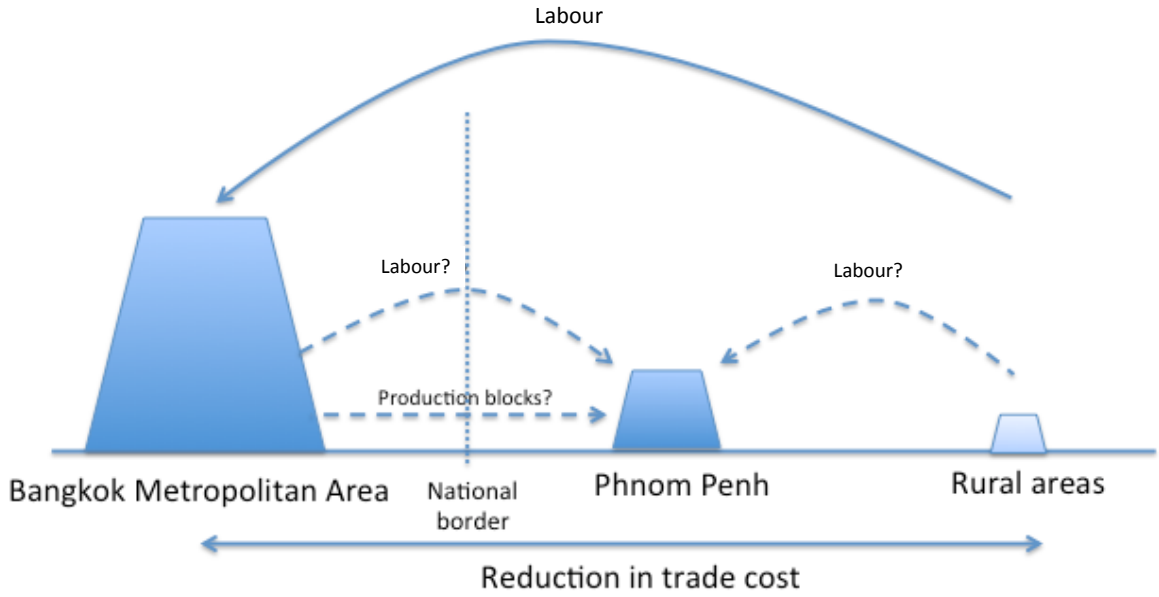
Figure 2.4. Mekong–India Economic Corridor



Source: ERIA CADP research team.

The recent development of the so-called 'Thailand+1' investment is a good sign of expanding production networks from the Bangkok Metropolitan Area to the neighbouring countries, together with reducing service link costs or trade costs. However, things may be a bit more complicated. As Figure 2.5 illustrates, the Bangkok Metropolitan Area has recently attracted a substantial number of labour from neighbouring countries. In the case of Cambodia, about 1 million out of 15 million Cambodians are now in Thailand working in unskilled labour–intensive sectors and the informal sector rather than in Phnom Penh. How can Phnom Penh attract labour from the rural areas and, at the same time, invite production blocks from Thailand? This is the case where reduced trade costs make both economic activities and people easier to move within Cambodia and across the national border.

Figure 2.5. Scenario for the Development of Phnom Penh



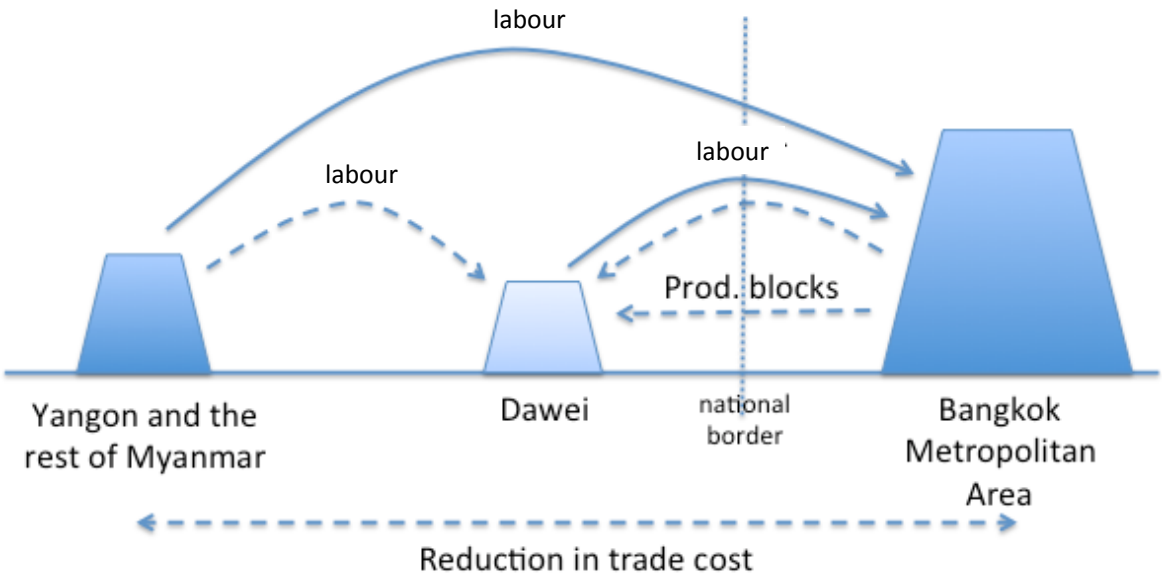
Source: ERIA CADP research team.

Although we need to conduct a serious micro study on the profile of migrant labour and its impact, a simplistic thought experiment is also useful. If the wage gap between Bangkok and Phnom Penh is too large, people do not come to Phnom Penh though production blocks may be motivated to come. On the other hand, if the wage gap is too small, production blocks do not come though people may flow into Phnom Penh. How can Phnom Penh attract both production blocks and people? The answer is the improvement of location advantages and liveability in Phnom Penh. The supplementary policy package may include the better provision of economic infrastructure services in Phnom Penh including better special economic zones (SEZs), more stable supply of electricity, and others. At the same time, people's movement costs from the rural areas to Phnom Penh may be reduced. People coming to Phnom Penh should be willing to stay in Phnom Penh, even if the salary is a bit lower than in Thailand, and enjoy comfortable living.

Another case of thought experiment is the Dawei development. Dawei also intends to attract both production blocks and people, thus requiring more drastic measures to meet its ambition than in the case of Phnom Penh. Currently, there is nothing in Dawei but a vast industrial site. One of the challenges is how to attract labour. To support this big industrial estate, we need at least half a million people. If some activities

are labour-intensive, wages should still be lower than in the Bangkok Metropolitan Area. This means that urban development just next to the industrial site is essential.

Figure 2.6. Scenario for the Development of Dawei

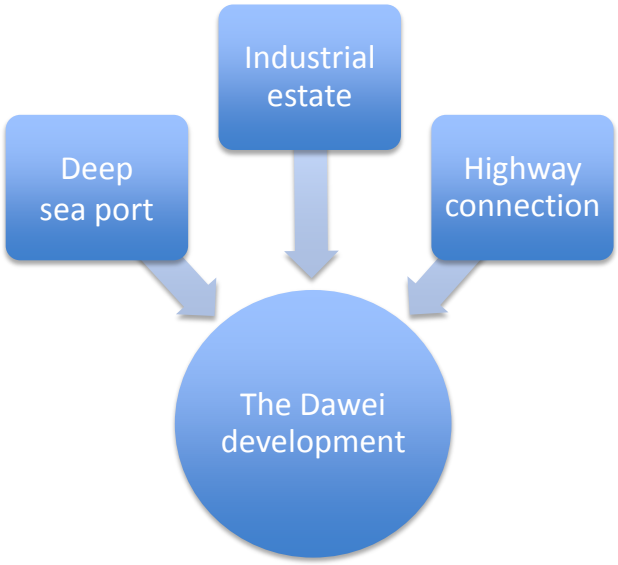


Source: ERIA CADP research team.

In addition, at least three projects—the industrial estate, highway connection to Thailand, and a deep sea port—must be implemented at the same time (Figure 2.7). This follows an old, yet important, idea of coordinated 'big push' (Rosenstein-Rodan, 1943; Murphy, Shleifer, and Vishny, 1989). If we miss one of them, the feasibility of the whole project would collapse.

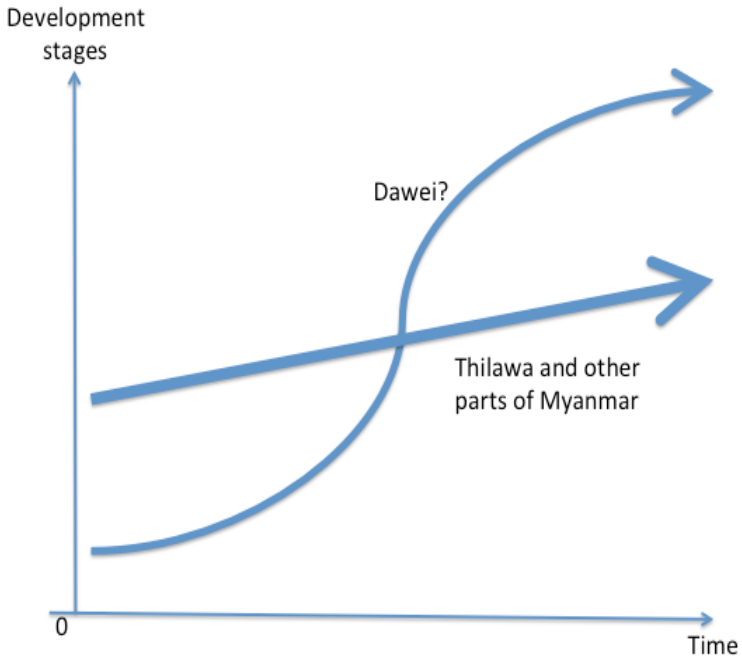
On the other hand, as shown in Figure 2.8, Dawei may 'leapfrog' (Bresiz, Krugman, and Tsiddon, 1993). Dawei is located far from the centre as a big vacuum. Land reclamation and other project preparations may be easier than in mainland Myanmar. It is closer to a massive industrial agglomeration in the Bangkok Metropolitan Area. It can jump to modern industrial technology and just-in-time logistics links, rather than step-by-step industrialisation. In this sense, speed will matter for Dawei. The construction of a deep sea port would take at least 10 years though Thilawa and others might take more time to have full industrialisation and a deep sea port. If so, Dawei could become a hub of industrial activities and logistics, which would also play a leading role for the industrialisation of mainland Myanmar.

Figure 2.7. Economics of Coordinated Investments



Source: ERIA CADP research team.

Figure 2.8. The Theory of Leapfrogging



Source: ERIA CADP research team.

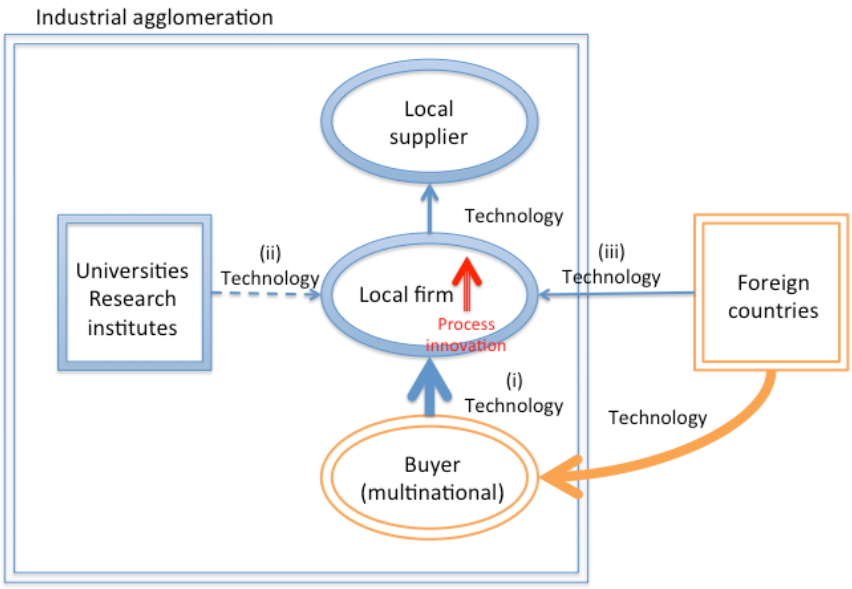
2-3. Industrial Agglomeration and Innovation

2-3-1. Catching-up and sources of technological information

In the globalisation era, local firms in developing countries inevitably face more exposure to competition and, at the same time, may enjoy better access to advanced technology. Up to some stages of development, the backwardness can potentially be an advantage for developing countries to learn from advanced countries at relatively low costs. Once we enter the era of the second unbundling, developing countries face globalisation in a deeper way.

ERIA has continuously conducted micro-level studies with structured questionnaires to scrutinise flows of technological information: what sort of technological information is flowing from where to where. A local firm may have three channels to access technology (Figure 2.9). The first is via affiliates of foreign firms in the same industrial agglomeration that are often in the downstream of production networks. The second is from universities or research institutes in the country. The third is direct learning from abroad by exchanges of technicians or through exports and imports. According to our questionnaire surveys, the first channel, via foreign affiliates in industrial agglomeration, is dominant in ASEAN. Furthermore, a local firm that receives technical training is likely to provide technical training to upstream firms (Kimura, Machikita, and Ueki, 2015).

Figure 2.9. Three Channels to Get Access to Technology



Source: ERIA CADP research team.

This is quite different from old models of technology acquisition. In the cases of Japan, South Korea, and Taiwan from the 1950s to 1970s, universities and research institutes played substantive roles in technology transfers and spillovers. Learning for export as well as imports of machines that embodied technology was also significant. In the case of ASEAN, these channels are relatively weak, and links with foreign affiliates are important. This indicates the weakness of indigenous capability of acquiring technology and the possible benefits of fragmented production.

Of course, not all local firms are automatically eligible to participate in production networks run by multinationals. To meet the strict quality standard of goods and services requested by other firms in the higher tiers of a production network, local firms must clear internal constraints—such as the lack of financial and managerial capability, weak competitiveness, and difficulty in having wider information/networks—in addition to external constraints, such as poor access to finance and unfavourable business and investment climate (Vo, Narjoko, and Oum, 2010).

The development of small and medium enterprises (SMEs) is certainly important, but we have to be careful as there exist different kinds of SMEs. In particular, SMEs in cottage industries and those in supporting industries are quite different. The confusion of these two may end up with inconsistent policies mixing social policy and economic policy. Both types of SMEs should be promoted but for different purposes and with different policy packages.

In connection with infrastructure development, it is crucial to form a critical mass of industrial agglomeration to enhance opportunities for local firms to link with foreign affiliates. Urban and suburban development is expensive and politically challenging but is an essential part of economic development.

2-3-2. Process and product innovation

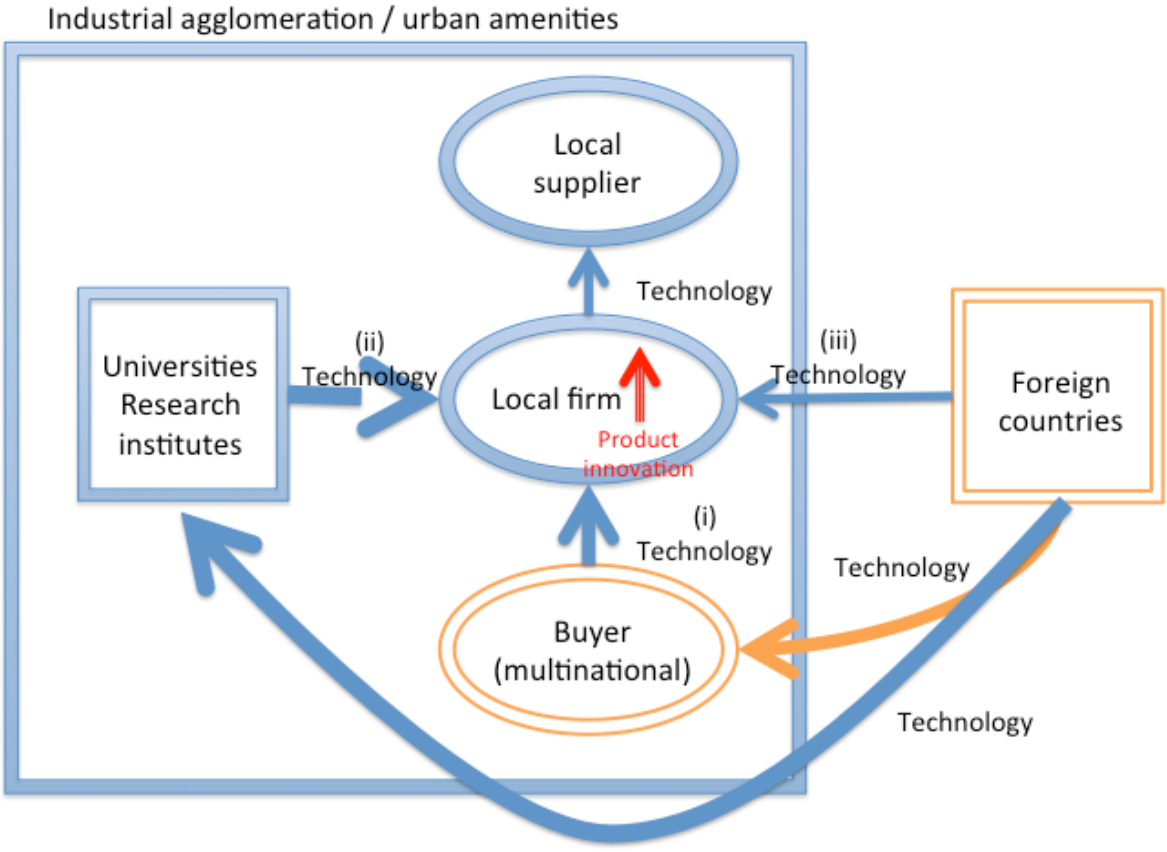
Productivity growth is derived from innovation at the micro level. In particular, after reaching the middle-income level, the innovation capability of local firms becomes the key for sustainable economic growth.

There is a ladder in innovation. The one at the lower end is process innovation. It includes minor changes in production processes through kaizen and QC circles, the improvement of production lines, and the restructuring of the whole operation. A firm

can improve efficiency while producing basically the same products or services. The higher end of the ladder is product innovation. A firm here introduces a new product or service; it could be new to the world, new to the country, new to the industry, or just new to the firm.

The higher a firm moves up the innovation ladder, the greater internal capability is required of it. The external interface of a firm also changes. The first channel of technology acquisition, which is via affiliates of foreign firms, can work well for process innovation and some product innovation for new to the firm. However, eventually, the second and third channels are going to be important, particularly after reaching the upper middle–income stage for product innovation. Then the supply of human resources will become crucial (Figure 2.10).

Figure 2.10. Technology Acquisition and Product Innovation



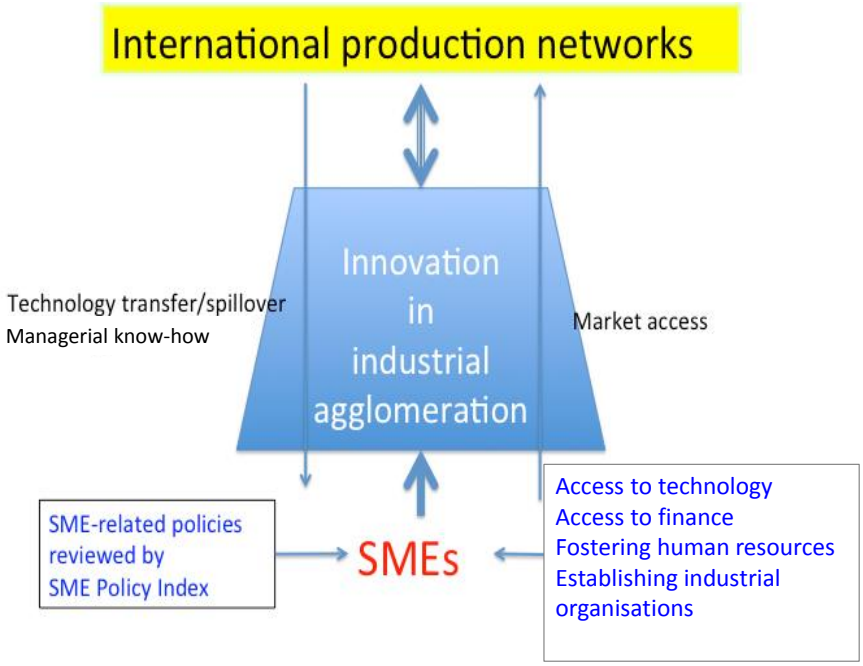
Source: ERIA CADP research team.

2-3-3. Industrial agglomeration and urban amenities

Infrastructure development is crucial in upgrading innovation in ASEAN and East Asia. The reason is twofold.

First, to accelerate process innovation and initiate some product innovation, the formation of industrial agglomeration beyond a critical mass is essential. In the era of the second unbundling, technology can come with fragmented production blocks, and local firms should take advantage of the proximity. Once industrial agglomeration grows up to a certain size, local firms have good chances to participate in production networks and get access to technology (Figure 2.11).

Figure 2.11. SMEs and Industrial Agglomeration



SMEs = small and medium enterprises.
Source: ERIA CADP research team.

In our experience in ASEAN and East Asia, a well-functioning industrial agglomeration seems to be as large as a circle of 100-kilometre (km) diameter in the case of a full-sized one and 50 km diameter in the case of a middle-sized one. The Bangkok Metropolitan Area is one good example of a full-sized industrial agglomeration. The role of government in the formation of an industrial agglomeration of the proper size is critical. An industrial agglomeration must be supported by urban/suburban infrastructure, which

includes logistics connection with neighbouring industrial agglomerations through a large port and an airport, urban and suburban highway system and urban transport, mass supplies of economic infrastructure services such industrial estates, supplies of electricity, water, and others.

By developing infrastructure, we must enhance positive agglomeration effects, which allow firms to set up a just-in-time system within 2.5 hours and increase chances for local firms to have a business relationship with multinationals. At the same time, negative agglomeration effects should be reduced by slowing down wage hikes, keeping living cost low, mitigating land speculation, avoiding traffic congestion, and staying away from pollution problems.

Because huge positive and negative externalities result from agglomeration effects, infrastructure projects for industrial agglomerations are often not financially viable if they are implemented purely by the private sector. However, we still need to implement some of them, with the involvement of the central/local governments that provide partial subsidies or insurance.

Second, at the stage of active product innovation, we must nurture and attract high-quality human resources and set up an innovation hub. It has not been much discussed in ASEAN yet, but eventually we need to think of how to provide good urban amenities or quality of life to attract intellectuals.

There are four critical urban amenities by Glaeser, Kolko, and Saiz (2001): (i) the presence of a rich variety of services and consumer goods, (ii) aesthetics and physical setting, (iii) good public services, and (iv) speed. The first urban amenity (i) must cover something that even advanced Internet shopping cannot provide, (ii) includes intellectual stimulus and comfortable living, (iii) contains opportunities for higher education and safety, and (iv) means easiness to get around and acceptable length of commuting.

In most ASEAN Member States and other East Asian developing countries, research and development (R&D) activities are still minimal. After the stage of upper-middle income, it is important to strengthen universities and government research institutes to accumulate R&D stock (Sunami and Intarakumnerd, 2011). Urban amenities are essential to attracting intellectual people, and infrastructure development must be headed in this direction.

2-4. The Narrowing of Development Gaps

Since Piketty's *Capital in the Twenty-first Century* (2013) became a bestseller, the issue of income distribution has been extensively discussed worldwide. Piketty claims that the income share of the highest one percent population substantially increased in the past few decades. Actually, such a pattern is observed in some countries. We at least cannot immediately conclude that globalisation aggravates income disparity.

If we simply look at the Gini coefficients of income size distribution, China and India have clearly experienced an upward trend since the 1990s whereas those of the ASEAN Member States have recently increased or decreased, depending on the country. Compared with that of other parts of the world such as Latin America, income disparity in ASEAN is not very serious, with relatively high Gini coefficients in Malaysia and the Philippines. In addition, the population below the poverty line has steadily reduced in ASEAN.

How to deal with super-rich people will become an important political agenda in ASEAN and East Asian countries at some point. In this aspect, Piketty's claim of the necessity of income redistribution policy would be applicable in the future. What ASEAN should immediately confront, however, is income disparity due to development gaps that are not pointed out by Piketty.

Development gaps are of two kinds: geographical and industrial.[3] Geographical development gaps are differences in income levels and development stages among countries or among regions within a country. Industrial development gaps refer to differences in productivity and development stages between multinationals and local firms, between large firms and SMEs, or between manufacturing and non-manufacturing.

Our development strategy, if it works effectively, can narrow these two development gaps. Geographical development gaps can be reduced in two ways. The first is through fragmentation of production. This is particularly applicable when production blocks move from a higher income country to a lower income country. If a less developed country/region can attract production blocks and participate in production networks, geographical development gaps are narrowed down. The second unbundling can exploit

[3] ERIA (2012b) proposes the concept of geographical inclusiveness, industrial inclusiveness, and societal inclusiveness. The first two are closely related to development issues and correspond to the narrowing of geographical and industrial development gaps.

differences in location advantages in a subtler and more articulate way than the first unbundling.

The second is through the movement of labour at the time an industrial agglomeration is forming. This particularly works when labour moves domestically from a rural area to an urban area. Less-developed countries typically have a huge agricultural/rural/informal sector where massive redundant labour resides. Smooth labour movements from the agricultural/rural/informal sector to the non-agricultural/urban/formal sector are often effective in reducing population below the poverty line and at the same time providing inexpensive labour to the manufacturing and modern services sectors.

Figure 2.12 illustrates the situation by using a simple diagram a la Lewis (1954). O_xO_z stands for the total labour supply of this country, and $VMPL_x^0$ and $VMPL_z^0$ are curves that represent the original values of marginal product of labour (VMPL) in the rural sector (x) and the urban sector (z).[4] In the initial situation, O_xL_0 and O_zL_0 are the amount of labour employed by sector x and sector z with equalised wages at w_0. The area below the VMPL curve corresponds to the total value of production in each sector. BA is a flat or nearly flat portion of $VMPL_x^0$ curve that indicates redundant labour in the rural area[5]. Suppose that new investment or productivity growth occurs in sector z and the $VMPL_z$ curve shifts up to $VAPL_z^1$. If labour can move without friction, the BA portion of labour moves from rural to urban. By this labour movement, the capitalist in sector z gains area BCA while shifted labour earns area BAL_1L_0 in sector z. Here, the wage level still stays around w_0. However, if sector z has further investment or productivity growth, labour will shift more and the upward-sloping portion of $VMPL_x^0$ will allow the wages in both sectors to increase. This is a typical trickle-down effect from urban to rural.

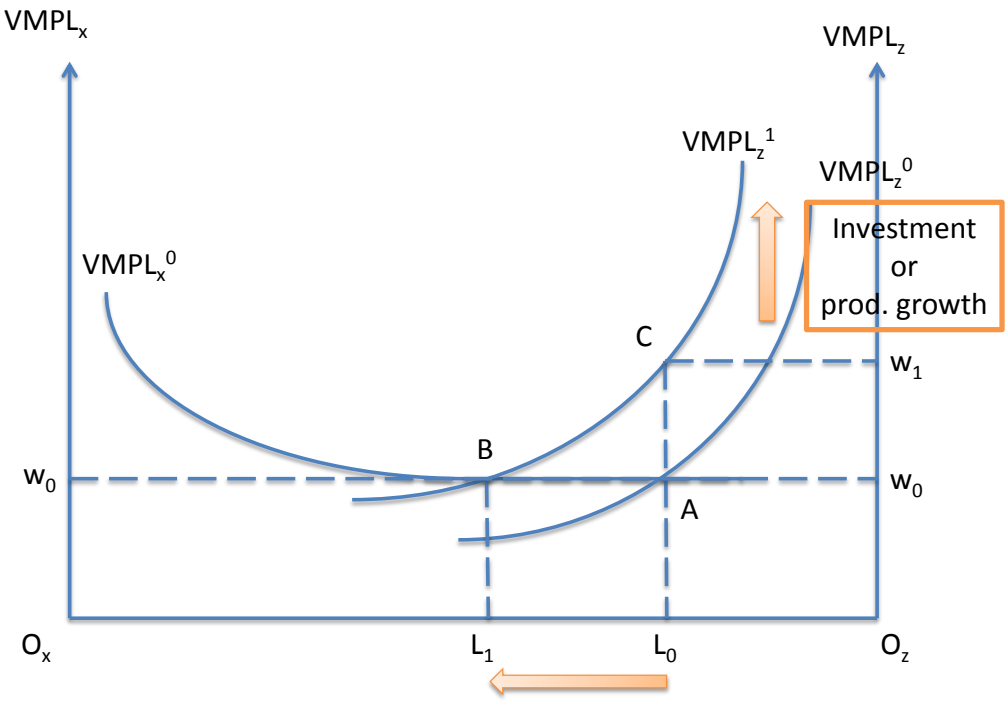
The key setting here is that labour can move in a frictionless manner. In cases where labour can move only with substantial friction, the living cost in the urban area is substantially higher than in the rural area, education gaps are too large between rural and urban, or the minimum wage applied in the urban area is too high, the labour movement from rural to urban becomes smaller than BA. In the extreme, if labour cannot move at

[4] The interpretation of sector x and sector z could be 'agriculture and manufacturing' or 'informal and formal sectors'.

[5] What redundant labour is doing or how high the marginal product of labour was a point of big debate in the literature of the 1960s, but we do not step into such an argument here.

all, the equilibrium for sectors x and z is A and C where capitalist in sector z loses BCA, and even further upward shifts in $VMPL_z$ do not provide wage increases in sector x.

Figure 2.12. Labour Movements from the Informal to the Formal Sector



Source: ERIA CADP research team.

As shown in Chapter 4, ASEAN and East Asia have achieved relatively smooth labour movements from rural to urban, from agriculture to manufacturing/services, and from informal to formal sectors, which allow workers' wages to stay relatively low compared to GDP per capita. This is because economic growth has mostly been led by the manufacturing sector and related services and educational gaps between rural and urban have been relatively small. This has rapidly reduced the population living below the poverty line.

Let us turn to industrial development gaps. In industrial agglomeration, plants or establishments held by multinationals and local firms are located side by side. This means that local firms are sitting just next to higher technology and managerial ability. This form of globalisation certainly enhances competition, which may hurt local firms. At the same time, it may generate opportunities for local firms to acquire new technology and

managerial ability. If it works as intended in our development strategy, we can narrow industrial development gaps.

2-5. Infrastructure for Connectivity and Innovation

2-5-1. The 2x3 matrix for infrastructure development

Based on our conceptual framework, infrastructure development can be tabulated as Table 2.3. The first row refers to infrastructure for connectivity while the second denotes infrastructure for innovation. Each of them is further classified by the degree of involvement in production networks, i.e., Tier 1, Tier 2, and Tier 3. Since infrastructure for Tiers 1a and 1b is often inseparable, the following will work with Tier 1 in total.

Table 2.3. Infrastructure for Connectivity and Innovation

	Tier 1: Forming industrial agglomeration	Tier 2: Coming into production networks	Tier 3: Rural development for creating business
Infrastructure for connectivity	Turnpike connectivity with other industrial agglomerations - Full-scale port with container yard/airport for regular carriers and LCC - Multi-modal (cargo, passenger) - Institutional connectivity for reducing transaction costs	High-grade connectivity to participate in production networks - Dual-modal (cargo, passenger) - Capital city, border area, connectivity grid - Mitigate border effects - Institutional connectivity / soft infrastructure for trade facilitation	Medium-grade connectivity for various economic activities - Agriculture/food processing, mining, labor-intensive industries, tourism, and others
Infrastructure for innovation	Metropolitan development for full-scale industrial agglomeration and urban amenities - Highway system, urban transport (LRT, subway, airport access) - Mass economic infrastructure services (industrial estates, electricity, energy, water, and others) - Urban amenities to nurture/attract intellectual people	Urban/suburban development for medium-scale industrial agglomeration - Urban/suburban development plan for a critical mass of industrial agglomeration - Economic infrastructure services (special economic zones, electricity, water, and others)	Discovery and development of historical/cultural/ natural heritage - Premium tourism - Cultural studies

Note: LCC = Low-cost carrier, LRT = Light rail transit.
Source: ERIA CADP research team.

2-5-2. Infrastructure for connectivity

2-5-2-1. Tier 1

A full-sized industrial agglomeration requires ‘turnpike’ connectivity with other industrial agglomerations by overcoming time and space. Expensive but essential infrastructure includes a full-scale port with an ample container yard for main shipping routes and a large airport for both regular carriers and low-cost carriers. Turnpike connectivity must be multi-modal, ‘fast and slow’, and ‘high-priced and low-priced’, for both cargoes and passengers as far as the physical geography allows.

Institutional connectivity should be achieved at a high level in order to support efficient industrial agglomerations and affluent urban amenities. Institutional harmonisation or convergence must be pursued to reduce transaction costs.

2-5-2-2. Tier 2

Countries/regions that are coming into production networks must establish ‘high-grade’ connectivity. Dual-modal connectivity, i.e. fast and slow, must be provided for both cargoes and passengers with road, port, and air transportation. Plans for middle-distance high-speed railways should be reviewed from a viewpoint of economic viability; due to competition with air transportation, 800–1,000 km seem to be a threshold.

The balance between the capital city and border areas must be carefully maintained. Connectivity grids may be a key to extend connectivity to Tier 3 regions.

Connectivity with information and communications technology (ICT) would work as both supplement and substitute for other types of connectivity. The use of ICT should be aggressively explored.

In Tier 2, border effects are still likely to be barriers to production networks, which should immediately be mitigated. In particular, soft infrastructure for trade facilitation is important.

2-5-2-3. Tier 3

‘Medium-grade’ connectivity is needed for various economic activities such as agriculture/food processing, mining, labour-intensive industries, tourism, and others. A bit slow but reliable logistics links help various industries to be activated.

2-5-3. Infrastructure for innovation

2-5-3-1. Tier 1

Metropolitan development must include the construction of full-scale industrial agglomeration in the size of 100 km diameter and urban amenities. At a higher development stage, urban amenities are going to increase their importance. We need to control positive and negative agglomeration effects by taking care of externalities.

The efficient highway system and urban transport, such as light rail transit, subways, and airport access, are needed. These projects may be justified even if the financial returns to the projects are expected to be small because they may generate huge positive externalities and mitigate negative externalities such as traffic congestion.

Mass economic infrastructure services should also be provided; these include industrial estates, electricity, energy, water, and others.

After reaching the upper middle–income level, urban amenities must be emphasised in infrastructure development. Urban amenities include (i) the presence of a rich variety of services and consumer goods, (ii) aesthetics and physical setting, (iii) good public services, and (iv) speed (Glaeser, Kolko, and Saiz, 2001). Infrastructure is certainly needed to achieve these.

2-5-3-2. Tier 2

Although the scale would be medium-size, i.e. 50 km diameter or so, the formation of industrial agglomerations should be initiated. Urban/suburban development plans for infrastructure development must be prepared in order to reach a critical mass of economic activities. Bottlenecks in economic infrastructure services, such as SEZs, electricity, water, and others, have to be removed.

2-5-3-3. Tier 3

In some specific places, there is potential for discovering and developing historical, cultural, or natural heritage. In such a place, we can think of premium tourism and the establishment of a cultural study centre.