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Part I
Theoretical Framework

1
Introduction

Akifumi Kuchiki and Masatsugu Tsuji

1. Background

Globalization is not a new phenomenon, but its importance is still growing at an ever faster pace. All economies must either cope with this reality or gradually lose their vitality. If economies successfully and positively respond to this world trend, their development will be ensured.

The economic development of East Asia can be considered a successful example of adaptation to globalization, although the region faced one serious economic crisis in 1997. Most East Asian economies recovered from that crisis, however, and have been rushing forward on a new growth path. A natural question is how these economies can regain their position as the center of world economic growth. Fueled by globalization, many regions in East Asia continue to attract all kinds of economic resources from all over the world, including foreign direct investment (FDI), funding, human resources, and advanced technology and know-how.

As part of what the United Nations Development Project has dubbed the "East Asian Miracle," harmonious relationships between the private and public sectors were emphasized and cultivated. This approach characterizes the famous Japanese industrial policy, in which government guides the private sector by targeting long-term and strategic objectives, seeking to concentrate resources and energy on these. The Korean and Taiwanese electronics industries represent other successful examples of public-private cooperation.

However, the agglomeration that has been occurring in East Asia since the 1990s cannot be attributed to traditional industrial policy. We wish to examine a new type of policy, which is more relevant to East Asia's current phenomena, known as industrial clustering policy. This book represents an attempt to formulate this type of policy.

Here the terms of agglomeration and cluster have the same meaning (the strict definitions will be provided in Chapter 1). The term cluster was utilized extensively by Porter (1998), who proposed applying a "diamond approach"

to determine whether a cluster can maintain competitive advantage relative to other clusters (see Introduction of Chapter 3 in more detail). Once a cluster is formed, Porter deems it to be "innovative" if four conditions – factor conditions, demand conditions, related industries, and firm strategy/rivalry – are satisfied. However, this approach does not address the question of how a government can intentionally form a cluster through industrial cluster policy. Baldwin (2003) discussed an industrial cluster policy theory, but did not demonstrate a practical application of the theory. A remaining question is whether an industrial cluster policy can be effective in practice. Answering this question is another aim of this book.

Industrial cluster policy is subtle and complex, requiring not only a traditional combination of targets and policy measures but also related arrangements such as economic reforms, deregulation, construction of infrastructure, establishment of legal systems, and so on. In addition, any successful economy must now meet global standards; without carrying out the reforms necessary for meeting these standards, no region can attract global resources.

Even for developed economies, clustering policy is necessary; Japan is a perfect example. The Japanese economy is only now emerging from a long recession that began in the early 1990s. Since then, countless measures to revitalize the industrial sector have been implemented by all levels of government. A significant amount of public funding has been poured into various projects, including promotion of venture businesses and support for universities through the TLO (Technology Licensing Office), which aims to further university-industry collaboration. However, these policy measures were largely unsuccessful in revitalizing Japanese industry. The lessons learned from these experiences has led to the recognition of the need to harness the power of industrial agglomeration; Japan and other countries must understand that new industries and new businesses do not emerge alone, in isolation from the regional economy, even in developed economies. With the advent of the field of spatial economics, the phenomenon of industrial agglomeration, or clustering, has been the focus of much recent research.

Taking these domestic as well as global circumstances into consideration, our research team focused on the questions of why firms agglomerate in particular regions, and what industrial cluster policies, if any, can be effective in forming industrial clusters. As a group, we have long been pursuing the answer to these important questions, in papers such as Tsuji, Giovannetti, and Kagami (2007) and in Kuchiki and Tsuji (2005). One result of our efforts has been the development of the "flowchart approach," first proposed by Kuchiki (2005). The "flowchart approach" is a synthetic concept that includes theoretical and policy frameworks, and attempts to answer the above two questions. The details of the approach will be explained in the next section.

Thus, the objectives of the research projects detailed in this book are to hypothesize and elaborate the flowchart approach by examining the current

situation of clustering in various economies and isolating the common factors that contributed to cluster formation in all of them. Moreover, we attempt to verify empirically the extent to which the flowchart approach can explain clustering phenomena, and to examine whether actual policies aimed at promoting agglomeration in certain regions or in certain industries are effective. In other words, we aim to generalize the flowchart approach so that it can be applicable to any economy or industry. It would not be an exaggeration to state that whether or not a region can survive in the competitive world may depend on the success or failure of industrial cluster policy. However, it is not yet known whether industrial cluster policy can by itself form an effective industrial cluster from scratch.

2. A prototype model of the flowchart approach

Figure 1.1, which appeared first in Kuchiki (2005), clearly indicates the components of the flowchart approach. The flowchart approach posits that industrial cluster policy can be effective in forming industrial clusters by establishing export-processing zones or industrial zones, building capacity, and inviting anchor firms. An anchor firm is defined as a firm that manufactures its products by assembling intermediate goods of parts and

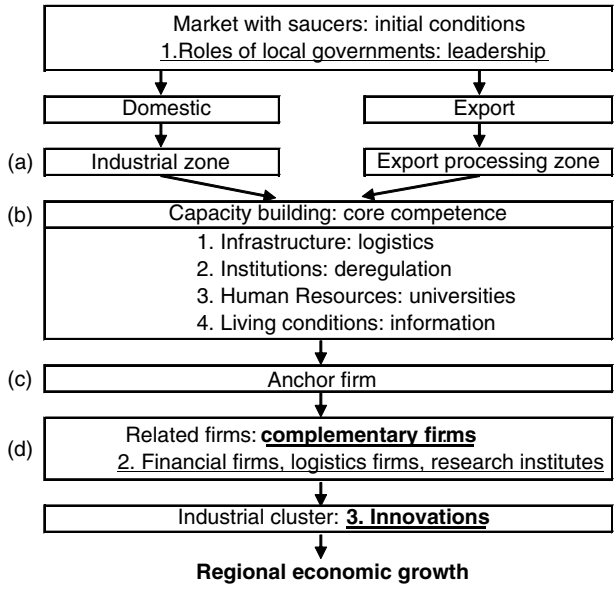

Figure 1.1 Flowchart approach to industrial cluster policy
Source: author.

components. Its relative firms are suppliers in the part and component industries. Capacity building is here defined as facilitation of infrastructure, institutional building, human resources development, and arrangements of living conditions. Appendix of this book proposed sufficient conditions for the formation of the type of industrial clusters common in the Asian manufacturing industry, whose presence enhances regional economic growth.

Typical industrial cluster policy theory defines an industrial zone as a "quasi-public good"; Appendix of this book showed that policies enhance economic growth if an anchor firm operates under a production function of "increasing returns to scale" (see the definition of industrial zone in Chapter 3). Critical levels of production necessary to create "scale economies," used by related firms to decide whether or not to invest in clusters, were also shown. Kuchiki (2007), and Tsuji and Quan (2005) illustrated two cases of successful cluster policy: Canon in Hanoi, Vietnam, and Toyota in Tianjin, China. Canon and Toyota, two Japanese companies, functioned well in those clusters as the "anchor firms" required by the flowchart approach.

The purpose of this section is to apply a prototype model of the flowchart approach to industrial cluster policy in the manufacturing industry. The flowchart approach offers two basic guidelines for the implementation of cluster policy. First, the timing and ordering of policy measures is vital. Second, one must specify the economic agents responsible for building the various types of capacity necessary for industrial cluster policy, choosing from among the actors of central government, local government, various actors in the quasi-public sector, and private firms.

An anchor firm in the manufacturing industry assembles products composed of various parts and components. An assembler in the automobile industry typically uses over 20,000 parts per car, and an anchor firm in the printer industry uses about 800 parts per printer. The anchor firm's related firms generally move into an industrial zone where their anchor firm is a tenant of that zone. If sufficient conditions are met, an industrial cluster will be formed around the industrial zone through agglomeration of the related firms. The agglomeration will bring growth to the region, including the cluster itself.

This pattern has been confirmed in several industrial clusters, including the automobile clusters in Tianjin and Guangzhou in China, the electronics cluster in North Vietnam, the automobile cluster near Bangkok, Thailand, and the electronics clusters in Penang and Johor, Malaysia. It is clear that the presence of an anchor firm and its related firms creates an environment that encourages regional growth.

Let us clarify the scope and the hypothesis of this book.

2.1. Scope

1. This book focuses on anchor firms, or core firms who procure parts and components from suppliers. These firms seek to minimize their total costs, including transportation costs.

2. We apply flowchart models to various manufacturing industries in Asia. Our prototype model differs from industry to industry, and from region to region. The flowchart for the information industry will be different from that of the manufacturing industry.
3. The role of central governments and local governments is capacity building, which prepares an investment environment that is inviting to foreign firms.

2.2. Hypothesis

A region creates industrial agglomeration by following the approach detailed in the flowcharts of Figures 1.1 and 1.2.

The flowchart approach to industrial cluster policy, shown in Figure 1.1, considers industrial cluster policy to be not a national industrial policy but a regional growth strategy. A sufficient condition for the successful implementation of industrial cluster policy is the satisfaction of the conditions of industrial zones, capacity building, and anchor firms, in the correct order.

Industrial clusters in East Asia typically satisfy the above conditions. A local government first forms an industrial zone as a "saucer" to invite foreign investors. Next, the government builds capacity for those investors. The capacity building includes constructing and facilitating physical infrastructure, developing institutions, developing human resources, and creating living conditions satisfactory to foreign investors. Physical infrastructure includes roads, ports, communications, and others. Institution building is crucial to successfully inviting foreign investors into a region, and may include streamlining investment procedures by providing one-stop services, deregulation, and introduction of preferential tax systems. Human resources include unskilled labor, skilled labor, managers, researchers, and professionals. Living environment includes, for example, the provision of hospitals and schools that meet the needs of foreign workers. An anchor firm will typically be motivated to invest in a region after the above-mentioned capacity is built.

We explain Step I our flowchart approach in Figure 1.2. First, we ask whether industrial zones have been established. If the answer is "No," then we must identify the actors responsible for establishing industrial zones. Generally, the central government establishes industrial zones during a country's early stage of industrialization. As a country's economy matures, other actors may establish industrial zones to attract more foreign investment. For example, in Thailand and Malaysia, actors in the government-affiliated semi-public sector, including local authorities, established export processing zones and free trade zones. In addition, Japanese trading corporations have helped to establish many industrial zones in the ASEAN countries.

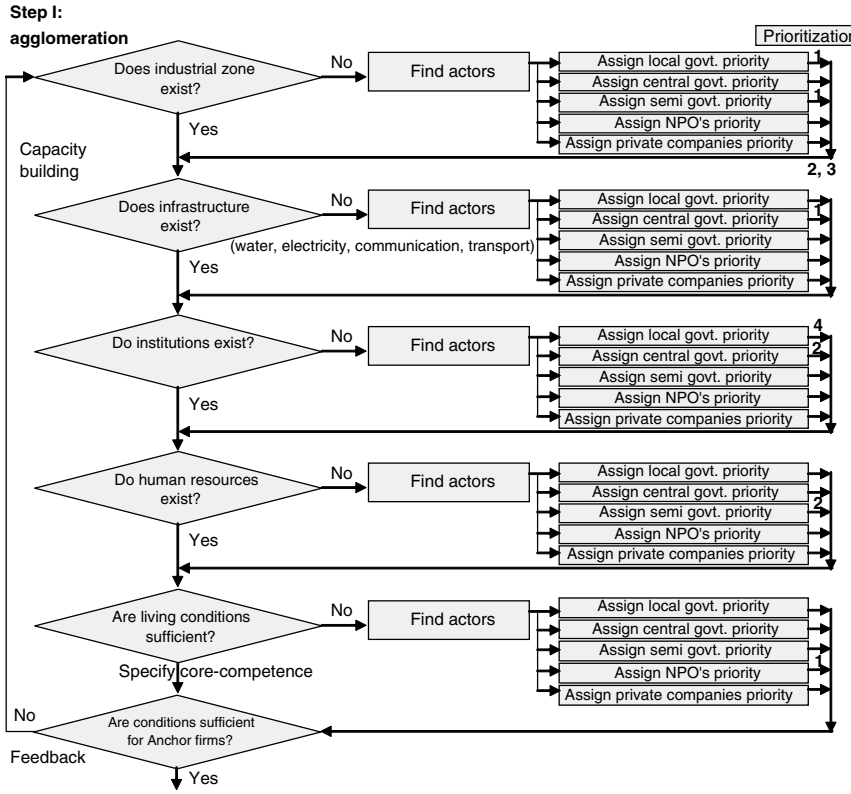

Figure 1.2 Flowchart approach: Step I. agglomeration
Source: Kuchiki (2007).

Following identification of the actors responsible for forming industrial zones, we return to the "main stream" of the flowchart to examine the components of capacity building. Following Figure 1.2, we determine whether water supply is sufficient for the industrial zones. If we verify the sufficiency of water supply, we proceed down along the flowchart to power supply, communication and transportation. An example of the importance of such infrastructure is the shortage of power supply in 2004 and 2005 in China's Guangdong Province, a serious concern for that cluster. The central government of China and the local government of Guangdong Province were the actors that moved to increase power supply. The central government drew up plans for building a nuclear power plant, constructed dams, and distributed electricity by estimating the total supply and demand of electricity in China. The local government of Guangdong Province planned to generate and distribute electricity. The local government also attempted to alleviate

the region's shortage of railways, subways and highways by building additional capacity in 2005.

After physical infrastructure is examined, we look at whether institutions have been developed and are ready to function. The central government must institutionalize national tax systems, while local governments must institutionalize local tax systems. It is well known that one-stop services for investment procedures are crucial to success in inviting foreign investors.

Concerning human resource development, during the early stages of a country's industrialization, a pool of highly literate unskilled labor is crucial to inviting foreign investors desiring to employ cheap labor. After industrialization progresses, an industrial 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.

Superior living conditions are crucial to inviting foreign investors. Staff members of foreign investor firms will have incentives to work hard if they can enjoy a superior quality of life in their region. Sufficient housing, schools, hospitals, and other such facilities must be developed in order to successfully invite anchor firms to a region.

We explain the priorities of each cluster actor in Figure 1.2. Local governments play a vital role in constructing industrial zones, supplying electricity, providing water and wastewater services, facilitating transport, and developing institutions. The central government's main functions are to build institutions and construct nuclear power stations, with both of these at about an equal priority level.

Next, Figure 1.3 clarifies the nature of a cluster by dividing step I, the process of industrial agglomeration, from step II, which involves the innovative activities of the agglomerated firms. Here, we define an industrial cluster as consisting of both "industrial agglomeration" (step I) and "innovative activities" (step II). Industrial agglomeration means that related firms are located in the same region; innovative activities refer to active innovation efforts by the agglomerated firms. Figure 1.3 shows the industrial agglomeration process of step I. Step I consists of industrial zones, capacity building (I), anchor firms, and related firms. Step II is a process of innovation, whose elements are universities and research institutes, capacity building (II), and anchor persons. Capacity Building (II) is different from Capacity Building (I). The conditions for innovation hold if this second type of capacity is built up and if anchor persons come.

We now explain the analysis manuals of the flowchart approach, presented in Tables 1.1, 1.2 and 1.3. The first row of Table 1.1 specifies a city as the core of a cluster. The second row lists industries in which clusters may form, such as the automobile industry, the electronics industry, the information industry, and the biotechnology industry. The third row confirms whether there are industrial zones as saucers to invite investors, whether the cluster's products are intended for domestic or export markets, when the

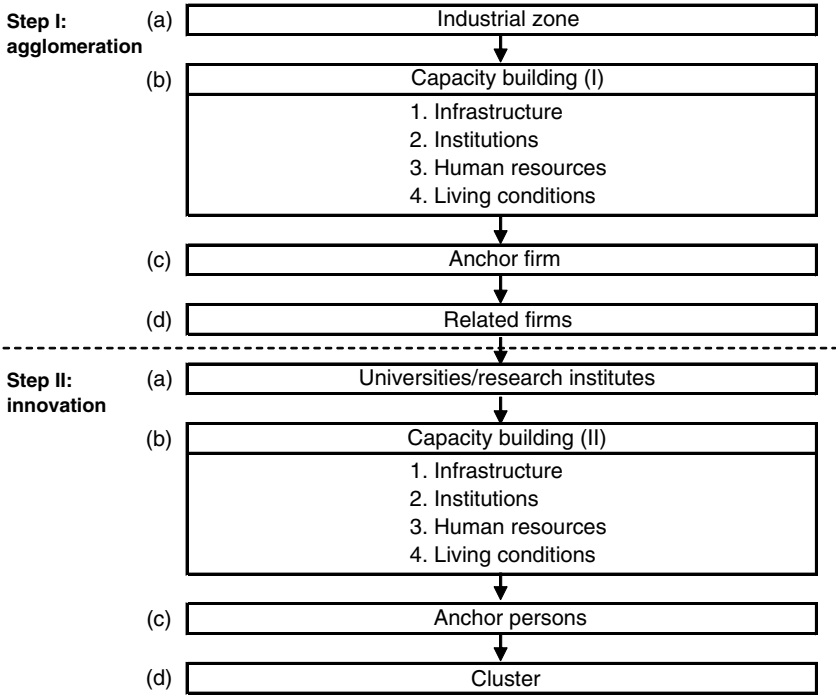

Figure 1.3 Flowchart approach to industrial cluster policy
Source: Kuchiki (2007).

Table 1.1 Format of the analysis I (check list)

(1) City: Hanoi, Tianjin, Penang, Guangzhou, etc.			
(2) Industry: automobile, eletronics, information technology, software, biology, etc. : **number of firms** related to an anchor firm			
(3) (a) Industrial zones	Market	Established year	Economic agents
	Domestic or export		Public, semipublic or private
(c) Anchor firm			
(4) Case: success or failure: **core competence**			

Source: author.

industrial zones were established, and which actors established the zones. Again, the possible actors include the central government, local governments, semi-governmental actors such as authorities, and private companies.

Table 1.2 provides a rubric for determining whether the capacity represented by infrastructure, institutions, human resources, and living

Table 1.2 Format of the analysis II: capacity building

			Actors					
			Sufficient or not	**Local gov.**	**Central gov.**	**Semi-gov.**	**NPOs**	**Private companies**
	IZ or EPZ							
Capacity	1. Infrastructure	(1) Water	–					
		(2) Electricity	–					
		(3) Communication	–					
		(4) Transport	–					
	2. Institutions	(1) One-stop services	–					
		(2) Deregulation	–					
		(3) Preferential treatments (tax incentives, etc.)	–					
		(4) Laws and regulations (bankruptcy laws and intellectual property right)	–					
	3. Human resource	(1) Unskilled labor	–					
		(2) Skilled labor	–					
		(3) Professionals	–					
	4. Living conditions	(1) Housing	–					
		(2) International schools	–					
		(3) Hospitals	–					
		(4) Entertainment	–					

Source: author.

Table 1.3 Format of the analysis III: related firms

Related firms	Established year	Products

Source: author.

conditions is sufficient for the success of the industrial cluster policy. Infrastructure includes water, electricity, communication and transportation. Institutions include one-stop services, deregulation and preferential treatments such as tax incentives, laws and regulations. Human resources include unskilled labor, skilled labor, and professionals. Living conditions include housing, schools, hospitals, shopping, and entertainment.

If a deficiency is identified, it is necessary to identify the actors responsible for addressing those shortages. These actors will facilitate the success of the industrial cluster policy by meeting the capacity shortages, as discussed earlier.

Once an anchor firm decides to invest in an industrial zone, that company's related firms decide whether to move into the industrial zone. Their decisions depend on the production volume of the anchor firm – in other words, on economies of scale. The related firms first estimate the costs and benefits of investment in the industrial zone and then make their decision accordingly. We compiled a list of examples of related firms in Table 1.3.

We should note that this prototype model cannot be applied to the biotechnology industry or the information technology industry, partly because those industries do not use a large number of parts and components in the manufacturing process and thus are not subject to economies of scale.

3. Summary of this book

This book consists of 9 chapters, each examining a theoretical aspect or empirical case study of the clustering process, namely, the first two chapters provide theoretical foundations of the flowchart approach, while the rest of chapters present current situations of clustering and policy in different economies as well as empirical studies. Let us introduce each chapter in more detail.

Masahisa Fujita's "Formation and Growth of Economic Agglomerations and Industrial Clusters: a Theoretical Framework from the Viewpoint of Spatial Economics" presents a microeconomic framework for understanding

the formation and growth of industrial clusters, drawing on the theory of spatial economics. Following the work of Ann Markusen, he presents a typology of industrial agglomerations, describing four basic types of agglomeration. In reality, most agglomerations exhibit a mix of the characteristics of the four types, and evolve gradually over time. Thus, the author presents a general framework for understanding the processes by which a wide variety of economic agglomerations and industrial clusters form and evolve, drawing on spatial economic models. The author explains in detail the economic mechanisms that give rise to clustering forces, focusing especially on endogenous models. Next, he examines the general effects of decreasing transport costs on the spatial distribution of economic activities; this is significant because the main engine for the recent dynamics of the global economy has been the steady reduction of (broadly defined) transport costs. Finally, the author explains the basic economic reasons for the formation of multinational firms (MNFs), as the rapid proliferation of these firms has been a prominent phenomenon in the current wave of globalization.

"The Flowchart Approach to Industrial Cluster Policy: Guangzhou's Automobile Industry Cluster," by Akifumi Kuchiki and Hiroyuki Tsukada, constructs a prototype model of the flowchart approach to industrial cluster policy and applies it to Guangzhou's automobile industry cluster, demonstrating the effects of the anchor firms Honda, Nissan, and Toyota on the cluster. The authors obtain two important conclusions. First, their flowchart approach is effective in analyzing the implementation and effects of Guangzhou's automobile industry cluster policy. Second, the local government of Guangzhou Municipality plays a crucial role in the success of the policy, by promoting joint ventures between Guangzhou Automobile and foreign firms (including the three Japanese firms mentioned above). The mayor of Guangzhou Municipality, whose job promotion is linked to regional economic performance, has an incentive to target industrial clustering and implement cluster policy.

In "Industrial Clusters in the Austin Area: The Austin Technopolis Case Study," Jobaid Kabir analyzes the robustness of the framework established by Dr. Kuchiki, and presents a broad overview of the process and causes of cluster formation in Austin in the U.S. He shows that, while Austin's high technology cluster development does not precisely follow Kuchiki's flowchart framework, there are significant similarities. The author presents a "revised flowchart" to describe Austin's cluster development. In this revised flowchart, the anchor firms first conduct a nationwide search for a location. Cities and states then compete with each other to meet the anchor firm's needs, providing plans and designs for capacity building in the area. Once the anchor firm selects a location, major capacity building activities such as infrastructure construction begin, and related firms then move into the

area to support the anchor firms. In Austin's case, key individuals and visionaries played a significant role in facilitating interaction among various stakeholders in the service of a common goal.

Aya Okada and N.S. Siddharthan, in "Automobile Clusters in India: Evidence from Chennai and the National Capital Region," analyze the spatial patterns of industrial agglomeration of the consumer electronics, electronics and hardware, and drugs and pharmaceuticals industries. They show that these industries are all geographically concentrated in the National Capital Region (Delhi and parts of Haryana and Uttar Pradesh adjacent to Delhi), Maharashtra, Gujarat, Tamil Nadu and Karnataka. In particular, firms in the Indian auto industry are mostly agglomerated in three main clusters: Chennai (Tamil Nadu), Pune-Mumbai (Maharashtra), and the NCR. Contrasting the situations of the Chennai and NCR clusters, the authors demonstrate the presence of inter-cluster variations in the patterns of auto cluster formation, and show that these differences are partly explained by the historical and policy conditions under which firms, particularly anchor firms, operate in these regions. Nevertheless, these two clusters share some common features: the creation of industrial estates by state governments, a large pool of well-educated workers, and the strong influence of government policy (especially industrial licensing and location policies). The authors' econometric analyses confirm that location in a cluster positively influences the performance of auto component firms, with those belonging to a cluster performing significantly better.

"The Process and Factors of Industrial Cluster Formation: A Flowchart Approach to Industrial Cluster Policy in Japan," by Kentaro Yoshida, provides an overview of the current condition of various types of industrial clusters in Japan whose formation was influenced by government policy, comparing and contrasting the factors that led to these clusters' formation. The paper then presents the results of a mail survey administered to public institutions responsible for cluster promotion, and uses these results to quantitatively test a hypothesis concerning the process and causes of industrial cluster formation. The mail survey demonstrates that anchor firms, related firms, universities, and research institutes are thought to have been effective factors in forming industrial clusters in Japan. The author concludes that there is a striking trend toward the development of knowledge-intensive economies, wherein there is a shift away from industrial agglomeration strategies toward innovation-based strategies. This shift is evident in the infrastructure building (incubation), system support, and human resources training being conducted as part of industrial cluster policy across Japan. the author stresses the necessity for the presence of cooperation promotion agencies, which enhance industrial cluster formation.

"The Evolution of the High-Tech Electronics Cluster in Guadalajara, Mexico," by Yoshiaki Hisamatsu, examines how and why Guadalajara has risen to prominence as "the Mexican Silicon Valley." The cluster is largely comprised of foreign companies, but there are some domestic firms as well. According to Hisamatsu, these major companies chose Guadalajara as a production site due to a variety of factors, chief among which were macroeconomic contingency (massive exchange rate devaluation in 1994), market proximity to the U.S., a relatively stable labor market environment, skilled human resources trained by local universities, history (prior investment), and institutional support. He also highlights the contributions of individuals who helped the cluster to exploit the above-mentioned locational advantages – local professional managers who promote the cluster through the local business association.

Examining the Mexican Silicon Valley through the lens of the flowchart approach, the author claims that the local business association (CANIETI) and its spin-off organization (CADELEC), functioning as quasi-public actors, provide the cluster with various coordination and information services that can be interpreted as quasi-public goods. These quasi-public actors establish a valuable process of trial and error that informs all businesses in the cluster. The author predicts that, through this collective learning process, the cluster will be able to continue to grow in the competitive global electronics market.

In "An Empirical Examination of the Flowchart Approach to Industrial Clustering: Case Study of Greater Bangkok, Thailand," Masatsugu Tsuji and Yasushi Ueki analyze agglomeration in Greater Bangkok in order to empirically verify the applicability of the flowchart approach. Based on data obtained by mail surveys given to firms located in Bangkok, the authors construct three models of clustering, utilizing probit estimations to isolate the impact of various clustering factors. The models take the year in which companies established their Bangkok offices as the dependent variable, with company attributes and clustering factors as the explanatory variables. Some of these clustering factors are predicted by the flowchart approach: namely, domestic demand, export, inter-firm relationships, the degree of pre-existing agglomeration, and capacity, which includes infrastructure, institutions, human resources, and living conditions. The authors obtain the following results from their estimation: Anchor firms entered the cluster first, followed by smaller firms. Capacity, in the form of "transportation infrastructure such as roads and ports" and "government policy regarding tax and investment," attracted these first-movers. The domestic market had a positive effect on agglomeration during the period of 1987–1994. Export, however, had no significance. Related and affiliated firms mainly came to Bangkok after the anchor firms. These estimation results largely support the flowchart approach.

4. Conclusions

Taken together, these studies capture the essential features of the industrial agglomerations currently forming in East Asia, and show how clusters in other regions share some key characteristics with their East Asian counterparts. The flowchart approach, which we show to be widely applicable to clusters in various industries, can therefore be used to construct industrial cluster policies. By identifying and prioritizing the factors required for agglomeration formation and cluster development, the flowchart approach offers a growth strategy for regional as well as national economies. The two major conclusions of this volume can be stated as:

1. Capacity building is a key factor to the success of the industrial cluster policy;
2. Capacity building should be targeted to invite anchor firms.

Although this volume focuses on the flowchart approach as an explanation of industrial agglomeration, it should be noted that the approach cannot explain all phenomena. Further research is required to identify the range of industries and industrial development levels for which the flowchart approach is most applicable. Moreover, some East Asian economies are reaching the innovation stage, progressing beyond simple production bases, and endogenous innovation and R&D activities are proliferating in these areas. These are natural outcomes of agglomeration, emphasized by Fujita and Thisse [2002]. Agglomerations enable and enhance exchanges of information, know-how, and even tacit knowledge, all of which promote the endogenous flow of innovation or R&D. The flowchart approach must be modified in the future in order to explain these processes.

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Introductory Note

References such as "178–9" indicate (not necessarily continuous) discussion of a topic across a range of pages, whilst "123f5.1" indicates a reference to figure 5.1 on page 123, "134t5.1" a reference to table 5.1 on page 134 and "145n2" a reference to endnote 2 on page 145 (with "nn" used where multiple notes are referenced). Wherever possible in the case of topics with many references, these have either been divided into sub-topics or the most significant discussions of the topic are indicated by page numbers in bold.

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