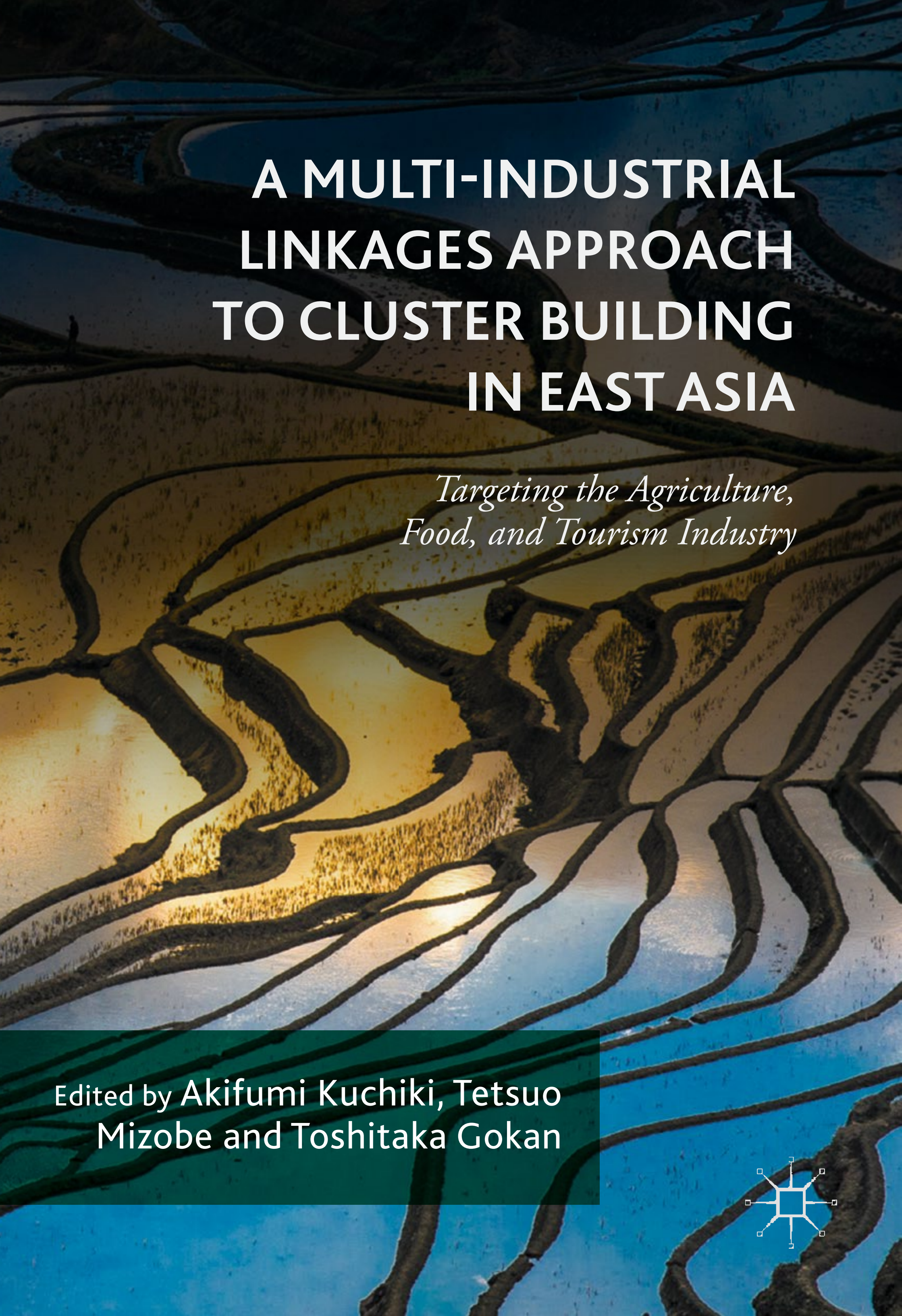

A MULTI-INDUSTRIAL LINKAGES APPROACH TO CLUSTER BUILDING IN EAST ASIA

Targeting the Agriculture, Food, and Tourism Industry

Edited by Akifumi Kuchiki, Tetsuo Mizobe and Toshitaka Gokan

A Multi-Industrial Linkages Approach to Cluster Building in East Asia

Akifumi Kuchiki • Tetsuo Mizobe • Toshitaka Gokan
Editors

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Preface

Kuchiki and Tsuji published a book entitled *Industrial Clusters in Asia* in 2004. This current volume delivers recommendations on policy measures for the promotion of regional industrial development in middle-income Asian countries through the establishment of multi-industrial linkages between three industries—agriculture, food and tourism (AFTI)—which is expected to generate innovation, enhance the quality of consumption and offer an escape from the economic traps now facing these countries.

The current volume introduces a model for creating AFTI clusters based on the concept of "economies of sequence," which dictates the order in which the segments of the industry cluster are formed, thereby increasing efficiency and avoiding failure.

Important positive externalities can be generated by establishing backward and forward linkages between industry and other economic sectors, such as agriculture and services, and these processes can be triggered on a local or a cluster level.

The final objective of this book is to propose measures to promote regional industrial development in Asia from the perspective of three industries: agriculture, food and tourism. For regional agriculture to develop, collaboration with the food industry is essential. Further, by linking to tourism, economic collaboration between the three industries is strengthened. The process of linking these industries is expected to generate innovation.

We would like to thank all the individuals and organizations who accepted our visits and shared with us their precious time and information. We are also indebted to Emi Kawamoto for her tireless secretarial work. We hope this publication will contribute to academia and toward a better understanding of AFTI clusters in Asia.

Kanagawa, Japan Akifumi Kuchiki

Contents

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Abbreviations

AFTI	Agriculture-food-tourism industry
AIC	Akaike Information Criterion
ASEAN	Association of Southeast Asian Nations
BIC	Bayesian information criterion
CAE	Chinese Academy of Engineering
CAS	Chinese Academy of Sciences
Centrair	Central Japan International Airport
CRS	Constant returns to scale
DNA	Deoxyribonucleic acid
FTA	Free trade agreement
GDP	Gross domestic product
GE	Global extent
HKTB	Hong Kong Tourism Board
HSP	Haidian Science Park
IC	Integrated circuit
ICT	Information and communications technology
IDE-JETRO	Institute of Developing Economies-Japan External Trade Organization
IPM	Institute of Policy Management
IRS	Increasing returns to scale
JICA	Japan International Cooperation Agency
JSPS	Japan Society for the Promotion of Science

LD	Local density
NHIZ	Nomura Haiphong Industrial Zone
NIES	Newly industrialized economies
ODA	Official development assistance
PP	Phillips–Perron
R&D	Research and development
RNA	Ribonucleic acid
S&T	Science and technology
SARS	Sever acute respiratory syndrome
SNP	Single nucleotide polymorphism
STB	Singapore Tourism Board
STPB	Singapore Tourism Promotion Board
THSP	Tsinghua Science Park
TLIP	Thang Long Industrial Park
TWAS	Third World Academy of Science
VAR	Vector autoregressive
VSIC	Vietnam Standard Industry Classification
ZSP	Zhongguancun Science Park

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Part I

Introduction

1

Basic Concept and Summary

Akifumi Kuchiki and Tetsuo Mizobe

1.1 The Basic Concept

1.1.1 The Concept of This Book

The Sustainable Development Goals set in 2015 by the United Nations are an attempt to foster innovation, although the main aim is to narrow the economic gap and protect the environment. Mega free trade agreements (FTAs) aimed at regional integration, such as the Trans-Pacific Partnership and the Trans-Atlantic Trade and Investment Partnership, not only seek to abolish import tariffs but also to network global value

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chains and set sustainable growth targets.[1] As pointed out by Kuchiki (2008), Asia can be seen as the growth center of the world in the twenty-first century. However, most Asian countries now face difficulties in achieving active innovation. Industrial clusters were hoped to provide a solution to these difficulties but none has been found to date (see Kuchiki and Tsuji 2008).

Manufacturing industry clusters in Asia, such as those for the electric/electronics industry and the automobile industry, have been analyzed by Kuchiki and Tsuji (2005, 2008, 2010, 2011), who proposed a flowchart approach to industrial cluster policy.

The agriculture-food-tourism industry (AFTI; also known as a primary-secondary-tertiary industry or first-second-third industry) can be called "a sextiary industry cluster." This new industry cluster is anticipated to enhance the quality of consumption and to kick-start middle-income Asian countries.

This book attempts to build a prototype model of the AFTI cluster and to deliver practical recommendations with regard to policy measures for industrial clustering. The model may help to promote regional networking through the establishment of multi-industrial linkages between the three industries of the AFTI.

For agriculture to enhance its added value, linkages between agriculture and the food industry are inevitable as the added value of agriculture itself is not particularly large in developing countries. By linking the food industry to the tourism industry, industrial linkages between the three industries can be tightened. Positive externalities are generated by strengthening the backward and forward linkages between the three industries. The processes involved in linking these industries help to generate innovations.

[1] Sustainable Development Goals: http://www.un.org/sustainabledevelopment/sustainable-development-goals/, May 5, 2016.

Trans-Pacific Partnership (Ministry of Economy, Trade and Investment of Japan): http://www.meti.go.jp/policy/external_economy/trade/downloadfiles/tpp/1602tppnitsuite_kosh in.pdf, May 5, 2016.

Japan External Trade Organization, *Progress Report on the Negotiation of Trans Atlantic Trade Investment Partnership*, Japan External Trade Organization, April, 2015 (in Japanese).

Table 1.1 Segment building

Segments		
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 rights)
	3. Human resources	1. Unskilled labor 2. Skilled labor 3. Professionals
	4. Living conditions	1. Housing 2. International schools 3. Hospitals 4. Entertainment

Source: A. Kuchiki

This book proposes the concept of "economies of sequence," in which the term "sequence" is used to mean the order in which the segments of an industrial cluster are built. Table 1.1 shows the segments involved. The prototype models of the flowchart approach to industrial cluster policy are built using the concept of economies of sequence to efficiently sequence and form the segments of the industry cluster. The concept is key to deciding the sequence of segments forming an industrial cluster.

1.1.2 The Purposes of the Book

Our aims are:

1. to *describe the current situation and issues* regarding the processes involved in forming the segments of AFTI clusters in Asia;
2. to *find the optimum sequence for efficiently forming the segments* of the AFTI cluster using the results presented in the various chapters of this book;

3. to *compare* the AFTI cluster with the automobile industry, the electric/electronics industry and the high-technology industry;
4. to *formulate a prototype model* of the flowchart approach to sextiary industry cluster policy.

This book establishes the concept of economies of sequence in segment building to formulate the flowchart approach to industrial cluster policy by introducing a time axis to spatial economics. Here the segments consist of physical infrastructure (e.g. roads and electricity supply), institutions (e.g. laws and regulations), human resources and living conditions.

Economies of sequence can be defined as the efficient ordering of segment formation in an industrial cluster, resulting in segment formation proceeding smoothly without high costs. Diseconomies of sequence refer to situations in which the sequence-formation process stops owing to cost factors resulting from errors in the sequence of segment formation. The flowchart approach is practical, as explained below.

> Developmental biology introduces a time axis to the flowchart approach. The economies of sequence are defined on the time axis. Some of the chapters in this book present cases illustrating the economies of sequence. The flowchart approach to the AFTI cluster is hypothesized based on the cases presented. The hypothesis on the economies of sequence is to be examined in further studies.

1.1.3 The Main Findings in the Book

The main findings from the literature on the economies of sequence in building the segments of industrial clusters in Asia are as follows:

1. The airport segment is first in the sequence when building the segments of a tourism industry cluster.
2. The access road from an airport to the city center is the second segment in the sequence when building the segments of a tourism industry cluster.

3. The railway and residential town segments are the first and second, respectively, when building the segments of a railway-led industry cluster.
4. Cultural factors, such as history, music, arts, food, textiles and alcoholic beverages, are key to sustaining an AFTI cluster.
5. A high priority should be given to the nomination of a leader as a "master switch" to start building the segments of clusters, not only in the information technology industry but also in the AFTI.

Part II gives cases of the economies of sequence in China, the Republic of Korea, Japan, Cambodia and Vietnam.

Part III gives the background theory on the economies of sequence using developmental biology, applies spatial economics to the AFTI, and compares this industry in Asia with that in Africa and with the information technology industry in China.

1.1.4 The Application of Biological Development to Industrial Cluster Policy: Time Axis

The book introduces the concept of levels of organizational hierarchy in biology presented by Odum and Barrett (2005) to understand the "time axis" and dynamic processes in building the segments of a cluster. Ecology is the study of life with an emphasis on the patterns found in relationships between organisms and their environment, whereas economics can be translated from the original Greek to mean the management of the household. Ecological economics bridges the gap between ecology and economics.

The concept of levels of organization can be seen as a hierarchal order, as shown in Fig. 1.1. The levels start from genes at the bottom, followed by segments, organisms, populations, communities and finally ecosystems at the top of the time axis. Systems containing living and non-living components constitute biosystems, which range from genetic to ecological systems. The community and the non-living environment function together as an ecosystem.

The following hypotheses are proposed. The vertical line in Fig. 1.1, starting from genes and ending with the ecosystem, is a time axis for

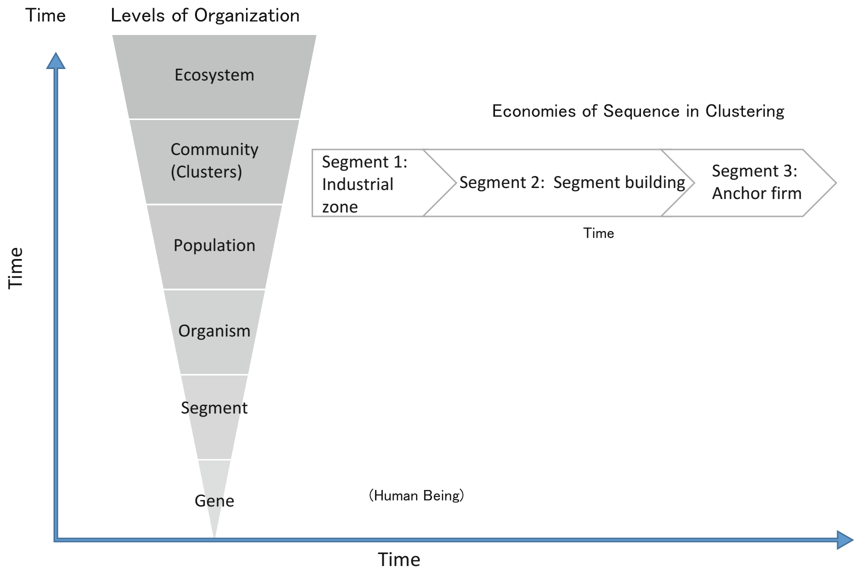

Fig. 1.1 Levels of organization hierarchy: the economies of sequence (*Source*: A. Kuchiki, based on Odum and Barrett [2005])

biogenesis, while the horizontal line, representing the community of the hierarchy, provides a time axis for the segments of a cluster to be built.

The formation of segments in an industrial cluster can be understood as a series of dynamic processes from organisms to people, and from people to community, moving through the levels of organization along the time axis. A community builds the segments of an industrial cluster. The segments can be viewed as the establishment of industrial zones, segment building and the invitation of an anchor firm on time axis.

1.1.5 The Definition of Economies of Sequence

There exist economies of sequence in the formation of the segments of an industrial cluster, which are defined as the efficient segment formation of an industrial cluster without huge cost. The costs related to segment formation are immense when the sequence is incorrectly ordered. This section explains the concept of the economies of sequence corresponding to the concepts of economies of scale and economies of scope, as defined in economics. The concept is based on the idea that the costs of forming the segments of an industrial cluster are reduced when the sequence of segment formation is optimized, while the costs of forming an industrial cluster are uneconomical if the sequence is incorrectly ordered. The sequence of segment formation is crucial to the normal birth of an organism. An organism is formed from the head to the heart and legs in a specific order, with the sequence of the Hox genes determining the sequence of segment formation.

The economies of sequence can be explained as follows. Suppose that there are three periods: the first, second and third. Let us examine two examples of segment formation sequencing in an industrial cluster. Policy measures form an organ, and there are two candidate sequences of policy measures: A and B. Suppose that a cluster consists of three segments $\{s_1, s_2, s_3\}$. The difference between A and B lies in the ordering of s_2 and s_3. In A, the sequence of segment formation is supposed to be $\{s_1 \rightarrow s_2 \rightarrow s_3\}$, and we can suppose that the sequence of policy measures to form a production function in A is $\{s_1 \rightarrow s_2 \rightarrow s_3\}$. A and B can be notated as follows:

$$A = \{s_1, s_2, s_3\},$$
$$B = \{s_1, s_3, s_2\}.$$

The production functions for sequences A and B can be given as Y_A and $Y_B\}$, respectively. The production function of sequence A changes from constant returns to scale (CRS) to increasing returns to scale (IRS) in sequence A (Y_A) by implementing the sequence of policy measures. The production function after implementing the successful sequence of policy measures of $\{s_1, s_2, s_3\}$is $Y_A = f(\{s_1, s_2, s_3\})$. Suppose that the production function in sequence A and B in the third period is Y_A and Y_B, respectively, or

$$Y_A = f(A) = f(\{s_1, s_2, s_3\}).$$

The production cost of Y_A is

$$C_A = (1 + r)^2 C_1(s_1) + (1 + r)C_2(s_3) + C_3(s_2),$$

where C_i (s_k) $(k = 1, 2, 3; i = 1, 2, 3)$ are the total costs of implementing the policy measure to form the segments s_k in the period i.

Now the productivity of A and B in the third period can be compared. Suppose that there exist "economies of sequence" between s_2 and s_3. That is, Y_B is very small while Y_A is large. The sequence of segment formation from s_3 to s_2 is inefficient in comparison to that from s_2 to s_3.

Definition: there exist economies of sequence between s_2 and s_3 such that

$$Y_B / C_B < Y_A / C_A.$$

Sequence A is more efficient than sequence B owing to the increasing returns to scale for sequence A.

1.1.6 Prototype Models of the Flowchart Approach to Industrial Cluster Policy

Each chapter of this book provides a snapshot of the dynamic processes involved in forming the segments of industrial clusters. The chapters present successful cases involving economies of sequence in Asia. The cases are part of a flowchart approach to industrial cluster policy and their summation results in a prototype model of the flowchart approach. The flowchart may be generally applied to industrial cluster policy in other regions in Africa and South America.

It is noted that the hypothesis for a flowchart approach cannot be proved by inductive or deductive methods. That is, the cases of successful economies of sequence can be illustrated and the number of cases can be increased, but the hypothesis regarding appropriate conditions cannot be proved. The hypothesized flowchart does not deny the validity of other flowcharts, whose ordering of segment building is different from the ordering of our flowchart.

1.1.6.1 The Automobile Industry Cluster and the Electric/Electronics Industry Cluster

Kuchiki (2008) established a prototype model of the flowchart approach to industrial cluster policy consisting of Step I (agglomeration) and Step II (innovation), as shown in Figs. 1.2 and 1.3, respectively. Figure 1.4 provides a summary of the agglomeration and innovation steps.

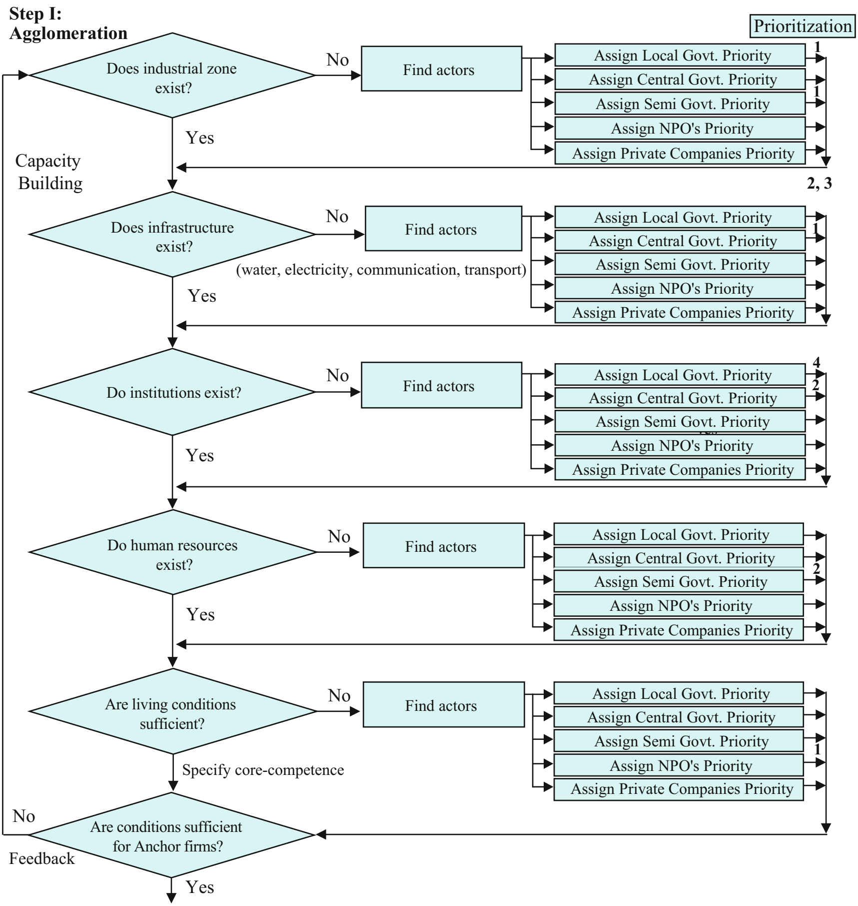

Fig. 1.2 Segment building: Step I: agglomeration (*Source*: A. Kuchiki)

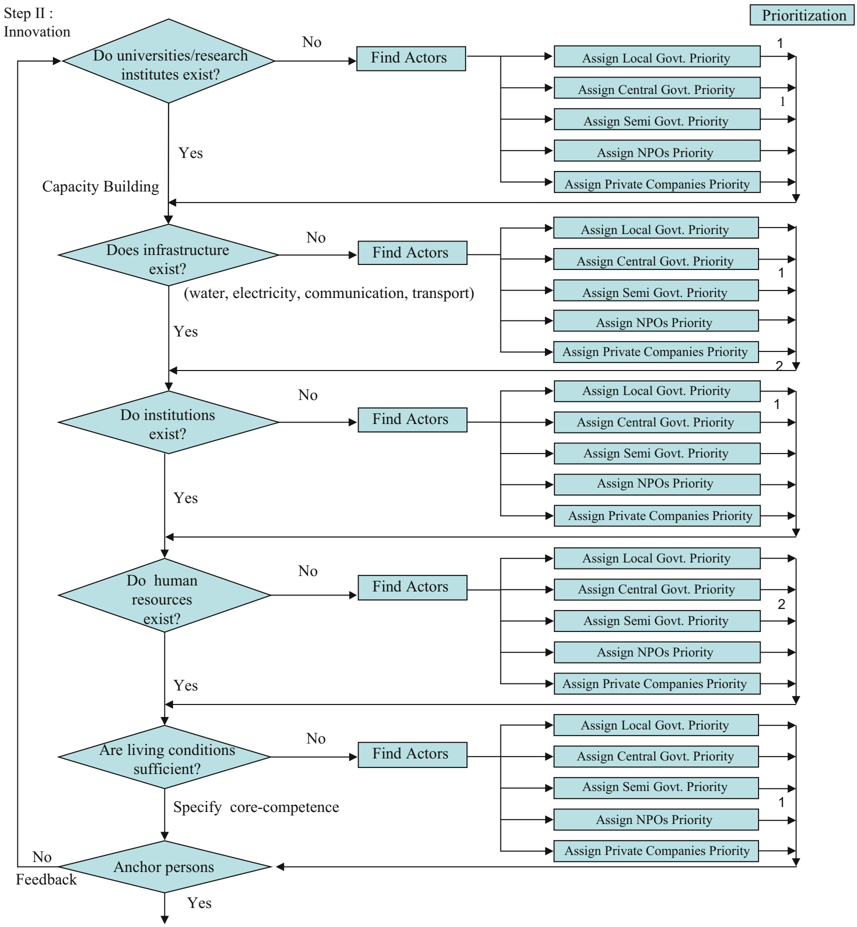

Fig. 1.3 Segment building: Step II: innovation (*Source*: A. Kuchiki)

The prototype model is practical since a cluster can be formed if the following four steps are taken in order. The first step of Step I is to find segments such as industrial zones, segment building, joint actions and an anchor firm, as shown in Fig. 1.2. The second step of Step I is to select the minimum number of factors from the segments found above for a flowchart. The third step of Step I is to order them along a flowchart. The fourth step of Step I is to specify actors to proceed at each step of the flowchart if the step goes, not to "Yes" but to "No."

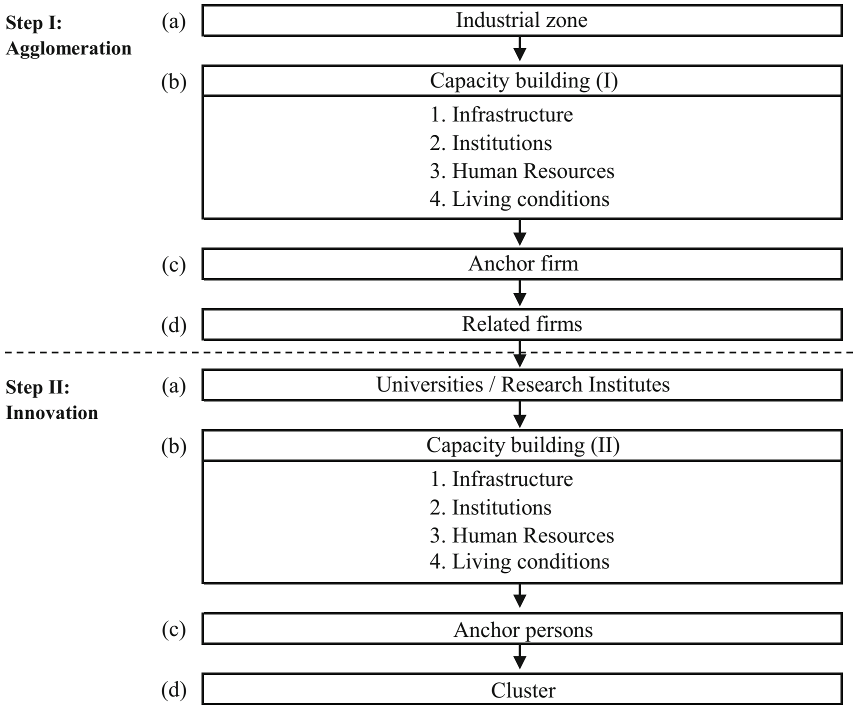

Fig. 1.4 Flowchart approach to industrial cluster policy (*Source*: A. Kuchiki)

Agglomeration in Fig. 1.2 explains the mechanism of industrial agglomeration from the perspective of building the segments related to (1) the construction of industrial zones; (2) the facilitation of physical infrastructure; and (3) institution building.

Kuchiki and Tsuji (2008) found a typical case of the flowchart approach to the automobile industry cluster in Guangzhou, China. He drew the conclusion that anchor firms play an important role in industrial cluster policy and that Guangzhou Municipality, in the role of coordinator, was key to its success.

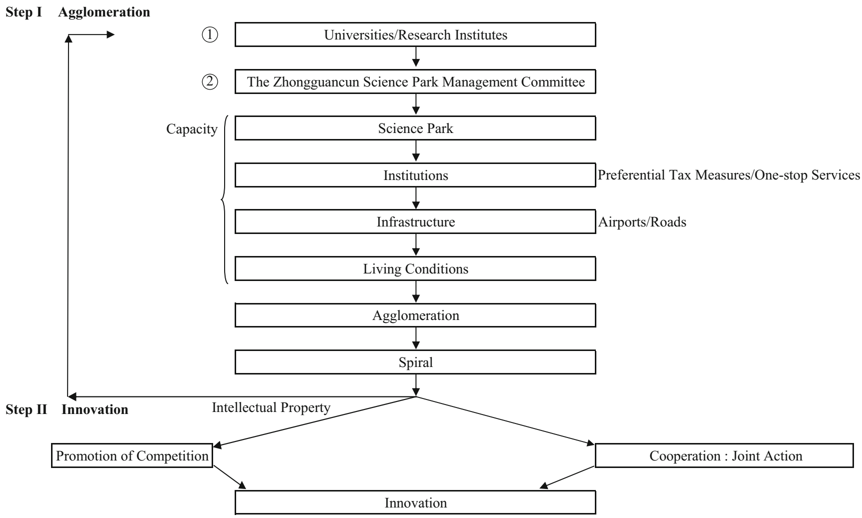

Fig. 1.5 Industrial cluster in Zhongguancun Science Park (*Source*: A. Kuchiki)

1.1.6.2 The Information Technology Industry Cluster

Figure 1.5 shows a case study of Zhongguancun Science Park (ZSP) in Beijing, China, and a hypothesized prototype model of the flowchart approach to an information technology industry cluster. The two actions in Step I are to strengthen the roles of universities and research institutes and to establish the ZSP Management Committee. Segment formation then proceeds to institution building, infrastructure construction and the facilitation of living conditions, resulting in the ZSP agglomeration.

1.2 The Agriculture-Food-Tertiary Industry Cluster

1.2.1 A Definition of the Agri-Food-Tourism Industry Cluster

First, we define the coverage of the tourism industry. No industrial code among the industrial classifications defines the tourist industry. The tourism industry includes restaurants, travel agents, hotels, transportation and confectionary (in the production of souvenirs). Medical care services are included in the case of medical tourism, and agriculture in the case of agricultural tourism. This means that the tourism industry covers various kinds of industry in the primary, secondary and tertiary sectors and that its coverage is not fixed.

Second, we explain the input–output table. A sector only inputs its output into the same sector when there is no industrial linkage between the sector and others, as shown in Table 1.2.

The agriculture sector inputs its output into the food manufacturing industry sector, which in turn inputs its output into the wholesale and retail industry sector as part of a tertiary industry when the industries are linked as shown in Table 1.3.

Third, we explain tourism industry clustering. Step I and Step II of clustering are industrial agglomeration and innovation, respectively, as explained by Kuchiki and Tsuji (2008). Step I in tourism industry clustering starts with the agglomeration of the tourism industry.

Fourth, we illustrate the value chain of a farm. An example of a value chain is that of the procurement of materials, production and marketing.

Table 1.2 Input–output table without industrial linkage

	Agriculture	Food	Logistics	Tourism
Agriculture	◎			
Food		◎		
Logistics			◎	
Tourism				◎

Source: A. Kuchiki

Table 1.3 Input–output table with industrial linkage

	Agriculture	Food	Logistics	Tourism
Agriculture	◎	◎	◎	◎
Food		◎	◎	◎
Logistics			◎	◎
Tourism				◎

Source: A. Kuchiki

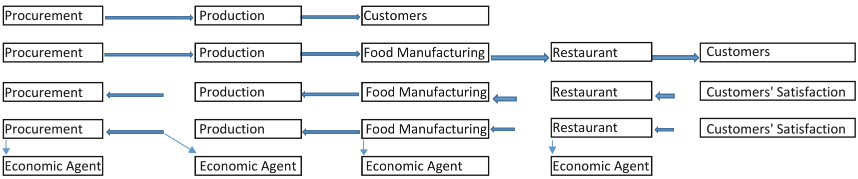

Fig. 1.6 The value chain (*Source*: A. Kuchiki)

Another example in agriculture is that of the procurement of materials, the production of an agricultural product, the processing of the product and the input to a restaurant, as shown in Fig. 1.6. The final output of these chains goes to customers.

The characteristic feature of value chain management is management to maximize the total value of the chain by maximizing customer satisfaction and strengthening "the backward linkage" of the chain, as shown in Fig. 1.6. Here the value chain is that of a restaurant, showing the processing, production and procurement of materials from the customer's perspective.

Here we define the AFTI cluster. The first step is the agglomeration of the agriculture, food and tourism industries. The second step is where firms in the three industries implement value chain management, allowing "backward linkages" between the three clusters to be created. The third step is where innovation occurs in the AFTI. Here the AFTI covers the agro-food-processing industry cluster and the AFTI cluster.

1.2.2 Attention to Production Value by the Agro-Food System

The agricultural sector consists of various related industries ranging from agricultural production upstream and food processing midstream to food service downstream. Added to these are the distribution industry (including wholesalers and retailers) and the transport industry, turning this sector into an enormous agribusiness.

The value of domestic production of agriculture- and food-related industries was USD94 billion in 2011. Of the total, the output from agricultural production, which is upstream, accounted for only 12 %. The highest output was USD36.3 billion of the food industry, which is equivalent to 38 %, followed by the distribution industry and the food service industry, at 26 % and 21 %, respectively.

The reason for the higher outputs from the food-processing industries is their ability to generate greater added value and profitability. Moreover, the output from the food service industry, centering on restaurants, which is downstream in the agro-food system, is expected to expand further with the economic development of the ASEAN (Association of Southeast Asian Nations) countries in the future.

1.2.3 The Necessity for the Vertical Integration of Agriculture, Food and Tourism as a Growth Strategy

The total import of agro-products in the entire East Asian region was a mere USD90 billion in 2000, but this rapidly expanded to USD230 billion in 2010. This boost was in accordance with the rise in China's import of agricultural products, which had increased along with its economic development. Also, Japan's food imports from East Asia reached 38 % of its total agro-products imports, and this figure has been further expanding. A similar trend can be observed in South Korea, where imports have doubled in the last ten years. The same applies to the ASEAN countries as a whole, where the total import of agro-products increased from USD20 billion to USD60 billion during the same period.

In the future, the agricultural sector in the East Asian region is most likely to shift to food-processing fields that have greater added value. The key to success in this shift and in achieving regional economic development is the method of agroindustry development in the ASEAN countries. If their agroindustry grows, stable domestic supply destinations (i.e. markets) for agro-products will be established. This will also make it possible to export processed food products with higher added value to Japan and China.

Further, tourism resources abound in the East Asian region, including Japan, China, the newly industrialized economies (NIES) and the ASEAN countries. To generate even greater added value from food, it is important that the food industry is linked to the tourism industry, with the food service industry at its core. Moreover, as their purchasing power increases with increasing income, more people will visit Japan from the ASEAN countries as tourists. Strengthening the link between tourism resources and the agro-food industry can be an effective strategy for local development and revitalization, even in an economically advanced country such as Japan.

Given the above, this book proposes a development framework that combines agriculture, food and tourism as a growth strategy for East Asia. To achieve this strategy, three different industries—agriculture, food, and tourism—are linked, as shown in Fig. 1.7, and the innovations necessary for improving productivity are expected to be generated.

1.2.4 Attention to the East Asian Economic Bloc

The presence of East Asia, including Japan, China, NIES and the ASEAN countries, in the world economy has been increasing. The region's gross domestic product (GDP) has reached USD18 trillion (in 2013), which accounts for 25 % of the world's GDP. With the addition of India, the share is expected to reach 40 % by 2050. Also, East Asia has a population of 2.2 billion, which accounts for a third of the world's population and constitutes a huge market. The East Asian region where economic

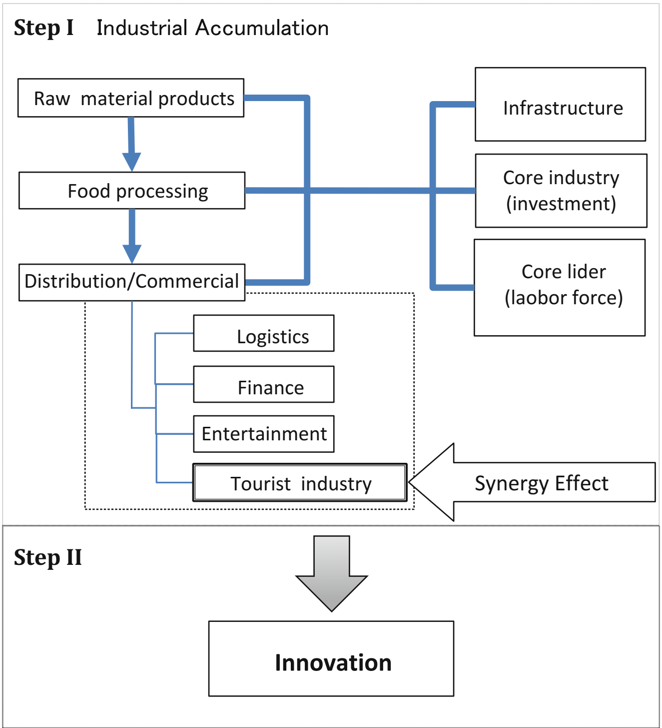

Fig. 1.7 Domestic production of the agricultural and food-related industries in Japan (2011) (*Source*: Author)

development will be expected in the years to come is an economic bloc that the world must keep an eye on.

In East Asia, many of the ASEAN countries are still in the midst of economic development and they have comparative advantages in terms of agriculture. However, land resources are in relatively short supply given the population concentration. Consequently, crops should be processed to increase their added value before they are exported, rather than exported as raw materials. For these countries it is important that their economic development is realized through the formation of industries that combine agriculture and food processing.

In East Asia, Japan, China and the Republic of Korea share a similar natural environment, and their agricultural production systems are

Table 1.4 Free trade agreement progress in East Asia, 2015

	ASEAN	Japan	China	Korea	India
ASEAN	E	C	E	E	C
Japan	C		NP	S	C
China	E	NP		S	UN
Korea	E	S	S		UN
India	C	UN	UN	S	

Source: Toshiharu Shimowatari, Journal of Food System Research, p. 73, Vol. 17, 2010

Note: *E* effective, *C* concluded, *UN* under negotiation, *S* suspended, *NP* no progress

similar. This renders the three countries competitive in agricultural production. However, the ASEAN countries have quite different natural conditions and also different production periods from these three. Thus, in agricultural production, the relationships between the ASEAN countries and Japan, China and the Republic of Korea are complementary.

As shown, Japan, China and the Republic of Korea invest in agriculture in the ASEAN countries and import food ingredients and raw materials from them. Under these conditions, the food trade between Japan and the ASEAN region has reached more than USD15 billion. From Japan, foodstuffs worth USD3 billion are exported to the ASEAN market. China and the Republic of Korea have similar trade relationships with the ASEAN countries. Further, as indicated in Table 1.4, East Asian countries, including Japan, have been pushing toward the conclusion and promotion of FTAs. These are likely to further strengthen the investment and food trade relationships between the East Asian countries.

1.3 Summary of This Book

This book examines the possibility of cluster building through the accumulation of three industries—agriculture, food and tourism—in the East Asian region, including Japan, China, South Korea and the ASEAN countries, from the perspectives described above. A summary of each chapter is given below.

1.4 Part II: Fact Finding: Experiences of Agriculture-Food- Tourism Industry Clusters

1.4.1 Chapter 2: Agriculture-Food-Tourism Industry Clusters in China

This chapter focuses on recent trends in the development of AFTI clusters in China. An AFTI cluster is defined as a cluster of a large number of farmers and companies engaged in both agricultural production and the processing and marketing of agricultural products while providing various tourism services, with the aim of utilizing local agricultural resources as efficiently as possible.

China recently finished a period of rapid growth, thus entering a new development stage known as the New Normal. Various factors are currently driving the Chinese government to develop AFTI clusters in order to stimulate the economy, create new industrial sectors and restore vitality.

The first factor driving the development of these clusters is the continuous increase in agriculture production costs. These costs are rising even as the prices of primary agricultural products in China fall. This has increased the necessity for the efficient processing and utilization of agricultural resources.

Second, although the number of farmers engaged in agriculture production is decreasing, the demand for a greater variety of higher-quality, safer agricultural products has grown.

The third factor is that even as labor costs for agricultural processing firms increase, these firms are unable to relocate to other areas. Their only option is to upgrade within the local area. That is because, unlike the industrial sectors, agricultural sectors are strongly affected by geographical conditions, such as weather, soil and culture.

Finally, agriculture itself has varied and changing functions. There has recently been increased emphasis on roles besides food production, such as protection of the environment, recreation and the preservation of local culture.

1.4.2 Chapter 3: The Agriculture-Food-Tourism Industry Cluster in the Republic of Korea: The Formation and Growth Factors of Clusters in Regional Agriculture

In this chapter the characteristics and present conditions of governmental cluster programs in regional agriculture in South Korea are examined, and elements related to the growth and formation of clusters are discussed. In Michael Porter's cluster theory, a cluster that generates innovation and has a competitive advantage is not only a simple, geographical group of associated enterprises and institutions but also involves the close association among those agents as an essential factor, and how this association is formed defines the formation and development of a cluster.

From this point of view, taking the Boseong Green Tea Cluster as a representative case study of the AFTI cluster in South Korea, the chapter identifies the formation and growth factors necessary to the development of a regional agriculture cluster through an analysis of cluster components (formation opportunity, configuration elements, activities and achievements of the cluster, etc.) in its development process.

As a result, central resources, continuous local government support and networking among associated agents (i.e. interorganizational learning and mutual complementarity) have been confirmed as important factors in the formation and growth of a cluster. In other words, these factors allow the development of mutual trust among associated agents through consistent and continual business promotion and organizational learning, allowing the cluster to develop into a business with strong mutual complementarity. Therefore the development of agents (coordinators) and a supportive foundation (platform) for each agent, as well as the construction of a system for the establishment of mutual relationships among agents, is essential in order to continue and promote, through political support, the formation and growth of regional agriculture clusters.

1.4.3 Chapter 4: The Agriculture-Food-Tourism Industry Cluster in Japan: Case Studies of Tourism Industry Clustering in Okinawa and Aichi

This chapter considers the case of an industrial cluster in Okinawa as the basis for an innovation process. It begins with a historical analysis of the fluctuation in the number of tourists. In addition, it shows that big events, such as an international exposition, can cause structural changes in the tourism industry. This study places this event as an example of a shift from Step I to Step II in the flowchart.

The purpose of this chapter is to clarify the effectiveness of the sequence theory developed as a gradual development model of the local economy by incorporating it into case studies of tourism development in Japan.

In Step I, added value was obtained because the food industry cooperated with the agricultural industry in the area. Generally in Asia, a food company procures agricultural products from the surrounding farmers. Therefore cooperation between agriculture and the food industry gives rise to various developmental effects, such as the inflection of local resources, a steady supply of food products and an improvement in the self-sufficiency ratio. Step II is the innovative creation stage to push forward agriculture, restaurants, and continuous cooperation and integration with the tourism industry.

This chapter review concreate cases of culture factors in the accumulation of "cultural" factors (Step I: accumulation) by applying the sequence theory model described above to tourism development, which is considered as an emerging sector in Japan. Based on this, we refer to two case studies in Aichi, which held an international event and opened an international airport at the same time, and we classify and analyze future issues.

1.4.4 Chapter 5: The Agriculture-Food-Tourism Industry Cluster in Okinawa, Japan: The Key Role of an Airport in Clustering

This chapter examines the impact of placing the construction of New Ishigaki Airport ahead of other infrastructure development in the

Yaeyama region. In so doing it focuses specifically on Ishigaki Island and Iriomote Island. The sequence of economic policies implemented after the construction of the airport is also examined in the context of tourism development. Based on this investigation, the chapter concludes that the next step in the sequence is the development of transportation access from the airport to the center of Ishigaki Island. For Iriomote Island, the next step is tourism marketing.

1.4.5 Chapter 6: Tourism Development in Cambodia: An Analysis of Factors in the Creation of Local Specialties

Japanese tourists represent a large proportion of the total number of tourists visiting Cambodia. It is expected that the amicable relationship between Japan and Cambodia will be developed further across a range of areas, including the economy, culture, sports and tourism.

In this chapter, in order to examine the potential for growth of the Cambodian economy based on sequence theory and local fieldwork, (1) the annual trends in economic growth and the industrial sectors; and (2) the inheritance routes and the traditional technologies of food culture based on the historical context will be classified in order to clarify various issues in the tourism industry in the country.

1.4.6 Chapter 7: The Collocation of Industries in Agriculture-Food-Tourism in Vietnam

The purpose of this chapter is to detect AFTI clusters and to examine their collocation. This will aid our understanding of the spatial structure of resources used to plan and invest in the development of tourism products, and will "prioritize the development of marine tourism, cultural tourism, and eco-tourism," one of the solutions proposed by the Socialist Republic of Vietnam.

The collocation of industries related to AFTI is discussed in this chapter. In the process of obtaining the GE and LD, clusters are detected using the Bayesian information criterion (BIC), which allows us to compare cluster schemes directly. Here we are interested in whether clusters exist in the same region. In other words, the links between industries are not part of our data analyses.

1.5 Part III: New Approaches to the Further Development of Cluster Analysis

1.5.1 Chapter 8: An Application of Levels of Organization in Biology to the Process Formation in an Industrial Cluster: The Economies of Sequence

The chapter focuses on the processes of the formation of an industrial cluster in the field of manufacturing as an example of clustering in the AFTI cluster. The methodology employed is characteristic in that it seeks to apply the concept of the levels of organization to the formation processes of an industrial cluster. An industrial cluster is efficiently formed when the sequence of segment formation is in the optimal order. We illustrate this using the examples taken from the field of manufacturing: the automobile industry cluster in the Eastern Seaboard region of Thailand and the electronics industry cluster in northern Vietnam. The indices for the measurement of the result of the economies of sequence in the manufacturing industry cluster are the number of firms agglomerated and the number of jobs created.

1.5.2 Chapter 9: Railway-Led Formation of the Agriculture-Food-Tourism Industry Cluster: Escaping from the Middle-Income Trap

This chapter proposes a strategy to develop an AFTI cluster by networking railway lines based on Japanese experiences of developing them in the private sector. The development of railway lines has fostered economic growth in Kansai in western Japan and Kanto in eastern Japan. In particular, Ichizo Kobayashi, the founder of Hankyu Corporation, developed a railway line and formed a railway-led AFTI cluster in Kansai, including the development of a residential town and a local culture. Such railway-led clusters in Japan typically run about 300 km from the start station to the end station. Clustering in rural areas can result in both economic growth and narrower income gaps between the core region and the periphery. This chapter assumes that clusters aim to protect the ecosystem and that strengthening cultural factors is crucial to keeping the management of railway lines profitable.

The first task when forming a tourism industry cluster is the construction of traffic infrastructure, including railways. As railways can transport people quickly and at low cost, they can serve as a policy measure to change the spread of economic activities. There are two approaches. One is to foster an AFTI cluster. This is useful in rural areas with resources to attract tourists by increasing access from the cities. The second is to develop a residential town and a large shopping mall along the railway line. In this approach, passengers in the residential town use the railway and contribute to the profits of the railway company. In both cases, upgrading the level of culture along the railway line is necessary to keep the management of the line profitable.

1.5.3 Chapter 10: Quantitative Analyses of the Economies of Sequence: The Impact of New Airport Construction on Tourism Industry Growth—A Case Study of Hong Kong and Singapore

The chapter explores what role (the opening of) an international airport plays in the creation of tourism clusters and what impact it has on the economy, using Hong Kong and Singapore as examples. The chapter looks at the trends in average annual numbers of tourists and in tourism revenue, as well as in the GDP growth rate. Using the Granger causality test, it carries out a statistical analysis of tourism revenue and economic growth in Hong Kong and Singapore to explain how they are causally related.

1.5.4 Chapter 11: An Application of the Flowchart Approach to the Agro-Food-Processing Industry Cluster in East Asia, and the Case of the Nacala Corridor Region in Mozambique

The purpose of the chapter is to examine whether industrial clusters in Africa can be established by applying the flowchart approach to industry cluster policy. The following four results are shown. First, the average value of the summation of the forward and backward linkage effects of the machinery industry is less than, or almost the same as, that of the food industry, although it has been recognized that agricultural clusters have a limited impact on the input–output linkage in the generation of employment opportunities. Second, a prototype model of the flowchart approach to the agro-food-processing industry cluster is proposed to strengthen the input–output linkage between the agriculture and food-processing industries. Third, our research data on Mozambique shows that a small investment in the food-processing industry in the Nacala Corridor Region generated more employment opportunities than did mega mineral mining firms in Mozambique. Fourth, the agro-food-processing cluster policy is formulated to enhance low agricultural incomes that result mainly from the small-scale farmers and limited markets in African countries.

1.5.5 Chapter 12: A Comparison of the Information Technology Industry Cluster with the Agro-Food Industry Cluster from the Perspective of the Economies of Sequence

This chapter proposes a flowchart approach to information technology industry cluster policy to prioritize policy measures for forming the segments of the cluster. The two cases of economies of sequence to determine the policy measures to efficiently form the segments of the information technology industry cluster were found in relation to information technology industry clustering in Beijing, China. First, the leadership of the ZSP Management Committee of the Beijing Municipality as a “master switch” was crucial to the success of the industrial cluster policy.

Second, the existence of universities is a precondition for university–industry linkages in the industrial cluster policy. The flowchart approach to the information technology industry policy is different from that to the automobile industry cluster policy.

There are two conclusions that can be drawn from the flowchart for the information technology industry clustering in Beijing. First, the existence of universities with human resources is a precondition for the clustering of the information technology industry. Second, the leadership of the ZSP Management Committee plays a crucial role in agglomerating information technology firms in the science park. The flowchart elucidated the mechanism that linked universities and firms in the ZSP as well as the organizational structure of the ZSP Management Committee. It should be noted, however, that the flowchart differs between the manufacturing industry and the information technology industry.

1.5.6 Chapter 13 Appendix: Introduction to an Application of Biology to the Formation of Segments in an Industrial Cluster

The chapter regards the formation process of an industrial cluster as a form of ontogenesis, analyzes the formation process of segments of an industrial cluster and examines the sequence of formation. A segment is a part of the body that performs a specific function. Hox genes in genetic engineering play a leading role in forming the segments of an industrial cluster. They are switches for ordering the formation of segments. The sequence of the Hox genes determines the sequence of segment formation.

The method used in this chapter is characteristic in applying the concept of Hox genes to the processes involved in industrial cluster formation. An industrial cluster will be successfully formed when the sequence of Hox genes is in the appropriate order. The indices for measuring the result of the economies of sequence in the manufacturing industry cluster are the number of firms agglomerated and the number of jobs created.

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Part II

Fact Findings: Experiences of the Agriculture, Food, and Tourism Industry Clusters

2

Agriculture-Food-Tourism Industry Clusters in China

Ke Ding

2.1 Introduction

This chapter focuses on recent trends in the development of Agriculture-Food-Tourism Industry (AFTI) clusters in China.[1] An AFTI cluster is defined as a cluster of a large number of farmers and companies engaged in both agricultural production and the processing and marketing of

[1] This chapter is an outcome of the research project "The upgrading of China's industrial agglomeration: an interdisciplinary approach of spatial economics and area study," funded by a grant from the Japan Society for the Promotion of Science (JSPS).

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agricultural products while providing various tourism services with the aim of utilizing local agricultural resources as efficiently as possible.[2]

A typical AFTI cluster generates both forward and backward linkages. Forward linkages are formed as agricultural product processing technology develops and the quality of agricultural products increases, thereby increasing value added and attracting more tourists to the cluster. Backward linkages form as the tourism industry develops and more tourists are attracted to the cluster, increasing demand for processed agricultural products and further developing the agricultural sector. Forward and backward linkages interact and stimulate the formation of an AFTI cluster.

China recently finished a period of rapid growth, entering a new development stage known as the New Normal. Various factors are currently driving the Chinese government to develop AFTI clusters in order to stimulate the economy, create new industrial sectors and restore vitality.

The first factor driving the development of these clusters is the continuous increase in agriculture production costs. These costs are rising even as the prices of primary agricultural products in China fall. This has increased the necessity for the efficient processing and utilization of agricultural resources.

Second, although the number of farmers engaged in agriculture production is decreasing, the demand for a greater variety of higher-quality, safer agricultural products has grown.

The third factor is that even as labor costs for agricultural processing firms increase, these firms are unable to relocate to other areas. Their only option is to upgrade within the local area. That is because, unlike the industrial sectors, agricultural sectors are strongly affected by geographical conditions, such as weather, soil and culture.

Finally, agriculture itself has varied and changing functions. There has recently been increased emphasis on roles besides food production, such as protection of the environment, recreation and the preservation of local culture.

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[2] Our definition of AFTI cluster is affected by Porter (1998) but does have some differences. Porter (1998, p. 78) stresses that "clusters encompass an array of linked industries and other entities important to competition." The case of the California wine cluster in his paper also appears to be a typical case of an AFTI cluster. However, I am different from Porter (1998) in two respects. First, I stress that an AFTI cluster must include all of the primary, secondary and tertiary sectors. Second, I focus on the roles of forward and backward linkages in creating such a cluster.

The remainder of this chapter is organized as follows. Section 2.2 introduces the policy background of the development of AFTI clusters in China. Sections 2.3, 2.4 and 2.5 investigate some typical cases of China's AFTI clusters, clarifying their characteristics, formation mechanisms and driving forces. Section 2.6 concludes.

2.2 The Policy Background of the Emergence of Agriculture-Food-Tourism Industry Clusters in China

The starting point of AFTI clusters in China is the well-known policy of agricultural industrialization (*Nongye Chanyehua*). According to an official definition given by the ex-vice prime minister, Jiang Chunyun,

> the essence of agricultural industrialization is to promote agricultural integration and create a mechanism through which the process of agricultural production, processing and distribution are well connected, and mutually facilitated so that an effective connection between farmers and market is realized, promoting the commercialization, specialization and modern transformation of agriculture, and maximizing the benefits of agriculture. (Ikegami and Hoken 2009, p. 11)

This definition makes it clear that the purpose of agricultural industrialization is to facilitate the integration of the primary, secondary and tertiary sectors. This is consistent with the purpose of AFTI clusters, although the role of tourism is not mentioned.

The so-called "Dragon Head Firms" (*Longtou Qiye*; "leading firms" hereinafter) play a key role in the process of agricultural industrialization. They are the organizers of agricultural value chains, focusing on key segments of the chains, such as processing and distribution. Generally, a leading firm is expected to complement the incomplete market institutions during China's market transformation rather than completely integrate the agricultural value chains (Watanbe 2009, p. 178).

As Table 2.1 shows, in the 1990s China introduced a series of policies to promote agricultural industrialization and foster leading firms. These

Table 2.1 Major policies on agriculture-food-tourism industry clusters in China

Year	Approving body	Document	AFTI-related content
1998	Central Committee of the Communist Party of China	Decision on several major agriculture and rural Issues	For the first time, agricultural industrialization is positioned as an important strategy of China's agricultural and rural development. Leading firms are positioned as the integrators of agricultural industrialization
2000	Central Committee of the Communist Party of China, State Council	Opinions on agricultural and rural works in 2000	Stresses that leading firms are the driving force behind the organization of farmers and agricultural industrialization. The central government provides strong support to leading firms in the construction of the agricultural base, the purchase of raw materials, the introduction of equipment, and exports of agricultural products
2000	Ministry of Agriculture, seven other ministries and commissions	Opinions on supporting major leading firms in agricultural industrialization	Sets selection standards and concrete policies (tax, finance and agricultural base construction) for central government-supported national level leading firms
2007	China Tourism Administration, Ministry of Agriculture	Notice of the promotion of rural tourism development by the China Tourism Administration and the Ministry of Agriculture	Stimulating the development of rural tourism in order to increase farmers' income, create jobs in rural areas and meet the increasing consumer demand
2010	China Tourism Administration, Ministry of Agriculture	Opinions of the Ministry of Agriculture and China Tourism Administration on the creation of	Stimulating the development of leisure agriculture and rural tourism. Breaking the boundaries between primary, secondary and tertiary

(*continued*)

Table 2.1 (continued)

Year	Approving body	Document	AFTI-related content
		leisure agriculture and rural tourism model counties and national leisure agriculture model spots	sectors. Leading the development of agricultural product processing, service, transportation, construction and cultural sectors
2015	Central Committee of the Communist Party of China, State Council	Several opinions by the Central Committee of the Communist Party of China and the State Council on the deepening of reform and innovation, and the acceleration of agricultural modernization	Stimulating the integration of rural primary, secondary and tertiary sectors. Extending agricultural value chain segments. Increasing agricultural value added. Stimulating the development of agricultural product processing. Exploring multifunctions of agriculture, such as ecology, leisure, tourism, culture and education
2015	Ministry of Agriculture	Guidance by the Ministry of Agriculture on further adjustment and optimization of the agricultural structure	Stimulating the development of agricultural industrialization. Fostering leading firms. Stimulating the formation of industrial clusters driven by leading firms. Stimulating the integration of primary, secondary and tertiary sectors. Leading the development of leisure agriculture and agricultural tourism. Exploring cultural resources of rural areas

Sources: Complied by K. Ding based on Ikegami and Hoken (2009, p. 13), http://www.gov.cn/zwgk/2007-04/20/content_589484.htm, http://www.moa.gov.cn/govpublic/XZQYJ/201008/t20100804_1612014.htm, http://news.xinhuanet.com/2015-02/01/c_1114209962.htm, http://www.moa.gov.cn/zwllm/zwdt/201502/t20150212_4407693.htm, accessed January 25, 2016

Table 2.2 The general situation in China's agricultural industry

Year	Number of processing enterprises	Total income from agricultural product processing (CNY)	Share of agricultural product processing income as a percentage of total industry	Comparison between agricultural product processing income and agricultural production volume
2003	50,000 (data for enterprises with annual sales over CNY5 million)	2.63 trillion (data for enterprises with annual sales over CNY5 million)	16 %	1
2014	76,000 (data for enterprises with annual sales over CNY20 million)	18.48 trillion (data of enterprises with annual sales over CNY20 million)	17 %	2.1

Source: Complied by K. Ding based on information from http://www.crr.gov.cn/articleContent?parentId=35&sonParentId=35&articleId=1921, accessed January 25, 2016

policies have achieved remarkable results in recent years. According to "Research report on the development of our country's agricultural products processing" proposed by the agricultural products processing office in the Ministry of Agriculture, the number of agricultural product processing firms in China increased to 455,000 in 2014.[3] Between 2003 and 2014 the number of large-scale processing firms increased remarkably. Most of these firms are considered leading firms. Firm size has increased while the value added of agricultural product processing has doubled (Table 2.2).

[3] The information about this research report was found at http://www.crr.gov.cn/articleContent?parentId=35&sonParentId=35&articleId=1921, accessed January 25, 2016.

Table 2.3 The general situation in China's rural tourism industry

Year	Featured villages and towns	Farm stays	Tourists	Total income (CNY)	Beneficiary farmers
2013	90,000	1.5 million	900 million	27 billion	29 million
2014	100,000	2 million	1200 million	32 billion	33 million

Source: Complied by K. Ding based on the information from http://www.agri.cn/V20/ZX/nyyw/201503/t20150310_4431699.htm, accessed January 25, 2016

Policy on rural tourism has also affected the development of AFTI clusters in China. As seen in Table 2.1, the Chinese government began to promote rural tourism in 2007. The government first officially recognized the importance of the linkages between primary, secondary and tertiary sectors in 2010, stressing the point twice in 2015. The Chinese mass media has also begun to formally use the term "Sixth Industry" (the integration of primary, secondary and tertiary sectors) to describe the phenomenon of AFTI clusters.

In comparison with agricultural industrialization, rural tourism remains at the stage of quantitative expansion. As Table 2.3 indicates, although all of the indicators are increasing, the growth rates of total incomes and the number of beneficiary farmers are not as large as the growth rates of the total number of special towns, farm stays (*Nongjiale*) and tourists.

2.3 The Current Situation in Agriculture-Food-Tourism Industry Clusters

We have collected some typical cases of AFTI clusters in Table 2.4. Looking at these, we can recognize some basic characteristics of these clusters.

In the primary sector, most regions concentrate on a single agricultural product. However, there are exceptions where multiple agricultural products co-exist. Interestingly, in the latter case, some regions grow into a single cluster while others show different growth paths, forming different clusters within the same region.

Table 2.4 Typical cases of agriculture-food-tourism industry clusters in China

Province	City or county	Leading firms in sectors	Agricultural products	Agricultural product processing	Marketing	Tourism	Total area of the cluster (mu)	*Sources*: Complied by K. Ding based on information from the following websites, accessed January 25, 2016
Zhejiang	Lishui	No	Tea	Various tea-related health products, foods and catering	Tea wholesale market	Cycling in tea gardens, tea tours, tea culture research association, tea performance team	–	http://news.lsnews.com.cn/system/2014/11/18/010565063.shtml
Zhejiang	Lishui	1,2	Shiitake	Various snack foods, medicines, pharmaceutical intermediates made of shiitake	Shiitake market and logistics center. Trading of shiitake in Tianjin's market	Qingyuan shiitake culture system is part of China's agricultural heritage. Shiitake pilgrimage is held jointly with Taiwanese farmers	-	http://news.lsnews.com.cn/system/2014/11/18/010565062.shtml
Hebei	Qingxian	No	Vegetables	Vegetable dinners	Fresh agricultural products logistics center, organic vegetable exhibition center	Park, temple, vegetable picking garden, International Bajiquan (Chinese kung fu) training center, painting and calligraphy exhibition center, redwood culture exhibition center, swimming area, Grand Canal sightseeing spot, Qingxian tourism festival	50,000	http://www.heagri.gov.cn/hbagri/detail.jsp?articleId=8aa0878c4b725124015142cbce344756
Hebei	Lincheng	1,2,3	Walnut	Activated carbon made of walnut, walnut juice, walnut oil, walnut powder	–	Nut picking, fishing	–	http://www.hbkjb.com/2015-08/31/content_1233405.htm

Hubei	Daye	1,3	Peach, lotus, rose, other fruits	Dishes of private kitchens	–	China rural garden expo, Peach blossom festival, picking festival, lotus festival. China incense museum		http://www.hsdcw.com/HTML/2015-5-26/712619.HTM
Shandong	Heze	1,2,3	Peony	Various health products, seed oil, cosmetics and toothpaste made of peony	–	Industrial tourism. Peony-related arts and crafts	–	http://epaper.dezhoudaily.com/dzrb-hz/html/2015-10/16/content_2_9.htm
Shandong	Xiajin	1,2,3 (Shengshuyuan)	Mulberry	Teas, brandy, steamed buns and breads made of mulberry	–	Mulberry products experience hall. Forest park. Old mulberries in the park are part of China's agricultural heritage	300	http://xj.dezhoudaily.com/jjxw/2015/08/2015-08-15907210.html
Guizhou	Longli	1,2,and 1,3	Pea tips, chilis	Vegetable processing	Logistics center, agricultural e-commerce.	Buyi style park, bullfighting festival. Buyi love song festival.	–	http://www.gzgov.gov.cn/xwzx/gszdt/qn/201509/t20150902_332644.html
Guizhou	Longli	1,2	*Rosa roxbunghi*	Preserved fruits, jelly and juice made of *Rosa roxbunghi*	-	*Rosa roxbunghi* planting area is developed as a resort with the functions of tourism, sports and leisure. A *Rosa roxbunghi* flower festival and a mountain bike challenge match are held in a mountain bike sports park		http://www.gzgov.gov.cn/xwzx/gszdt/qn/201509/t20150902_332644.html
Jiangxi	Wannian	1,2,3 (Xiguo Lvhua)	Rice	Organic rice	Internet crowdfunding	Heqiao village in Wannian is one of the places where rice originated and is designated as a	1800	http://www.quanguwan.cn/

(*continued*)

Table 2.4 (continued)

Province	City or county	Leading firms in sectors	Agricultural products	Agricultural product processing	Marketing	Tourism	Total area of the cluster (mu)	*Sources*: Complied by K. Ding based on information from the following websites, accessed January 25, 2016
						World Agriculture Heritage site. The leading firm holds a family planting festival, harvest festival and straw festival regularly. Free tours have been arranged for crowdfunders		
Jiangxi	Shangyou	1,2	Tea, rice, organic vegetables, ecofish, osmanthus, podocarpus, bayberry	Camellia health products, ecofish products	–	Holds tea forums, tea parties, tea contests, tea performances, tea making contests, rafting festivals and mountain bike matches regularly. Vegetable picking can be experienced. Creative agricultural park, creative oil painting park and outdoor adventure available	–	http://www.jxshangyou.com/tt/201512/t20151205_312800.htm,http://www.ganzhou.gov.cn/zwgk/zwdt/bmdt/201508/t20150803_853211.htm
Jiangxi	Nanchang	1,2,3 (Yuming)	Fish, grape, chicken, llama	Vine, chickens fed on silkworms, llama blood for medicine. Farmers' special green foods.	Participating in fairs, creating the leading firm's own sales network	Fruit picking, water sports, tourism service center, fishing.	1800	http://ce.jxcn.cn/system/2015/06/26/013993262_01.shtml

Jiangxi	Anyi	1,2,3 (Lvneng)	Rice	Packaged refined rice with own brand	Establishing the leading firm's own sales network, such as market-places and super-markets. Receiving orders from industrial parks and school cafeterias. Making use of e-commerce. Introducing order-made sales and membership sales.	Antique farm tools show and experience zone. Rice farming experience zone. Fruit picking experience zone. Golden rapeseed tourist area.	6000	http://www.ncwbw.cn/html/2015-06/08/content_236956.htm?div=-1
Hainan	Danzhou	1,2 (Xinteng Shengtai)	Black pig	Hot spring pork, whole pig dinner	No	Hot spring tourism	-	http://hnrb.hinews.cn/html/2015-04/16/content_4_1.htm

In the secondary sector, we can observe two types of cluster. The first focuses on agriculture and tourism while the secondary sector is simply a catering service based on local foods. In the second type of cluster the secondary sector is highly developed and local agricultural products have been processed intensively.

In the tertiary sector, an AFTI cluster generally consists of both a tourism and a marketing component. There is also a great deal of variety in the tourism sector. In order of importance, tourist activities include fruits or vegetable picking and other agricultural experience activities, cultural facilities, sightseeing, sports, festivals and others. In terms of marketing activities, a cluster generally has an agricultural product wholesale market and a logistics center. Powerful leading firms also construct their own sales networks. Recently the internet has become an important marketing tool.

There are two factors that enable the development of the marketing sector in an AFTI cluster. The first is that most clusters have long promoted the development of agricultural industrialization. The second factor is that tourism alone cannot bring about sufficient demand for a leading firm to enjoy economies of scale in the food-processing sector.

When examining the linkages between the primary, secondary and tertiary sectors, we find that the development of these sectors in each AFTI cluster is unbalanced. As shown in Table 2.4, in some clusters the tourism industry exceeds the scope of local agricultural products. In some cases, however, the scope of agricultural product processing is much wider than the tourism industry and some products are obviously not sold to tourists.

This implies two different strategies for developing AFTI clusters in China. The first is to give priority to the tertiary sector in order to stimulate the development of the tourism sector and generate backward linkages. The second strategy is to give priority to the secondary sector in order to stimulate the development of agricultural product processing and generate forward linkages. In some cases, such as the vegetable cluster of Longli in Guizhou Province, both the forward and the backward linkages between secondary and tertiary sectors are undeveloped. This is because most of the leading firms in this region were invited by local governments from outside the areas and they are very new.

2.4 The Role of Leading Firms in Agriculture-Food-Tourism Industry Clusters

Leading firms have played a crucial role in the formation of China's AFTI clusters.[4]

In the primary sector, the main role of leading firms is to organize farmers. Two methods of organization have been observed. The first is to make farmers employees of the leading firm. For example, in the case of the Shengshuyuan Company in Xiajin, Shandong Province (Table 2.4), farmers lend land and mulberries to the company. The farmers are then employed by the company and are paid wages. The second method is contract farming. Farmers are engaged in agricultural production under contract, with the leading firm collecting all of the agricultural products. In the case of the Lvneng Company in Anyi, Jiangxi Province (Table 2.4), the company employs more than 100 employees and over 3000 contract farmers.

In the secondary sector, leading firms play key roles by intensively processing agricultural products and creating value added. As Table 2.4 shows, agricultural products are processed into not only foods (including snacks and desserts) but also various products for daily use, medicines and other items.

In the tertiary sector, leading firms both create their own sales networks and construct parks in which agriculture, processing and tourism co-exist (Table 2.4). In most cases, processing and tourism services are provided by the leading firms. Sometimes, however, a leading firm may also act as a platform manager and invite outside firms to carry out related businesses.

Currently, not all leading firms are powerful enough to organize the three sectors. In these circumstances the local government will play a more active role in complementing the deficiencies of leading firms. We will discuss this issue in the next section.

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[4] Not only leading firms but also farmers cooperatives and specialized markets can be considered as driving forces in the development of agricultural industrialization (Huang 2010, pp. 148–154). In reality, we find few cases in which famers cooperatives or specialized markets have taken the initiative in the development of an AFTI cluster. In the AFTI, however, the role of leading firms is irreplaceable.

Leading firms generally employ two strategies for organizing the primary, secondary and tertiary sectors and creating AFTI clusters. The first is to focus on generating backward linkages. The firm first develops the tertiary sector in order to attract a large number of tourists as consumers. The large demand from the downstream sector then drives the development of the primary and secondary sectors.

The Weijia Villa cluster run by the Yuming Company in Nanchang County, Jiangxi Province, is a typical case.[5] The company invested a large amount of resources into both tourism and marketing activities. In the secondary sectors, however, both the chicken breeding technology and the llama blood processing technology were obtained from a joint venture with a high-tech company in Shanghai.

Because of recent advancement in the information and communications technology (ICT) industry, many leading firms began to actively use internet technology to stimulate the development of the tertiary sector, as seen in the case of the Xiguo Lvhua Company in Wannian, Jiangxi Province (Table 2.4). This firm attempted to use internet crowd funding for its farm. Everyone who contributed to the campaign can obtain fresh rice regularly from the farm and share in the income generated by events such as the farming festival held by the firm. In order to improve the user experience and deepen their commitment, the Xiguo Lvhua Company installed monitors on the farm. Crowd funders can use a smartphone to easily monitor the growth of the rice from any angle 24 hours a day.[6]

The second strategy of leading firms focuses on generating forward linkages. Leading firms first build up the capacity of their agricultural product processing operations, then attract tourists as consumers to come to the farm in order to buy products, experience farm work or sightsee. For example, the Lvneng Company was established in 2009. Initially it was engaged in rice farming, farming technology research, and the rough processing, intensive processing, branding and marketing of rice. Its production line has the ability to intensively process 100,000 tons of

[5] The information about Yuming Company was found at http://ce.jxcn.cn/system/2015/06/26/013993262_01.shtml, accessed January 25, 2016.

[6] The information about Xiguo Lvhua Company was found primarily at http://www.quanguwan.cn/, accessed January 25, 2016.

rice and its drying equipment can process 240 tons of rice per day. As Table 2.4 shows, this company also formulated various strategies to establish its own sales network. Recently, Lvneng began to enter the tourism sector, extending its business scope from rice to fruit and rapeseed flowers to enhance the customer experience.

2.5 The Roles of Local Government in Agriculture-Food-Tourism Industrial Clusters

As stated above, not all leading firms are able to organize all three sectors and generate forward and backward linkages simultaneously. The local government plays an indispensable role in growing the rural area into an AFTI cluster.

The first role of local government is to invite leading firms from other areas to invest in the cluster. This policy is especially important in less industrialized areas with rich agricultural resources.

For example, Longli is a county located in Guizhou Province.[7] The area has rich resources of vegetables, fruit and tourism but it remains less developed. The planting area of pea tips and chilis amounts to 46,200 mu.[8] To develop these vegetables, the local government has invited three firms from Hong Kong and other areas to engage in the processing of clean vegetables. To help these firms and farmers to efficiently sell and transport their processed vegetables, the local government established the largest logistics park for agricultural products in Guizhou. The local government also invited several specialized agricultural product e-commerce firms to invest in Longli and help to sell local vegetables on the internet.

Longli has the largest planting area for artificially planted *Rosa roxbunghii* in China, amounting to 145,000 mu. The annual production

[7] The information about Longli was found at http://www.gzgov.gov.cn/xwzx/gszdt/qn/201509/t20150902_332644.html, accessed January 25, 2016.

[8] 1 mu = 0.067 ha.

volume of *Rosa roxbunghi* is 75,000 tons and the total output value is CNY375 million. To intensively process the plant the local government has invited six food- and biotechnology-related firms to engage in the production of preserved fruits, jelly and juice. The local government also took the initiative to develop the *Rosa roxbunghi* planting area as a resort. It further established a mountain bike sports park, where *Rosa roxbunghi* flower festivals and mountain bike challenges are held.

The second role of local government is to help leading firms to find sufficient land (see Table 2.4) within a specified space so that they can efficiently manage all of the primary, secondary and tertiary sectors and enjoy economies of scale.

In China, following the introduction of the household contract responsibility system, the use rights of lands were divided among farming households and were not allowed to be transferred to other economic actors. This policy ensured a safety net for farmers but made it difficult for the agricultural sector to utilize economies of scale. To improve this situation the Chinese government formulated a new policy in 2008, permitting Chinese farmers to transfer contractual land-management rights to other economic actors. Rural land is still prohibited from real-estate development, but land use for agricultural product processing and rural tourism is now possible.

For leading firms, however, it is still costly to obtain large areas of land because they must negotiate with every dispersed farmer and it is difficult for them to establish trust with them in a short period of time. The land-transfer problem thus becomes a bottleneck in the development of AFTI clusters.

To overcome this hurdle, local governments designed various systems to help leading firms to acquire land more easily. For example, the abovementioned leading firm Lvneng is located in Anyi County, Jiangxi Province.[9] The government of Anyi established a cooperative to coordinate land transfers. Under this system the local government helps farmers to transfer their land based on a formal contract rather than an oral

[9] The information about Anyi County and Lvneng Company was found at http://www.ncrbw.cn/html/2015-06/08/content_236866.htm?div=-1, accessed January 25, 2016.

agreement. The local government also convinced farmers to sign a long-term (five years or more) contract instead of the current one-year contract.

According to the owner of the Lvneng Company, this new system has guaranteed land-management rights for the long term. The company can feel secure enough to expand its business based on a long-term perspective. By the end of 2014, Lvneng had obtained 18,000 mu of land through the new system of land transfers.

The third role of local government in the formation of AFTI clusters is the creation of local brands in the primary, secondary and tertiary sectors, or as a whole. This point will become particularly important if leading firms are not powerful enough to formulate their own branding strategies.

For example, Shangyou County is a typical agricultural area with substantial ecological resources in Jiangxi Province. The agricultural population of Shangyou is 277,000, accounting for 86.3 % of the total.[10] The local government of Shangyou has formulated various branding strategies to make this cluster famous.

The first involves participation in as many of the various contests held by central government as possible. This has resulted in the name of Shangyou being found in many rankings on ecological issues. The following titles are some typical cases:

- China's most attractive ecotourism county
- China's best cultural ecotourism destination
- China's low-carbon tourism model county
- China's top 100 influential cultural tourism county
- National first green energy model county
- National leisure agriculture and rural tourism model county
- National ecoprotection and construction model county
- National top 10 ecoteas county
- National top 10 culture ecoscenic spots (for Doushui Lake scenic spots in Shangyou)

[10] The information about Shangyou County was found at http://www.jxshangyou.com/tt/201512/t20151205_312800.htm; http://www.ganzhou.gov.cn/zwgk/zwdt/bmdt/201508/t20150803_853211.htm, accessed January 25, 2016.

- National beautiful village (for Shaduan Village, Shexi Town, in Shangyou)
- Jiangxi leisure agriculture model spot (for Meishui Xiangyuan Village in Shangyou)

The second strategy is to build the brand image of Shangyou by stressing the strong linkages between the agriculture and tourism sectors, such as sightseeing, health and culture. The local government promotes Shangyou using the slogan "Go to the green water and blue mountains in Shangyou." The government also publicizes the health benefits of local teas, creating a famous local brand, Shangyou Green Teas.

The fourth role of local government is to support the development of the tertiary sector in order to increase the number of consumers and tourists, and strengthen backward linkages in the cluster.

There are two approaches. The first is to provide transaction and transportation infrastructure to the cluster to enable the more efficient marketing of agricultural products. As Table 2.4 suggests, local governments have established physical marketplaces and logistic centers in various clusters.

The second approach is to hold tourism festivals. For example, since the 2010s the Daye government in Hubei Province has held various festivals such as a peach blossom festival, a vegetable picking festival and a lotus festival.[11] During the peach blossom festival of 2015, more than 90 restaurants and 48 agricultural product booths participated. The Daye government also began the China Rural Garden Expo in 2014. During the period between September and October, a million tourists visited the garden expo and generated total income of over CNY350 million.

The fifth role of local government is to support the development of the secondary sector in order to increase the value added of agricultural products and strengthen forward linkages in the cluster. Currently, China's leading firms generally do not have strong processing capabilities. The processing rate of agricultural products is a mere 55 %, which is much lower than that of developed countries (80 %). In the case of meats,

[11] The information about Daye County was found at http://www.hsdcw.com/HTML/2015-5-26/712619.HTM, accessed January 25, 2016.

the rates are 17 % and 60 %.[12] Local government must therefore do more to support leading firms and increase processing rates.

A typical case is Heze in Shandong Province, China's most famous peony cluster.[13] There are 120 peony processing-related leading firms located in this city. The local government of Heze plans to grow the city into a huge cluster with multiple functions, including pharmaceuticals and chemicals, chemical pollution, food processing, nutrition and health, arts and crafts, industrial tourism and ecological protection. For this purpose the Heze government has established relations with more than ten universities and research institutes. It has also established China's first peony application research institute, the Sino-America Peony Bio-technology Research Institute. There are currently 20 peony-related research projects in Heze.

2.6 Conclusion

China's AFTI clusters have emerged as a result of two government policies—namely, the agricultural industrialization policy and the rural tourism policy. The efforts made by the central government for the revitalization of the rural economy, combined with the New Normal, have finally resulted in the emergence and flourishing of AFTI clusters in China.

At the local level, both leading firms and local governments have played crucial roles in the development of these clusters. Leading firms not only organize farmers and process agricultural products using new machines and technologies, but also endeavor to develop tertiary sectors through the construction of sales networks and tourism services. Local governments have also played key roles by inviting leading firms, improving land-

[12] The information about processing rates was found at http://www.crr.gov.cn/articleContent?parentId=35&sonParentId=35&articleId=1921, accessed January 25, 2016.

[13] The information about Heze City was found at http://epaper.dezhoudaily.com/dzrb-hz/html/2015-10/16/content_2_9.htm, http://news.iqilu.com/shandong/yuanchuang/2015/1014/2571936.shtml, accessed January 25, 2016.

transfer systems, providing infrastructure (e.g. marketplaces), holding festivals and creating local brands.

According to Ding (2011), there are three main strategies of regional development in China. The first is to develop the local economy by providing industrial parks and inviting outside foreign firms. The second strategy is to stimulate the development of commercial sectors by providing marketplaces that facilitate the search and matching between numerous local small businesses and distant market buyers. The third strategy uses industrial clusters dominated by state-owned or local government-supported leading firms. From the analysis of this chapter, it is clear that AFTI clusters are the result of a combination of the abovementioned three patterns.

In 2015 the Chinese government again stressed the indispensable role of leading firms in the development of AFTI clusters (Table 2.2). Because of strong government support and growing organizational capabilities, leading firms are expected to play increasingly active roles in China's AFTI clusters. Accordingly, the role of local government will gradually be reduced to the provision of local public goods.

Lastly, it must be pointed out that from the perspectives of both leading firms and local governments, the development of AFTI clusters in China remains unbalanced. In some clusters, backward linkages are more obvious, while in other clusters, forward linkages are stronger. This suggests that China's AFTI clusters may have two directions in the future. The first is one in which the cluster is formed primarily by generating backward linkages that develop the tertiary sector. In this case, the industrial cluster will create more value added by fostering tourism, culture and creative industries. The other direction is where the cluster is formed primarily by generating forward linkages so that the secondary sector develops more efficiently. In this case, the industrial cluster will create more value added in the industrial sectors, such as food processing and biotechnology.

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3

The Agriculture-Food-Tourism Industry Cluster in the Republic of Korea: The Formation and Growth Factors of Clusters in Regional Agriculture

Youkyung Lee

3.1 Introduction

The industrial development of the Republic of Korea has been promoted by hub-development model industrial policies under state initiatives focused on "selection" and "concentration." The basis of these initiatives is the theory of external economic effects through industry accumulation (Marshall 1920), which states that outcomes such as economies of scale are achieved through the formation of a labor market for skilled workers and peripheral industries, as well as the establishment of divisions of labor when enterprises in the same industry accumulate in a region. Industrial estates are a typical example of this, and the economy in the Republic of Korea was founded on the development of industrial estates accumulating

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the required labor and capital for the textile, petrochemical, steel, shipbuilding, automobile, electrical and electronics industries in specific regions.

However, with the emergence of developing nations and the arrival of a knowledge-driven economy based on information, technology and innovation, the demand for clusters with sufficient competitiveness to generate innovation has increased as growth through the simple accumulation of labor and capital was limited. In these situations the Roh Moo-hyun presidency, inaugurated in 2003, took "regional innovation" as a slogan for its public policy and set the establishment of a regional innovation system as its first policy agenda. As a result the formation of clusters in every economic and social field was promoted, and the same approach was taken in regional agriculture and rural development.

In the field of regional agriculture, a government program to develop "regional agriculture clusters"—that is, cooperative systems established around the industrialization of specialized items (regional resources) among production, processing and distribution agents in agriculture and universities, research institutes and governmental agencies to produce synergistic effects for the agricultural industry—has been promoted recently.

Incidentally, Michael Porter (1998) defined a cluster as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities." That is to say, a cluster that generates innovation and has a competitive advantage is not only a simple, geographical group of associated enterprises and institutions but also involves the close association among those agents as an essential factor, and how this association is formed defines the formation and development of a cluster.

Therefore, in this chapter, I shall examine the characteristics and present conditions of governmental cluster programs in regional agriculture in the Republic of Korea, taking the Boseong Green Tea Cluster as a representative case study, and I shall identify the formation and growth factors necessary to a regional agriculture cluster through an analysis of a cluster's configuration elements in its development process.

3.2 Regional Agriculture Clusters in the Republic of Korea

3.2.1 The Background to the Emergence of Regional Agriculture Clusters

The concept of a regional agriculture cluster in the Republic of Korea emerged under the conditions detailed below.

First, the full-scale operation of the regional government system saw a rise in the demand for strategies to contribute to the development of the regional economy. The regional government system in the Republic of Korea has been in place since the first local elections held in June 1995. This system emphasized the administration of regional areas and brought a new focus on rural tourism to discover and utilize unique regional resources and to develop businesses specializing in regional products.

Second, reconstruction measures for regional industries were desired in order to correct regional gaps. The Republic of Korea had achieved strong economic growth under a centralized administrative framework led by the state during the 1960s and 1970s. Consequently, economic growth was focused on limited areas and fields, such as the metropolitan and industrial areas, resulting in regional gaps. The Republic of Korea's GDP in 2002 was notably high in Seoul (21.9 %) and Gyeonggi Province (21.1 %), followed by South Gyeongsang Province (6.8 %), North Gyeongsang Province (6.6 %) and Busan (6.1 %). Significant regional gaps were obvious, and to improve this situation the enhancement of local governance and the reconstruction of regional industries were demanded. The regional agriculture cluster program appeared to be an effective approach in response to these demands.

3.2.2 Details of the Regional Agriculture Cluster Program

Regional agriculture clusters appeared as a part of agricultural policy in the Republic of Korea when the Regional Agriculture Cluster Promotion Measure was announced in the Comprehensive Agriculture, Rural Strategy (Ministry of Agriculture and Forestry 2004). In this strategy a regional agriculture cluster is defined as

> An assembly of agricultural industry to innovate regional agriculture by the development of an organic network of agricultural industries including production, processing, storage, etc., regional universities (agriculture universities), agricultural research institutes, and the local government such as cities and counties in a specific region, namely, industries, academia, research institutes and government, and through the appropriate use of existing resources.

The objective of these regional agriculture clusters is to enhance the overall competitiveness of regional agricultural by linking production-based agriculture to secondary and tertiary industries, thereby generating new added value and employment opportunities. Further, the cluster's most significant role in this development is to assemble various agriculture-related agents, both in and outside the region, and, at the same time, establish a cooperative relationship between them. Therefore policy support is provided for the implementation of a platform to mutually obtain and share information among industries, academia, government agencies and research institutes. Simultaneously, support for regional agriculture brand development, research and development (R&D), cooperative marketing and the preparation of shared facilities are provided (Lee 2013).

The regional agriculture cluster program was introduced as a model business, but its necessity and effect were recognized, and the business scope and range were expanded, with its promotion continuing to the present even after two changes of title—to the Regional Strategy Industry Development Program (2009–2011) and then the Wide-Area Cluster Development Program (2012 to present).

3.2.3 Current Situation Regarding Regional Agriculture Clusters

The number of targets selected as subjects for the regional agriculture cluster policy by the central government were 20 in 2005, 22 in 2008, 12 in 2011 and 12 in 2013, making a total of 66 targets, and support has been provided for their development.

According to the business evaluation of regional agriculture clusters (Industry-Academic Cooperation Foundation, Chung-ang University

2012) conducted in 2012 (Table 3.1), in relation to the operating models of regional agriculture clusters, business association models driven by business associations composed of enterprises and farms make up the majority with 29 cases (54 %), while local government-driven models account for 37 % of the total with 20 cases. These business-operating agents largely impact the continuity of the business. For example, while all projects categorized as business association-driven models remain in business, 60 % of local government-driven and university/institution-driven model businesses were aborted. This tendency is particularly evident in simple business-type models of production and processing, and it is considered to be caused by poor business outcomes and a lack of structural organization (owing to formation of the operating business association in

Table 3.1 Regional agriculture clusters by operating agent

Unit: case, %

Category		Business Association-driven	Local Government -driven	University/ Institution-driven	Total	
					Case	Rate
Production/ Distribution		16	8	4	28	52%
Processing		11	7	1	19	35%
Tourism Theme Model		2	5	0	7	13%
Total	Case	29	20	5	54	100%
	Rate	54%	37%	9%	100%	

Source: Compiled by Y. Lee referring to "A study on the validity of the development of industrial complexes for the food industry by inter-regional road areas," Industry-Academic Cooperation Foundation, Chung-ang University (2012)

Notes:
1. The table was prepared based on interview surveys conducted on each business association
2. Business association-driven models are operated and managed by business associations composed of participating enterprises and farms as the operating agent
3. Local government-driven models are primarily operated and managed by regional officials with local governments, including cities and counties as the operating agent
4. University/institution-driven models are operated and managed by universities and research institutes as the operating agent
5. In a tourism theme model, a specific theme is set and related various experience programs (e.g. traditional craft making, rice planting orientation, etc.) are planned and operated for the business

order to receive the subsidy). For these reasons the continuity of business in local government-driven and university/institution-driven models is regarded as an important issue.

On the other hand, based on calculations by the Ministry of Agriculture, Food and Rural Affairs, the government invested a total of KRW103.6 billion in 52 business associations from 2005 to 2009, and overall annual sales increased by up to KRW378.2 billion in comparison with those prior to the implementation of the program. This is recognized as the result of encouraging related agents in the region to participate in the commercialization of agriculture products, processed goods and technology development from the planning phase, and providing opportunities for linking rural industries to the regional culture and tourism industry. The next plan is to promote the development of processed goods for overseas markets and identify new market opportunities by linking regional agriculture clusters developing across the country to national food industry clusters.[1]

3.2.4 The Characteristics of the Regional Agriculture Cluster Program

The agriculture industry has traditionally aimed to secure a safe food supply and established related institutions to support regional agriculture production, such as agricultural cooperatives, the Agriculture Technology Center (extension), rural public corporations (infrastructure development) and agriculture advisory offices for the construction of production support systems that meet specific regional characteristics. That is to say, various agriculture-related agents are geographically proximate and concentrated owing to the inherent agricultural characteristics of the immobility of land and the suitability of farm products to particular climates.

[1] The South Korean Food Valley development project is a national food cluster project that aims to develop estates that accumulate domestic and foreign food businesses, research institutes and related industries in one location in preparation for the future expansion of the global food market. The masterplan was determined in July 2012, the introduction and organization of various facilities were planned to be executed by 2015 and full-on operation from 2016.

The "regional agriculture cluster" promoted by the agricultural administration of the Republic of Korea utilizes the above characteristics to form a cluster by assembling agriculture production-related agents spread out across a region in an organic network. It is based on the concept of a total system for the development of new products and technology, and the generation of new businesses through interagent communication within a cluster. The direction of this cluster formation is unlike that of other famous examples of industry clusters, such as the Californian wine cluster or Silicon Valley, which developed naturally, focusing on a specific region on the basis of competitive advantages. The development process is opposite to that of general industry clusters, with various factors required for cluster formation being provided by government support to encourage their development.

3.3 The Creation of a Regional Agriculture Cluster and Its Formation and Growth Factors: Case Study of the Boseong Green Tea Cluster

As mentioned, the agricultural administration of the Republic of Korea supports the development of regional agriculture clusters. However, as clusters disappear, in many cases, with the end of subsidiary programs, it is necessary to identify and supplement the conditions necessary to enable the effective formation and continued operation of clusters.

The strength of a cluster lies in its ability to generate innovation. Innovation is not simply created from the association of agents but is also achieved by building relationships among agents within a cluster. These relationships are established through the free flow of information within the cluster, trade and transactions that produce added value, the desire to cooperate, and motivation to improve. In other words, success in the formation and continued operation of a cluster is solely dependent on the establishment of these relationships.

Factors for the formation of a cluster with a competitive advantage are described in Michael Porter's cluster theory. However, the dynamic aspect of how these formation factors are developed is not mentioned.[2]

For the agricultural administration of the Republic of Korea to continue the political support of cluster development in the future, it is necessary to identify the development process of the interagent relationships within a cluster. Therefore, in this section, I shall examine the Boseong Green Tea Cluster in South Jeolla Province, Republic of Korea—selected as a target for the regional agriculture cluster business at the start of the initiative—, as a case study in order to analyze how the mutual relationships among the associated agents were formed as part of the cluster formation and development process and to identify the essential factors for the formation and continuance of clusters.

3.4 An Overview of the Boseong Green Tea Cluster

3.4.1 Boseong County, South Jeolla Province

Boseong County, South Jeolla Province, has a population of 45,349 (of which 15,182 were citizens over the age 65 as of December 2015) and is a typical rural area. Located in the mid-western region of the southernmost area of the Republic of Korea, it is rich in tourism resources, with mountain areas and lakes inland, and a coastline with about 2200 islands in the southern part of the county. The region is the largest tea producer in the country, with a tea-production area of 1062 ha (as of 2014), which accounts for 36 % of the total acreage devoted to green tea production in the Republic of Korea and 42 % of all domestic production. The annual mean temperature is 13.4 °C and the annual mean rainfall is 1400 mm. Its climate is characterized by frequent misty days and the landform is suitable for tea production. The green tea fields in Boseong

[2] On this, Harada (2009) has presented the utility of the use of Annalee Saxenian's concept of a regional industry system.

County in particular were developed through the cultivation of land in the 1960s, resulting in terraced fields covering the mountain slopes.

The area under tea cultivation in Boseong increased from the 1960s to the 1970s owing to exports to Japan, but by the mid-1990s dramatic decreases were observed in both acreage and farmers as a result of the impact of the "Fake Tea Issue" in 1976, a fall in demand and decreased production caused by cold weather damage. On the other hand, with the rise of the well-being movement and health consciousness from the late 1990s, the production area again expanded with the increased demand for green tea (110 ha in 1970 to 885 ha in 2005). However, the "Pesticide Green Tea"[3] issue in 2007 caused a rapid drop in green tea consumption. Moreover, with the increase in coffee consumption in recent years, the demand for green tea continues to drop, leading to a reduction in green tea production.

3.4.2 The Trigger for the Development of the Boseong Green Tea Cluster

In 2002, Boseong Green Tea was registered as the first geographical indication in the Republic of Korea and the region gained wide national recognition as a green tea production area. In addition, the terraced green tea field (approximately 700 ha) scenery was selected as a filming location for popular television dramas and commercials at the time, and it received much attention as a tourist attraction. As a result of these factors, Boseong County decided on a plan to grow green tea as a specialized regional product, which was eventually implemented when the plan was selected for the regional agriculture cluster project for 2005 by the central government. The development of the cluster was initiated by assembling green tea-related agents in the region (a total of KRW12.4 billion was invested over three years), and steps were taken to organize a tea-production platform and to set up a cooperative processing facility, establish a regional

[3] "Pesticide Green Tea" is an incident related to a television report in 2007 that claimed that the green tea in tea bags contains high levels of pesticides. This incident is said to have ignited marked distrust among consumers and gave rise to a boycott movement.

brand, diversify into tea and processed goods and further the R&D of functional products.

The cluster project was composed of green tea-related forward and backward agents within the region including Boseong County (local government) and the Tea Producer Incorporation, tea-processing vendors, the Chonnam National University, the Tea Laboratory and the Agricultural Technology Institute. A dedicated division was established in Boseong County Office to direct the overall operation, and an innovation committee (composed of 14 representatives from the participating organizations) for the consolidation of the opinions of all related agents and for decision-making was established and set in motion.

The region was designated as the Special Industry Zone for Green Tea in 2007. In addition to support provided for the improvement of production and processing capabilities as a green tea production area (e.g. cooperative tea-processing facilities), orientation programs including tea picking and tea ceremonies were run alongside the development and management of green tea railway tourism products. Coordination with the region's cultural resource, Pansori (traditional music) and tourism resources, such as the local beaches, was also pursued. Income expansion for local residents and the development of the regional economy have been addressed to date by collaboration between the green tea, culture and tourism industries.

3.4.3 The Roles of Agents in the Green Tea Cluster

As for the roles of each agent, the Boseong Green Tea Producer Incorporation and the Boseong Organic Farming Tea Producer Cooperative Incorporation oversee tea production and quality management, introducing a sensory evaluation system and traceability system to ensure thorough quality control with the aim of producing safe and high-quality green tea. The Tea Laboratory and the Agricultural Technology Institute direct tea production technology and the development and popularization of new varieties of tea, while Chonnam National University provides support in the development and extension of green tea-processing technology as well as management assessment and consulting, and the processing vendors address the development and production of diverse processed green tea products.

The leader of the project, Boseong County, manages the certification of "geographical indication" and hosts green tea industry-related seminars, farmer training and development, tea ceremony training and meetings. It also functions as the main channel for communication among the associated agents. In addition, it stages events to attract domestic and foreign tourists, hosting regional festivals through political coordination with the tourism industry.

3.4.4 The Economic Effect of the Boseong Green Tea Cluster

The aim of the cluster is the development of the regional economy and income expansion of farming households by attracting domestic and foreign tourists with regional festivals combining green tea and regional culture resources. The economic effects of these approaches are described below.

Table 3.2 shows the trend in sales and the number of visitors for green tea-related businesses in the Boseong Green Tea Cluster. Overall sales have increased from KRW78.1 billion in 2012 to KRW86.1 billion in 2014. (The rates of change increased from 2.4 % to 7.6 %.) The

Table 3.2 Trend in sales by and the number of visitors to green tea-related businesses

Category	2012	2013	2014	Rate of change 2012–2013 (%)	Rate of change 2013–2014 (%)
Sales (KRW billions)	78.1	80.0	86.1	2.4	7.6
Processing vendor income	5.1	4.9	4.9	−3.9	0.0
Farmer income	40.6	36.7	35.0	−9.6	−4.6
Festival income	32.4	38.4	46.2	18.5	20.3
Number of visitors to special industrial zone for green tea	1,195,553	1,307,700	1,487,311	9.4	13.7

Source: Compiled by Y. Lee from relevant materials provided by Boseong County Green Tea Research Institute breakdown shows a downward trend in sales for green tea processing and production as a result of the slowdown in demand for green tea, but a significant increase can be observed for sales from regional festivals. This festival income includes admission fees and orientation fees. Farmers are securing additional income beyond the existing production and processing business boundaries by participating in the region's festivals, hosting tasting events and selling processed goods. Visitors to the special industrial zone for Green Tea are increasing as a result of these festivals, and this is contributing to regional development.

In addition, the annual number of visitors to the Korea Tea Museum, established in 2010 as a regional landmark, increased from 233,000 in 2012 to 256,000 in 2014.

Besides exhibition rooms presenting the history and culture of tea, the museum operates tea-making orientation programs and tea ceremony classes, thereby raising annual sales of KRW32.840,000. The orientation programs for tea picking, tea making, tea ceremonies and processed goods production, in particular, are extremely popular. Tea farmers and local residents participate in such programs as guides and operators.

Furthermore, the purchase of fresh tea leaves enabled by the establishment of cooperative tea-processing facilities has led to a reduction in processing costs and the realization of consistent, high-quality tea processing. The annual participation of 250 local residents in the care and management of the approximately 700 ha of terraced tea fields is also generating employment opportunities.

3.4.5 Growth Factors for the Boseong Green Tea Cluster

The Existence of Central Resources

Boseong County is one of the leading green tea production areas in the Republic of Korea. Public recognition of the county as a tea production area is strong, with Boseong being widely equated with green tea. Systematic organization, such as the geographical indication and establishment of the special industry zone for green tea, is one of the factors contributing to this recognition.

The county has established the position of green tea as a special local product and, in addition to its use in tea production and processing, green tea-linked product development and new businesses are being pursued in various fields, such as the green tea beach, which utilizes tea leaves, and the breeding of tea leaf-fed green pork and green beef.

The Continuous Promotion of Business by the Local Government

Boseong County has established green tea as the region's special product and has continuously promoted this business. In 2005 in particular, an independent and dedicated division, the Green Tea Foundation, was established within the county administrative division to direct the planning and promotion of green tea-related businesses within the region as the special zone for green tea, in addition to the regional agriculture cluster project. In 2010, the Green Tea Foundation was elevated to become the Green Tea Industry Division and has since been working to strengthen coordination with related divisions such as the Culture and Tour Division and the Economy and Industry Division.

Generally, political business projects run by administrations have the disadvantages of being short term. However, through the consistent approach demonstrated above, the administration has enabled planning and execution of business centered on green tea to be coordinated with related industry divisions, and has gained the trust of associated agents participating in the business, including tea-producing farmers, tea-processing vendors, universities and research institutes. Consequently, the administration has achieved cooperation among tea-producing farmers and processing vendors with regard to its vision of a green tea cluster and the government-hosted seminars and festivals.

Networking Between Associated Agents

When looking at the relationships between associated agents in the development process of the Boseong Green Tea Cluster to date, we see that the project first focused on organizing a platform with which to establish green tea fields within the region as a "tourism resource," and providing unilateral support to the tea farmers through the distribution of aid.

With the launch of the regional agriculture cluster project in 2005, the Innovation Committee (platform) was established and so-called "interorganizational learning " started through regular meetings and seminars, as well as networking events in which tea production-related forward and backward agents can exchange and share information related to tea production, processing and sales (from 2005 to 2009). Since the end of the regional agriculture project, the administration has continued to hosts various seminars, meetings and gatherings to provide communication opportunities for the associated agents, and it has continued to act as coordinator in these communications, supporting smooth communication among the agents.

Through this interorganizational learning, the challenges facing each agent have been shared, and cooperative approaches aimed at problem resolution have been taken. For example, green tea farmers faced the challenge of the deterioration of tea quality as a result of inadequate organic cultivation know-how and aging processing facilities, while processing vendors had to determine how to secure a stable supply of high-quality raw tea. Measures to address both issues were subsequently implemented. First, a cutting-edge cooperative tea-processing facility was established. The challenges faced by farmers with regard to aging facilities were resolved by this, and tea-processing vendors found a way to secure a stable supply of high-quality raw materials. In addition, measures were implemented with regard to the selective breeding of old tea plants and the popularization of improved varieties by farmers and the Tea Laboratory.

Along with these approaches, Boseong County has been providing farmers with opportunities to participate in training programs on cultivation technology, consumer needs and business management, and to visit leading production sites, while universities and research institutes have been focused on the development of organic tea cultivation technologies and processed product-related technologies (noodles, breads, oils and sauces using green tea), as well as research on the functionality of green tea. In promoting businesses linked with tourism resources, tea farmers, tea ceremony masters and regional residents have cooperated in orientation and tourism programs as supervisors and business agents.

With regard to the need for publicity for regional brands and tourist attractions, the administration has been publicizing the Boseong Green Tea Brand via media such as television, newspapers, magazines and exhibitions. A business project gains strong mutual complementarity through the enhancement of trust brought about by the repetition of such interorganizational learning, and this contributes to the growth of the cluster (Fig. 3.1).

Furthermore, the internal solidarity (internal networking) of each agent is essential in the continued association of agents within a cluster. Tea producer associations involved in tea production and processing, such as the Boseong Green Tea Producer Incorporation, the Boseong Green Tea Incorporation and the Boseong Organic Farming Tea Producer Cooperative Incorporation, establish structures through which to share high-quality tea-cultivation technologies and production know-how. Therefore they retain incentives for new members to join these organizations, such as obtaining information from participation, technology and quality improvement through technical competition among producers through

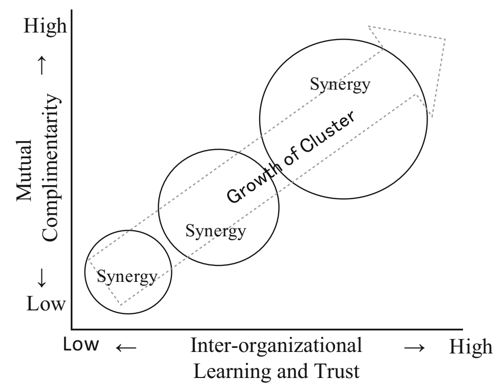

Fig. 3.1 Relationship of interorganization learning, trust, and mutual complementarity in cluster development (*Source*: Y. Lee. *Note*: Circles indicate synergistic effects and the arrow indicates the development of the cluster)

regular competition fairs, production cost reductions through the cooperative purchasing of organic materials, and the acquisition of global organic certifications (European Union, USA, Japan). As a result, the Boseong Green Tea Producer Incorporation was able to increase its membership from 174 in 2005 to 589 members in 2014, the Boseong Green Tea Incorporation from 17 to 45 enterprises, and the Boseong Organic Farming Tea Producer Cooperative Incorporation from 17 to 22 members, and these organizations continue to uphold the cluster.

3.5 Conclusion

This analysis of the Boseong Green Tea Cluster as a case study in relation to the formation and growth factors of regional agriculture clusters in the Republic of Korea has revealed a number of issues, as follows.

The existence of central resources, continuous local government support and networking among associated agents (i.e. interorganizational learning and mutual complementarity) have been confirmed as important factors in the formation and growth of a cluster. These factors allow the development of mutual trust among associated agents through consistent and continual business promotion and organizational learning, allowing the cluster to develop into a business with strong mutual complementarity. Currently, green tea production in Boseong has been in decline in terms of the production volume and the number of farmers since 2007. However, within the green tea cluster, events such as tea picking and orientation tours outside tea production are undertaken at production sites through the coordination of the green tea and tourism industries, and the diversification of business is possible through collaboration with regional cultural and tourism resources. The economic effect of the tourism business, including regional festivals, is greater than that of the tea production and processing sector, and its contribution to the economic development of the region is significant.

As observed above, the development of agents (coordinators) and a supportive foundation (platform) for each agent, as well as the construction of a system for the establishment of mutual relationships among agents, are essential in order to continue and promote, through political support, the formation and growth of regional agriculture clusters.

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4

The Agriculture-Food-Tourism Industry Cluster in Japan: Case Studies of Tourism Industry Clustering in Okinawa and Aichi

Teppei Yamashita

4.1 Introduction

This chapter clarifies the effectiveness of the sequence theory by applying it to the case of Okinawa in Japan for developing the tourism industry cluster. It analyzes the increase and decrease in tourism numbers and finds that a big event such as an international exposition causes a structural change in the tourism industry. The event is given as a case of a shift from Step I (agglomeration) to Step II (innovation) in the flowchart approach.

The purpose of this study is to clarify the effectiveness of the sequence theory developed as a gradual development model of the local economy by incorporating it into case studies of tourism development in Japan.

The economy of sequence is a hypothesis that the economic effect will increase if a sequential order of the inputs is followed correctly. In developing countries in Asia, rapid growth of the macroeconomy has been realized by arranging the factors for socioeconomic growth in a compressed and multilayered way. However, at the same time, the

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widening of domestic income gaps, environmental issues and the primary discontinuation of culture/traditions have become obvious. At this point, three issues have arisen. The first is the response to the external diseconomies that occurred as a result of the rapid growth of the macroeconomy, as described above. The second issue is the unclear relationships (continuity) among the factors for socioeconomic growth. The third is the validation of the degree of their contribution as factors for socioeconomic growth. Concerning the first issue, it is not touched on in this section because it has already been positioned as the most important issue in the development of developing countries. Concerning the second issue, Kuchiki (2007) attempted an analysis by using sequence theory (see Fig. 4.1).

The analysis qualitatively classifies the factors and the development of the formation processes of industrial clusters in Asia. As shown in Fig. 4.2, a study in relation to the sequence of the processes has been developed in the form of a flowchart approach, with the arrangement of the development stages and the order of the factors as a process leading to the innovation and creation of clusters (Kuchiki 2012).

In Step I the added value occurs because the food industry cooperates with the agriculture industry in the area. Generally in Asia, a food

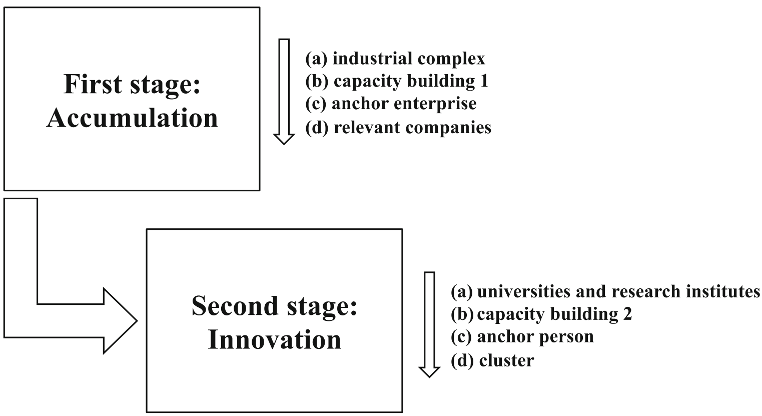

Fig. 4.1 A flowchart approach (*Source*: Created by T. Yamashita based on Kuchiki (2012))

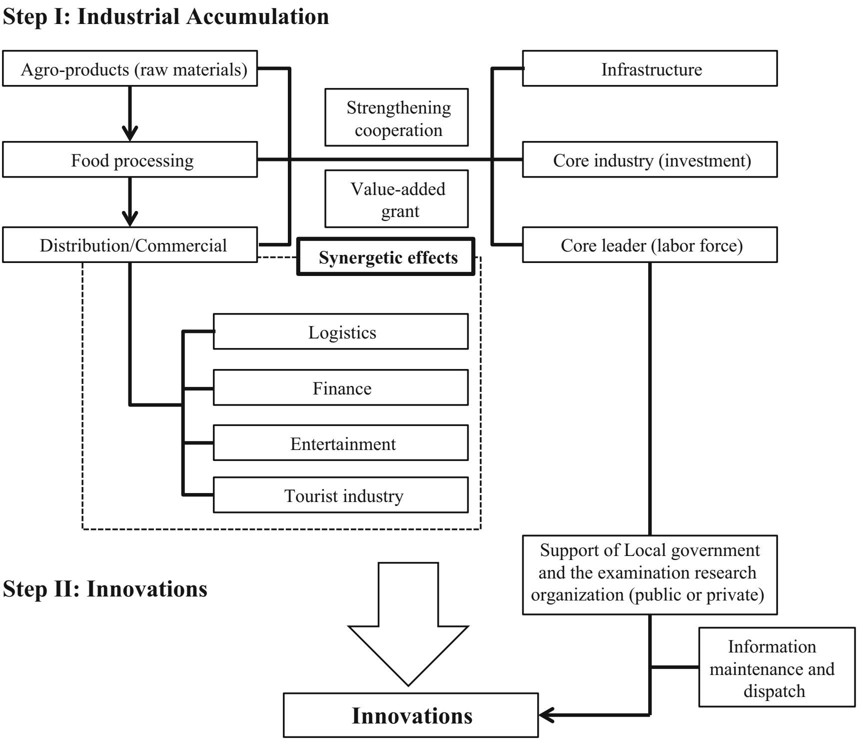

Fig. 4.2 From industrial accumulation to innovations combining agriculture, food and tourism (*Source*: Mizobe (2015))

company procures agricultural products from local rural farmers. Therefore the cooperation with agriculture and the food industry has various impacts on development, such as the effective inflection of local resources, a steady supply of the food in the level and a self-sufficiency ratio improvement. Step II involves innovation to push forward agriculture, a meal, cooperation and integration of the sightseeing continuously.

In Sect. 4.2 I classify basic cultural factors in the stage of accumulation of "cultural" factors (Step I: accumulation) by applying the sequence theory model described above to tourism development, which is considered as an emerging sector in Japan. Based on this, in Sect. 4.3 I refer to case studies in Aichi, where an international event was stage and an international airport was opened at the same time. In Sect. 4.4 I identify and analyze future issues.

4.2 Tourism Development and Culture

4.2.1 The Background to Tourism Development in Japan

Past tourism development in Japan is summarized below. The Basic Act for Promoting a Tourism-Oriented Country went into effect in January 2007, and the Basic Plan for Promoting a Tourism-Oriented Country was approved in a Cabinet meeting in June 2007 for comprehensive and systematic promotion towards a tourism-oriented country. In addition, the Act on the Partial Revision of the Ministry of National Land and Transportation Establishment Act for the establishment of the Tourism Agency was enacted on April 25, 2008, and the Tourism Agency was established in the Ministry of Land, Infrastructure, Transport and Tourism on October 1, 2008.

There are various considerations forming the background to these actions, such as the expectations of Japan to activate local economies through tourism development and to realize local regeneration through an increase in its tourism capacity (Mizuno 2011), great expectations for a ripple effect on other industries through tourism consumption (Hibino et al. 2009), and an increase in efforts to make use of the social need to seek spiritual richness, local revitalization and cultural resources, including historical architecture in tourism development, in order to move towards community creation and the development of local industries (Kakiuchi and Okuyama 2009) and so on.

4.2.2 Cultural Components: Case Studies in Okinawa

According to Kuchiki (2012), Okinawa's food culture and entertainment were fostered under the historical and traditional contexts of the Ryukyu Dynasty, and the innovations that created tourism resources (tourism clusters) were developed through its natural beauty, including the sea in Okinawa (Okinawa Churaumi Aquarium), health and healing powers.

Behind these were investments in large-scale social-related capital projects (roads, ports and airports in particular) under the Act on Special Measures concerning the Promotion and Development of Okinawa of 1971, and the intensive promotion of the tourism industry, the information and communications industry, and the international distribution bases industry under the Okinawa Promotion and Development Special Treatment Act of 2002. In addition, the provisions for obligations to develop cultural/environmental activities (the conservation of scenic landscapes and the conservation/regeneration of the natural environment, etc.), international cooperation and international exchanges were established. Moreover, the 26th G8 Summit (the Kyushu-Okinawa Summit) was held in 2000, which attracted attention as Japan's first summit to be held in a regional city. In this way, "culture" formed the basis for tourism resources. To transform the culture into tourism resources as tourism clusters, infrastructure investments were made and events to raise public awareness were held. As a result, the number of tourists exceeded 5 million in 2005 and has been increasing steadily, with 5.48 million as of January 2012 (Fig. 4.3).

Regarding the various tourism resources in Okinawa, the cultural components of food, music, history, fabrics, crafts, art, resorts, alcoholic beverages, festivals/dances, religion and architecture, as well as the increase in the number of tourists, are classified in Fig. 4.4. Furthermore, Table 4.1 lists examples of mainly special food products of Okinawa.

4.2.3 Cultural Components: Various Areas of Japan and Central Vietnam

Cultural components in various areas of Japan are classified in Table 4.2 using the same categories described in the previous paragraph. The table shows that factors that can become tourism resources have become accumulated in various areas. Therefore it can be considered that all areas have potential tourism resources.

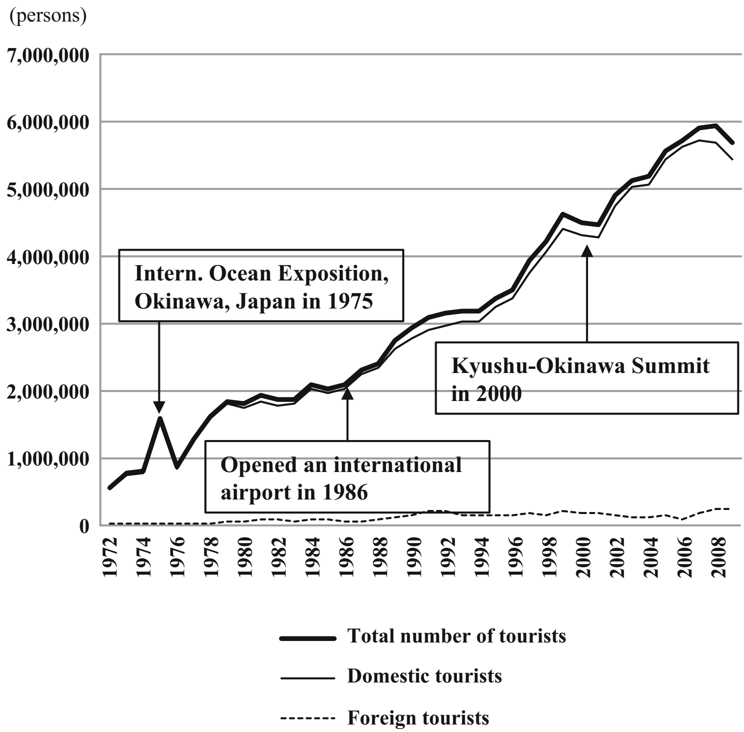

Fig. 4.3 The number of tourists to Okinawa (*Source*: Created by T. Yamashita based on http://www.pref.okinawa.jp/toukeika/)

Concerning the examples in Okinawa again, I should like to focus on two impacts: the improvement of the airport infrastructure and Kyushu-Okinawa Summit. In Okinawa, which consists of isolated islands, airports and ports are a major part of the transportation infrastructure. Tourists from other prefectures and foreign countries cannot visit Okinawa without it. Thus, obviously, the improvement of airports is the most important issue in terms of tourism development. In addition, Okinawa gained publicity when it staged a major international event: the Kyushu-Okinawa Summit.

In the next section I refer to the case studies in Aichi, which held an international event and opened an international airport at the same time,

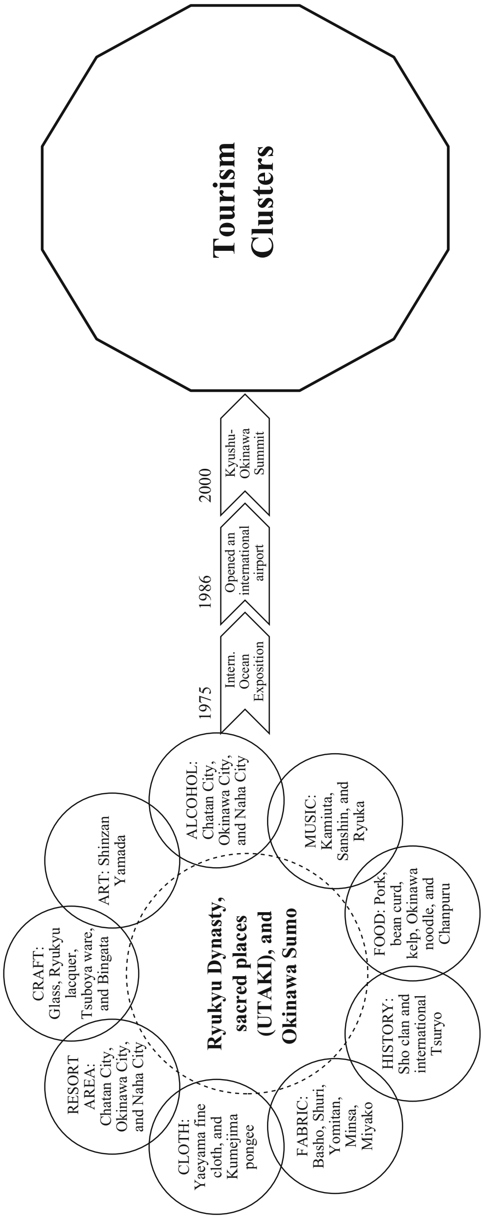

Fig. 4.4 The Ryukyu Dynasty's tourism cluster (*Source*: Created by T. Yamashita based on Kuchiki (2012))

Table 4.1 The AFTI cluster in Okinawa, Japan

Products	Type	Number	Point in time
Seaweed	Producers	489	August, 2009
Goya vegetable	Farms	–	n/a
Turmeric	Farms	239	end of 2009
Black sugar	Factories	7	end of 2010
Ishigaki beef	Farms	20	April, 2011
Motobu beef	Farms	1	April, 2011
Tuna	Cultivators	1	April, 2011
Rice brandy Awamori	Firms	48	Industrial survey in 2008
Beer	Firms	3	Industrial survey in 2008
Okinawa soba noodle	Firms (members)	21	Cooperative of Okinawa's noodle producers
Mango	Farms	–	n/a
Salt for food	Firms	23	Industrial survey in 2008

Source: Department of Logistics, Okinawa Prefecture (April 30, 2011)

and already had sufficient access (Shinkansen and expressways, etc.) at that time.

4.3 Overviews of Aichi, Nagoya City, the Expo and Central Japan International Airport

4.3.1 Aichi

Urbanization in Aichi has increased compared with the national average. However, among the prefectures having large urban areas, Aichi has a large percentage of forest and agricultural land, has relatively lush greenery and uses its marginal land. The estimated population is 7.415 million people (as of April 1, 2012), which places it fourth in Japan after Tokyo, Kanagawa and Osaka prefectures. The gross prefectural product is JPY31.855 trillion, which is third in Japan after Tokyo and Osaka. According to the classification by industry, tertiary industries account for more than half and secondary industries for about a third.

In particular, the share of the manufacturing industry is extremely large compared with that of other prefectures. The shipment value of

Table 4.2 Cultural components in various areas of Japan

Southern	Okinawa	Miyazaki	Kagoshima
Basic cultural factor	Ryukyu Dynasty, sacred places and Sumo	Himuka Myth Road	Satsuma Domain and Sakurajima
Food	Pork, bean curd, kelp, Okinawa noodle and Chanpuru	Local chicken dishes, Miyazaki beef and pumpkin	Satsuma-age and Black Berkshire pork
Music	Kamiuta, Sanshin and Ryuka	Folk songs and Imogarabokuto	
History	Sho clan and international Tsuryo	Amanoiwato, Ito Family and tumulus	Shimazu Family
Fabric	Basho fabric, Shuri fabric, Yomitan fabric, Minsa fabric, Miyako fine cloth, Yaeyama fine cloth and Kumejima pongee	Diagonal cloth	Oshima pongee
Craft	Glass, Ryukyu lacquer, Tsuboya ware and Bingata	Hyuga lacquer (from Okinawa), Go board and Go stone	Satsuma ware
Art	Shinzan Yamada	Eikyu	Seiki Kuroda and Western paintings
Resort	Chatan City, Okinawa City and Naha City	Ebino Plateau	Ibusuki
Alcohol	Awamori (distilled spirit)	Buckwheat shochu (distilled spirit)	Satsuma shiranami
Festival/dance	Eisa, finger flute, Ryukyu dances and combination dances		Kirishima Ondo
Religion	Shisa (lion statues)		
Architecture	Castle		

Northern	Niigata	Hokkaido	Miyagi
Basic cultural factor	Snowy area, rice-producing region and sake-producing region	Ezo and Ainu	Provincial office of Mutsu Province and the Oshu Fujiwara clan

(*continued*)

Table 4.2 (continued)

Northern	Niigata	Hokkaido	Miyagi
Food	Rice, rice cakes, rice biscuits, green soybeans and northern shrimp	Corn, seafood, potato, ramen and mutton barbecue	Rice, green soybean paste, oyster, ox tongue, shark fin and sasa kamaboko (boiled fish paste)
Music	Sado Okesa and Yoneyama Jinku	Boraraika, Tonkori and Umatonkori	Tairyo Utaikomi and Sansa Shigure
History	Kenshin Uesugi and Kanetsugu Naoe	Ainu culture, Samkusaynu and development in the Meiji period	Masamune Date
Fabric	Ojiya cloth, Shiozawa pongee,	Ezo cotton	Sendai fabric
Craft	Murakami wooden red lacquer and paulownia cabinets, Echigo Yoita striking edge tool and stainless Western tableware	Glass art and woodcarving	Kokeshi and Sendai cabinets
Resort	Echigoyuzawa, Myokokogen, Sado,	Niseko, Furano, Shiretoko, Asahikawa, Otaru, Kushiro and Hakodate	Matsushima, Zao and Nakayamadaira
Alcohol	Hakkaisan and Koshinokanbai Shimeharitsuru, and Kubota	Beer	Ichinokura, Yukinomatsushima and Uragasumi
Festival/dance	Nagaoka Festival	Yosakoi Soran Bushi and Sapporo Snow Festival	Sendai Star Festival

(*continued*)

Table 4.2 (continued)

Northern	Niigata	Hokkaido	Miyagi
Religion	Yahiko shrine, Hakusan shrine and the largest number of shrines in Japan	Hakodate Orthodox Church in Japan and natural beliefs	Shiogama shrine and Kinka mountain
Architecture	Bandai bridge, Takada castle and Shukunegi	Goryokaku, clock tower and Otaru canal	Taga castle and Aoba castle site

Central	Kanagawa	Aichi	Osaka
Basic cultural factor	The city opening a port, Keihin manufacturing district and coast/ mountain	Military commanders, Chukyo manufacturing district and neophilia	Merchant city, the Kitchen of the Nation and Kamigata culture
Food	Chinese dumplings, Miura radish, curry, shirokoro grilled pork offal, young sardines, sanmamen and processed fish paste	Nagoya food	Octopus dumplings, fried skewer, okonomiyaki, Kansai-style udon and grilled squid
Music	Yokohama City song, Red Shoes and Danchone Bushi	Okazaki Gomangoku	Kawachi Ondo and Rokko Oroshi
History	Yoritomo Minamoto, Hojo clan and Shinden Yoshida	Nobunaga Oda, Hideyoshi Toyotomi, Ieyasu Tokugawa, Okehazama historic battlefield and Nagakute historic battlefield	Naniwa no Nagara no Toyosaki no Miya, Hideyoshi Toyotomi, tumulus and rice market in Dojima
Fabric	Scarves	Bishu and Nagoya Yuzen	Woven carpet, Senshu towels and cotton short-fiber fabrics

(*continued*)

Table 4.2 (continued)

Central	Kanagawa	Aichi	Osaka
Craft	Hakone Zaiku, Oyama spinning top, Odawara lantern and Shibayama lacquer ware	Akazu ware	Naniwa tin ware, Ranma carving, Senshu paulownia cabinets and Osaka pâper-maché
Resort	Hayama, Shonan, Tanzawa, Hakone and Yugawara	Toyokawa, Toyota, Gamagori, Inuyama and Komaki	
Alcohol	Beer	Kiyosuzakura brewing	Amanosake
Festival/dance	Hiratsuka Star Festival	Owari Tsushima Tenno Festival and Konomiya Hadaka Festival	Tenjin Festival and Danjiri Festival
Religion	Kawasaki Daishi, Samukawa shrine and Tsurugaoka Hachimangu	Toyokawa Inari and Iga Hachimangu	Sumiyoshi shrine and Shitenno temple
Architecture	Landmark tower, foreign cemetery, Odawara castle and Sankeien	Nagoya castle, Okazaki castle, Inuyama castle, Joan and Konren temple	Osaka castle, Tsutenkaku and Tower of the sun

Chugoku and Shikoku	Hiroshima	Ehime
Basic cultural factor	Mori clan, Onomichi kite and Itsukushima shrine	Iyo hot spring and naval forces
Food	Okonomiyaki (food grilled on an iron plate), Onomichi ramen, oysters and Momiji manju	Japanese orange, Iyo orange, sea bream rice, octopus rice and five-colored somen
Music	Atsumori-san	Uwajima Sansa
History	Motonari Mori and Kiyomori Taira	Soseki Natsume and pilgrims (Shikoku)
Fabric	Bingo pongee	Imabari towels
Craft	Kumano brush, Hiroshima Buddhist altar, Miyajima Zaiku and Fukuyama harp	Tobe ware and Ozu Japanese paper

(*continued*)

Table 4.2 (continued)

Chugoku and Shikoku	Hiroshima	Ehime
Resort	Fukuyama, Onomichi, Hiroshima and Miyajima	Dogo Onsen and Uwajima
Alcohol	Kamotsuru	Umenishiki
Festival/ dance	Portable shrine event in Tadaumi no Gion Festival	Niihama Drum Festival and Matsuyama Festival
Religion	Itsukushima shrine and Aki Monto	Uwatsuhiko shrine, Ishite temple, Taisan temple and Oyamazumi shrine

Source: Created by T. Yamashita

manufactured goods of business establishments with four or more employees is JPY38.2108 trillion—the highest in Japan for 34 consecutive years. Concerning the shipment value of manufactured goods, according to the classification by type of business in order of the highest shipment value, these are transport machinery, iron and steel, groceries and plastics.

4.3.2 Nagoya City

In Nagoya City the construction of the castle of Ieyasu Tokugawa, who took power in the country at the Battle of Sekigahara, started in 1610. Along with this, warriors and common people in Kiyosu migrated to the city and an urban area was created. Nagoya City subsequently became the center of the Owari Domain as the main castle town of the three privileged branches of the Tokugawa family, and the fourth largest city after Edo, Osaka and Kyoto. With a prosperous economy between the Meiji period and early Showa period, the city continued steady development as a commercial and industrial center, and it staged the Nagoya Pan-Pacific Peace Exposition in 1937.

In addition, the city rapidly launched projects for reconstruction plans after the Second World War, such as the construction of a 100 m-wide road and the relocation of cemeteries to Heiwa Park, which enabled it to establish its current base. Takenaga (2011) characterized Nagoya City as follows: (1) Nagoya City used to be an industrial city and the base of the manufacturing industry led by Toyota. (2) Therefore it had a poor viewpoint, or rather no viewpoint, as a tourism city. This led to a lack of awareness of the abundant potential tourism resources. (3) Accessibility to the airport, Tokyo, Kansai (Kyoto, etc.), Takayama and Nagano is an advantage for Nagoya City. A wide-area tour from Nagoya City can be promoted based on the aspect of transportation. (4) After the Expo, Nagoya became known throughout the country. However, this was not based on its attractiveness as a tourism city. It can be considered that innovation in tourism is called for, based on these four characteristics.

According to a survey entitled "The assessment of the tourism in Nagoya on a nationwide basis" conducted by Nagoya City, there are various reasons for visiting Nagoya, such as "visit family and friends (32.4 %)," "visit sightseeing facilities (30.7 %)," "shopping (28.5 %)" and "business (27.8 %)." In addition, regarding the recognition of Nagoya asked about in the same survey, these included "Nagoya food (71.5 %)," "military commanders associated with Nagoya and historical sites/heritage of Owari-Tokugawa (62.4 %)," "Atsuta-jingu shrine (53.1 %)," "Higashiyama zoo (41.1 %)" and "Sakae (40.6 %)." Based on these, it can be said that the major attractions of Nagoya are its food and history.

4.3.3 The Expo

The period of the 2005 World Exposition, Aichi, Japan, was between March 25, 2005 and September 25, 2005—185 days. The main areas were Nagakute-cho, Toyota City and Seto City. There were two venues: Nagakute and Seto. Visitors could travel between the two venues using a gondola. With the main theme of "Natural wisdom", the Nagakute venue had the basic structures called the "Global commons (Overseas pavilion)" and the "Global loop (air corridor)" realizing the "Global large exchange." The Seto venue was a symbolic zone that embodied the theme of "Natural wisdom," with the utmost consideration being given to the conservation of the natural environment. The final official number of visitors was 22,049,554.

There were no adjacent parking areas but a park & ride system was implemented. This transportation system reduces traffic congestion and the environmental impact of traffic by making visitors park their cars in spaces provided by the Expo and take a shuttle bus from there to the venues. The parking spaces were set up over a wide area, from Toyota City to Nagoya Airport in Toyoyama-cho. It took about 15–35 minutes to the venues using the expressway. In the case of train travel, a shuttle bus and Linimo were available from Banpaku Yakusa station, the closest station to the Expo. In addition, to increase transportation capacity, extra direct trains were provided between Nagoya station and Banpaku Yakusa station during the Expo period. Moreover, direct shuttle buses were provided between Nagoya station and the venues.

4.3.4 Central Japan International Airport

Central Japan International Airport (Centrair) was opened on February 17, 2005 and is located on the Ise Bay in Tokoname City in the Chita Peninsula, 35 km to the south of Nagoya City, Aichi. It is the third largest offshore airport after Nagasaki Airport and Kansai Airport, and it provides services 24 hours a day so that flights can arrive and depart at a convenient time according to the local time. In addition, cargo can be transported smoothly because late-night arrivals and departures are exclusively for cargo transportation. Moreover, thanks to the long runway (3500 m), direct flight services with larger passenger numbers and cargo loads for distant cities (e.g. US east coast, Southern Europe and North Africa) are available.

It takes about 30–40 minutes by car from Nagoya City to Centrair using the Nagoya Express Way, Chita Peninsula Road and Centrair Line. The parking spaces directly connected to the terminal building are available 24 hours a day so that users can freely enter/exit early in the morning or late at night. In the case of train travel, it takes around 28 minutes from Nagoya City using the Nagoya Railroad. In addition there are buses connecting various cities in Chubu, ships providing routes to Tsu and Matsuzaka and taxies. There are about 110 shops in the terminal building and various events (e.g. a guided tour using Segways) are held there, which actively gather airport users other than those taking an airplane.

In Aichi, the airport was opened in 2005, the same year as the Expo. According to the graph prepared using the statistical data regarding the users of tourism recreation published by the Tourism Convention Department of Aichi prefecture, it was found that the number of users had significantly increased in three areas (Nagoya, Northern Owari and Chita/Eastern Kinuura) since 2005. In particular, Northern Owari experienced a typical temporary impact (Fig. 4.5).

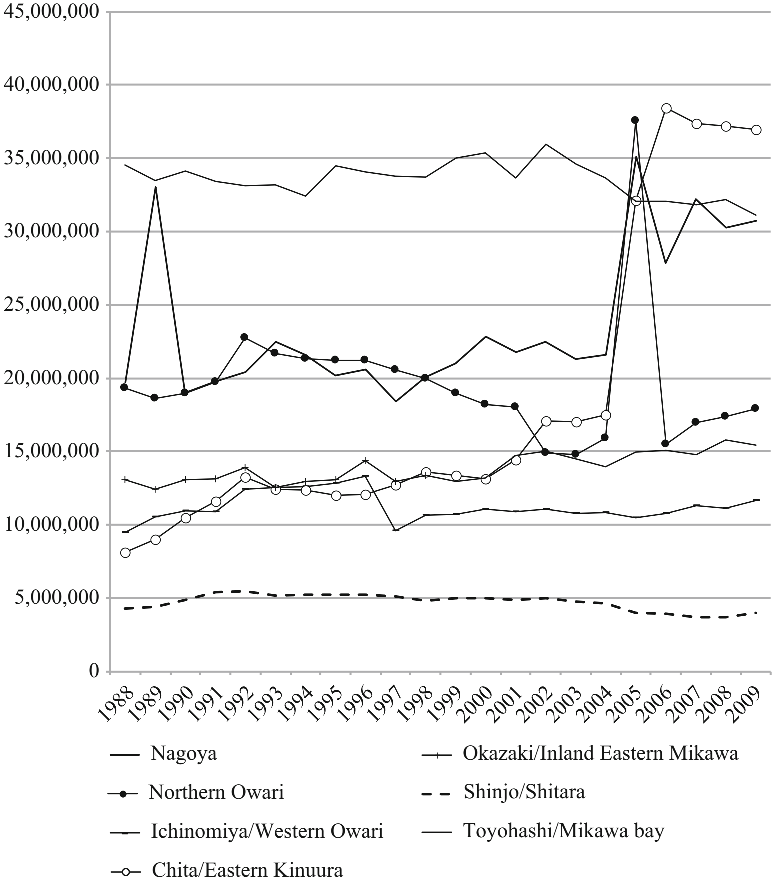

Fig. 4.5 The statistical data regarding the users of tourism recreation (*Source*: Created by T. Yamashita based on "Sightseeing recreation user statistics in 2010" http://www.pref.aichi.jp/0000085398.html)

4.4 Future Issues

First, there is the issue of the short-term nature of events. It has been clarified that a long-term improvement in accessibility is a primary factor for the formation of tourism clusters, but this revealed another issue—that is, how to continue the impact of events. We hope that this issue will be a temporary issue in the way that the radiation issue of the Great East Japan Earthquake was, but there are also likely to be other negative events so this should not be assumed.

Second is the issue of "pull" and "push" factors. Chita/Eastern Kinuura has secured a large number of tourists as a result of things. Chita/Eastern Kinuura offers good examples of potential recreation resources (marine sports, etc.), which were discovered through improving accessibility and good publicity. These have produced a strong pull effect. On the other hand, the number of tourists in the Toyohashi, Mikawa Bay, Shinjo and Shitara areas has gradually been declining. The development of tourism resources around these areas encouraged a push effect (or throughput). From the original perspective, a tourism cluster is designed to improve a region's ability to attract customers as a result of the connections between the surrounding tourism resources. However, the examples highlighted in Aichi are not necessarily part of a tourism cluster.

Third, there is the issue of differentiating between targets of domestic tourists and those of foreign tourists. Most foreign visitors are from Asian countries, especially China (including Taiwan and Hong Kong) and the Republic of Korea. Among the tourists between January 2012 and May 2012 (about 2.36 million people), the number from China (including Taiwan and Hong Kong) was about 1.02 million and the number from the Republic of Korea was about 0.6. In addition, more than 60 % of them visited Tokyo, 26.1 % Osaka and 24.0 % Kyoto for sightseeing (according to an investigation by the Japan National Tourism Organization in 2010). That is, considering foreign tourists, it appears that the main part of the Visit Japan campaign was achieved via the pull effect of these three prefectures. In order to avoid dependence on this structure, it is necessary to break away from the existing approach.

Lastly, in future it will be necessary to make a comparison of the basic factors—that is, the cultural components—and to make a precise comparison between the opening of airports and the holding of events in various areas. In addition, as described in the third issue, it is difficult to counter the influence of the three large cities (Tokyo, Osaka and Kyoto) using the current approach. Therefore it is necessary to formulate a political policy to transform tourism resources into a cluster as a sightseeing area in Chubu. The enhancement of the support network is necessary to respond to these issues. The support network is composed of the technology development of the product corresponding to the person of actual demand needs, supply and demand information, and collection and delivery of a variety of information including the customer information about the manufacture. These support projects require initiative of the public–private cooperation involve a research organization.

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5

The Agriculture-Food-Tourism Industry Cluster in Okinawa, Japan: The Key Role of an Airport in Clustering

Koh Kikuchi

5.1 Introduction

New Ishigaki Airport, the gateway to the Yaeyama region, was opened in March 2013 with a 2000 m runway. Aircraft departing from the airport do not have weight restrictions, so transits at Naha Airport and Miyako Airport are no longer required, and medium-sized jets can be operated.[1] This new airport has the potential to bring major changes to tourism and logistics in the Yaeyama region, which includes both Ishigaki Island and Iriomote Island.

[1] The old airport had a 1500 m runway from which only small jets could be operated. Furthermore, small jets could not take off or land carrying a full load. There were also weight limits on freight for aircrafts departing from the old airport, and flights departing for areas outside Okinawa had to fly via Miyako Airport or Naha Airport. Note that passenger capacity is 150 for a small jet and 230 for a medium-sized jet. The flying time for direct flights is three hours and 30 minutes for inbound flights, and two hours and 40 minutes for outbound flights. It takes four hours and 20 minutes for both inbound and outbound flights with a transit stop.

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Okinawa is a unique area of Japan because it is located at the southern border of the temperate zone and the northern border of the tropical zone. Okinawa comprises more than 160 islands (when those of at least 0.01 sq. km are counted) scattered across an area which stretches 1000 km from east to west and 400 km from north to south. The Yaeyama region is located close to Taiwan. Iriomote Island is famous, even within Okinawa, for its ocean resort activities, such as sea kayaking and snorkeling. It is rich in nature and represents the sole habitat of the Iriomote wild cat (*Felis iriomotensis*).

This chapter examines the impact of placing the construction of New Ishigaki Airport ahead of other infrastructure development in the Yaeyama region. In so doing so it focuses specifically on Ishigaki Island and Iriomote Island. The sequence of economic policies implemented after the construction of the airport is also examined in the context of tourism development. Based on this investigation, I conclude that the next step in the sequence is the development of transportation access from the airport to the center of Ishigaki Island. For Iriomote Island, the next step is tourism marketing.

5.1.1 Possible Sequences in the Yaeyama Region

The Yaeyama region, and Iriomote Island in particular, has been the subject of many studies focusing on environmental issues as well as tourism development and regional development.[2] The major findings from these studies can be summarized as follow. Sato (2008) pointed out the importance of incorporating elements of tourism in regional development. In remote islands in particular, where population decline is an issue, tourism is important for regional development. The people as well as goods that flow into the islands from outside as a result of tourism development have positive effects.[3] In addition, Kuchiki (2014) has stated that infrastructure development could trigger the reorganization of

[2] The focus in this chapter is on regional development by means of tourism. Environmental issues are not discussed.

[3] In some cases, people from outside Okinawa resettle in the Yaeyama region, working as helpers in guest houses or tour guides, eventually becoming members of the regional society.

existing industries. He sought to develop an industry cluster policy based on sequence analysis. Yamashita, Hashimoto and Kuchiki (2013) argue that the development of an airport is an essential element in forming a tourism industry cluster. Based on a case study of Central Japan International Airport, they show how the development of an airport leads to the sequential development of other infrastructure, which in turn leads to the formation of a tourism industry cluster and the subsequent stimulation of the regional economy. The construction of New Ishigaki Airport was prioritized above other infrastructure development in the Yaeyama region in a similar manner to Central Japan International Airport. It is hoped that economic development based on the sequential implementation of regional development will also occur in the Yaeyama region.[4]

According to Kuchiki (2007), a certain timeframe is needed to form an industrial cluster, with not everything being formed simultaneously. The organizations sections that play a central role in formation of the industrial cluster are formed first, followed by other necessary bodies. Innovations are only generated after the formation of these key organizations, leading to cluster formation. There is a particular order in which the organizations sections should be formed, and an industrial cluster is established by setting and linking each one of these in an efficient manner. This sequence is developed on the basis of local needs. I examine this sequence with a focus on the case of New Ishigaki Airport.

The Ripple Effect of New Ishigaki Airport Across the Yaeyama Region

The Okinawa Prefecture (2014) estimated that the economic ripple effect of tourism consumption in the prefecture for the fiscal year 2012 was JPY676.7 billion. It is also estimated that tourism has created 81,041 new

[4] Central Japan International Airport provides a good example of how rebuilding (and improving) an existing regional airport can trigger sequential development. New Ishigaki Airport is not an extension of an existing airport; it is an airport which was relocated and newly constructed. It is anticipated that infrastructure will be put in place in the future, leading to a reorganization of the existing facilities. Since there is the possibility that existing facilities may be reorganized around New Ishigaki Airport, we used sequence analysis in this chapter in support of tourism development on Ishigaki Island.

jobs. The increase in the number of tourists has had various economic benefits to Okinawa. When viewed in the context of the sequence mentioned by Kuchiki, the opening of New Ishigaki Airport has created the potential for new developments in the Yaeyama region.[5] This sequence starts with the establishment of an airport, followed by industrial infrastructure development, including the construction of access roads. According to Chen et al. (2014), the opening of international airports in Hong Kong and Singapore contributed not only to the development of tourism but also to economic development. The tourism industry grew with the development of the economy, which in turn strengthened the economy as a whole, leading to further improvement in infrastructure and facilities. As a result, the tourism industry increased further, following the path of sequential development of the economy. The Yaeyama region has the potential to follow a similar path.

As mentioned above, direct services are now offered from the Kanto and Kansai regions since the opening of New Ishigaki Airport. Visitors have easy access to Taketomi Town, which comprises a number of unique islands, including Kohama Island, the location of a popular television drama. Taketomi Island (Photo 5.1) has organized streetscapes under landscape ordinance, and Iriomote Island offers visitors rich natural scenery and a variety of fun activities. Iriomote Island in particular is striving for sustainable tourism through locally driven tourism development instead of development driven by major travel agencies.

As shown in Fig. 5.1, an issue inherent to the old Ishigaki Airport—that is, the clash between tourism and agriculture, hindered the formation of a cluster on Ishigaki Island. Summer is the peak season for shipping fresh pineapples, which coincides with the high season for tourism. Aircraft would be required to carry mainly tourists' luggage, resulting in the accumulation of fresh pineapples which could not be shipped off the island. This issue was resolved by the opening of New Ishigaki Airport. Reorganization and the formation of a cluster is expected to follow in the Yaeyama region, with the airport serving as the core.

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[5] The main regional divisions of Okinawa are the main island of Okinawa, the Miyako region and the Yaeyama region. Ishigaki Island and Iriomote Island fall under the latter.

Photo 5.1 Landscape of Taketomi Island (*Source*: Taken by K. Kikuchi, September 13, 2012)

The number of tourists by month in the Yaeyama region since 2001 is summarized in Table 5.1. A general upward trend can be observed from 2001 to 2008, despite a number of ups and downs. The number of tourists peaked in 2008 at 782,749. However, after the 2008 financial crisis, the number fell from 2009 to 2011, before increasing again in 2012 and reaching 557,684 by September 2013. The total number of tourists in 2013, the year when New Ishigaki Airport was opened, was 942,964. This was a significant increase from the number in 2012 (713,058). A further increase was observed in 2014, with 1,121,622 tourists visiting the region.

The Sequence After the Opening of New Ishigaki Airport and Its Impact

The airport, which serves as the core for tourism development in the Yaeyama region, has been relocated. However, access from the airport to

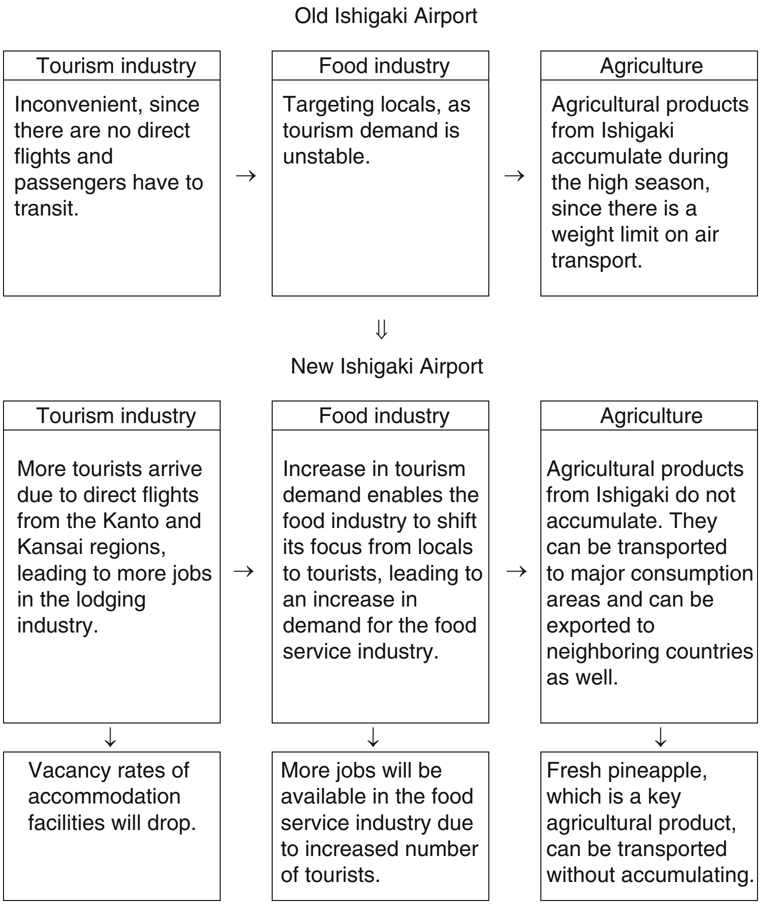

Fig. 5.1 Potential of AFTI clusters in the Yaeyama region (*Source*: Developed by K. Kikuchi)

the city center remains inadequate. New Ishigaki Airport is located far from the city center. Tourists must rely on bus transportation to go to the airport, with the bus schedule being based on flight departure and arrival times. This is not convenient for tourists because there are only two flights per hour. Furthermore, tourists do not use local buses on regular routes when they tour around Ishigaki Island because those buses are run to serve local people. Many tourists rent cars to tour the island. To drive between the airport and the city center, cars mainly use the existing National

Table 5.1 The number of tourists to the Yaeyama region by month

	January	February	March	April	May	June	July
2001	43,623	49,113	64,451	49,735	42,013	43,646	54,979
2002	41,401	51,904	69,560	50,738	45,224	45,215	52,412
2003	45,573	53,207	77,165	53,850	52,159	49,960	64,440
2004	53,570	61,767	76,893	70,028	55,859	52,934	65,645
2005	57,859	60,558	76,779	69,291	57,373	56,822	67,053
2006	61,421	63,825	82,626	71,978	56,585	54,402	63,104
2007	63,378	67,628	85,119	69,988	50,813	54,997	72,832
2008	55,913	61,202	76,027	73,047	57,837	59,246	74,966
2009	53,852	55,906	74,181	63,656	48,655	58,901	79,751
2010	47,710	56,337	69,834	60,558	59,123	59,742	74,678
2011	47,049	52,461	56,553	50,530	47,580	55,053	69,367
2012	38,055	46,749	58,796	72,055	58,831	59,478	82,435
2013	44,214	50,560	77,866	85,333	71,396	77,609	102,408
2014	56,676	69,666	87,520	109,604	104,621	103,689	116,564

	August	September	October	November	December	Total
2001	65,348	42,077	42,910	43,898	37,185	578,978
2002	62,648	44,347	47,961	54,263	47,689	613,362
2003	67,338	57,567	60,121	61,963	52,951	695,681
2004	64,528	57,604	53,347	56,050	47,552	715,777
2005	66,791	63,176	62,206	59,675	53,599	751,182
2006	70,818	59,779	67,782	65,139	54,379	771,838
2007	75,586	64,726	64,047	66,207	52,181	787,502
2008	81,647	63,825	70,051	58,815	50,173	782,749
2009	77,740	68,233	57,302	50,895	43,522	732,594
2010	77,675	68,562	59,481	49,884	42,051	725,635
2011	69,277	64,446	63,038	46,282	38,874	660,510
2012	76,152	65,133	55,682	53,144	46,542	713,058
2013	114,684	105,388	83,648	67,085	62,773	942,964
2014	131,471	119,957	91,262	68,646	61,946	1,121,622

Source: Developed by K. Kikuchi based on the "Statistics on Tourism in Yaeyama, Okinawa Prefecture". http://www.pref.okinawa.jp/site/somu/yaeyama/shinko/documents/documents/kankoutantou. html. Accessed 1 July 2015

Highway Route 390. Cars must pass through residential areas such as Ohama, Miyara and Shiraho before arriving at the airport. A new prefectural road, Route 214, is currently under construction and is due to open in 2017 as a new access road. It is expected to reduce the time required to drive between the airport and the city center by 13 minutes.

Signs of economic development, as shown in Fig. 5.2, have begun to emerge on Ishigaki Island since the opening of the airport. The policies

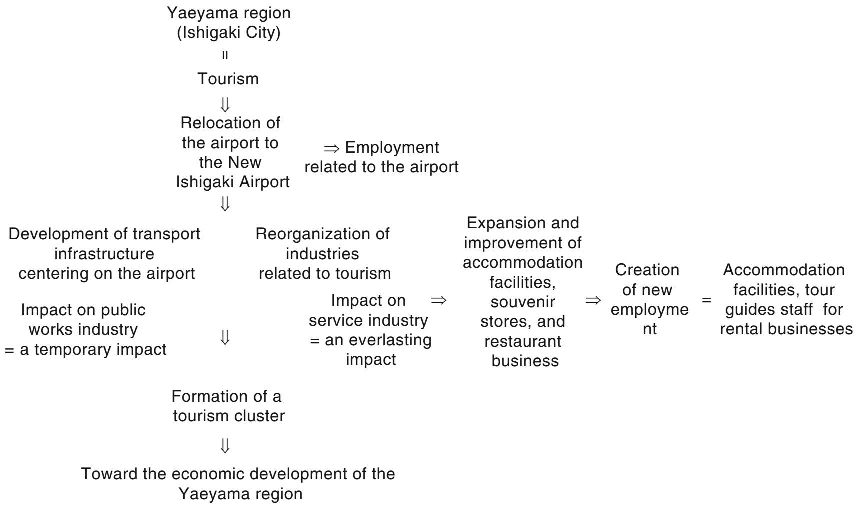

Fig. 5.2 The impact of the relocation of the airport to New Ishigaki Airport on the Yaeyama region (*Source*: Developed by K. Kikuchi)

underpinning this development are based on the "Master plan for city planning in Ishigaki City – Striving to be a city of nature and culture in the southernmost place in Japan" (Ishigaki City [2]).

If the number of tourists increases, so will the demand for souvenirs. New souvenir stores must be developed to meet the increased demand, and souvenir products must be produced in larger quantities. However, tourists would not spend more money if conventional products were simply produced in larger quantities. The point is to expand the depth and range of the souvenir products on offer. This means an increase in quantity as well as in the range to be sold, which could lead to the creation of additional jobs.

The existing accommodation is also expected to become insufficient for the growing number of tourists. Therefore the number of facilities must be increased to respond to this growth.[6] A consequence of this would be

[6] In an interview conducted in the summer of 2013 at farm inns on Iriomote Island, some interviewees said that the number of tourists had definitely increased owing to the opening of the new airport. More specifically, tourists who were not able to find accommodation in Ishigaki Island had to stay on Iriomote Island, about an hour away.

further job creation as more workers would be needed to staff the new facilities. In addition, employment would be created for those who can respond to the various needs of tourists, such as nature tour guides for the Yaeyama region. All of these factors imply that more workers will be needed as a result of increasing tourist numbers. These workers must be equipped with the relevant skills. Since these skills will be unique to the Yaeyama region, setting up local venues for technical training and establishing educational institutions to provide professional skills may also have to be considered.

While the impact of New Ishigaki Airport is not yet fully understood, the employment opportunities expected to be created are shown in Fig. 5.3. There is a clear sign of an economic impact when employment is viewed in terms of the active job opening-to-application ratio. Figure 5.4 shows the opening-to-application ratio in Okinawa and the Yaeyama region. In general, the ratio is higher in the Yaeyama region than in

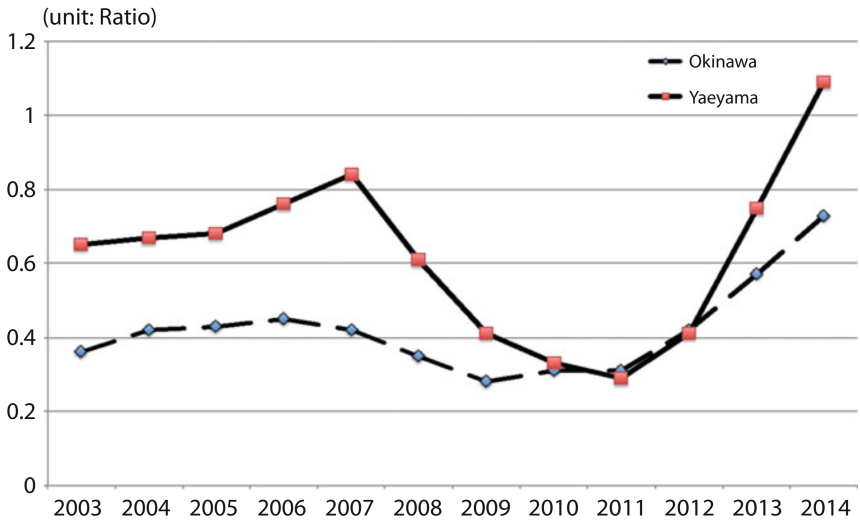

Fig. 5.3 Opening-to-application ratio in Okinawa and the Yaeyama region (*Source*: Developed by K. Kikuchi based on the Okinawa labor bureau's "Monthly report of employment security operations, Okinawa" and Yaeyama public employment security office's "Monthly report on operations, Sangosho (Coral Reef).")

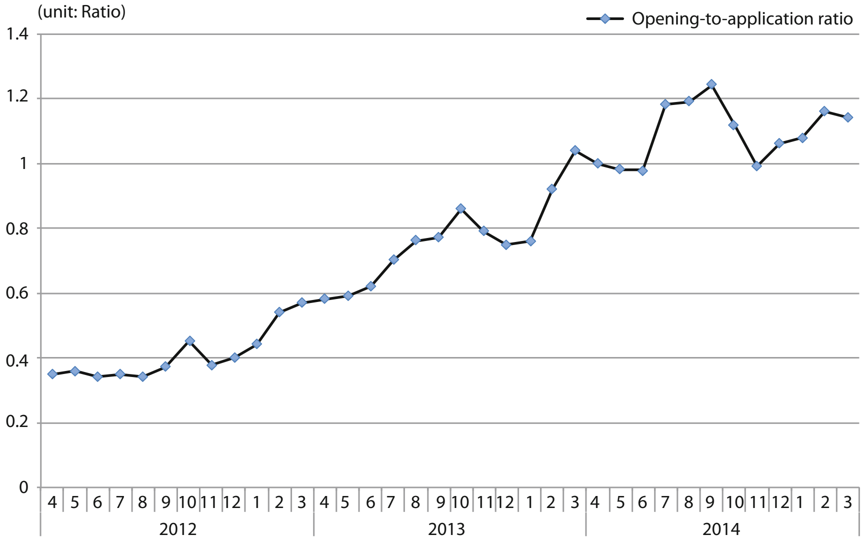

Fig. 5.4 The job opening-to-application ratio in the Yaeyama region by month (*Source*: Developed by K. Kikuchi based on the Yaeyama public employment security office's "Monthly report on operations, Sangosho (Coral Reef)")

Okinawa as a whole. Until recently, however, the ratio has been 1.0 or less, except in the fiscal year 2014, indicating that employment conditions have not been very good. Having identified the trend from fiscal year 2003 to 2014 in Figs. 5.3 and 5.4 shows the opening-to-application ratio in the Yaeyama region in greater detail. An upward trend can be seen in the monthly figures from fiscal year 2012 to 2015. This trend becomes more significant after the opening of New Ishigaki Airport, with the ratio increasing from 0.5 to above 1.2 in September 2014. While the ratio has declined since then, it has not decreased to the level prior to the opening of the airport. Based on the opening-to-application ratio, the impact of the new airport on employment in the Yaeyama region appears to have been significant.

As stated above, the impact of New Ishigaki Airport is unclear apart from the increase in the job opening-to-application ratio. However, the airport is expected to become the core of the tourism industry. AFTI clusters should be developed around an airport, as shown in Fig. 5.3. It can be said that the New Ishigaki Airport has brought about the reorganization of existing tourism-related industries and has impacted the restructuring of AFTI clusters.

5.1.2 New Ishigaki Airport from the Perspective of Tourism Marketing

The Survey Method and Respondents

The opening of New Ishigaki Airport has made it more convenient for tourists from outside Okinawa to visit the Yaeyama region. According to Taketomi Town [3], the number of visitors has increased by 17,405 from 2012 to 2013—that is, before and after the opening of the new airport. Transit via Naha Airport is no longer required. However, since there is no air service to Iriomote Island, visitors must use boats that depart from a remote island terminal on Ishigaki Island. A survey was conducted at this remote island terminal on September 3 and 4, 2014. The main items on the questionnaire included access from New Ishigaki Airport to the central area of Ishigaki City, reasons for visiting Iriomote Island, convenience in visiting Yaeyama, duration of visit, amount of money spent on souvenirs and some personal details.

The questionnaire was returned by 190 respondents. Among them, 84 had visited Iriomote Island. These 84 are the focus of the analysis in this chapter. Respondents' details are shown in Table 5.2. Some 50 (59.5 %) of the 84 respondents who had visited Iriomote Island were women. Those younger than 40 dominated (62, 73.8 %). Some 52 respondents (61.9 %) were from households with three or fewer members, indicating that the majority were from small families. In terms of disposable income per month, 22 respondents (26.2 %) had JPY50,000 or more and 33 (39.3 %) had less than JPY50,000. Surprisingly, 27 respondents (32.1 %) did not have any disposable income, indicating a range in financial circumstances among the respondents. In terms of monthly income, for 38 respondents (45.2 %) the head of the

Table 5.2 The attributes of respondents

		Frequency	Ratio
Sex	Male	34	40.5
	Female	50	59.5
Age	Below 40	62	73.8
	40 and above	22	26.2
Members of household	3 or less	52	61.9
	4 or above	28	33.3
	No response	4	4.8
Disposable income	Less than JPY50,000	33	39.3
	JPY 50,000 and above	22	26.2
	None	27	32.1
	No response	2	2.4
Monthly income	JPY290,000 or less	39	46.4
	JPY300,000 or above	38	45.2
	No response	7	8.3
Region	East Japan	40	47.6
	West Japan	42	50.0
	No response	2	2.4

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

household earned JPY300,000 or more, while for 39 (46.4 %) the head earned less than JPY300,000.

The Characteristics of Respondents by Group

The results of the questionnaire were sorted by group. The groups were then compared and examined in terms of their perceptions regarding the old and new Ishigaki airports, the convenience of New Ishigaki Airport and the amount of money spent on souvenirs in Iriomote Island. A principal component analysis was conducted based on the indicators listed in Table 5.3, and the results of that analysis are shown in Table 5.4.

As shown in Table 5.4, the accumulated proportion of variance for principal components 1–4 was 76.2. For the first principal component, the loading for East Japan and West Japan was 0.88 and −0.87, respectively. Hence this was the principal component concerning "the respondents' home region." The second principal component was "the monthly income of the worker," and the loading for monthly income and worker were both 0.87. The third principal component was "the number of the

Table 5.3 Indicators for the principal component analysis

Sex	Monthly income
Age	East Japan
Members of household	West Japan
Disposable income	Number of visits to Iriomote Island
None	

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

Table 5.4 Principal component loading

	Principal component 1	Principal component 2	Principal component 3	Principal component 4
Sex	0.23	0.20	0.32	−0.62
Age	−0.34	0.47	−0.39	−0.22
Members of household	0.37	0.16	0.67	0.08
Disposable income	−0.20	0.18	−0.16	0.76
Monthly income	−0.39	0.87	0.22	0.06
Worker	−0.39	0.87	0.22	0.06
Unemployed	0.81	0.36	−0.20	0.05
Student	0.41	−0.22	0.58	0.30
East Japan	0.88	0.35	−0.23	0.03
West Japan	−0.87	−0.30	0.21	−0.05
Eigenvalue	3.00	2.20	1.30	1.12
Proportion of variance	30.05	22.02	12.98	11.19

Source: Developed by K. Kikuchi

respondent's household members," with the loading being 0.67. The fourth principal component concerned "the respondents' disposable income," with the loading being 0.76.

Cluster analysis was conducted based on the scores for the four principal components as input indicators. The cluster is shown in Fig. 5.5, and the respondents were classified into the following groups based on the cluster analysis results:

(i) Respondents categorized into the "West Japan, no disposable income" group reside in West Japan. There are many members in

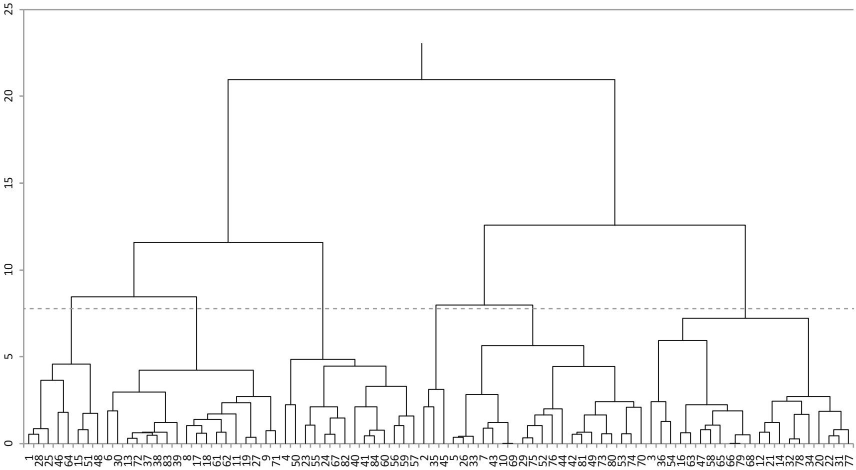

Fig. 5.5 Tree diagram (*Source*: Developed by K. Kikuchi)

their households, and they do not have any disposable income despite their monthly income being at an average level.

(ii) Those categorized into the “West Japan, average monthly income” group reside in West Japan. Their monthly income is at an average level. Households are basically nuclear families comprising a wife and a husband. The number of household members is small, so the amount of disposable income is at an average level.

(iii) Respondents in the “West Japan, low monthly income” group reside in West Japan, and their monthly income is below average. Their disposable income is limited because their monthly income is low. Their households are basically nuclear families comprising a wife and a husband. The number of household members is small.

(iv) Respondents in the “West Japan, many household members” group reside in West Japan. However, unlike the other “West Japan” groups, respondents in this group are young. Their monthly income is at an average level. Since they live with their parents, the number of household members is large. They have more disposable income because their monthly income is at an average level and they live with their parents.

(v) The "East Japan, average monthly income" group resides in East Japan. Households are basically nuclear families comprising a wife and a husband, and the number of household members is small. Their monthly income is at an average level. However, the amount of disposable income is limited.

(vi) Those in the "East Japan, low monthly income" group reside in East Japan. Since they live together with their parents, the number of household members is large. Many respondents in this group are young and their monthly income is below average. The amount of disposable income is limited because their monthly income is low.

The respondents were categorized into these six groups . However, as there were only three respondents who fell into the "West Japan, many household members" group category and could therefore be identified, they were not included in the analysis. In the section below I examine the frequency of visits, issues concerning access and activities participated in by group. Since there were large differences in terms of values for these items, we did not treat them quantitatively; rather, we examined specific differences between the groups.[7]

Perceptions Regarding the Opening of New Ishigaki Airport

The frequency of visits by the respondents to Iriomote Island is shown in Table 5.5. Those who answered that "it was the first time" accounted for 60 % or more of respondents except in the "West Japan, average monthly income" group. For many of the respondents it was their first time and the impact of the opening of New Ishigaki Airport was significant. However, there were some groups that had many respondents who answered that it was the "third time or more." While the frequency was not very high, five respondents (26.3 %) in the "East Japan, average monthly income" group and two (25.0 %) in the "West Japan, no disposable income" group fell into this category.

[7] The analysis was performed using Mac Tahenryokaiseki v. 2.0.

Table 5.5 Frequency of visits to Iriomote Island

	First time		Second time		Third time or more	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
Total	58	69.0	8	9.5	15	17.9
West Japan, no disposable income	5	62.5	1	12.5	2	25.0
West Japan, average monthly income	10	58.8	3	17.6	4	23.5
West Japan, low monthly income	11	78.6	0	0.0	3	21.4
East Japan, average monthly income	14	73.7	0	0.0	5	26.3
East Japan, low monthly income	17	85.0	2	10.0	1	5.0

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

It took around 10 minutes by car from the old Ishigaki Airport to the center of Ishigaki City. Access from New Ishigaki Airport to the city center is less convenient than before because the airport is now located on the outskirts of the city. It takes about 30 minutes by car from the airport to the city center. As explained above, a bypass road for National Highway Route 309, which directly connects the airport and the city center, is due to be completed by fiscal year 2016 because the new airport was opened without resolving the issue of access[8]. The visitors' method of assessing the access to and from New Ishigaki Airport is a matter of concern. This point is summarized in Table 5.6.

Tourists arrive on Ishigaki Island by plane, and then take a boat from Ishigaki Port to visit the remote islands in the Yaeyama region. The future direction of tourism development depends on how the tourists assess the access from the airport to the port. Kuchiki (2013) says that industries accumulate based on the sequential development of infrastructure. The same is planned for the airport, which will act as the core of the transport infrastructure, followed by the development of an access network.

Two groups, namely the "West Japan, no disposable income" group and the "West Japan, average monthly income" group, assessed the access

[8] Details concerning this point are provided in [5].

Table 5.6 Assessment of access from New Ishigaki Airport to the city center

	Less convenient than before		Same		Almost the same	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	4	50.0	1	12.5	2	25.0
West Japan, average monthly income	6	33.3	3	16.7	1	5.6
West Japan, low monthly income	2	14.3	1	7.1	2	14.3
East Japan, average monthly income	5	25.0	1	5.0	4	20.0
East Japan, low monthly income	1	4.8	2	9.5	3	14.3
	Indifferent		**Better than before**		**Other**	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	1	12.5	0	0.0	0	0.0
West Japan, average monthly income	3	16.7	2	11.1	0	0.0
West Japan, low monthly income	3	21.4	2	14.3	1	7.1
East Japan, average monthly income	3	15.0	2	10.0	2	10.0
East Japan, low monthly income	6	28.6	3	14.3	4	19.0

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

as inconvenient (Table 5.6). In other words, a group with no disposable income and a group with an average monthly income expressed the opinion that access is inadequate. On the other hand, the “West Japan, low monthly income” group and the “East Japan, low monthly income” group responded that they were “indifferent” regarding access. This means that groups with an average level of monthly income felt some inconvenience, while groups with lower than average monthly income did not have any complaints. The result concerning access was somewhat unexpected, indicating that those who are economically better off felt greater inconvenience.

Table 5.7 Convenience of New Ishigaki Airport

	Direct flights are convenient		Hasn't changed much	
	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	5	62.5	2	25.0
West Japan, average monthly income	7	38.9	4	22.2
West Japan, low monthly income	6	42.9	1	7.1
East Japan, average monthly income	9	45.0	5	25.0
East Japan, low monthly income	10	47.6	2	9.5
	First-time user		Other	
	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	0	0.0	1	12.5
West Japan, average monthly income	3	16.7	3	16.7
West Japan, low monthly income	2	14.3	2	14.3
East Japan, average monthly income	1	5.0	4	20.0
East Japan, low monthly income	3	14.3	4	19.0

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

Next we summarized the points concerning the convenience of New Ishigaki Airport in Table 5.7. The airport has a 2000 m runway, which allows it to be used by medium-sized passenger planes. Moreover, it is now possible to have direct flights from the Kanto and Kansai regions. Concerning this change, many respondents in all groups answered that "direct flights are convenient." A certain number of respondents did not perceive the change, and two (25.0 %) in the "West Japan, no disposable income" group and five (25.0 %) in the "East Japan, average monthly income" group responded that it "hasn't changed much." However, we can say that access to the Yaeyama region, including Ishigaki Island, has generally become more convenient owing to the introduction of direct flights.

Respondents' Activities in Iriomote Island and Their Evaluation of Those Activities

Accommodation on Iriomote Island is summarized in Table 5.8. In the "West Japan, average monthly income" group, the "East Japan, average monthly income" group and the "East Japan, low monthly income"

Table 5.8 Accommodation facilities on Iriomote Island

	Guest house (including farm inn)		Hotel		Other	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	3	37.5	3	37.5	2	25.0
West Japan, average monthly income	9	50.0	8	44.4	1	5.6
West Japan, low monthly income	3	21.4	6	42.9	5	35.7
East Japan, average monthly income	10	50.0	8	40.0	2	10.0
East Japan, low monthly income	13	61.9	5	23.8	3	14.3

Source: Developed by K. Kikuchi based on the results of the questionnaire survey
Note: Ratios are calculated by excluding nonresponses

group, more than half of the respondents stayed in guest houses (including farm inns). There are only three large resort hotels on the island and most of the accommodation facilities are guest houses run by locals.[9] As a result, few of the respondents stayed in the hotels. Since most tourists stay in guest houses, the income goes directly into the local tourist economy. In the past, concerns have been raised by a major company regarding resort development (The Yaeyama Mainichi [4]), but guest houses remain the primary form of accommodation on the island. Again, as there are only a few large-scale resort hotels there, as shown in Table 5.8, respondents have to book their accommodation themselves once on the island.

The nature of the trip, which served as the reason for their visit, was "self-planned tours," as shown in Table 5.9. "Self-planned tours" are highly self-determined tours. Among the "East Japan, average monthly income" group, 13 respondents (65.0 %) visited Iriomote Island on "self-planned tours" and went on highly self-determined tours. While there were a certain number of respondents who selected tours that were mostly

[9] According to the Taketomi Town Association of Commerce and Industry [6], five hotels, one Japanese-style hotel, five small Western-style guest houses and cottages, and twelve guest houses in Iriomote Island are members of the association. The accommodation facilities are predominantly guest houses.

Table 5.9 Nature of respondents' trips to Iriomote Island

	Package tour organized by a travel agency in Tokyo or other areas		Package purchased on Ishigaki Island		Self-planned tour	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	1	12.5	2	25.0	0	0.0
West Japan, average monthly income	4	22.2	1	5.6	10	55.6
West Japan, low monthly income	5	35.7	0	0.0	7	50.0
East Japan, average monthly income	6	30.0	0	0.0	13	65.0
East Japan, low monthly income	5	23.8	1	4.8	9	42.9

	Homecoming		Other	
	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	1	12.5	1	12.5
West Japan, average monthly income	0	0.0	3	16.7
West Japan, low monthly income	1	7.1	1	7.1
East Japan, average monthly income	1	5.0	0	0.0
East Japan, low monthly income	0	0.0	6	28.6

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

designed by others, many of them came on highly self-determined tours. A similar trend was seen in the "West Japan, low monthly income" group. However, while seven respondents (50.0 %) said they went on "self-planned tours," there were some who went on tours that were mostly designed by others, with five (35.7 %) saying that they went on a "package tour organized by a travel agency in Tokyo or other areas." The "West Japan, average monthly income" group had a tendency to select highly self-determined tours, with ten (55.6 %) saying that they went on "self-planned tours." There were, however, four (22.2 %) who said that they went on a "package tour organized by a travel agency in Tokyo or other areas." Respondents from West Japan can be characterized by their tendency to select highly self-determined tours, while there were a certain number who selected tours that were mostly designed by others. Based on

Table 5.10 Activities on Iriomote Island

	Canoeing (including sea kayaking)		Snorkeling		Trekking	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	5	29.4	5	29.4	2	11.8
West Japan, average monthly income	10	29.4	5	14.7	4	11.8
West Japan, low monthly income	4	19.0	5	23.8	4	19.0
East Japan, average monthly income	6	20.7	2	6.9	4	13.8
East Japan, low monthly income	10	38.5	4	15.4	4	15.4
	Water buffalo cart ride on Yufu Island		**Pleasure boat**		**Other**	
	Frequency	Ratio	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	1	5.9	1	5.9	3	17.6
West Japan, average monthly income	7	20.6	2	5.9	6	17.6
West Japan, low monthly income	3	14.3	3	14.3	2	9.5
East Japan, average monthly income	7	24.1	7	24.1	3	10.3
East Japan, low monthly income	2	7.7	2	7.7	4	15.4

Source: Developed by K. Kikuchi based on the results of the questionnaire survey

the above, it can be said that most respondents tended to select highly self-determined tours on Iriomote Island rather than selecting those designed by others.

The major activities undertaken by the respondents are shown in Table 5.10. The tourists mainly took part in canoeing and other watersports activities. Five (29.4 %) among the "West Japan, no disposable income" group, ten (29.4 %) among the "West Japan, average monthly income" group, six (20.7 %) among the "East Japan, average monthly income" group and ten (38.5 %) among the "East Japan, low monthly income" group took part in canoeing (including sea kayaking). Respondents in the "West Japan, low monthly income" group preferred snorkeling over canoeing, with five (23.8 %) taking part in the former. "A water buffalo cart ride in Yufu Island" was also enjoyed by seven (20.6 %) among the "West Japan, average monthly income" group, and seven (24.1 %) among the "East Japan, average monthly income" group. Respondents in these two groups also participated in a unique activity on Iriomote Island apart from watersports. Looking at the specific features of the groups, the "West Japan, no disposable income" group and the "East Japan, low monthly income" group focused on a single activity, which was canoeing (including sea kayaking). In contrast, the "West Japan, low monthly income" group did not show any clear intent concerning their participation in activities, and it seems that visiting Iriomote Island was in itself the purpose of their trip.

The Amount of Money Spent by Respondents on Souvenirs, and Their Keenness to Revisit Iriomote Island

Figure 5.6 shows the amount of money spent on souvenirs in the Yaeyama region, including on Iriomote Island. Respondents from East Japan spent more, while those from West Japan spent less, on souvenirs. When broken down by group, the "East Japan, average monthly income" group spent the most, with JPY1274.9, while the "West Japan, no disposable income" group spent the least, with JPY937.3. While respondents from West Japan spent less on souvenirs in general, the "West Japan, average monthly income" group spent JPY1138.8. The amount of spending on souvenirs depended not only on the economic circumstances of the respondents but also on whether they were from East Japan or West Japan. In other words, respondents' spending on souvenirs is determined by regional differences as well as economic factors. Tourists' regional characteristics should therefore be taken into consideration when designing souvenirs.

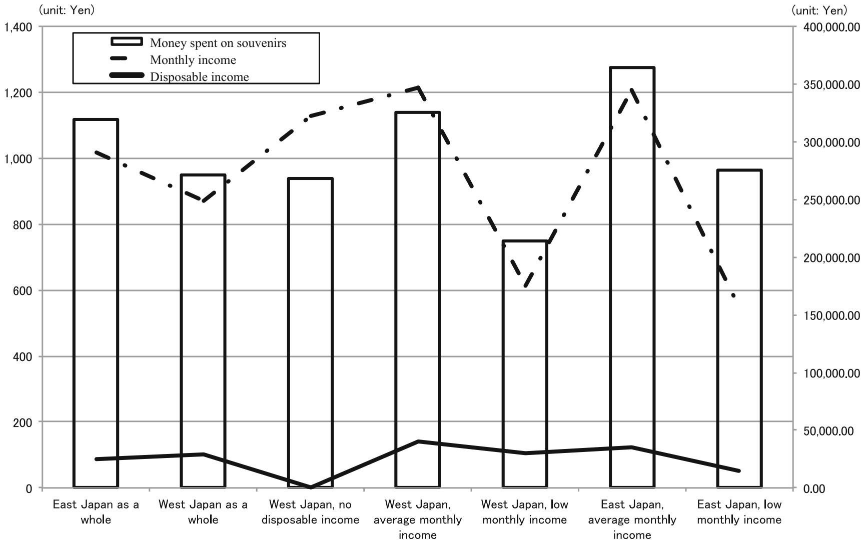

Fig. 5.6 Spending on souvenirs, monthly income, and disposable income by group (*Source*: Developed based on the results of the questionnaire survey)

Respondents' keenness to revisit the island in the future is summarized in Table 5.11. Three (60.0 %) among the "West Japan, no disposable income" group indicated that they "strongly desire to do so". The remaining two respondents (40.0 %) in that group indicated a "desire to do so," which means that all of the respondents in this group wished to return to the island. Concerning the revisit, a "desire to do so" was the favored answer among the rest of the groups as well. All respondents in the "West Japan, low monthly income" group indicated a "desire to do so." The two options—namely "strongly desire to do so" and "desire to do so"—were chosen by 100.0 % of respondents in the "West Japan, average monthly income" group, in the "East Japan, average monthly income" group and in the "East Japan, low monthly income" group. This indicates that tourists are willing to return to Iriomote Island if there is a chance to do so.

Table 5.11 Keenness to visit the Yaeyama region again

	Strongly desire to do so		Desire to do so	
	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	3	60.0	2	40.0
West Japan, average monthly income	1	14.3	6	85.7
West Japan, low monthly income	0	0.0	4	100.0
East Japan, average monthly income	2	22.2	7	77.8
East Japan, low monthly income	3	30.0	7	70.0
	Not very interested		**Do not know**	
	Frequency	Ratio	Frequency	Ratio
West Japan, no disposable income	0	0.0	0.0	0.0
West Japan, average monthly income	0	0.0	0.0	0.0
West Japan, low monthly income	0	0.0	0.0	0.0
East Japan, average monthly income	0	0.0	0.0	0.0
East Japan, low monthly income	0	0.0	0.0	0.0

Source: Developed by K. Kikuchi based on the results of the questionnaire survey
Note: Ratios are calculated by excluding nonresponses

5.2 Conclusion

Statistics on tourist visitors have shown an upward trend, which indicates that direct flights from the Kanto and Kansai regions to New Ishigaki Airport have had a positive impact. However, there was a concern prior to the opening of the airport about its location, which is on the outskirts of Ishigaki City, increasing the time it takes to get to the city center.

The opening of the airport enabled the operation of medium-sized jets, and freight from Ishigaki no longer accumulates owing to lack of transport. In addition, the number of tourist visitors has increased. The new airport has also had an impact in terms of the reorganization of existing tourism-related industries, and it has the potential to facilitate the formation of AFTI clusters. The effect of creating new jobs on remote islands where job opportunities are limited has had a significant impact on regional development. In this chapter, three issues were evaluated: the impact of New Ishigaki Airport on the regional economy in terms of employment; the convenience of the new airport; and the activities undertaken by the users of the new airport.

The impact of the airport on the economy of the Yaeyama region can be summarized as follows. The job openings-to-applications ratio has always been 1.0 or lower in Okinawa, and it was 0.9 or lower prior to the opening of New Ishigaki Airport. However, after the opening, the ratio showed an upward trend and is now steady at around 1.0. This indicates that the airport has had a positive impact on the economy of the Yaeyama region.

Access from the new airport to the city center and its convenience as perceived by respondents can be summarized by the following two points. First, the opening of the airport has made it easier for tourists from Tokyo and Osaka to travel to Ishigaki directly. All respondent groups appreciate the convenience of direct flights. Moreover, all groups have expressed their desire to revisit the Yaeyama region because there are direct flights. Second, however, there is a need to improve access from the airport to the city center. Groups with average monthly income, both from East Japan and West Japan, felt that the access was inadequate. The "West Japan, no disposable income" group gave a particularly low score in this regard.

The following three points should be considered as the next steps in the tourism marketing of Iriomote Island. The first is the production of souvenirs that take into consideration the regional differences among tourists. Looking at the actual spending by respondents, the average JPY1116 for those from East Japan, and JPY948 for those from West Japan, indicating that spending on souvenirs was low in the west and high in the east. The second point is the expansion and improvement of the accommodation facilities. Since many respondents expressed their desire to revisit Iriomote Island, accommodation that is suited to independent tours must be expanded and improved. The third point relates to the creation of businesses that offer "tourism activities" for the various income groups. The "East Japan, average monthly income" group enjoyed all of the major activities in Iriomote Island to the full. On the other hand, groups with lower monthly income and those with no disposable income tended to focus on a single activity.

The next measures in the sequence should be infrastructure development to resolve the issue of access, while expanding and improving accommodation facilities to meet the increasing number of tourists. There are some issues that need to be addressed in regard to the different types of tourists: those who focus on a single activity, those who enjoy multiple activities to the full and those whose purpose is travelling itself. Efforts must be made to retain a regular flow of tourists, to create regular customers and to increase customer satisfaction by implementing marketing activities that match the tourists' purposes. Such efforts could enable sustainable regional development for the Yaeyama region as a tourist destination.

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6

Tourism Development in Cambodia: An Analysis of Factors in the Creation of Local Specialties

Teppei Yamashita

6.1 Introduction

This chapter examines the possibility of the cluster development of agriculture, food and culture in Cambodia where self-sufficient agricultural production is the mainstream. The sequence theory is applied to examine the potential for the growth of the Cambodian economy. A field survey method is adopted together with analyzing the annual trends in economic growth and industrial sectors. The traditional technologies of food culture based on the historical context are classified in order to clarify various issues in the tourism industry in Cambodia.

In this study I classify and examine the possibility of the cluster development of agriculture, food and culture (Kuchiki et al. 2012) in Cambodia where self-sufficient agricultural production is still the mainstream, based on the impacts from neighboring countries (Vietnam, Thailand and China).

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For rapidly growing Cambodia, Japan is the largest aid donor. Japan has provided official development assistance (ODA) to Cambodia since 1992, and this reached USD1.96 billion in 2010 (MoFA). In addition, a forward-looking trade relationship has been established between Japan and Cambodia. In recent years, Angkor Vat, registered as a World Heritage Site in 1992, has attracted attention worldwide, and the number of tourists in Cambodia has been increasing (Ministry of Tourism of Cambodia). Japanese tourists rank among the highest. It is expected that the amicable relationship between Japan and Cambodia will be developed further in a range of areas, such as the economy, culture, sports and tourism.

In this study, for the purpose of looking into the potential for the growth of the Cambodian economy based on the sequence theory and local fieldwork, (1) the annual trends in economic growth and industrial sectors and (2) the inheritance routes and the traditional technologies of food culture based on the historical context will be classified in order to clarify various issues in the tourism industry in Cambodia.

6.2 The Annual Trends in Economic Growth and Industrial Sectors

In Cambodia about 30 % (56,600 km^2) of the area of the whole country (181,000 km^2) is agricultural land, and 67 % of the total population (14.7 million people as of 2013) are engaged in agriculture. Examples of major agricultural products in 2011 are rice (8.78 million tons), cassava (4.37 million tons), corn (720,000 tons) and pork (100,000 tons). Since the cultivation of rice, the main agricultural product, is dependent on rain and is conducted mainly during the rainy season, the productivity is low. In general, Cambodian farmers cultivate rice for personal consumption and sell any surplus to earn cash. That is, most farmers carry out self-sufficient agriculture, so their lives are inevitably economically unstable. Based on this, multiple projects for the improvement of rice productivity have been implemented in the country for the purpose of improving the lives and reducing the poverty of the farmers.

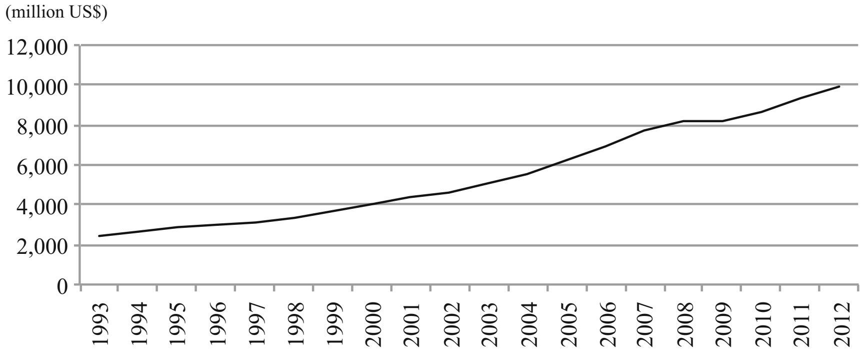

Fig. 6.1 Cambodia real GDP (1993–2012) (*Source*: World Bank, http://data.worldbank.org/country/Cambodia)

As shown in Fig. 6.1, Cambodia's GDP has been growing steadily over the last 20 years. According to the Ministry of Foreign Affairs, the average growth rate of real GDP for the five years between 2007 and 2011 was 6.0 %. The rate of inflation has been stable in recent years and was 2.9 % on average in 2012. In addition, strong economic growth is expected in the future owing to a steady increase in foreign direct investment.

As shown in Fig. 6.2, the breakdown of major industries accounting for Cambodia's GDP was agriculture (33 %), mining and manufacturing (21 %) and services (39 %). The industry I should like to focus on is services, which accounts for about 40 % of GDP. Among the components of the service industry, tourism is one of the major industries supporting Cambodia's economy. The expansion of various commercial services in relation to tourism and economic development can be expected as a result of the enhancement of commercial services (sale of goods, etc.) in general. In Japan, Angkor Wat was selected as the most popular overseas tourist site for Japanese visitors three years running. According to the Ministry of Tourism of Cambodia, the number of visitors to Cambodia in 2012 was 3.58 million people, which represented an increase of 24 % compared with the previous year (Fig. 6.3). It expects 7.5 million foreign visitors a year by 2020.

Along with an increase in the number of foreign tourists, tourism revenues have been growing (Fig. 6.4). The proportion of tourism revenues in Cambodia's GDP has been more than 17 % since 2004. The

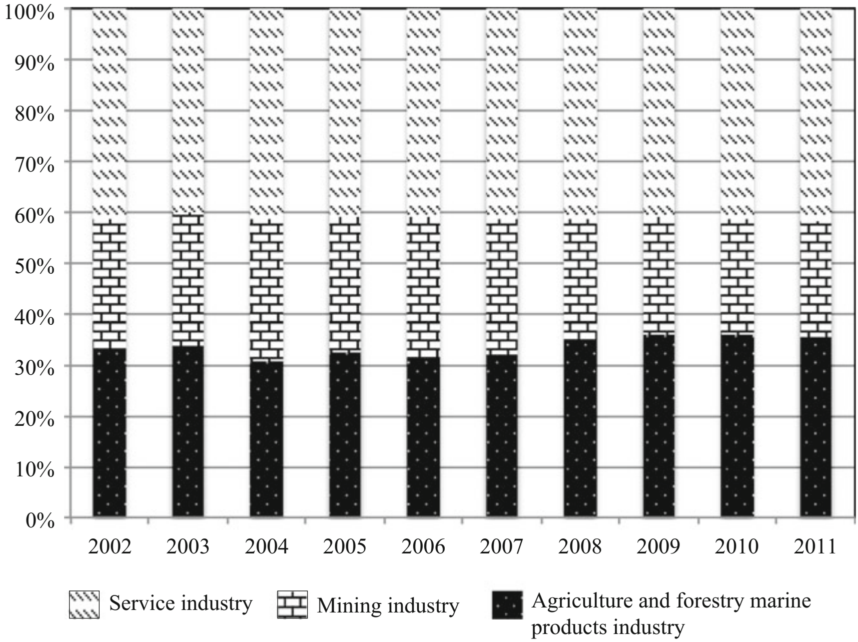

Fig. 6.2 The breakdown of major industries accounting for Cambodia's GDP as of 2011 (*Source*: JETRO, http://www.jetro.go.jp/world/asia/kh/stat_01/)

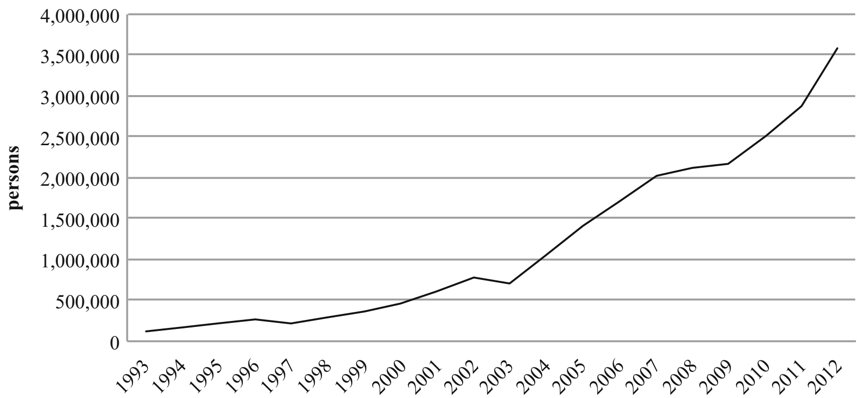

Fig. 6.3 The number of visitors to Cambodia (*Source*: Ministry of Tourism of Cambodia, http://www.tourismcambodia.org/mot/statistic_report)

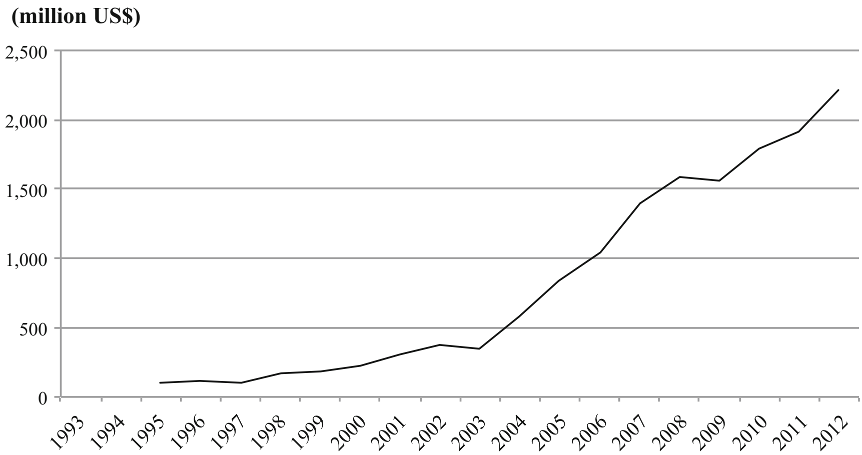

Fig. 6.4 The amount of tourism revenue in Cambodia (*Source*: Ministry of Tourism of Cambodia, http://www.tourismcambodia.org/mot/statistic_report)

latest rate of increase in tourism revenues is around 10 % (the average rate of increase between 1996 and 2012 was 22 %) after peaking in 1998 (an increase of 61 %) and 2004 (an increase of 67 %).

Based on this record, it can be shown that the development of the service industry, particularly tourism, in relation to economic growth in Cambodia will become a principal pillar in the future. However, the sources of tourism revenues are concentrated in Siem Reap Province, where Angkor Wat is located, owing to the reputation of the latter as the main tourist site in Cambodia. In addition, as there are repercussions on the farmers who account for 70 % of the population, there is an urgent need to carry out strategic development of the tourism industry based on the cluster theory.

6.3 Potential Tourism Resources: Inheritance Routes of Food Culture

From the viewpoints of history and trade, I next analyze the inheritance routes for the creation of Cambodia's food culture. Regarding the history, as described above, Cambodia has developed its culture in the process of its establishment while having a significant impact from neighboring countries (Vietnam, Thailand, China, and India) and being a colonial period of France, and is based on the culture in the Angkor (Khmer) period with cultural elements of Polynesia coming from Indonesia (Fig. 6.5).

For example, rice cultivation was passed on from China. The impact of China can be shown from the fact that Chinese people appear in the murals in Angkor Thom. It is believed that rice cultivation originated in the middle of the Chang Jiang basin in southern China, and this practice was passed on to groups of people who lived in the area for hunting and gathering.

Cambodia was founded after the Angkor period as well as being founded as a country subject to Kingdom of Funan. It has had a strong relationship with China since early times. Chinese food has affected Cambodian food culture, and various Chinese dishes (e.g. stirfries, soups and stews) have been adopted by the country.

While some foods in Cambodia are also common to China and Vietnam, the production processes have been adapted. For example, rice noodles are a staple dish in all three countries. In China and Vietnam, the dough is kneaded, rolled out into a thin sheet and then cut. In Cambodia, however, the method is classic and simple. The kneaded dough is placed into a tube with many holes in the bottom, a wooden weight is placed on top and the noodles are extracted using leverage. They pass directly from the tube into a pan filled with hot water, in which they are boiled (Fig. 6.6).

These rice noodles can be kept for four to five days. The sales from a production plant make USD25 a day and the profit is USD5 a day. The busiest and most profitable periods for the sale of rice noodles are the Lunar New Year in February, Khmer New Year in April and Obon summer holiday in August. Based on this, rice noodles are considered to be a daily food as well as a special food to be eaten at traditional events. Spices, such as pepper and chili pepper, which are essential for Cambodian food, are inherited from India. It can be assumed that spices were brought to Cambodia in parallel with the characteristics, religion and theory of the rights of kings that came from India, and that they have become established as a part of Cambodia's food culture.

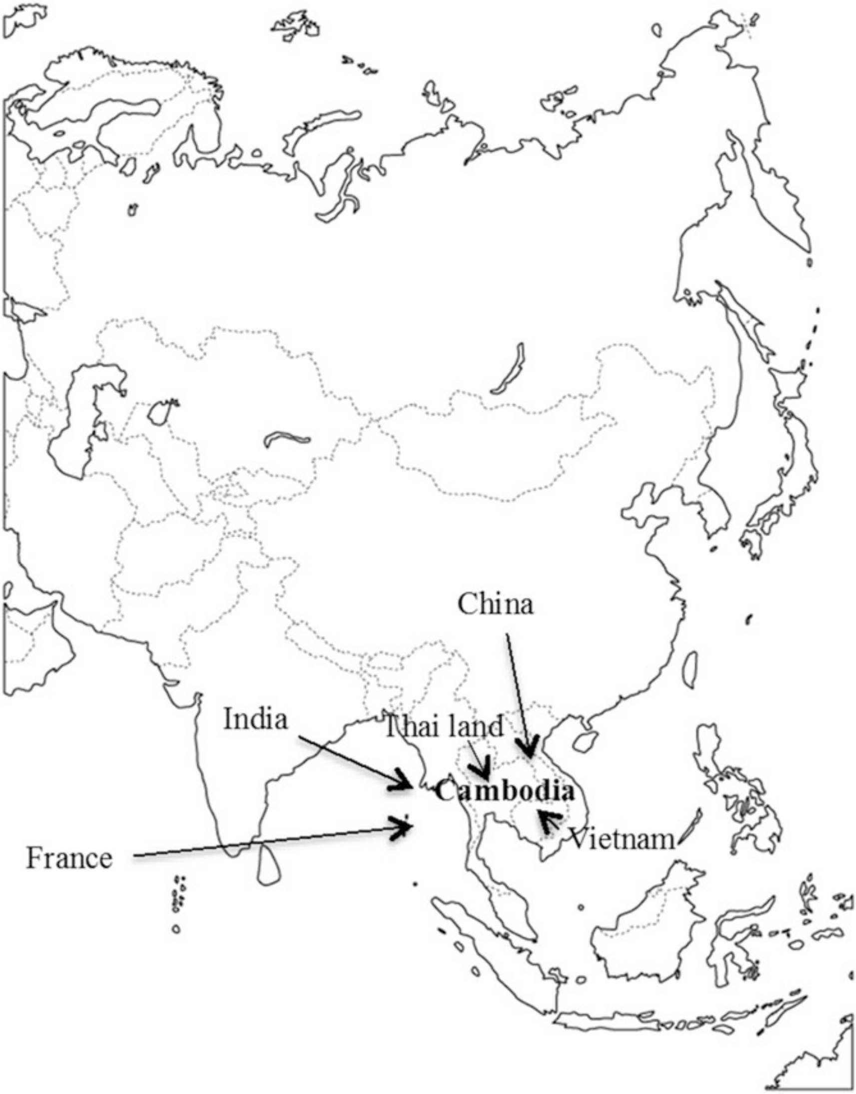

Fig. 6.5 Inheritance routes of Cambodia's food culture (*Source*: Developed by T. Yamashita based on information at http://www.freemap.jp/item/asia/kouiki.html and http://www.tourismcambodia.org/mot/statistic_report)

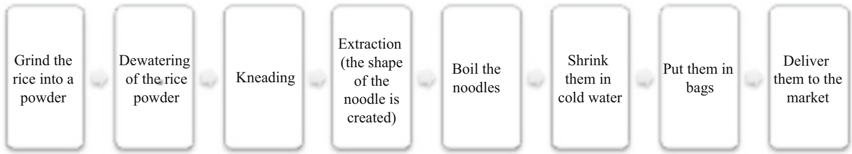

Fig. 6.6 Production process of rice noodles (*Source*: Developed by T. Yamashita, from interviews in Cambodia)

Regarding the inheritance route of the utensils to eat and cook food, chopsticks are not used in Cambodia as they are in Vietnam. People in Cambodia but mainly use spoons and forks. This is the same as people in Central Thailand. It is said that people generally used their hands to eat food in ancient times and then used shells or Chinese noodle spoons to eat soups. Because Cambodia was a French colony, it is believed that Western culture was passed down to Cambodia, including eating utensils (spoons and forks, etc.). Examples of cooking utensils include Chinese-style cutting boards, Chinese knives and Western knives. Regarding pans, there are Indian-style pans without a handle, aluminum pans with a handle and unglazed pans. Since the mixing and grinding of seasoning and spices using a mill is considered to be most important in cooking, it can be said that kitchens and cooking methods in Cambodia are similar to those in Thailand and India, where they cook curry on a daily basis.

6.4 Food Culture in Khmer: Processing Freshwater Fish

Cambodians frequently eat fish, similar to the Vietnamese. The fishing industry is flourishing in Tonle Sap Lake, the largest lake in Southeast Asia, and it accounts for 10 % of Cambodia's GDP. The storage capacity and the area of the lake vary hugely from the rainy season to the dry season. In the dry season the volume of water is low and the surface area is small, so a large number of fish can be caught in fixed nets. Fish have been used to make preserved foods since early times. It takes a long time to deliver the fish caught in the Gulf of Thailand to Phnom Penh, the capital of Cambodia, by crossing the mountains, so two methods of fish preservation have been developed as well: dried fish and salted fish guts. There are various types of dried fish and smoked fish. The salted fish guts are the result of different production processes, which include prahoc, mam, kapi and tuk trey.

Prahoc is the most popular, which is made from cyprinoid fish. After cutting off the head, scaling, removing the entrails, draining off the water and adding salt (10 % of the weight), the fish is exposed to the sun and left for a whole day and night. It is then ground using a mill and put into a bottle (adding salt if necessary). The top of the bottle is left open during the day to expose the fish to the sun, then closed over night. This process is repeated for about a month (Takahashi 2005). Prahoc is used in various Cambodian foods, including a dipping sauce for vegetables. Tuk trey is an infusion used during the production process of prahoc. It is made from freshwater fish, and it is different from nam pla (fish sauce in Thailand) or nuoc mam (fish sauce in Vietnam). Mam came from Vietnam, which is made by adding roasted rice powder to the fish and fermenting it. Kapi is similar to that produced in Thailand, which is made by salting opossum shrimps and turning them into a paste.

A popular Khmer food called amok is made from fish (snakehead fish), coconut milk and curry paste. The fish are wrapped in banana leaves and steamed. This amok is made from snakehead, which has a sweet flavor and is eaten with boiled cabbage.

6.5 Daily Meals in Cambodia

In addition to the Cambodian food described above, people in Cambodia use Vietnamese, Thai, and Chinese restaurants on a daily basis, while they frequent French and Japanese restaurants for special occasions when they want to enjoy a fancy meals. I found that there is no local specialty of Cambodia that tourists should eat.

In recent years the number of foreign tourists visiting Cambodia has been increasing year by year, as described above. There are various factors behind this. For example, Angkor Wat, which is registered as a World Heritage Site and is the pride of Cambodia, has attracted attention worldwide, and there have been many multinational restaurants (e.g. French, Japanese, Chinese, Italian, Indian, Thai and Vietnamese) and entertainment facilities, including casinos (mainly in Chinese capital hotels and Korean capital hotels), are developing in Phnom Penh, which is known as "the Paris of the East." However, these restaurants and facilities are operated by foreign capital companies as part of the development of their businesses in Cambodia to target foreign tourists. If this trend continues, these cannot become tourism resources for the Cambodian people. Based on this situation, I would recommend a modelization for the creation of local specialties against the background of the cluster theory, by focusing on the lack of such specialties that can be exploited as tourism resources.

6.6 Creation of Local Specialties Against a Background of Agriculture-Food- Culture Clusters

The essential factors for the creation of local specialties include (1) a historical story (tradition); (2) a link with agricultural products; and (3) additional values (e.g. organic, rarity and endemism). Based on this model, the potentialities for local specialties among the existing foods will be examined (Fig. 6.7).

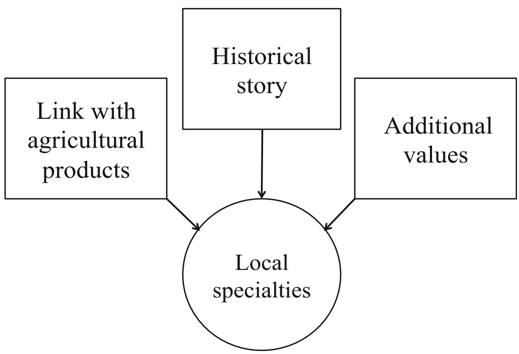

Fig. 6.7 Social, economic and cultural factors for creating local specialties (*Source*: Developed by T. Yamashita)

As shown in Fig. 6.8, the major agricultural product in Cambodia is rice. This has been consumed as a staple food since early times. It is cultivated through a primitive form of extensive agriculture. Pesticides and chemical fertilizers are not used heavily as they are in China and Vietnam, which results in a low yield. The aim of a current project is to increase rice yields. High-quality and delicious rice (aromatic rice, etc.) is distributed at a low price. Rice noodles, made from rice that the farmers have cultivated, are also produced using primitive methods. These have poor keeping qualities because no additives are used, but they have a good taste and are healthy.

In Fig. 6.9, the creation of local specialties in relation to prahoc, made for preserving freshwater fish for long periods, is examined. The Tonle Sap Lake is a popular tourist site in Cambodia. The creation of a local

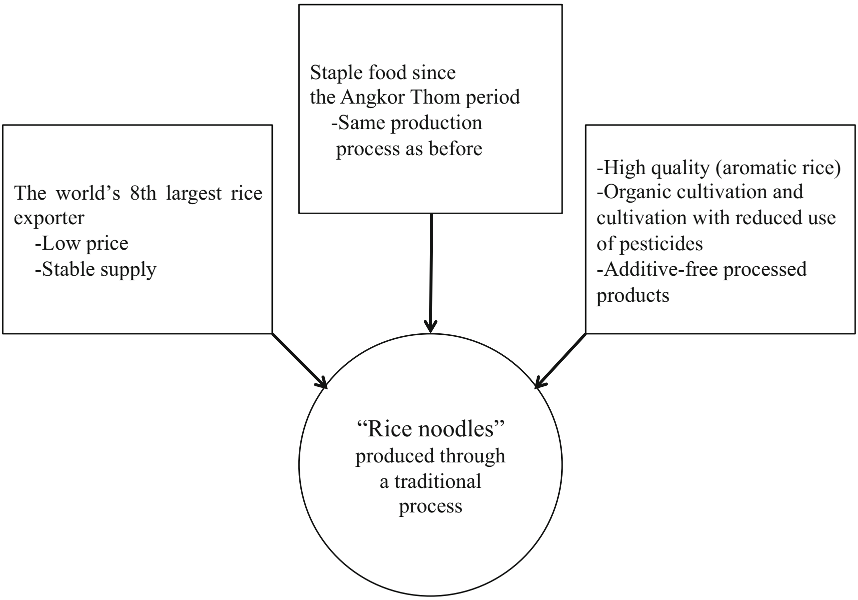

Fig. 6.8 Factors for local specialties in relation to rice noodles (*Source*: Developed by T. Yamashita)

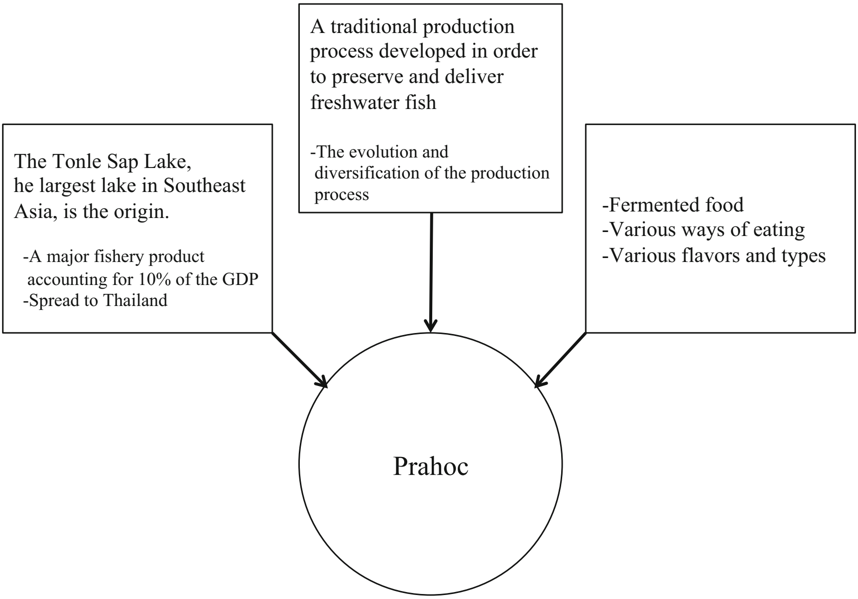

Fig. 6.9 Factors for local specialties in relation to prahoc (*Source*: Developed by T. Yamashita)

specialty focusing on the fish caught in the lake has a good chance of success. However, it should be noted that most of the fishermen there are of Vietnamese origin. Since one of technologies for prevention of decay is prahoc, the key is how to provide a back story.

Finally, I examine the activities involved in the recovery of pepper production that are being carried out around Phnom Penh (Fig. 6.10). In general, Cambodian restaurants commonly prepare and serve dishes using raw peppers. The superior flavor of these peppers is an important factor in differentiating them from others, which gives them a good chance of success. Photo 6.1 shows employees selecting peppers in Kurata Pepper, which is operated by Japanese people. Pesticide-free production, careful hand selection and creative packaging all contribute to the strategic development of an attractive tourist product.

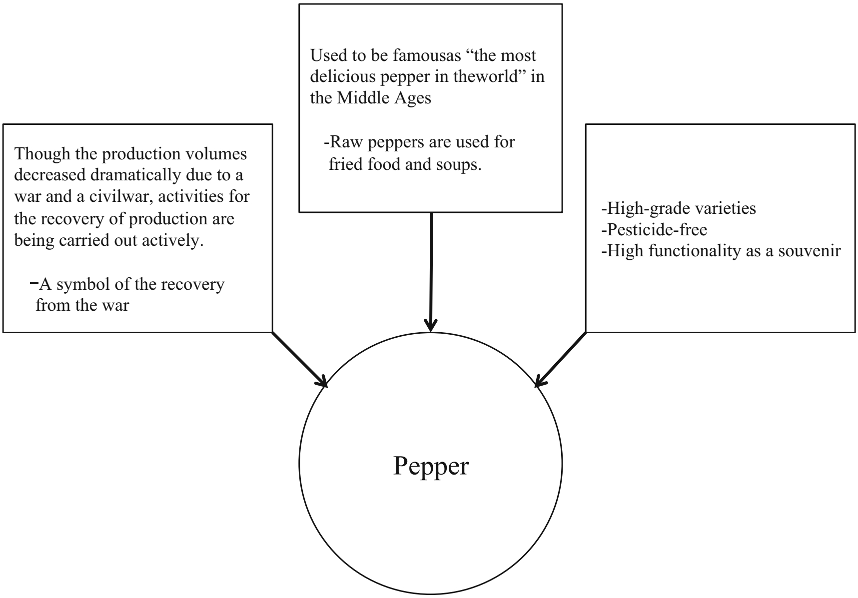

Fig. 6.10 Factors for local specialties in relation to pepper (*Source*: Developed by T. Yamashita)

Photo 6.1 Selecting peppers in Kurata Pepper (*Source:* Taken by T. Yamashita during interviews in Cambodia, http://www.kuratapepper.com/index.html)

6.7 Summary

It is obvious that tourism will become the source of an industrial cluster in the future if the relationships between agriculture, food and culture in Cambodia are assessed from the viewpoint of creating such a cluster. The major issues to be taken into account are that (1) about 70 % of the citizens are farmers and most of their farming methods are primitive; (2) owing to the impact of the long-lasting war, women's participation in society has been promoted and most of the women are public workers; and (3) tourism resources in Cambodia are concentrated on the Angkor ruins. Regarding the latter point, it is recommended that using the Angkor ruins as a tourism resource is more efficient than improving them.

Regarding farming, the good agricultural land in Cambodia is a factor that inhibits the spread of intensive agriculture. On the other hand, the safety and security of food and local production and consumption that advanced countries are calling for again fit well with the way in which agriculture is already practiced in Cambodia. That is, the foundation for green tourism has already been established unintentionally. In addition, the female worker-based society is suitable for specializing in the service industry which involves careful, patient and sensitive operations. In fact, according to interviews with Japanese companies (Kurata Pepper and Asuka Shokai), there are problems with the use of male Cambodians in the workforce whereas women can perform tasks to a high standard following appropriate training.

Lastly, people have a fixed idea of Angkor Wat as the main tourist attraction. However, there are beautiful coastlines and virgin mangrove forests remaining in the south, and there are many areas that could become tourism resources, such as the dynamic waterfalls from the Mekong River, wild animals (river dolphins, etc.) and ethnic minority cultures in the northeast. As shown in Table 6.1, there are many tourism resources that have already been established but not yet adequately used. That is because the areas where these features exist have not been sufficiently developed as tourist sites, so the improvement of the access environment and the development of infrastructure (hotels, etc.) are necessary. If investment in the improvement of accessibility and

Table 6.1 List of factors for tourism resources in Cambodia

Type of factor	Factor	Origin/story	Distribution channel
Major agricultural product	Rice	Rice cultivation has been handed down from China. Chinese people appear in a mural in Angkor Thom	China
Food/alcohol	Sura-so (rice spirit)	A rice spirit that originated in Takev	Takev
History	Pol pot regime	Genocide between 1972 and 1997	Siem Reap
	Angkor period	Angkor ruins	
Music, dance, festival	Sbaek Touch Sbaek Thom Water festival	A dance expressing the story of three religions, which develops like a picture-card show	Polynesia
Art	Angkor ruins	Angkor period	Cambodia
Craft, fabric	Silverwork	The characteristic feature of silverwork is engraving	Thailand to Cambodia
	Cambodian silk (e.g. Krama)	Very popular, with smaller stitches than Thai silk	
Religion	Buddhism (Theravada Buddhism)	Cambodia and Khmer account for 90 % of the total number of believers. Affected by Buddhism, Hindu and Islam, and has established the current style	Cambodia
	Islam	Cham people	
Architecture	Islamic architecture Hindu architecture Buddhist architecture	Cambodia's Angkor ruins were also affected by these three religions and established the current style	Cambodia

Source: Developed by T. Yamashita from interviews in Cambodia

accommodation is secured, increasing numbers of tourists could be accommodated in many more areas that have the potential to become significant tourism resources. This would lead to visitors staying in the region for longer and thus increased tourism-related revenues, so the local economy and employment could be revitalized as a result. To attract more foreign visitors, the prime minister has personally carried out an invitation for launching direct flight services, and a design plan for a new international airport is under way.

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7

The Collocation of Industries in Agriculture-Food-Tourism in Vietnam

Toshitaka Gokan

7.1 Introduction

Gearing et al. (1976) list the following as possible by-products of developing a tourism industry:

> (iii) Tourism can be the main component of a regional policy aimed at achieving an equitable balance between major industrial areas and other non-industrial areas of the country; (iv) The tourist industry may contribute to the development of the other industries, e.g., leather goods, handicrafts, watchmaking, jewelry, textile, glassware, food and beverage, specialty confectionery, recreational equipment, and supplies, etc.

In addition, after a tourism site has been developed sufficiently, a by-product may become a main product of the tourism industry. My focus is fostering AFTI in rural areas.

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The "Strategy on Vietnam's tourism development until 2020, vision to 2030" (Socialist Republic of Vietnam 2011) clarifies the following purposes of the strategy: developing tourism into a key economic sector and in the direction of professionalism and modernism; developing domestic and international tourism simultaneously; and developing sustainable tourism. The long list of solutions to reach these goals includes developing "green" tourism products, and respecting natural elements and local cultures (Socialist Republic of Vietnam 2011). These are related to fostering clusters within the AFTIs.

The purpose of this chapter is to detect AFTI clusters and to examine their collocation. This will aid our understanding of the spatial structure of resources that are used to plan and invest in the development of tourism products, and will "prioritize the development of marine tourism, cultural tourism, and eco-tourism," one of the solutions proposed by the Socialist Republic of Vietnam (2011).

For this purpose I apply the indices developed by Mori and Smith (2014), namely GE and LD. The advantage of using the indices of Mori and Smith (2014) is that they show the spatial structure of each industry. Some indices make clear the geographical distribution of an industry in relation to all industries. However, I can detect clusters or concentrations of economic activities in an industry in each region without using the geographical distribution of another industry.

The collocation of industries related to AFTI is discussed in this chapter. In the process of obtaining the GE and the LD, clusters are detected using the Bayesian Information Criterion, which allows me to compare cluster schemes directly. Here I am interested in whether clusters exist in the same region. In other words, the links between industries are not part of my data analyses.

This chapter is organized as follows. Section 7.2 introduces the industries I focus on and the geographical structure of clusters in Vietnam using a combination of GE and LD for each industry. Section 7.3 shows the collocation of clusters in industries related to AFTI. Lastly, Section 7.4 concludes.

7.2 Spatial Structure of Industries Related to AFTI

7.2.1 Industries Related to AFTI Clusters

With regard to AFTI clusters, 79 industries were selected from the following three-digit industries, taken from the Vietnam Standard Industrial Classification (VSIC 2007, codes in parentheses):

Primary industry: growing paddy (111); growing maize and other cereals (112); growing bulb, root and tuber for grain (113); growing sugar cane (114); growing tobacco (115); growing fiber crops (116); growing oil seeds (117); growing vegetables, legumes, flowers and plants for ornamental purposes (118); growing other non-perennial crops (119); growing fruits (121); growing oleaginous fruits (122); growing cashew nuts (123); growing pepper trees (124); growing rubber trees (125); growing coffee trees (126); growing tea trees (127); growing spices, aromatic, drug and pharmaceutical crops (128); growing other perennial crops (129); plant propagation (130); raising cattle and buffalo (141); raising horses and other equines (142); raising sheep and goats (144); raising pigs (145); raising poultry (146); raising other animals (149); mixed farming (150); marine fishing (311); freshwater fishing (312); marine aquaculture (321); freshwater aquaculture (322); and production of breeding fish (323). We refer to these as A-industries.

Secondary industry: processing and preserving meat (1010); processing and preserving fish, crustaceans and mollusks (1020); processing and preserving fruit and vegetables (1030); manufacturing vegetable and animal oils and fats (1040); manufacturing dairy products (1050); manufacturing grain mill products (1061); manufacturing starches and starch products (1062); manufacturing bakery products (1071); manufacturing sugar (1072); manufacturing cocoa, chocolate and sugar confectionery (1073); manufacturing macaroni, noodles, couscous and similar farinaceous products (1074); manufacturing prepared meals and dishes (1075); manufacturing other food products n.e.c. (1079); manufacturing prepared animal, fish and poultry feeds (1080); distilling, rectifying and blending spirits (1101); manufacturing wines (1102); manufacturing malt liquors and malt (1103); and manufacturing soft drinks;

producing mineral waters and other bottled waters (1104). We refer to these as F-industries.

Tertiary industry: wholesale of agricultural raw materials (except wood and bamboo) and live animals (4620); wholesale of rice (4631); wholesale of food (4632); wholesale of beverages (4633); retail sale in non-specialized stores, with food, beverages or tobacco predominating (4711); other retail sale in non-specialized stores (4719); retail sale of food in specialized stores (4721); retail sale of food stuffs in specialized stores (4722); retail sale of beverages in specialized stores (4723); renting and leasing of motor vehicles (7710); renting and leasing of recreational and sports goods (7721); travel agency activities (7911); tour operator activities (7912); other reservation service activities (7920); landscape care and maintenance service activities (8130); sport and entertainment activities (8551); art and cultural education (8552); other educational activities n.e.c (8559); educational support services (8560); Hospital, dispensary activities (8610); Medical and dental practice activities (8620); standby medical activities (8691); activities of human ability recovery centers (8692); other human healthcare n.e.c (8699); nursing care facilities (8710); museum activities (9102); botanical and zoological garden and nature reserve activities (9103); lottery, gambling and betting activities (9200); operation of sports facilities (9311); activities of sports clubs (9312); other sports activities (9319); activities of amusement parks and theme parks (9321); other amusement and recreation activities n.e.c (9329); and sauna and steam baths, massage, and similar healthcare services (except for sport activities) (9610). We refer to these as T-industries.

7.2.2 The Combination of Global Extent and Local Density

Mori and Smith (2014) used four distribution patterns of economic activities in order to explain the spatial structure of an industry, using a combination of the GE and LD indices. The GE shows the share of the total area of essential containment, which is the smallest convex-solid set containing the set of essential clusters, relative to that of the entire country. The LD indicates the share of the total area of an industry's essential clusters relative to that of its essential containment.

The procedure in Appendix A is used to identify the location of essential clusters and the locations in the essential containment with the data in Appendix B. In other words, the essential clusters are calculated using the method introduced in Appendix A. Then I fill the space between some of the essential clusters following a procedure that yields essential containments. If less (more) additional space is required to obtain essential containments, clusters are concentrated more (less) on each other. Thus a smaller (larger) LD indicates the spatial distribution of an industry that is more (less) dispersed throughout the essential containment. Thus LD explains the geographical relationships between clusters in a particular part of a country. On the other hand, GE explains the relative size of the areas containing some clusters in a country. A larger (smaller) GE represents a spatial distribution of clusters that is more (less) dispersed throughout a country.

Industries with a low GE demonstrate a relatively "confined" spatial pattern, while those with a high GE exhibit a relatively "dispersed" pattern. Likewise, industries with a high LD demonstrate a relatively "dense" pattern, while those with a low LD indicate a relatively "sparse" pattern. Thus I obtain the following four patterns of spatial structure: the "globally dispersed and locally dense" pattern; the "globally dispersed and locally sparse" pattern; the "globally confined and locally dense" pattern; and the "globally confined and locally sparse" pattern. I use the extreme examples of these patterns for purposes of illustration. Supposing that almost all regions have clusters, both the GE and LD will be large, which we can regard as a "globally dispersed and locally dense" pattern. Next, supposing that very few clusters are spread in many parts of a country, GE will be large and LD will be small, which we regard as a "globally dispersed and locally sparse" pattern. Then, supposing that very few clusters exist only in one corner of a country, GE will be small and LD will be large, which we refer to as a "globally confined and locally dense" pattern. Finally, supposing that only one region has a cluster, both the GE and LD will be small, which we can regard as a "globally confined and locally sparse" pattern.

7.2.3 The Spatial Structure of Industries Related to Agriculture-Food-Tourism Clusters

We start with the trends in the A-industry, F-industry and T-industry. Table 7.1 shows the average GE and LD in each. The GE is almost the same among these industries. Thus we find that the distribution of clusters relative to the overall country is almost the same, although the F-industries are more dispersed. Then the LDs differ among these industries. The A-industry clusters tend to be spread out in some areas, whereas the T-industry clusters are interspersed.

Although additional analyses are needed, ubiquitous industries will more easily satisfy the conditions required for a cluster to emerge and be sustained. Thus it should be easier to foster a cluster in an A-industry in existing T-industry clusters than it will be to foster a T-industry cluster in existing A-industry clusters. Furthermore, it should be easier to link industries that already exist within the same region.

The geographical distribution of A-industries differs among products, as shown in Table 7.2. For example, we can regard growing fruits (121), raising cattle and buffalo (141), raising pigs (145), raising poultry (146), raising other animals (149) and freshwater aquaculture (322) as industries in the "globally dispersed and locally dense" pattern. Then, we can regard growing vegetables, legumes, flowers and plants for ornamental purposes (118) and the production of breeding fish (323) as industries in the "globally dispersed and locally sparse" pattern. The difference between the "globally confined and locally dense" pattern and the "globally confined and locally sparse" pattern is small. The following industries are suitable for the "globally confined and locally dense" pattern: growing oil seeds (117), growing cashew nuts (123), growing pepper trees (124), raising horses and other equines (142) and mixed farming (150). Then the following industries fall within the "globally confined and locally

Table 7.1 A comparison between A-industries, F-industries and T-industries

	A-industries	F-industries	T-industries
Global extent	0.312	0.391	0.307
Local density	0.335	0.223	0.068

Source: Developed by T. Gokan

Table 7.2 GE and LD in the A-industries

Industry	Global extent	Local density
Descending order of GE		
322	0.75768	0.29018
145	0.67799	0.43443
146	0.64614	0.28733
118	0.56383	0.17821
141	0.54943	0.27226
323	0.51683	0.14641
149	0.50132	0.35270
121	0.47887	0.38043
321	0.46752	0.13029
130	0.46327	0.35918
128	0.45445	0.11690
129	0.45200	0.09237
125	0.43354	0.39186
119	0.41586	0.06142
114	0.40331	0.07328
111	0.32533	0.11102
126	0.30230	0.45113
312	0.23777	0.57909
127	0.23017	0.14201
112	0.16000	0.02921
116	0.15300	0.03321
144	0.15230	0.03378
113	0.13054	0.03290
115	0.09404	0.01252
122	0.06410	0.03875
311	0.01753	0.36728
150	0.00486	1
123	0.00215	1
124	0.00106	1
117	0.00006	1
142	0.00003	1
Descending order of LD		
150	0.00486	1
123	0.00215	1
124	0.00106	1
117	0.00006	1
142	0.00003	1
312	0.23777	0.57909
126	0.30230	0.45113
145	0.67799	0.43443

(*continued*)

Table 7.2 (continued)

125	0.43354	0.39186
121	0.47887	0.38043
311	0.01753	0.36728
130	0.46327	0.35918
149	0.50132	0.35270
322	0.75768	0.29018
146	0.64614	0.28733
141	0.54943	0.27226
118	0.56383	0.17821
323	0.51683	0.14641
127	0.23017	0.14201
321	0.46752	0.13029
128	0.45445	0.11690
111	0.32533	0.11102
129	0.45200	0.09237
114	0.40331	0.07328
119	0.41586	0.06142
122	0.06410	0.03875
144	0.15230	0.03378
116	0.15300	0.03321
113	0.13054	0.03290
112	0.16000	0.02921
115	0.09404	0.01252

Source: Developed by T. Gokan

sparse" pattern: growing maize and other cereals (112), growing bulbs, roots and tubers for grain (113), growing tobacco (115), growing fiber crops (116) and raising sheep and goats (144).

The geographical distribution of F-industries does not show any special trends, as shown in Table 7.3. However, we find the following industries in each of four spatial structures. We can regard manufacturing vegetable and animal oils and fats (1040) and manufacturing malt liquors and malt (1103) as industries in the "globally dispersed and locally sparse" pattern. Manufacturing starches and starch products (1062) falls within the "globally dispersed and locally dense" pattern. Then manufacturing grain mill products (1061) is an industry within the "globally confined and locally dense' pattern, and manufacturing prepared meals and dishes (1075) falls within the "globally confined and locally sparse" pattern.

Table 7.3 GE and LD in the F-industries

Industry	Global extent	Local density
Descending order of GE		
1103	0.65666	0.14023
1079	0.56874	0.28141
1101	0.54807	0.28138
1072	0.54186	0.33498
1040	0.46803	0.10406
1010	0.46794	0.10932
1062	0.46049	0.60561
1104	0.45468	0.16222
1020	0.45381	0.08344
1030	0.42459	0.23530
1050	0.39655	0.05085
1073	0.39132	0.11876
1074	0.36007	0.07359
1080	0.20474	0.35512
1102	0.20375	0.03025
1071	0.19307	0.15747
1075	0.17545	0.06605
1061	0.06342	0.83050
Descending order of LD		
1061	0.06342	0.83050
1062	0.46049	0.60561
1080	0.20474	0.35512
1072	0.54186	0.33498
1079	0.56874	0.28141
1101	0.54807	0.28138
1030	0.42459	0.23530
1104	0.45468	0.16222
1071	0.19307	0.15747
1103	0.65666	0.14023
1073	0.39132	0.11876
1010	0.46794	0.10932
1040	0.46803	0.10406
1020	0.45381	0.08344
1074	0.36007	0.07359
1075	0.17545	0.06605
1050	0.39655	0.05085
1102	0.20375	0.03025

Source: Developed by T. Gokan

Table 7.4 GE and LD in the T-industries

Industry	Global extent	Local density
Descending order of GE		
9200	0.74741	0.17349
4632	0.51037	0.13488
4721	0.50974	0.08510
9321	0.50406	0.01998
4620	0.46958	0.21818
8130	0.43433	0.04435
9311	0.43204	0.14355
9610	0.42749	0.08122
4633	0.42724	0.05748
9329	0.42706	0.02949
8559	0.40571	0.02734
7920	0.40352	0.02459
9312	0.39983	0.16787
7912	0.37951	0.01389
4711	0.37367	0.05209
4719	0.32805	0.19253
4631	0.21366	0.28085
9103	0.17346	0.03303
8620	0.16815	0.07934
9102	0.16795	0.01498
9319	0.16715	0.02843
7911	0.14620	0.02011
8610	0.14611	0.01670
8699	0.13883	0.02417
8551	0.12156	0.02619
8552	0.12051	0.01563
8560	0.12038	0.01947
8691	0.11941	0.00832
8710	0.11923	0.00453
8692	0.11592	0.00418
Descending order of LD		
4631	0.21366	0.28085
4620	0.46958	0.21818
4719	0.32805	0.19253
9200	0.74741	0.17349
9312	0.39983	0.16787
9311	0.43204	0.14355
4632	0.51037	0.13488
4721	0.50974	0.08510
9610	0.42749	0.08122

(*continued*)

Table 7.4 (continued)

8620	0.16815	0.07934
4633	0.42724	0.05748
4711	0.37367	0.05209
8130	0.43433	0.04435
9103	0.17346	0.03303
9329	0.42706	0.02949
9319	0.16715	0.02843
8559	0.40571	0.02734
8551	0.12156	0.02619
7920	0.40352	0.02459
8699	0.13883	0.02417
7911	0.14620	0.02011
9321	0.50406	0.01998
8560	0.12038	0.01947
8610	0.14611	0.01670
8552	0.12051	0.01563
9102	0.16795	0.01498
7912	0.37951	0.01389
8691	0.11941	0.00832
8710	0.11923	0.00453
8692	0.11592	0.00418

Source: Developed by T. Gokan

The geographical distribution of T-industries tends to be small in terms of LD, as shown in Table 7.4, which implies that the clusters in T-industries are interspersed, even if we focus on a particular area within the country. Here, wholesale of food (4632), retail sale of food in specialized stores (4721), lottery, gambling, and betting activities (9200) and activities of amusement parks and theme parks (9321) fall within the "globally dispersed and locally sparse" pattern. Travel agency activities (7911), sport and entertainment activities (8551), art and cultural education (8552), educational support services (8560), hospital and dispensary activities (8610), standby medical activities (8691), activities of human ability recovery centers (8692), other human healthcare n.e.c. (8699) and nursing care facilities (8710) fall within the "globally confined and locally sparse" pattern.

7.3 Collocation of Industries Related to Agriculture-Food-Tourism

In this section I focus on the “core” clusters only, rather than on the “core” and “member” clusters in the various industries.

Table 7.5 shows the top 20 locations of A-industry, F-industry and T-industry clusters. The popular tourism locations appear in the list, although the World Heritage Site Ninh Binh is not ranked particularly highly. The results of the table do not follow the contents of tourist guidebooks. However, the list could show which cities have the most resources related to AFTI clusters.

The top-ranked city is Vinh City. This may indicate a bright future for the city if its clusters can be managed well. Da Lat City, which is a summer resort, comes third. These are followed by Hue, the old capital

Table 7.5 Top 20 locations in terms of the number of AFTI clusters

Region	Total	Agriculture	Manufacturing	Service	Airport
Vinh City	29	3	7	19	○
Buon Ma Thuot City	28	12	6	10	○
Da Lat City	28	8	4	16	○
Hue City	28	3	7	18	○
Ninh Kieu	27	0	8	19	△
Nha Trang City	26	3	7	16	○
Thanh Hoa City	24	2	8	14	△
Dong Hoi City	20	3	4	13	○
Vung Tau City	20	2	5	13	○
Phan Thiet City	20	2	4	14	
Soc Trang Township	19	5	3	11	
Hai Chau	19	3	5	11	○
Qui Nhon City	19	3	4	12	○
Ninh Binh Township	19	2	8	9	
Tuy Hoa Township	19	2	5	12	○
My Tho City	19	2	3	14	
Ca Mau City	19	2	3	14	○
Quang Ngai Township	19	1	6	12	
Nam Dinh City	19	1	6	12	

Source: Developed by T. Gokan

Note: ○ shows that an airport exists in the region, while △ shows that the construction of an airport has been planned or that an airport is located in a neighboring region registered as a World Heritage Site; Ninh Kieu, an urban district of Can Tho in the Mekong Delta that offers boat tours; and Nha Trang, which is seaside resort town.

In Table 7.5, Buon Ma Thuot City is ranked second. Wiki travel (http://wikitravel.org/en/Buon_Ma_Thuot) refers to the city as follows: “Despite what the guidebooks say, Buon Ma Thuot has a very solid selection of good eats. Fast development and not much tourist infrastructure mean that the guidebooks are behind the times and sorely misleading”. That is, the link between food and agriculture seems to exist in the city. Large numbers of agricultural clusters there ensure its high rank in the list. These clusters are categorized in the following industries: growing maize and other cereals (112); growing tobacco (115); growing fiber crops (116); growing vegetables, legumes, flowers and plants for ornamental purposes (118); growing fruits (121); growing rubber trees (125); growing coffee trees (126); growing spices and aromatic, drug and pharmaceutical crops (128); plant propagation (130); raising poultry (146); and raising other animals (149). That is, the city has diversified its production of agricultural goods, maintaining a relatively large scale in each industry.

This result seems appropriate because Buon Ma Thuot is referred to as “Vietnam’s coffee metropolis.” For example, Buon Ma Thuot Robusta coffee was identified for Geographical Indication by the National Office of Industrial Property in Vietnam (Durand and Fournier 2015). The Buon Ma Thuot coffee festival is held for a few days biennially. It was examined as an example of a link between a coffee industry and tourism by Jolliffe et al. (2009). The festival includes coffee pavilions, coffee-related conferences and workshops, a coffee exchange floor, and a coffee gastronomy night and cultural event. Jolliffe et al. (2009) point out that the festival was conducive to the branding of the coffee and tourism in the province and the city.

The opportunity to foster many agricultural clusters seems to be increased by “a very active university in Buon Ma Thuot, the Tay Nguyen University” (Hung et al. 1995), as well as other local research institutes. For example, Khanh et al. (2009) show that research on improving livestock production has developed links among stakeholders and expanded activities geographically, although this work is based on the rural area of the province, Ea Kar, not Buon Ma Thuot, the capital city of the Daklak Province. The network of stakeholders has become significantly more complex. At first, stakeholders included key farmers, the university and the district office. Then they became farmer groups, and offices of the local government joined the group of. Finally, traders and banks also became stakeholders. The research project combined foraging technology, research and partnerships, and it has changed what was a cow-calf raising system into a market-oriented beef production system. Khanh et al. (2009) conclude that "the development of trust among actors was central to the development effort," which "may not have been possible with a different set of people." As a result, farmers enjoy the diversity of their products by avoiding being over-reliant on coffee, which was dubbed "riding a roller coaster to increase vulnerability" because of the volatility of international coffee markets (Khanh et al. 2006).

Table 7.5 shows that the higher-ranked regions have an airport, which is advantageous. Gokan (2016) explains that it is easier to locate industries in regions with new transport facilities, such as railways, high-speed motorways and airports, whereas it is difficult in the neighboring regions. However, of all the clusters in the A-industry, F-industry and T-industry, few regions are not ranked in the top 20, even if they have an airport. Thus these regions have potential, compared with their neighboring regions. Gokan (2016) also explains that the positive impact of these transport facilities on locating industries in the hinterland increases more if the facilities connect only hinterland regions. However, the impact is mitigated if these new transport facilities connect the city and hinterland. In reality, the new transport system connecting hinterland regions might be difficult to operate until economic activities become more active there.

Figure 7.1 shows that more than half of the regions have only one cluster, at best. The horizontal axis shows the rank of regions in descending order of the total number of clusters in the total number of industries in a region. The costs or inputs associated with fostering clusters in each industry can be saved if existing clusters are utilized. Thus, from the viewpoint of fostering AFTI clusters, prioritization means that regions without clusters or with few clusters are omitted.

The way to support such regions is to link a region without clusters one with enough clusters. An example is the well-known Irodori project in Japan. The remote mountainous area began a project to sell leaves that are

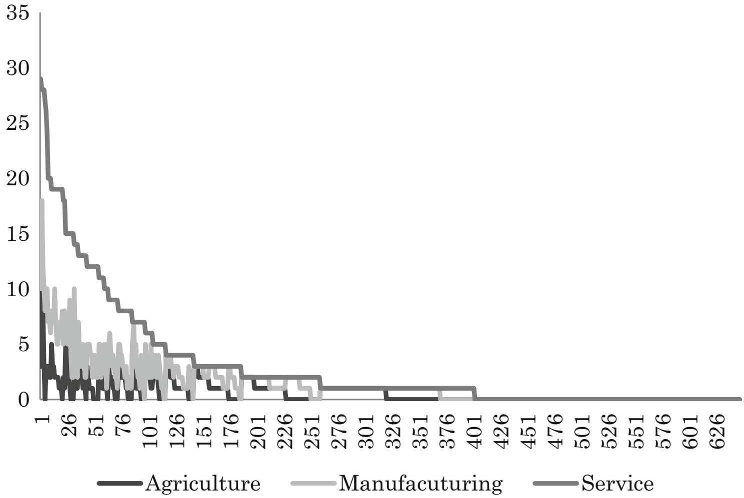

Fig. 7.1 The number of clusters related to AFTI in each region (*Source*: Developed by T. Gokan)

used to decorate dishes in restaurants in cities far from the rural area. Because these leaves are not found in cities, the customers in restaurants find the combination of food and leaves very appealing. Some restaurants look for leaves of a certain condition and at a specific time, so these leaves can be regarded as differentiated goods. By building a spatial economics model and analyzing the location of brand agriculture, Fujita (2006) found that unique local products that are highly differentiated can be produced in remote areas.

A sufficiently differentiated product can be sold at a higher price, which decreases the ratio of transport costs to the overall price. Thus the demand for differentiated goods does not decrease dramatically in cities located far away from the areas where unique local products are grown. In the Irodori project, products became differentiated because agricultural technology supervisors ate in restaurants in the cities, and spoke to chefs to understand precisely what customers demands (Yokoishi 2007). Furthermore, a system was built to gather market information and quickly distribute it to farmers (Yokoishi 2007). By responding to specific demands, the leaves became differentiated products and, as a result, farmers in the mountainous area became wealthy.

Figure 7.1 shows that the large number of clusters in T-industries determines whether a region is ranked in the top 80. The ranks around 60 or 100 seem to be determined by whether there are small numbers of clusters in the T-industries.

Figure 7.2 shows the distribution of all clusters in the A-industries, F-industries and T-industries in each region. Most regions have very few or no clusters. The figure shows that both spacious regions and small areas form the subdivisions of Vietnam. The small areas occur in or around Hanoi and Ho Chi Minh and are dotted among the rural areas. These imply the existence of cities or populated regions. Such regions have large numbers of clusters in the three types of industries.

To determine the trends in the collocation of industries in the A-industries, F-industries and T-industries, Figs. 7.3, 7.4, 7.5, 7.6, 7.7, 7.8 and 7.9 show Vietnam divided into seven maps, from north to south. A white circle shows that there is no cluster in the region. The proportion of dark (pale) gray in a circle represents the ratio of clusters in the T-industry (A-industry) to the total number of clusters in the A-industries, F-industries and T-industries. A mid-gray color indicates the ratio of clusters in the F-industry.

Figures 7.3, 7.4 and 7.5 show clusters concentrated in the Red River Delta, while clusters in the hinterlands are dotted. However, cities in the hinterland also have clusters in A-industries, F-industries and T-industries. In the Red River Delta, many regions have T-industry clusters, surrounded by regions that have only F-industry clusters. The regions with clusters in the A-industries, F-industries and T-industries are limited in inland areas. An exception to this, shown in Fig. 7.4, is a large island in Ha Long Bay, which contains clusters in all three industries on the west and north coasts.

The regions around Da Nang City and Hue City have clusters in all three types of industry, as shown in Fig. 7.6. Figure 7.7 shows that very few regions have clusters in all three types of industry. In Fig. 7.8, the regions some distance from Ho Chi Minh City to the north that have clusters in all three types of industry are dotted. In addition to the Red River Delta, regions with T-industry clusters are located in or around Ho

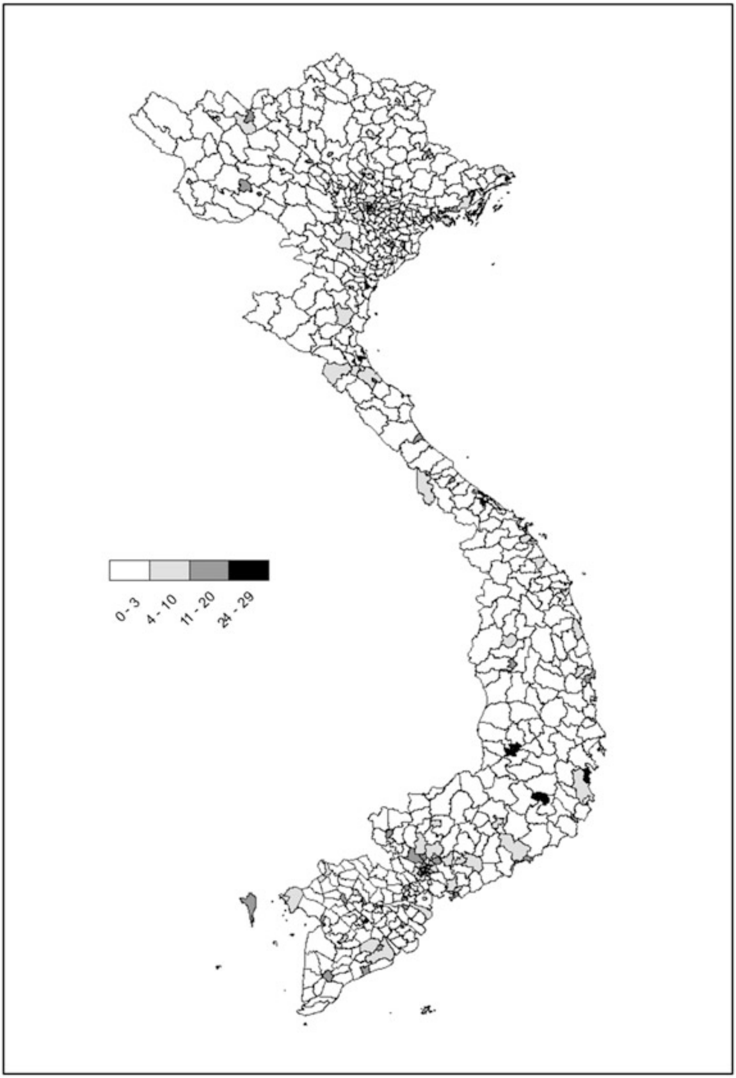

Fig. 7.2 The total number of clusters in the A-industries, F-industries and T-industries (*Source*: Developed by T. Gokan)

Fig. 7.3 Collocation of industries in the A-industries, F-industries and T-industries in the northwest region and the Red River Delta (*Source*: Developed by T. Gokan)

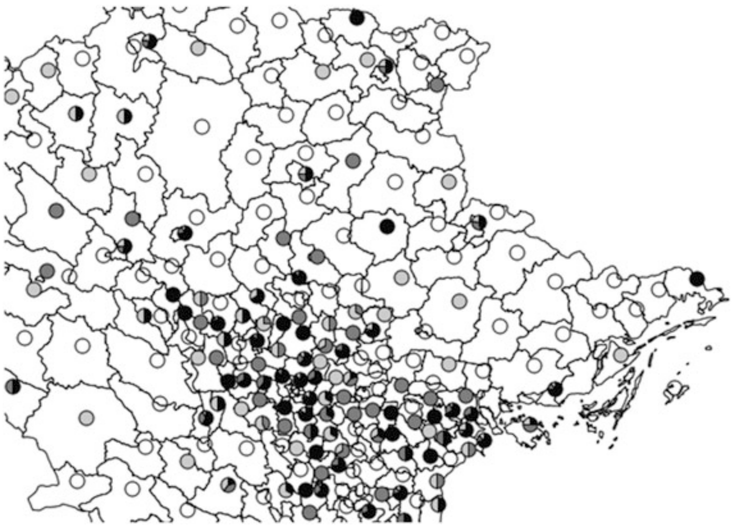

Fig. 7.4 Collocation of industries in the A-industries, F-industries and T-industries around the Red River Delta and its northeast region (*Source*: Developed by T. Gokan)

Fig. 7.5 Collocation of industries in the A-industries, F-industries and T-industries around the Red River Delta and its southern region (*Source*: Developed by T. Gokan)

Chi Minh City. In contrast to the Red River Delta, Figs. 7.8 and 7.9 show that many regions around Ho Chi Minh City have clusters in the A-industries, F-industries and T-industries. Figure 7.9 shows that there are many such regions in the Mekong Delta.

Figures 7.10 and 7.11 show the correlations between industrial sectors, although my analysis does not consider whether there are links between industries. These figures seem to show that there is no relationship between the numbers of clusters in the A-industries and F-industries, but there is a positive relationship between the numbers of clusters in the F-industries and T-industries.

With regard to the links between tourism and food production, Telfer and Wall (1996) explain the successful case of the Sheraton fish program, established between the hotel and local fishermen, and the Sheraton vegetable and herb program, established between the hotel and local farmers by the executive chef of a resort on the island of Lombok, Indonesia. Using these programs, the hotel purchases local fish and agricultural goods. It enjoys lower prices for fish and agricultural products

Fig. 7.6 Collocation of industries in the A-industries, F-industries and T-industries around Da Nang City (*Source*: Developed by T. Gokan)

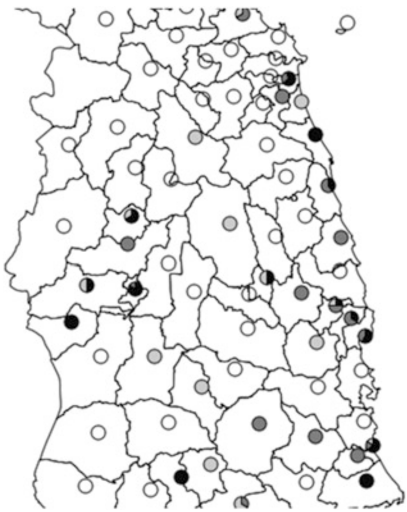

Fig. 7.7 Collocation of industries in the A-industries, F-industries and T-industries around the Central Highlands and South Central Coast (*Source*: Developed by T. Gokan)

Fig. 7.8 Collocation of industries in the A-industries, F-industries and T-industries around the Central Highlands and Southeast region (*Source*: Developed by T. Gokan)

Fig. 7.9 Collocation of industries in the A-industries, F-industries and T-industries in the Southeast region and the Mekong River Delta (*Source*: Developed by T. Gokan)

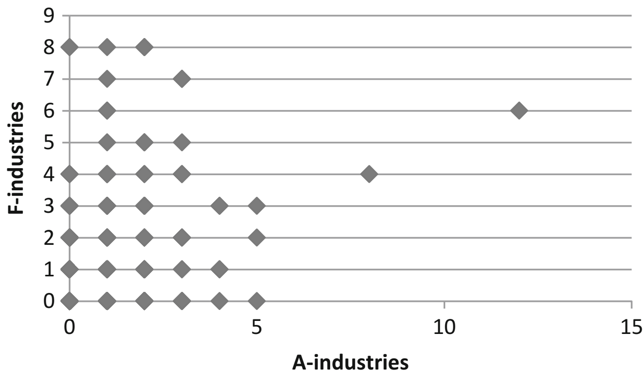

Fig. 7.10 The relationship between the numbers of clusters in A-industries and in F-industries (*Source*: Developed by T. Gokan)

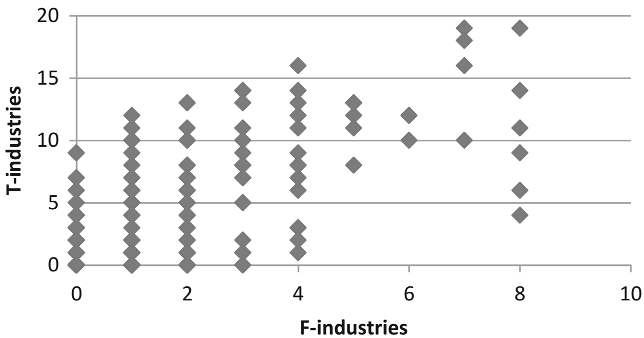

Fig. 7.11 The relationship between the numbers of clusters in T-industries and in F-industries (*Source*: Developed by T. Gokan)

within the standard set by the hotel, and the fishermen and farmers benefit from the additional local demand from the hotel. As a result, other hotels in the region have followed suit. This appears to be a case of circular causality, according to new economic geography (Fujita et al. 1999), which gives rise to the possibility of industrial agglomerations, with greater local demand and lower local prices. New economic geography shows that circular causality leads to lock-in effects in the region, which will sustain economic activities by the hotels and agricultural workers in the area. Furthermore, Telfer and Wall (1996) explain the importance of institutional commitment instead of relying on a specific person.

Although tourism falls within the service sector, findings from the manufacturing sector on technical transfer/absorption from subcontracting relationship may be helpful to foster local links between the agricultural sectors and the tourism sectors because it encourages the supplier to meet the demands of customers. Wong (1991) clarified the perceived importance of various processes of technology transfer/absorption, by small- and medium-sized enterprise suppliers in manufacturing sector. Here, (1) product design specification and performance requirements, (2) exposure to multinational enterprise systems of managing and organizing manufacturing activities and observing multinational enterprise corporate cultures, and (3) testing and diagnostic feedback on quality and other dimensions of performance of the supplier's products are very important. Furthermore, (1) advice/training on quality management systems and other "good manufacturing practices," (2) early supplier involvement in prototype development and the value engineering stage, (3) advanced indications of future quality/performance/features requirements and targets, and (4) introducing potential technology suppliers or joint venture partners are of medium importance. These processes or efforts will strengthen the links between the agricultural sector and the tourism sector. However, universities or research institutes may need to support the agricultural sector to foster these links.

7.4 Conclusion

This chapter has identified industrial clusters and explained the indices of Mori and Smith (2014). It has examined the collocation of AFTI using the identified clusters.

Collocation is evident around Ha Lon Bay, in the rural cities of northern Vietnam, in some coastal cities in the middle of Vietnam, around rural cities some distance from Ho Chi Minh City, in regions near Ho Chi Minh City and in some regions in the Mekong Delta. However, I did not examined the existence of links between the industries in these regions. Because rural cities already have clusters related to AFTI, strengthening these links will help to foster AFTI clusters. In order to connect industries, the success stories and case studies mentioned in this chapter may be helpful.

Appendix A: Deriving the Global Extent and Local Density

The process of deriving the GE and LD can be divided into three steps: detecting the clusters, determining the essential containment and then calculating the GE and LD.

The first step is to find a cluster scheme $\mathbb{C}^*$ with a maximum value for the BIC among the candidate cluster schemes. Cluster scheme $\mathbb{C}$ is simply one or more disjoint clusters, C_j, for $j = 1, \ldots, k$, and the residual set of all non-cluster regions. The BIC increases with a larger log-likelihood of $\widehat{P}_{\mathbb{C}}$, the location probability of cluster scheme $\mathbb{C}$ for each basic region, given an observed location pattern x. However, the BIC decreases with the penalty term composed by $k_{\mathbb{C}}$, which expresses the number of clusters in cluster scheme $\mathbb{C}$, and n, which expresses the number of establishments in the total area, such that $BIC_{\mathbb{C}} = L_{\mathbb{C}}\left(\widehat{P}_{\mathbb{C}}|x\right) - \frac{k_{\mathbb{C}}}{2}\ln n$. The location probability of cluster scheme $\mathbb{C}$ for cluster $j=1, \ldots, k$, $p_{\mathbb{C}}(j)$ can be rewritten as $\widehat{p}_{\mathbb{C}}(j) = n_j(x)/n$, where $n_j(x)$ expresses the sum of the number of establishments in cluster $j=1, \ldots, k$ and n expresses the total number of establishments in all regions. In the above log-likelihood functions, $n_j(x)$ and n_r are related with a sequence of independent location decisions by individual establishments. Each region is included as part of a cluster C_j, $j=1, \ldots, k$, or the residual set of all non-cluster regions. Thus the right hand-side of the log-likelihood function of the location probabilities (i.e. the probability that a randomly sampled establishment is located in a region within a certain cluster) expresses the law of total probability. Here the log-likelihood function can be divided into two parts. The first term gives the location probabilities of n_j establishments being located in a cluster C_j, $j=1, \ldots, k$. The second term gives the location probability that n_r establishments are located in region r in cluster C_j, $j=1, \ldots, k$, given that individual establishments choose their location randomly within each cluster, such that

$$L_{\mathbb{C}}\left(\widehat{P}_{\mathbb{C}}|x\right) = \sum\nolimits_{j=0}^{k_{\mathbb{C}}} n_j(x)\ln\widehat{p}_{\mathbb{C}}(j) + \sum\nolimits_{j=0}^{k_{\mathbb{C}}} \sum\nolimits_{r\varepsilon C_j} n_r ln \frac{a_r}{aC_j},$$

where a_r expresses the economic area in region r and a_{C_j} expresses the economic area in cluster C_j, $j=1, \ldots, k$. A new cluster is formed and compared with other possible modifications of the current cluster scheme in order to find the highest value of the BIC. In the process of expanding an existing cluster by adding regions consisting of the d-convex solid of the core part only, the shortest path distance is used. The "core" part is used in the analysis in Sect. 4, whereas the "core" and "member" parts are used in Sect. 3. For more detail on "core" and "member" parts, see Mori (2014).

The second step is divided into two parts. The first determines the essential clusters, which are the most significant in terms of incremental contributions to the BIC given that the sum of the incremental contributions to the BIC exceeds a certain proportion (λ) of $BIC_{\mathbb{C}}$. Following the recommendation of Mori and Smith (2014), the value of λ is set to 0.91. The second part of the second step determines the smallest convex-solid set in the total area containing the set of essential clusters. Intuitively, a convex-solid set means that the set is connected and has no dents in its perimeter and no internal cavities. Then the regions in the smallest convex-solid set can be regarded as an essential containment.

In the last step we can obtain the GE for an industry by dividing the total economic area of essential containment for an industry by the total economic area of the whole country. Similarly, we can obtain the LD for the industry by dividing the total economic area of the essential clusters of the industry by the total economic area of the essential containment.

Finally, we test whether the BIC of the best cluster scheme is significantly better than that under a random location pattern generated by a Monte Carlo test. Among all industry studies, the null hypothesis of complete spatial randomness was rejected, with p-values of virtually zero.

Appendix B: Data for Analysis

"Basic regions" are taken to be district-level divisions, which are subsubdivisions of Vietnam. Considering the consistency within the regions in the industrial census data of 2011 and after removing islands, we focus on 649 regions. "Economic regions" are calculated by subtracting the area of forests, lakes, marshes and undeveloped areas from the total area of the region using a satellite image in Global Land Cover 2000. The travel distance between each pair of neighboring regions is calculated with a shape file on road networks. The shortest-path distances are computed as in Mori and Smith (2014). The employment data used in this analysis are based on the VSIC of 2007. The number of employees across 79 industries, which I described earlier, is taken from the 2012 establishment census of Vietnam.

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Part III

New Approaches for Further Development of Cluster Analysis

8

An Application of the Levels of Organization in Biology to Process Formation in an Industrial Cluster: The Economies of Sequence

Akifumi Kuchiki and Tetsuo Mizobe

8.1 Introduction

One of the most important economic issues in both developed and emerging economies is how they develop innovative economic activities. Industrial clusters are expected to be able to do so. Thus, practical research results are needed with regard to the formation of these clusters. We apply ecological biology to the analysis of industrial clusters and introduce the concept of economies of sequence.

Porter (1998) defines clusters as geographic concentrations of interconnected companies and institutions in a particular field, and he examined how an industrial cluster generated innovative activities through his diamond approach to cluster theory. Fujita (2003) made a distinction

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between Step I (agglomeration) and Step II (innovation). Spatial economics focuses on the analysis of geographical agglomeration, while Porter (1998) examined the conditions of active innovative processes in his cluster theory.

Table 8.1 clarifies the differences between the following three approaches: (1) the spatial economics of Fujita et al. (2003); (2) the diamond theory of Porter (1990); and (3) the flowchart approach by Kuchiki (2010). The columns and rows in Table 8.1 demonstrate the difference between theoretical analyses and practical analyses, and the difference between agglomeration and innovation, respectively. Spatial economics is positioned in the column representing theoretical analyses and the row representing the dynamic process of agglomeration. Porter's diamond theory is positioned in the column representing practical analyses and the row of the dynamic process of innovation. The flowchart approach examines the practical analyses on the processes of both agglomeration and innovation in the table.

Figures 8.1 and 8.2 present the difference between the diamond model of Porter (1990) and the flowchart approach. Figure 8.1 from Porter (1990) shows how he constructed a diamond model based on four attributes to determine the competitive advantage of a country or region. However, it is not easy for a region to satisfy the four attributes of the diamond model in a static analysis. Kuchiki (2008) proposed the flowchart approach to the industrial cluster policy by sequencing the

Table 8.1 Taxonomy of spatial economics, cluster theory and flowchart approach

Step	Step I: agglomeration	Step II: innovation
Theory and practice		
Theoretical analyses	Spatial economics: statics, comparative static and dynamic processes	n/a
Practical analyses	Spatial economics: geographical simulation model	Porter's cluster theory (diamond model: static factor analysis)
	Flowchart approach: Step I (dynamic processes of forming the segments of a cluster; based on the experiences of East Asian countries)	Flowchart approach: Step II

Source: Developed by A. Kuchiki

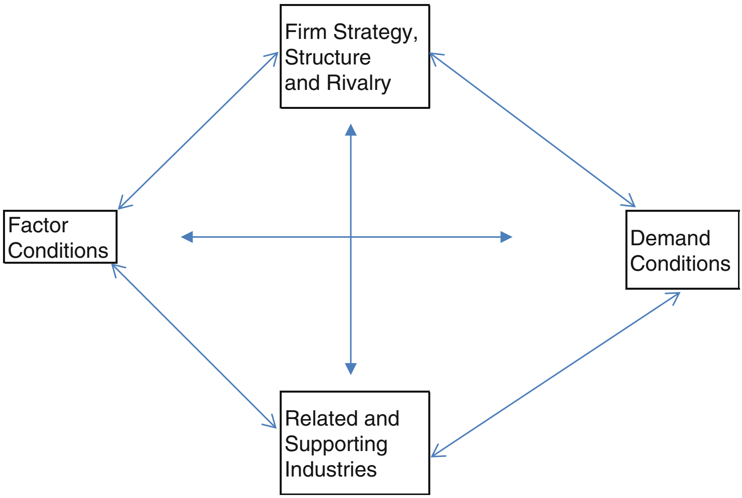

Fig. 8.1 Porter's international competitive advantage (*Source*: A simplified version of the figure of M. Porter (1990, p. 78) by A. Kuchiki)

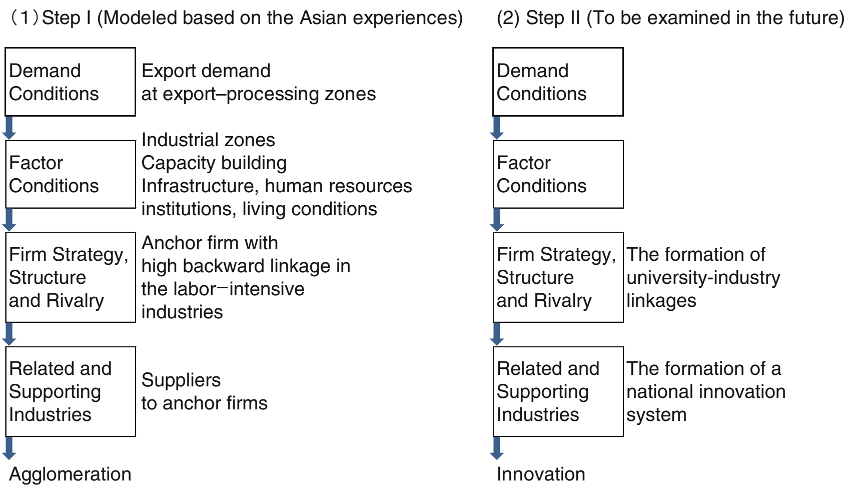

Fig. 8.2 The sequence of the diamond approach (*Source*: A. Kuchiki)

factors involved in policy measures along a timeline to ensure their feasibility. Figure 8.2 from Kuchiki (2008) shows the sequence of policy measures as constituting a practical action plan. The aim of the flowchart approach is to sequence the policy measures, not on a diamond plane but along a timeline as a dynamic process of clustering.

First, the spatial economics proposed by Fujita et al. (2003) introduce "space" to economics. The flowchart approach introduces "time axes" to spatial economics to make industrial cluster policy more practical. Second, we will apply a biological approach to the analysis of industrial clusters.

This chapter aims to analyze the sequence of segment formation in an industrial cluster and show the existence of the economies of sequence in segment formation in such a cluster by examining the results of industrial cluster policies following the approach of Kuchiki et al. (2013). The economies of sequence, corresponding to the economies of scale in economics, are defined as a concept by which the costs of forming an industrial cluster are most efficiently controlled by optimally sequencing the order of segment formation in the industrial cluster. There are three points on the time horizon in the formation of an industrial cluster: (1) ex ante the formation (planning time before the formation of an industrial cluster); (2) the process of industrial cluster formation; and (3) ex post the formation (completed time after the formation of an industrial cluster). The subjects of this study are industries such as the food industry, manufacturing industry, information technology industry and tourism industry. We assume that, as is shown in Table 8.2,

Table 8.2 The segments of a cluster

Capacity	Segment
Infrastructure	Roads
	Railways
	Airport
	Port
	Communication
	Water
	Electricity
	Industrial zones
Human resources	Unskilled labor
	Engineers
	Managers
Institutions	Laws and regulations
	Land ownership
	Foreign exchange system
	Political system

Source: Developed by A. Kuchiki

the segments of an industrial cluster consist of roads, ports and institutions, while the segments of an organism are the head, heart, legs and so on. This chapter focuses on the processes of the formation of an industrial cluster in the field of manufacturing as an example of clustering in the AFTI cluster.

The methodology employed in this chapter is characteristic in that it seeks to apply the concept of the levels of organization to the formation processes of an industrial cluster. An industrial cluster is efficiently formed when the sequence of segment formation is in the optimal order. We illustrate this using the examples taken from the field of manufacturing: the automobile industry cluster in the Eastern Seaboard region of Thailand and the electronics industry cluster in northern Vietnam. The indices for the measurement of the result of the economies of sequence in the manufacturing industry cluster are the number of firms agglomerated and the number of jobs created.

The chapter is organized as follows. Section 8.2 focuses on and provides an explanation for the levels of organization in biology. Section 8.3 defines the economies of sequence. Section 8.4 illustrates the successful sequence of segment formation achieved in the automobile industry cluster in the Eastern Seaboard region of Thailand and the electronics industry cluster in northern Vietnam. Section 8.5 relates the economies of sequence to the flowchart approach. Section 8.6 concludes and offers a summary of the chapter.

8.2 Levels of Organization Hierarchy in Biology and the Economies of Sequence

Schumpeter (1934) was a central figure in the introduction of evolutionary theory from biology to economics. Fujimoto (1997) classified genetics into phylogenesis[1] in order to analyze organizations in the automobile industry. We now introduce "time axes" in order to analyze the process of segment formation in an industrial cluster, as shown in Table 8.2. This chapter takes

[1] Phylogenesis is organic evolution and ontogenesis is the process by which an individual organism grows organically. This chapter regards the formation process of an industrial cluster as ontogenesis. The analysis of the formation process of segments in an industrial cluster, and examination of the sequencing of the formation process, is based on the concept of a segment as a part of the body that performs a specific function.

snapshots of these processes based on the ideas of Kanai (2012), who emphasized the importance of analyzing dynamic processes rather than pursuing static analyses, as proposed by Porter (1990), to identify the factors in his diamond model. Nishizawa (2012) insists that industrial clusters must be sustainable within an “ecosystem” in a review of concepts.

This chapter introduces the concept of levels of organizational hierarchy in biology presented by Odum and Garrett (2006) to consistently understand the three phenomena of time axes, dynamic processes and ecosystems. This concept explains that ecology is the study of life with an emphasis on the patterns found in relationships between organisms and their environment, and economics can be similarly translated as the management of the household, with ecological economics bridging the gap between ecology and economics. The levels of organization in ecology can be seen as a hierarchal order, as shown in Fig. 8.3. The levels start from genes at the bottom, followed by segments, organisms, populations, communities, and ecosystems at the top of the time axis. Systems containing living (biotic) and non-living (abiotic) components constitute

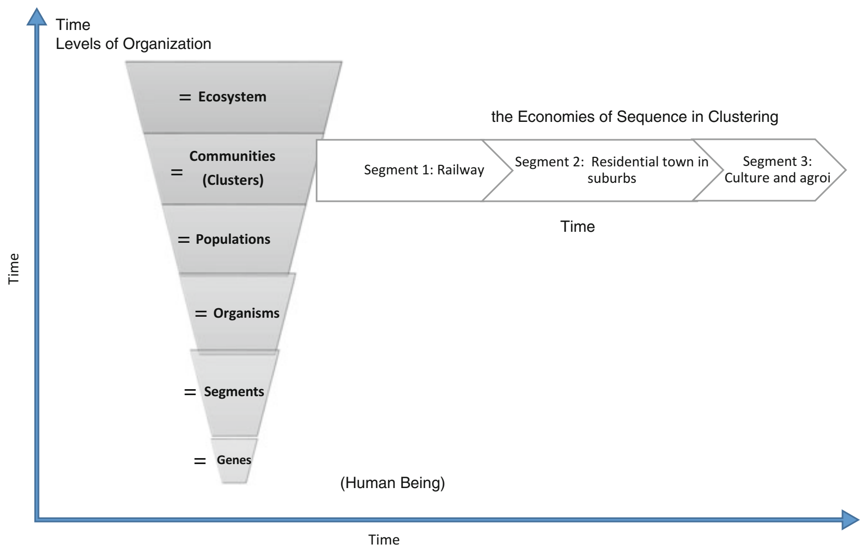

Fig. 8.3 Levels of organization—hierarchy: The economies of sequence (*Source*: A. Kuchiki’s based on Odum and Garrett (2006))

biosystems, which range from genetic to ecological systems. The community and the non-living environment function together as an ecosystem.

We understand the formation of segments in an industrial cluster as a series of dynamic processes from organisms to people, and from people to community, moving through the levels of organization along the time axis. A community forms the segments of an industrial cluster by sequencing human beings.

We can propose the following five hypotheses. First, in Fig. 8.3, the vertical line, starting from genes and ending with the ecosystem, is the time axis for biogenesis. Second, the horizontal line representing the community of the hierarchy has a time axis for the segments of a cluster to be formed. The segments can be illustrated as the transportation facilitation of the infrastructure, institutional development and human resource development. Third, the segments of the industrial cluster are formed in the ecosystem along the vertical axis. That is, industrial clusters are sustainable if they are formed in sustaining the ecosystem. Fourth, there exist economies of sequence in the formation of each segment, which is defined as its most efficient formation without huge cost. The costs associated with segment formation are immense when the formation sequence is incorrect. Fifth, the initial value of the sequence is crucial to the efficient formation of a cluster since it represents the initial value, or master switch, in the formation of the segments.

8.3 The Sequence of Efficient Segment Formation in an Industrial Cluster

Table 8.2 shows the segments of a manufacturing industry cluster. These are built as follows. Physical infrastructure refers to ports, roads, communications and so on. Institutional buildings, which are crucial to success in inviting foreign investors, include the streamlining of investment procedures through one-stop services, the deregulation of laws and the introduction of a preferential tax system. Human resources include unskilled labor, skilled labor, managers, researchers and professionals. The living environment includes, for example, the provision of hospitals and international schools in order to invite foreign firms. Policy measures, or segments, are represented as follows:

$$C_M = (\{G_1, G_2, G_3, \ldots, G_{15}\}).$$

This chapter seeks to examine the sequence of efficient segment formation using examples taken both from during the process and ex post. Here we suppose that the sequence of segment formation in a manufacturing industry cluster starts from the building of a port, as shown in Table 8.2.

We examine the case of automobile industry clustering by constructing a port and roads when firms in the labor-intensive automobile industry invest. The factory operates when materials are imported through the port of Leamchabang and subsequently transported by road (Kuchiki et al. 2013). In general, a successful sequence results in the invitation of an anchor firm preceded by capacity building in the automobile industry cluster. The anchor firm is a high-value industrial link and invites its related suppliers. There exist economies of sequence between the segment building and the anchor firm, and between the anchor firm and the related suppliers. Appendix A strictly defines the concept of the economies of sequence, while Appendix B illustrates the conditions that hold true for the economies of sequence.

8.4 Examples of the Economies of Sequence in East Asia

This section illustrates the efficient sequence explained in the previous section in the automobile industry cluster in the Eastern Seaboard region of Thailand and the electronics industry cluster in northern Vietnam. An automobile consists of more than 20,000 parts. Mitsubishi Automobiles invested in the Eastern Seaboard region of Thailand and imported many components, mainly from Japan, as only a few were produced locally.

8.4.1 The Eastern Seaboard Development Program of Thailand

This section focuses on the official Japanese development assistance provided to the Eastern Seaboard region of Thailand, as shown in Fig. 8.4. It took 11 years, from 1982 to 1993, and around USD680 million to complete the sequence process. The sequence of projects to form the segments of the industrial cluster consisted of creating "port facilities," "a water supply," "an industrial estate," "railways," "roads" and "industrial agglomeration" (see Kuchiki 2011). The loan contracts for the Laemchabang Port project and the water project were agreed in 1982 and 1984, respectively, for the Laemchabang Water Pipeline Project in 1984, for Laemchabang Industrial Estate in 1985, and for the railway and road projects in 1988.

The subsequent sequence of policy measures to form the segments was as follows:

1. Port: Laemchabang Port began operations in January 1991. It was designed to be a new deep sea port and a substitute for Bangkok Port, which is a river port. Cargo from and to Bangkok requires transshipment at either Hong Kong Port or Singapore Port as hub ports. Laemchabang Port eventually developed into a hub port for Southeast Asia.
2. Water supply: An improved water supply was important because many firms need an adequate supply for their plants to operate.
3. Industrial zones: The Laemchabang Industrial Estate covered 420 ha in 1999, then expanded to about 520 ha in 2009.
4. Highways: When roads are free of congestion, the average time required for trucks to travel from Bangkok to the Chonburi Industrial Estate in Chonburi Province in the Eastern Seaboard region is an hour and ten minutes owing to the highway networks built for the Eastern Seaboard region. It takes two hours from Bangkok to the Rayong Industrial Estate in the Eastern Seaboard region and an hour from Bangkok to the Amata Nakorn Industrial Estate in Chonburi Province.

(Unit: 100 million yen)

	Loan contract agreement	Loan completion	Loan executed	Total of loan executed
Leamchabang Port	9/1984	6/1993	31.78	
	11/1986	11/1993	48.42	
	2/1990	9/1995	58.68	138.88
Nongkho/Laemchabang Water Pipeline	9/1984	4/1987	1.03	
Nongplalai Reservoir Construction	9/1988	1/1995	32.26	
Maptaphut/Sattahip Water Pipeline	11/1988	3/1994	10.52	
Nongplalai/Nongkho Water Pipeline	2/1990	6/1995	1.56	
				45.37
Leamchabang Industrial Estate	10/1985	10/1992	25.76	
	9/1987	9/1992	19.89	
				45.65
Railway Projects				
Siracha/Leamchabang	9/1988	7/1996	9.2	
Sattahip/Maptaphut	9/1988	1/1997	28.26	
Khlong19/Kengkoi	2/1990	12/1999	72.98	
				110.44
Road Projects				
Chonburi/Pattaya	11/1988	3/1994	40.74	
Bangkok/Chonburi	12/1990	4/1993	134.35	
Outer Bangkok Ring	12/1990	4/1993	128.28	
				303.37
Mitsubishi Motors (Thailand)	Established in 1992		Total	643.71

Its suppliers	Main suppliers for Mitsubishi Motors: SUMMIT SHOWA MANUFACTURING CO., LTD. SUMMIT KURATA MANUFACTURING CO., LTD. THAI SUMMIT HARNESS CO., LTD.
Industrial agglomeration	SUMMIT AUTO BODY INDUSTRY CO., LTD. SUMMIT AUTO SEATS INDUSTRY CO., LTD. SUMMIT STEERING WHEEL CO., LTD. THAI SUMMIT HARNESS CO., LTD. THAI CHANATHORN INDUSTRY CO., LTD.

Fig. 8.4 The sequence of the Eastern Seaboard region: The case of Mitsubishi Motors (*Source*: A. Kuchiki and T. Gokan based on Shimomura (1996))

5. Tax preference incentives: The Board of Investment of Thailand grants tax preferences in the form of three types of industrial zones. The tax preferences take the form of tariff exemptions and corporate tax

reductions. In 2009 the corporate tax exemption period was five years for Zone 1, seven years for Zone 2 and eight years for Zone 3.

6. Anchor firm: Mitsubishi Motors constructed its plant in 1992. The economic growth of the Eastern Seaboard region was noteworthy in Chonburi Province from 1990 to 1995.
7. Suppliers: The suppliers to Mitsubishi Motors agglomerated in the Laemchabang area. The local conglomerates, the Summit Group and Siam Group, also grew together with Japanese firms.
8. Results: The automobile industry agglomerated in the industrial zones in Thailand. Other firms acting as anchor firms are located in the Eastern Seaboard region. The assembly plants for Honda, Toyota, Nissan, Mitsubishi, Isuzu, Ford and GM are all located in Thailand. In 2008 the number of cars exported was 760,000 and the number of domestic car sales was more than 600,000, with the total number of car sales being the largest in Southeast Asia. The region along Route 331 in Thailand is known as "the Detroit of the East". About 90 firms have moved in and about 30,000 people are employed on Laemchabang Industrial Estate. In addition, about 70 firms have set up and another 20,000 people are employed on the Saha Group Industrial Estate in Laemchabang.

8.4.2 The Electronics Industry Cluster in North Vietnam

This section focuses on the official Japanese development assistance provided and explains the sequence of policy measures related to the industrial cluster in northern Vietnam. The Thang Long Industrial Park, where Canon has established operations, is located near the airport in Hanoi in northern Vietnam. Canon is an anchor firm that acts an attractor for its related suppliers in the case of northern Vietnam. We refer to the situation described here as the "Canon effect".

The flowchart approach to the Canon effect is a typical case among successful ventures in East Asia. Figure 8.5 shows the sequence of policy measures and the total amount of approximately USD600 million of ODA provided by JICA. In this case the sequence of policy measures to efficiently form the segments of the industrial cluster consisted of "the

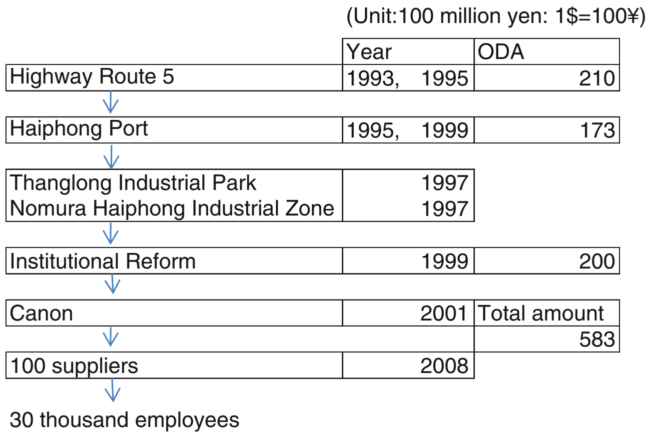

Fig. 8.5 The electronics industry cluster in North Vietnam (*Source*: A. Kuchiki)

rehabilitation of a port," "the construction of highways," "the simplification and liberalization of investment procedures as capacity building" and "the establishment of industrial zones" (see Kuchiki 2007).

The sequence of policy measures was as follows:

1. Port: Haiphong Port was efficiently rehabilitated to allow the import of raw materials and the export of products.
2. Highways: National Highway Route 5 is 100 km in length and links Hanoi in the west and Haiphong in the east. Hanoi is the capital of Vietnam, while Haiphong is a major port city.
3. Industrial zones: Sumitomo Corporation established the Thang Long Industrial Park (TLIP) in Hanoi, while the Nomura Security Company established the Nomura Haiphong Industrial Zone (NHIZ) in Haiphong. Both TLIP and NHIZ offer high-quality infrastructure. TLIP lies at one end of Route 5 in Hanoi. The NHIZ realized a positive effect in a relatively short time owing to the completion of Route 5.
4. Anchor firm: Sumitomo Corporation began selling land lots in TLIP in 1997. Canon established a plant there in April 2001 and began operations in May 2002.

5. Related firms: Companies that provide parts to Canon decided to move into TLIP, particularly in 2002. Thus Canon acts as an anchor company that leads other companies into a location for the purpose of providing parts and components.
6. Results: Canon and its related firms established factories in TLIP after Route 5 was constructed and Haiphong Port was rehabilitated, starting from 2002. Consequently, by 2007, the number of suppliers to Canon had risen to around 100, including about 20 local companies. The exports by firms in TLIP account for 3.3 % of the total amount of Vietnam's exports (interview of T. Gokan by A. Kuchiki in Hanoi on August 28–30, 2008). Between 1997 and 2007 some 82 foreign firms invested in TLIP, and about 37,000 people are employed there.

8.5 The Relationship Between the Economies of Sequence and the Flowchart Approach

Kuchiki and Tsuji introduced their flowchart approach to industrial cluster policy in 2008. This section relates the economies of sequence to this approach. The flowchart approach to the sequencing of policy measures for the formation of segments in an industrial cluster consists of the following three stages. First, the segments forming an industrial cluster need to be identified. If we take the example where the segments in the manufacturing industry are A, B, C, D and E, the number of possible permutations including all five segments is 120. Second, the minimum number of segments for the industrial cluster policy to succeed needs to be selected from the segments identified. Suppose A is an anchor firm, C is capacity building and E is the establishment of an industrial zone, the number of possible permutations is $3 \cdot 2 \cdot 1$, or 6. Even though the number is smaller, we can still only implement one industrial cluster policy. Third, the segments need to be placed in sequence along a flowchart based on previously successful examples of industrial cluster policy in the automobile industry. The range of a cluster depends not on the distance between the anchor firm and its suppliers but on the cost for the suppliers to transport their products to their anchor firm.

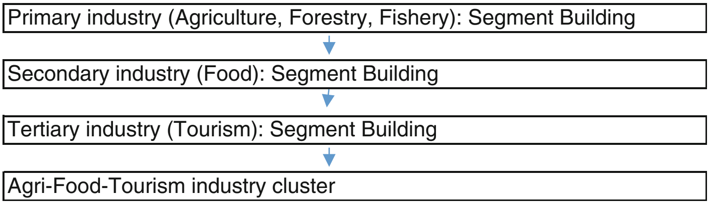

Fig. 8.6 Flowchart approach to the AFTI cluster (*Source*: A. Kuchiki)

We developed a hypothesis for success in an automobile industry cluster policy in Step I: agglomeration. The segments related to capacity building at this stage include the construction of physical infrastructure, institutional creation, human resource development and the facilitation of living conditions amenable to foreign investors.

Figure 8.6 shows an example of the sequence of segment formation in an AFTI cluster. This example is a prototype model of this book. To form an AFTI cluster, we should start by developing the tourism industry. Based on economies of sequence, the first task is the formation of a platform comprising a leader and members to develop a plan, and the construction of a traffic link between the region involved and other regions to encourage tourists. Airports, highways, railways and ports all combine to form the traffic link. The development of basic cultural elements, such as food, music and the arts for the benefit of tourists, is the next step in the sequence of tourism industry formation.

8.6 Summary and Conclusions

This chapter has introduced the flowchart approach, analyzed the sequence of segment formation in an industrial cluster and showed the existence of the economies of sequence in the efficient formation of an industrial cluster by examining the results of industrial cluster policies in Asia. The economies of sequence, corresponding to the economies of scale in economics, are based on the concept that the costs of forming an industrial cluster are insurmountable unless the sequence of segment formation in an industrial cluster is optimized by efficiently sequencing the segments. The economies of sequence exist in the establishment of labor-intensive manufacturing industries in the export-processing zones in Asia. The sequence is the order in which the establishment of industrial zones, the construction of a port and the invitation of an anchor firm are implemented.

We have applied developmental biology to the process of segment formation in an industrial cluster. The segments of a cluster consist of the physical infrastructure, including road construction and electricity supply, as well as institutional creation. Based on our examination of the examples above, we are able to draw the following conclusion. The economies of sequence determine the efficient sequencing of segment formation in an industrial cluster within the flowchart approach to industrial cluster policy proposed by Kuchiki and Tsuji (2008).

Every region in East Asia faces a number of difficulties in shifting from Step I (agglomeration) to Step II (innovation), as demonstrated by Kuchiki and Tsuji (2011). Further work is needed to find the most successful sequence of policy measures for Step II.

Acknowledgements We are grateful to T. Fujimoto and W. H. Wang for their valuable comments and suggestions. All errors are ours. This research was supported by JSPS (21530276) Kaken.

Appendix A: The Definition of the Economies of Sequence

This section illustrates and defines the concept of the economies of sequence as corresponding to the concepts of the economies of scale and the economies of scope as defined in economics. The economies of sequence can be defined as the concept by which the costs of forming the segments of an industrial cluster are reduced when the sequence of segment formation is optimized, while the costs of forming an industrial cluster are uneconomical if the sequence is incorrectly ordered. The sequence of segment formation is crucial to the normal birth of an organism. An organism is formed from the head to the heart and legs in a specific order, with the sequence of the Hox genes determining the sequence of segment formation. We can illustrate the importance of the economies of sequence as follows.

Case 1: Model construction: A plastic model of an airplane needs to be assembled according to the sequence provided in the instructions.

Case 2: Painting: The role of the undercoat is to protect against rust, the role of the middle coat to improve durability and the role of the final coat to enhance the outside appearance. The correct sequence of undercoat, middle coat and final coat must be followed for an effective paint job.

Case 3: Construction of a house: Carpenters build the framework of a house, plasterers put up its walls, painters fix the outside appearance and the electrical work is the final stage.

The above three examples intuitively demonstrate the existence of the economies of sequence.

These can be strictly defined as follows. Suppose that there are three periods: the first, second and third. Let us examine two examples of segment formation sequencing in an industrial cluster. Policy measures form an organ, and there are two candidate sequences of policy measures: A and B. Suppose a cluster consists of three segments $\{s_1, s_2, s_3\}$. The difference between A and B lies in the ordering of s_2 and s_3. In A, the sequence of segment formation is supposed to be $\{s_1 \rightarrow s_2 \rightarrow s_3\}$, and we can assume that the sequence of policy measures to form a production function in A is $\{s_1 \rightarrow s_2 \rightarrow s_3\}$. We can therefore describe A and B as follows:

$$A = \{s_1, s_2, s_3\},$$
$$B = \{s_1, s_3, s_2\}.$$

The production functions for sequences A and B can be given as Y_A and Y_B. The production function of sequence A changes from CRS to IRS in sequence $A(Y_A)$ by implementing the sequence of policy measures. The production function after implementing the successful sequence of policy measures of $\{s_1, s_2, s_3\}$ is $Y_A = f(\{s_1, s_2, s_3\})$. Suppose the production function in sequence A and B in the third period is Y_A and Y_B, respectively, or,

$$
\begin{aligned}
Y_A &= f(A) = f(\{s_1, s_2, s_3\}), \\
Y_B &= f(B) = f(\{s_1, s_3, s_2\}).
\end{aligned}
$$

We can assume without loss of generality that the interest rate in all periods is the same at r. The production costs of Y_B and Y_A are

$$
\begin{aligned}
C_B &= (1+r)^2 C_1(s_1) + (1+r)C_2(s_2) + C_3(s_3), \\
C_A &= (1+r)^2 C_1(s_1) + (1+r)C_2(s_3) + C_3(s_2),
\end{aligned}
$$

where $C_i(s_k)$ ($k = 1, 2, 3$; $i = 1, 2, 3$) is the total costs in implementing the policy measure to form the segment s_k in the period i.

Now we can compare the productivity of A and B in the third period. Suppose there exist economies of sequence between s_2 and s_3. That is, Y_B is very small while Y_A is large. The sequence of segment formation from s_3 to s_2 is inefficient in comparison to that from s_2 to s_3.

Definition: there exist economies of sequence between s_2 and s_3, such as

$$
Y_B / C_B < Y_A / C_A .
$$

Sequence A is more efficient than sequence B owing to the IRS for sequence A.

Appendix B: The Existence of Economies of Sequence

This appendix considers the case in which the local government imposes a tax for cultural production on individuals. We assume that the production function of culture enhances the level of culture by increasing the tax revenue of the local government. The level of culture gives utility to the individuals. Our model demonstrates the existence of economies of sequence.

Let m, l, x and u denote goods, leisure time, culture elements and the utility function of the representative individual, respectively:

$$u = u(m, l, x). \tag{8.1}$$

The maximization problem is solved under the constraint of $\tau = 24$ hours:

$$l + a = \tau, \tag{8.2}$$

where a denotes labor time.

Here, if w, t and T_i denote wage rate, tax rate for an individual i and the total tax for an individual i, then the budget constraint is

$$wa \geq m + T_i. \tag{8.3}$$

If T_i is tax for the provision of cultural public goods, then

$$T_i \leq twa \tag{8.4}$$

as the total tax is twa. The total tax of a region (T) can therefore be given as

$$T = nT_i,$$

where n is the population.

The social production function of culture is

$$x = H(T), \tag{8.5}$$

Where

$$T = f(\{H_1, H_2, H_3\}),$$
$$0 = f(\{H_1, H_3, H_2\}),$$

and

$$0 = f(\{H_2, H_1, H_3\}).$$

Here we suppose that a cluster consists of three segments: H_1 , H_2 and H_3. The segments are formed one by one along the time axis. This means that the production level will be zero if the sequence of organ formation is incorrect.

Proposition: There exist economies of sequence under certain conditions.

Proof:

The Lagrangian function, taking considerations from (1) to (5), is

$$L = nu(l, m, x) - \alpha\{n(1-t)wa - nm\} - \beta(l + a - \tau) - \gamma(T_i - twa) \\ - \delta(x - (nT_i)).$$

The solution is

$$\frac{\partial u}{\partial l} = w \cdot \frac{\partial u}{\partial m} + \left(n \cdot \frac{\partial \mathrm{H}}{\partial \mathrm{T}} - \frac{\partial u}{\partial m}\right) tw.$$

In the case of $t = 0$ (i.e. where no tax is imposed on the population),

$$\frac{\partial u}{\partial l} = w \cdot \frac{\partial u}{\partial m}, \tag{8.6}$$

where the left side, which is positive, is the marginal utility of leisure and the right side is the marginal utility of goods and services gained by the wages paid for the supply of labor.

The case of $t > 0$ can be given as

$$\left(n \cdot \frac{\partial \mathrm{H}}{\partial \mathrm{T}} - \frac{\partial u}{\partial m}\right) tw.$$

The difference between the two cases is

$$\left(n \cdot \frac{\partial \mathrm{H}}{\partial \mathrm{T}} - \frac{\partial u}{\partial m}\right) tw.$$

Here we assume that $\left(n \cdot \frac{\partial \mathrm{H}}{\partial \mathrm{T}} - \frac{\partial u}{\partial m}\right) > 0$.

So

$\left(-\frac{\partial u}{\partial m}\right) tw$, in the case of the incorrect sequence for the formation of organs, or

$$\left(n \cdot \frac{\partial \mathrm{H}}{\partial \mathrm{T}} = 0\right).$$

The sign is minus to explain the negative effect of the economies of sequence in the case where the sequence of organ formation is incorrect.

The left side is the marginal utility of leisure time and the right side is the marginal utility of the goods and services earned by the wages. Both sides are equal and positive.

In the case of the existence of external economic effects, equation (8.6) becomes

$$\frac{\partial u}{\partial l} = w \cdot (1 - t) \frac{\partial u}{\partial m} + twn\left((\partial u / \partial x) \frac{\partial \mathrm{H}}{\partial \mathrm{T}}\right).$$

The left side is the marginal utility of leisure time and the right side is the sum of the first and second terms. The first term is the marginal utility of the goods and services gained by the wages after the reduction in tax. With regard to the second term, the sum of the multiplication of the wage (w) and the tax rate (t) is the tax revenue for the local government from the representative individual, and the sum of the multiplication of wt and the population, or wtn, is the total tax revenue for the local government from the society. The middle parenthesis of the second term $\left((\partial u / \partial x) \frac{\partial \mathrm{H}}{\partial \mathrm{T}}\right)$ is the multiplication of the marginal utility of the individual by the external effect of culture and $n\left((\partial u / \partial x) \frac{\partial \mathrm{H}}{\partial \mathrm{T}}\right)$ is the marginal product of the external effect by the total tax revenue. In sum, the second term is the multiplication of the total tax revenue and the parenthesis—that is, the external effect for the society. This equation becomes

$$\frac{\partial u}{\partial l} = w \cdot \frac{\partial u}{\partial m} + \left(n \cdot (\partial u/\partial Y)\frac{\partial \mathrm{H}}{\partial \mathrm{T}} - \frac{\partial u}{\partial m}\right)tw. \tag{8.7}$$

In the case that the second term of equation (8.7) is positive, we can enhance the level of utilities of n persons by imposing tax on the n persons and providing them with the external effects. Comparing equation (8.7) with equation (8.6), we find the following difference in the second term:

$$\left(n \cdot (\partial u/\partial Y)\frac{\partial \mathrm{H}}{\partial \mathrm{T}} - \frac{\partial u}{\partial m}\right)tw > 0.$$

We assume that the wage is positive ($w > 0$) and the tax rate is positive ($t > 0$). Transforming the above equation gives

$$\left(twn \cdot (\partial u/\partial Y)\frac{\partial \mathrm{H}}{\partial \mathrm{T}} > tw\frac{\partial u}{\partial m}\right). \tag{8.8}$$

This inequality means that the community obtains a higher level of utility in the case of the intervention of the local government than in the case of no intervention if the total external effects are greater than the marginal utility forgone by the tax payment of ntw. The inequality in (8.8) becomes

$$\left(twn \cdot (\partial u/\partial Y)\frac{\partial \mathrm{H}}{\partial \mathrm{T}} - tw\frac{\partial u}{\partial m}\right) > 0.$$

The inequality shows the deviation of the net total external effect from the market solution without intervention.

Now we will explain the case of $H\,(C_A) = 0$ in equation (8.5). In that case, the economies of sequence do not hold and the sequence is incorrect from the point of efficiency. The marginal utility of the representative individual from the external effect of culture for the population is zero. On the external effect of culture$\left((\partial u/\partial Y)\frac{\partial \mathrm{H}}{\partial \mathrm{T}}\right)$, the marginal production of the total tax is zero, $\left(\frac{\partial \mathrm{H}}{\partial \mathrm{T}} = 0\right)$. We have a negative effect in this case. This means that the marginal utility $\left(\frac{\partial u}{\partial m}\right)$of the tax on the wages of the representative individual (tw) is negative:

$$\left(-tw\frac{\partial u}{\partial m}\right) < 0.$$

Consequently, we show that the marginal utility is negative if the economies of sequence do not hold and the sequence is incorrect. In summary, the external effect on culture by the local government is positive if the local government imposes a tax on culture, the economies of sequence hold and condition (8.8) holds. However, we can show that the external effect of culture becomes a disexternal effect if the economies of sequence do not hold. This appendix therefore explains the above economies of sequence from the point of view of welfare economics.

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9

Railway-Led Formation of the Agriculture-Food-Tourism Industry Cluster: Escaping the Middle-Income Trap

Akifumi Kuchiki, Toshitaka Gokan, and Toyojiro Maruya

9.1 Introduction

JICA (2014) forecast that the ASEAN region, except for Singapore, Brunei and Malaysia, will not escape from the middle-income trap by 2025. It is thus necessary for the ASEAN countries to upgrade the quality of their consumption by changing their industrial structure. AFTI clusters contributes to this process of upgrading consumption quality by

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maximizing the effect of industrial linkages between agriculture, the food manufacturing industry and tourism (e.g. in restaurants and hotels) by developing service industries in the tertiary industry.

Nikken Sekkei[1] built a model for establishing a railway line and developing towns along it. Chen et al. (2014) showed that the construction of a traffic system, such as a railway line, precedes the formation of other segments, such as airports in the case of the tourism industry cluster. However, no analysis has been carried out of the dynamic processes of forming the segments of the AFTI cluster by networking railway lines.

This chapter proposes a strategy to develop an AFTI cluster by networking railway lines based on Japanese experiences of developing them in the private sector. The development of railway lines has fostered economic growth in Kansai in western Japan and Kanto in eastern Japan. In particular, Ichizo Kobayashi, the founder of Hankyu Corporation, developed a railway line and formed a railway-led AFTI cluster in Kansai, including the creation of a residential town and a local culture. Such railway-led clusters in Japan typically run about 300 km from the starting station to the ending station. Clustering in rural areas can result in both economic growth and narrower income gaps between the core region and the periphery. This chapter assumes that clusters aim to protect the ecosystem and that strengthening cultural factors is crucial to keeping the management of railway lines profitable.

The first task when forming a tourism industry cluster is the construction of traffic infrastructure, including railways. As railways can transport people quickly and at low cost, they can serve as a policy measure to change the spread of economic activities. There are two approaches. One is to foster an AFTI cluster. This is useful in rural areas with resources to attract tourists by increasing access from the cities. The second is to develop a residential town and a large shopping mall along the railway line. In this approach, passengers in the residential town use the railway and contribute to the profits of the railway company. In both cases, upgrading the level of culture along the railway line is necessary to keep the management of the railway line profitable.

[1] Nikken Sekkei: http://nikken.co.jp/jp/archives/40013.html (2016.11.3)

The remainder of this chapter is organized as follows. Section 9.2 explains the impact of railways from the viewpoint of spatial economics. Section 9.3 states that one policy to escape from the middle-income trap is to enhance the quality of consumption. Section 9.4 shows that the formation of an AFTI cluster is an example of such a policy. Section 9.5 builds the Hankyu Railway Model and explains Ichizo Kobayashi's model. Section 9.6 concludes.

9.2 A Railway-Led Cluster from the Viewpoint of New Economic Geography

Railways can be used as a policy measure to change the geographical distribution of economic activities. Decisions about the location of railway stations and routes can become political issues because of the economic ramifications. This section explains the impact of new railways on the geographical distribution of manufacturing firms and agricultural production from the viewpoint of new economic geography. For this purpose the results of Fujita and Krugman (1995) are introduced to represent the case when railways are not constructed, and Gokan (2016) is referred to as the case when new railways are constructed. By comparing the two, we aim to clarify the impact of new railways on relocating manufacturing firms from cities. In the following, we assume a long, narrow economy on a line along which lies land of homogeneous quality. We start with the case when all manufacturing firms are located in cities.

9.2.1 The Case Without Railways

The spatial distribution of economic activity results from the balance between agglomeration and dispersion forces. New economic geography (Fujita et al. 1999) uses input–output linkages as the source of agglomeration forces, and immobile factors such as the agricultural sector and the higher price of agricultural goods in a city as the source of dispersion forces. The case discussed below focuses on the positive circular causality resulting from the forward and backward linkages between firms supplying manufactured goods and consumers demanding these goods. For the forward linkage, an increase in the number of firms in the city implies more local varieties, which suggests that transport costs are reduced and prices in the city lowered. For the backward linkage, an increase in the number of consumers in the city expands demand for goods, resulting in higher nominal wage rates for manufacturing firms under the existence of the transport costs of these goods. By combining these forward and backward linkages, real wage rates increase because nominal wage rates rise and prices decrease, which leads to a larger population in the city. In contrast, regarding dispersion forces, firms that are located in a remote area from the city enjoy better access to demand in the hinterland under the existence of transport costs. The balance between agglomeration and dispersion forces thus changes depending on the transport costs for manufactured goods and agricultural goods.

As a result, an agglomeration shadow emerges. This means that a firm located in the neighboring region of the industrial agglomeration of manufacturing firms cannot earn enough compared with its agricultural production. Thus another industrial agglomeration can emerge in a location far away from the industrial agglomeration.

In the case without railways, supposing there is no choice of transport mode such that the transport costs of manufactured goods per unit distance are given, the impact of decreasing transport costs becomes vague. This is because a decrease in the price of agricultural goods (manufactured goods), which results in a decrease in their transport costs, leads to a larger (smaller) city population and a greater (smaller) distance between cities.

The shape of the hinterland and the price of agricultural goods in the city can be determined by the interaction between the city and its hinterland. More precisely, these two values are determined by the equality of demand and supply in a market for agricultural goods and the equality of the real wage rates of agricultural workers at the frontier and manufacturing workers in the city, such that workers in any location remain where they are.

In terms of the equality of demand and supply for agricultural goods, supposing that the total population in both a city and its hinterland is given, a larger population in the city means fewer workers in the agricultural sector. Thus the supply of the agricultural goods decreases and their demand increases, which results in a higher price of the agricultural goods in the city. Since a larger population in the city reduces the size of the hinterland, there is negative relationship between the size of the hinterland and the price of the agricultural goods. However, the equality of real wage rates between agricultural workers at the frontier and manufacturing workers in the city, which makes workers remain where they are, leads to a positive relationship between the size of the hinterland and the price of the agricultural goods.

Focusing on the nominal wage rate, the price index at the frontier clarifies this relationship. Higher nominal wage rates in the hinterland for the agricultural sector imply a higher price for agricultural goods in the city. However, the price of the agricultural goods at the frontier falls lower than their price in the city because the frontier is located farther away from the city owing to the transport costs of the agricultural goods. Furthermore, the farther away the frontier is from the city, the higher is the price index at the frontier owing to the transport costs of manufactured goods, and the lower is the price index at the frontier owing to that of the agricultural goods. Note that the impact of the transport costs of the agricultural goods on the price index becomes smaller than the same impact on income because the price index is not organized only by the price of the agricultural goods. In short, the increase in the price index with higher transport costs for manufactured goods and the decrease in income owing to the transport costs of the agricultural goods located further away from the city are compensated by the increase in income for agricultural workers at the frontier because of the increase in price of the agricultural goods.

9.2.2 The Case with Railways

The economy so far has railways. That is, we break the assumption of only one level of transport costs for one product per unit distance. We assume lower transport costs of agricultural goods and manufactured goods per unit distance for connecting the city and only one point in its hinterland (the country station) represent railways, instead of assuming that railways cannot be accessed from the street at any point. We suppose also that the higher transport costs of agricultural goods and manufactured goods per unit of distance are available anywhere, such as on ordinal streets.

This setting may cause an area near the country station but far from the city to enjoy better access to the city than an area far from the country station but near the city because the lower costs for sending agricultural goods allow for paying the land rent even in an area far from the city. Following the above mentioned process, railways modify the shape of the hinterland where the agricultural goods are produced. Figure 9.1 shows an extreme case, where the hinterland areas are shown with bold lines. Before building a country station, the geographical distance from the city determined the shape of the hinterland. After building a station in the hinterland, geographical distance is no longer equal to the distance related to economic activities because of the greater accessibility through better transportation. As a result, agricultural production becomes profitable around the country station far away from the city, which means that local demand for manufactured goods also emerges in remote areas because agricultural workers remain around the country station.

Now we examine whether a manufacturing firm can relocate from the city to the country station, using the market potential function of manufacturing. This function for a location is composed of the real wage rate of manufacturing workers in the location, divided by the real wage rate of agricultural workers in the same location. Thus manufacturing firms dominate agricultural production in the location when the function has a value larger than 1. The vertical axis in Fig. 9.1 shows the value of the market potential function of manufacturing, while the horizontal axis shows the distance from the city. We assume that a country station is located at a point on the

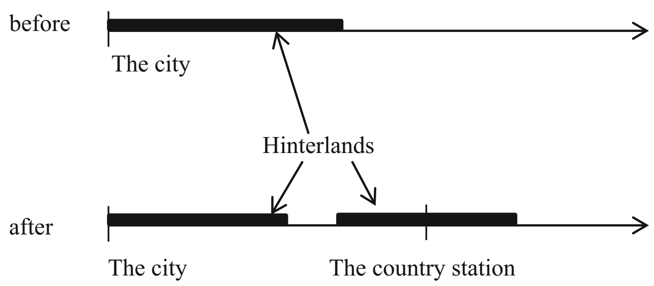

Fig. 9.1 Change in the shape of the agricultural hinterland (*Source*: Developed by A. Kuchiki)

horizontal axis. Thus the peak of the market potential function of manufacturing emerges at this point, whereas the market potential function without railways (see Fujita and Krugman 1995) becomes a smooth function without kinks outside the city, although firms can relocate under a large population size in the economy even if kinks do not exist. Therefore the railway raises the likelihood of manufacturing firms relocating to the country station. As railway-related transport costs fall, the peak of the kink shifts upward. Thus the value of the market potential function for manufacturing at the peak becomes larger than 1 by the lower railway-related transport costs, which implies that manufacturing firms may relocate to the country station. In short, the lower cost of railways tends to help firms to relocate to the country station. Note, however, that this discussion does not include the input–output linkages between manufacturing firms and agricultural production. If such a linkage exists, relocation would emerge more easily as a result of additional agglomeration forces at the country station.

9.3 Upgrading the Quality of Consumption to Escape from the Middle-Income Trap

Many Asian countries are stuck in the middle-income trap. Productivity in labor-intensive industries, such as textiles and shoemaking, is generally low and the wages not that high. These countries thus need to shift from industries with low productivity to those with high productivity to escape the middle-income trap. In the case of Guangdong Province in China, labor-intensive industries find it difficult to make a profit because of rising minimum wages, and they are thus forced to shift their factories from the province to other areas. The province must then create new industries with higher productivity.

One way of escaping the middle-income trap is to change the industrial structure by upgrading the quality of consumption and productivity of manufacturing industries. Manufacturing industries must increase investment in equipment, such as through the introduction of robots in production processes. Upgrading the quality of consumption is a way of escaping the middle-income trap in Asia since welfare depends on not only income but also education and health. The levels of education and health are key indices of the Human Development Index (Kuchiki 2014). One way of escaping this trap is to start businesses related to medical care, beauty, sport or nursing. Another way is to promote businesses concerning the environment, education and culture.

Rationalization in the logistics industry in middle-income countries in Asia is needed to reduce the costs of margins in both wholesale and retail processes. Regarding the marketing of commodities, people buy products at supermarkets instead of open-air markets as their economies grow. Further, they buy commodities at fixed prices without negotiation after a higher stage of economic development and they prefer safe vegetables to those that were previously available. We can easily illustrate the new entry of firms from the manufacturing to the primary industry. Toyota (a car company), NTT (a telecommunications company) and Fujitsu (an electronics company) all began providing services to manage the process of agricultural production.

The income level of China is also in a middle-income trap. China's per capita GDP in 2013 was USD6959 according to Asian Development Outlook 2014. In 2013, China proposed policies to help its economy get out of the trap by upgrading the quality of consumption in the following tertiary industries: (1) social services (medical care, nursing, sport and beauty), (2) information technology consumption (online games), (3) cultural services (tourism, cinema, animation and arts) and (4) economic services (financial services and logistics).

9.4 The Formation of the Agriculture-Food-Tourism Industry Cluster to Upgrade the Quality of Consumption

9.4.1 Tertiary Industry

Table 9.1 describes the tertiary industry as defined by the Ministry of Economy, Trade and Industry in Japan. Public utilities such as the electricity, telecommunication and transportation sectors (F, G, H) are

Table 9.1 Sectors in the tertiary industry

F	Electricity, gas, steam and air conditioning supply
G	Information and communication
H	Transportation and postal activities
I	Wholesale and retail trade
J	Financial and insurance activities
K	Real estate activities
L	Professional, scientific and technical activities
M	Accommodation and food service activities
N	Activities of households as employers; arts, entertainment and recreation
O	Education
P	Human health and social work activities
Q	Other service activities

Source: Developed by A. Kuchiki based on Ministry of Economy, Trade and Industry, Japan (http://www.meti.go.jp/press/2014/06/20140609002/20140609002-C.pdf)

included in the tertiary industry. The services in the hotels and restaurants sector (M) enhance the utility of people as the economy grows. Lifestyle services, education and study support, medical care and welfare are all promising sectors in Asia. Table 9.2 shows the breakdown of the classification of lifestyle services. The sectors relating to ceremonial occasions, tourism and sport are all promising.

9.4.2 Definition of the Agriculture-Food-Tourism Industry Cluster

First, we define the coverage of the tourism industry. No industrial code in the industrial classifications defines the tourist industry. Tourism includes various sectors, such as restaurants, travel agents, hotels, transportation, confectionary and souvenirs. Medical care services are included in the case of medical tourism, and agriculture is included in the case of agricultural tourism. This means that the tourism industry covers various industries in the primary, secondary and tertiary sectors, and that the coverage of the tourism industry is varied.

Second, we explain an input–output table. A sector only inputs its output into the same sector when there is no industrial linkage between the sector and others (Table 9.3). The agricultural sector inputs its output into the food manufacturing sector, while the food manufacturing sector

Table 9.2 Breakdown of lifestyle services in Japan

Laundry, beauty and bath services
Establishments engaged in administrative or ancillary economic activities
Laundries
Barbershops
Hairdressing and beauty salon
Public bathhouses
Miscellaneous public bathhouses
Miscellaneous laundry, beauty and bath services.
Establishments engaged in administrative or ancillary economic activities.
Travel agency
Domestic services
Garment sewing services and repairs
Checkrooms, safety deposit services
Crematoriums and graveyard custodians
Ceremonial occasions
Living-related and personal services n.e.c.
Establishments engaged in administrative or ancillary economic activities
Cinemas
Performances (except otherwise classified), theatrical companies.
Bicycle, house, motorcar and motorboat race track operations and companies.
Sports facilities
Public gardens and amusement parks.
Amusement and recreation facilities

Source: Statistics Bureau, Ministry of Internal Affairs and Communications

Table 9.3 Input–output table without industrial linkages

	Agriculture	Food	Logistics	Tourism
Agriculture	◎			
Food		◎		
Logistics			◎	
Tourism				◎

Source: Developed by A. Kuchiki

inputs its output into the wholesale and retail sectors in the tertiary industry when the industries are linked, as shown in Table 9.4.

Third, we explain the clustering of the tourism industry. Step I and Step II are industrial agglomeration and innovation, according to Kuchiki and Tsuji (2008). Fourth, we illustrate the value chain in agriculture, which includes the procurement of materials, the production of an

Table 9.4 Input–output table with industrial linkages

	Agriculture	Food	Logistics	Tourism
Agriculture	◎	◎	◎	◎
Food		◎	◎	◎
Logistics			◎	◎
Tourism				◎

Source: Developed by A. Kuchiki

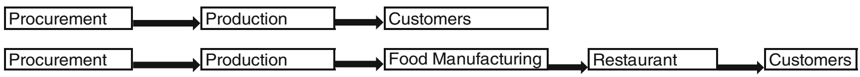

Fig. 9.2 Value chain (*Source*: Developed by A. Kuchiki)

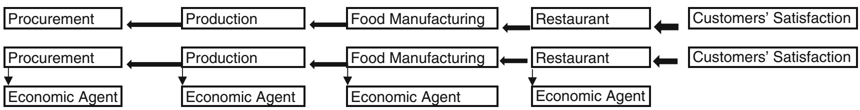

Fig. 9.3 Value chain management with the industrial linkages of agriculture, the food industry and restaurants (*Source*: Developed by A. Kuchiki)

agricultural product, the processing of the product and the input of a restaurant (Fig. 9.2). The final output of this chain goes to customers.

Value chain management aims to maximize the total value of the chain by increasing customer satisfaction and strengthening the backward linkages of the chain (Fig. 9.3). The restaurant value chain in Fig. 9.3 shows the processing, production and procurement of materials from customers.

Here we define the steps of the AFTI cluster that are different from those of the manufacturing industry cluster. The first step is agglomeration in agriculture, the food industry and the tourism industry. The second step is where firms in these three industries implement value chain management. Backward linkages between the three clusters are then created. The third step is innovation in the AFTI. The formation of the AFTI cluster can enhance the quality of consumption. Its purpose is to maximize the effects of industrial linkages between the three industries. Figure 9.4 shows that the sequence of the formation of segments is the development of the primary industry, the secondary industry and the tertiary industry in the industrial agglomeration stage (Step I). This

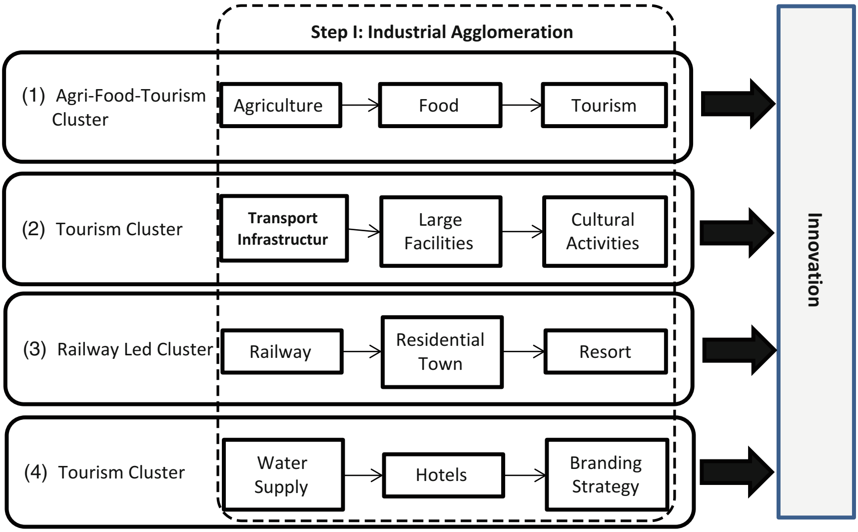

Fig. 9.4 Sequence in the formation of the segments of the AFTI cluster (*Source*: Developed by A. Kuchiki)

sequence facilitates the provision of transport infrastructure, constructing large facilities such as shopping malls, and improving tourism resources. For example, the construction of museums to enhance the cultural level in the tourism cluster contributes to the management of a railway company.

9.5 Prototype Model of the Hankyu Railway Model: Odakyu and Other Railway Companies

This section proposes a prototype model for the railway-led cluster in Japan, termed the Hankyu Railway Model. Figure 9.5 shows the possible formation of the railway-led cluster in the following sequence: the construction of a railway, the development of a residential town along the railway line and the provision of cultural activities.

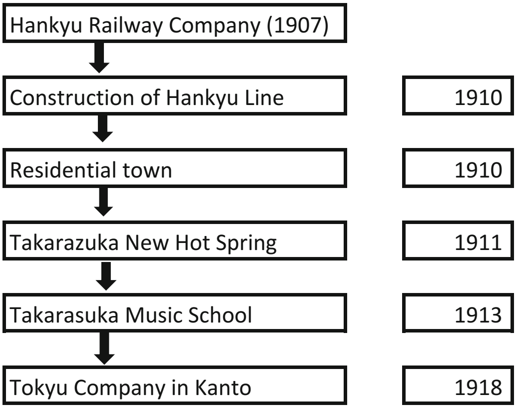

Fig. 9.5 Hankyu model (*Source*: Developed by A. Kuchiki based on Tsuganezawa [1991], Committee on Editing the History of Takarazuka City [1977] and Hankyu Railway [2014])

9.5.1 The Hankyu Railway Model

Ichizo Kobayashi, the chair of Hankyu Railway, was successful in fostering clusters in Kansai, southern Japan, as an initial stage of the sequence of forming an industrial cluster by establishing the Hankyu private railway. His business model was to construct a residential town in suburbs, and for its residents to use the railway to contribute to the management of the railway. Schools and tourism facilities such as a hot spring were constructed at the ending station of the railway. Therefore people used the railway from the center to the suburbs and vice versa. First, a private railway was established in 1907. In 1910, a line linking Osaka Umeda and Takarazuka opened, and the construction of a residential town at Ikedamuromachi along its line was then completed.[2]

Figure 9.6 shows that railways link stations at a starting point, a middle point and an ending point (department stores at the starting point, a resort town at the ending point, and residential towns, a stadium and schools at middle points along the line). The Hankyu Department Store,

[2] Ikeda City Library (2016. 11.3): http://lib-ikedacity.jp/kyodo/kyodo_bunken/kobayashiichizo/index.html

Fig. 9.6 Development of the AFTI cluster by railway express (*Source*: Developed by A. Kuchiki)

the first department store at a terminal station in Japan, was opened in 1929. Takemura (1988) called the line the "cultural region of the railway." The level of culture was enhanced along the line. Hobsbawm and Ranger (1983) found that people make an effort to create tradition over time. Matsuda (2003) pointed out that the development of residential towns in suburbs is crucial to the management of private railways. In summary, the sequence of forming the segments of a cluster is the construction of a railway, the development of residential towns and cultural creation.

9.5.2 Odakyu Railway in Eastern Japan, Kanto

There are two main regions supporting the Japanese economy: Kansai in the west and Kanto in the east. The Hankyu Railway Model in Kansai is a prototype model to develop regions in Japan. The establishment of Odakyu Railway in Kanto originated from the Kobayashi model. The line linked Shinjuku in the center of Kanto and Odawara in the suburbs of Kanto. Later, a bullet train linked Odawara in Kanto and Osaka in Kansai. Residential towns, and cultural facilities (e.g. museums and shopping malls) were constructed along the Odakyu line. Agriculture in the suburbs also helped to narrow the gap between the center and the suburbs. We explain the case of Odakyu in Fig. 9.7. Nararoku Ando established Odakyu in 1923. Express trains were introduced to link Shinjuku and Odawara. The figure shows the sequence of forming schools in 1925 and 1926, the Odakyu line in 1927, a residential town in 1929, and a cinema and a broadcasting station in 1932.

Thanks to the construction of the residential town, the number of passengers from Odakyu increased from 293,413 in 1929 to 661,707 in

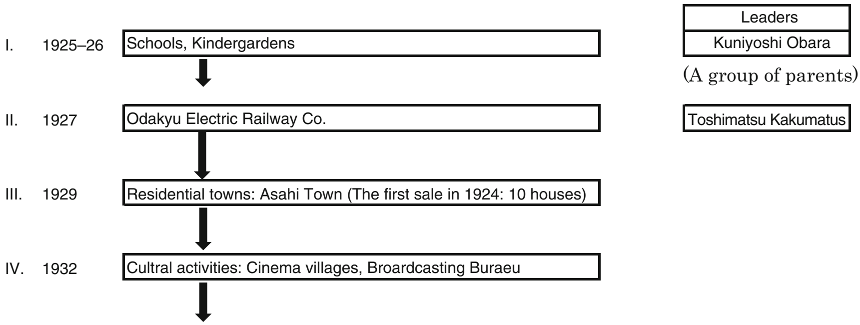

Fig. 9.7 Sequence of building the segments of Odakyu Railway (*Source*: Developed by A. Kuchiki)

1930 (Table 9.5). The average number from 1930 to 1936 increased to 689,706, proving that the construction of a residential town is effective in managing a railway company. The case of Odakyu thus confirms that the establishment of schools is effective at keeping railways manageable.

The enhancement of the cultural level is also needed to manage a railway company. Yamashita et al. (2013) explained that culture is composed of history, food, dynasty, resorts, alcoholic beverages and so on. Becker (1965) found that the independent variables of leisure utility (U) are composed of both time (T) and goods and services (G): U = U (T, G).

This chapter takes into consideration the quality of leisure utility. The level of utility depends on the quality of design (D) as an exogenous variable, or U = U (T, G: D). Miraikeizaiken (2002) insisted that the level of culture (C) is a kind of infrastructure for creating good design U = U (T, G: D(C)). In short, the level of leisure utility depends on the level of culture.

9.5.3 Private Railway Companies in Kanto

Kaichiro Nezu started Tobu Railway in Kanto (Table 9.5). The destination station of the line is the sightseeing spot of Nikko. Hideo Shibusawa opened the Tokyu Line in 1922, which helped to reduce the travel time between the center of Kanto and rural areas. Keita Goto then constructed

Table 9.5 History of the development of Japanese railway companies

Private railway company	Leader	The sequence of forming the segments of the cluster
Hankyu (1910)	Ichizo Kobayashi	Takarazuka Revue Company (Takarazuka Music School, Takarazuka Hot Spring) (1914) *Source*: Kobayashi (1955) The development of a residential town (1910) A large facility: the entertainment facility: Takarazuka New Hot Spring (1911) Umeda Koma Theater (1956) Sport: a baseball team of Hankyu (1947) *Source*: Hankyu Railway (2014) http://www.hankyu.co.jp/company/), Hankyu Culture Foundation http://www.hankyu-bunka.or.jp/
Tobu (1905) (Tokyo-Nikko (1929) 94.5 km)	Kaichoro Nezu	Nikko Toshogu Shrine-Kinugawa Hot Spring town (1927) Shopping center: Utsunomiya Department Store (1959) *Source*: Nakagawa, Koichi(1972/3)History of Tobu Railway, The genealogy of Tobu Railway: http://ktymtskz.my.coocan.jp/nakagawa/toobu.htm)
Odakyu (1923)	Nararoku Ando	Shinjyuku-Odawara (1949) 1700 types of super express train: Romance Car (1951) The development of a residential town (the Housing Loan Corporation in 1953) A large facility: a rose garden (1958) Odakyu Beach House (1958) Odakyu Pool Garden (1961) *Source*: Odakyu: http://www.odakyu.jp/company/history80/
Tokyu (1922)	Hideo Shibusawa	Study tours: a suburb in London and San Francisco in 1919 A high-class residential town: Denenchoufu (1926) The development of an Etoile-type road
	Keita Goto	Tokyo Institute of Technology (1924) Keio University (1934)

(*continued*)

Table 9.5 (continued)

Private railway company	Leader	The sequence of forming the segments of the cluster
		Nippon Medical School (1931) A shopping center: a terminal department store: Shibuya Toyoko Department Store (1934) *Source*: Goto et al. (1980)

Source: Developed by A. Kuchiki

schools and a shopping mall. Hence the Hankyu Railway Model contributed to the growth of both Kansai and Kanto.

9.6 Conclusion

Countries in the middle-income trap must upgrade the quality of their consumption in order to escape it. One way of upgrading consumption quality is to form an AFTI cluster by introducing the railway-led clustering of private electric railway companies. The sequence of AFTI clustering is forming agriculture, the food manufacturing industry and the tourism industry. The industrial cluster policy should also aim to maximize the effect of the industrial linkages between these sectors.

Railway-led industry clusters include the construction of the railway, the development of a residential town and the enhancement of the level of culture. A railway system consists of subways, railways and bullet trains. Railways play a key role in forming clusters since residential towns, large facilities such as shopping malls and resort towns are constructed within about 200 km of the starting station to the ending station along a railway. The management of a railway company is then profitable when passengers in the residential town use the railway.

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10

Quantitative Analyses of the Economies of Sequence: The Impact of New Airport Construction on Tourism Industry Growth—A Case Study of Hong Kong and Singapore

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10.1 Introduction

While Asian economies are developing, there are few cases where an industrial policy of fostering manufacturing sectors has turned out to be successful. The Asian financial crisis in 1997 prompted Asian countries to

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shift their growth strategy from a state-led industrial policy to an industrial cluster policy in which local governments took a leading role. Aiming to build a knowledge-intensive cluster with Singapore ONE as a start and to become a regional headquarters in Asia, the government of Singapore has promoted the expansion of the tourism industry. China, with the world's second largest nominal GDP, also switched with its 11th Five-Year Plan from an industrial policy to an industrial cluster policy (A. Kuchiki 2007). In recent years it has become a key issue for Asia to establish a tourism industry cluster.

In previous studies of the creation of such a cluster, C. Ryan (2003) pointed out that tourism industry development has a close relationship with sociotechnical innovation, and transportation convenience constitutes a critical element. A. Kuchiki (2007) analyzed industry clusters in Asia through a flowchart approach. With the majority of existing work focusing on labor-intensive industries, there are few studies of the formation of a tourism industry cluster of all tertiary industries in Asia. There are also very few studies which, through the use of a quantitative method, analyze the relationship between tourism and economic growth in Asia. Consequently, it has become an important to identify the essential elements and requirements for the efficient creation of a tourism industry cluster and the sequence of applying them using the theory of the economies of sequence.

This chapter explores what role (the opening of) an international airport plays in the creation of tourism clusters and what impact it has on the economy, using Hong Kong and Singapore as examples. First, Sect. 10.2 provides an overview of the process of the development of international airports and tourism industry clusters in the two countries. Next, Sect. 10.3 looks at the trend in average annual rates of increase in the number of tourists and tourism revenue, as well as that in GDP growth rate. Using the Granger causality test, Sect. 10.4 carries out a statistical analysis of tourism revenue and economic growth (GDP growth rate) in Hong Kong and Singapore to explain how they are causally related. Section 10.5 concludes.

10.2 Tourism Industry Cluster Formation and an Outline of Airport Industries

This section gives an overview of the formation of tourism industry clusters in Hong Kong and Singapore, as well as the entire process from the opening of Hong Kong International Airport and Changi Airport to their development. We have gathered study materials on the tourism industries and the international airports, and conducted interviews to investigate their current situation.

10.2.1 Tourism Industry Cluster Formation

10.2.1.1 Tourism Cluster Formation in Hong Kong

The Hong Kong Tourism Board (HKTB) plays a key role in the creation of tourism industry clusters in the region. Consisting of 20 members, all of which are selected from the private sector[1] and appointed by the government of Hong Kong, the HKTB is engaged in compiling materials targeted at travelers from all over the world and the tourism industry in Hong Kong to improve travel services.[2] Other than the preparation of materials, from 2002 to 2003 it contributed to the easing of regulations, such as lifting the limit on the number of mainland Chinese visiting Hong Kong and abolishing restrictions on entry by mainlanders from certain regions (Yearbook of Hong Kong Tourism Industry Statistics 2003). In addition to playing a political role, the HKTB actively tackles various issues, including the deterioration in guide service quality and retailers' customer services owing to an increasing number of tourists. It also

[1] The members are selected from a range of travel-related sectors, such as transportation, hotel management, travel agency, retail and restaurants. The HKTB has offices in about 16 cities around the world and it conducts advertising campaigns centering on the cities where its offices are located (Yearbook of Hong Kong Tourism Industry Statistics 2001).

[2] The HKTB has compiled materials for tourists from all over the world, such as *Hong Kong Tour Guide*, *Shopping and Restaurants Guidebook* and *Hong Kong Stories*, and those for the tourism industry in Hong Kong, such as *Guidelines for Hong Kong Tourism Business* and *Hong Kong Guide*, to improve the level of travel services (Yearbook of Hong Kong Tourism Industry Statistics [2003]).

contributed to the development of the Hong Kong Disneyland Resort. Entry by anchor companies such as Disneyland Resort[3] into the Hong Kong tourism market has boosted the attractiveness of its sightseeing and the number of visitors from Asia.

Buoyed by the opening of Hong Kong International Airport, the number of airline companies increased to 76 (in 2011) and the number of scheduled flights per week reached 2719. The number of hotels and inns also increased from 508 (in 1998) to 836 (at the end of 2011), while the occupancy rate reached 89 % (in 2011). Moreover, the average daily room rate rose to HKD1356. The use of taxis, buses and ships has increased owing to the increasing number of tourists from mainland China. Connected with eight ports in Guangdong Province, Hoi Tin Harbor (next to the airport) was used by 2.4 million tourists in 2011. Transportation convenience has further increased the number of tourists and created a synergistic effect.

As we have seen so far, active private sector involvement has played a crucial role in the creation of tourism industry clusters in Hong Kong.

10.2.1.2 Tourism Cluster Formation in Singapore

Considering that the tourism industry would help the economy to develop through the creation of employment and the acquisition of foreign currency, the Singapore government established the Singapore Tourism Promotion Board (STPB) in 1964. In the 1960s and 1970s, the STPB launched its "Instant Asia campaign and built the Merlion in order to promote Singapore overseas as a "Garden City". In the 1980s, focusing on the preservation of cultural sites to respond to changing tourist needs, it put much effort into increasing tourist awareness of its ethnic and historic sites.[4] In 1996 the STPB was renamed the Singapore Tourism

[3] Disneyland Resort consists of Hong Kong Disneyland, Hong Kong Disneyland Hotel and Inspiration Lake Recreation Center.

[4] The STB called for relevant government bodies to redevelop Chinatown, Little India, Kampong Glam and so on, and it was actively involved in these redevelopment projects. The projects not only built new tourist attractions but also contributed to raising Singaporeans' awareness of their own culture (Yeoh and Chang 2001).

Board (STB) as an organ responsible for transforming Singapore into a world-class tourist destination. At the same time, it announced a new masterplan to be implemented towards the twenty-first century, the Tourism 21 plan, and it redefined its own role. The STB has carried out a number of projects[5] over the years since the initiation of the Tourism 21 plan, and it has set much store by international cooperation with the Indonesian Archipelago and others[6] in order to drive further innovation. In addition, working together with universities and research institutes, it has been developing information and communications technology, while adopting the latest information and research outcomes.[7]

Because Singapore is an island country and its tourism resources are very limited, the government has taken the initiative to develop tourist attractions. In 2008 the construction of the Singapore Flyer (the world's largest observation wheel) was completed and the country successfully hosted a Formula One race. Meanwhile, the country's success in inviting low-cost carriers such as AirAsia and Tigerair has resulted in a rapid increase in the number of tourists. The number of hotels has increased from 139 (in 1991) to 243 (in 2008), while the number of scheduled flights per week grew to 1,995 in 2008. In 2011 an integrated resort with a casino was developed, and a new cruise terminal was opened in order to attract tourists from India, China and Indonesia. In addition, a variety of artificial gardens such as Gardens by the Bay and River Safari were opened in 2011 and 2012, respectively. As a result, in 2011 the number of hotels and scheduled flights per week rose to 304 and 2530, respectively. Moreover, about 600 events took place in 2011 took place aided by financial support to both domestic and overseas events, and policy relaxation including streamlined immigration procedures. Owing to a synergistic effect created by these factors, the

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[5] In cooperation with the National Heritage Board, the STB promoted extensive discussions with business operators, residents, retailers and so forth in Chinatown, encouraging them to make a donation to the National Heritage Board. In 2003 the STB took the initiative in renovating three streets in Chinatown for use by pedestrians and in transforming them into a street market comprising more than 100 stores.

[6] Joint development projects with the Indonesian Archipelago highlight the importance of international cooperation between Singapore and neighboring countries so that they can benefit from their complementary relationship.

[7] In collaboration with a university, the Department of Statistics developed a tourism satellite account and assessed the extent of contribution from the tourism industry to the real economy.

number of tourists reached 13.17 million in 2011 and tourism revenue expanded to SGD17.7 billion.

In Singapore, as we have seen so far, the STB and government-owned companies have constructed tourist attractions, while tourism industry clusters have been formed with government-owned operations acting as anchor companies and their affiliated firms cooperating and competing with each other.

10.2.2 An Outline of Hong Kong International Airport and Changi Airport

Table 10.1 shows the process of the development of Changi Airport (1975–2012) and Hong Kong International Airport (1989–2012). These will be described further below.

Table 10.1 Process of development of Hong Kong International Airport and Changi Airport

Year	Hong Kong International Airport	Year	Changi Airport
1989	Construction agreed	1975	Construction agreed
1992	Construction started	1981	Operation of terminal 1 started (29 gates)
1998	Operation started	1991	Operation of terminal 2 started (35 gates)
1999	Operation of second runway started	2006	Operation of budget terminal started (28 gates) for low-cost carriers
2001	Became the world's third largest airport		
2012	Number of users per year reached 56 million	2008	Operation of terminal 3 started (28 gates)
Current number of employees	65,000	Current number of employees	28,000

Source: Created by Z. Chen

10.2.2.1 The Process of Development of Hong Kong International Airport

Hong Kong International Airport was opened in July 1998 for reasons such as the following: in line with economic development, Kai Tak Airport's arrival and departure capacities had become unable to meet the growing demand; and owing to a dramatic change in flight conditions in the surrounding area of Kai Tak Airport, safe operation was no longer ensured. In the year immediately after the opening of the airport, the number of users stood at 27.6 million. In 2000, the number swelled to 32.64 million and the volume of freight transport reached 2.06 million tons. After that, the number of users declined to 26.75 million, dented by the dot-com bubble burst in 2001 and the severe acute respiratory syndrome (SARS) outbreak in 2003. However, since 2004, when the negative effect of those factors was eliminated, demand for Hong Kong International Airport has picked up remarkably.

Despite a dip in both the number of users and the volume of freight transport on account of Lehman's collapse, they started to recover in 2010. In 2012 the number of users, the volume of freight transport and the annual arrivals and departures totaled 56 million, 4.03 million tons and 352,000 flights, respectively. These figures indicate that the opening of the new airport has not only made it easier for travelers to get to Hong Kong by air but has also facilitated the development of a range of industries through the improvement of air transport capacity. Hong Kong International Airport together with related facilities has created job opportunities for 65,000 people.

10.2.2.2 Process of Development of Changi Airport

The Singapore government launched the "Second Industrial Revolution" in 1979 with a view to resolving inconsistency between labor-intensive production and capital-intensive production. The objective was to transform Singapore into a producer country using more advanced technologies, get it out of the race with low-wage countries and help it to enter a stage of high economic growth. To this end the government placed emphasis in the 1970s on not only industrial fields such as aircraft, automobiles/automotive products and precision equipment but also on industrial services, medical facilities and high value-added industries that used water and air routes in Southeast Asia. The construction of Changi Airport began around 1975 to accommodate the rapidly increasing demand for air travel and it was completed in 1981. The number of users reached 5.4 million after the opening of terminal 2 and surged to 6.9 million in 1994.

The construction of a budget terminal in 2006 led directly to an increase in the number of tourists; for eight months after its opening the number of airport users increased by a million. Owing partly to Lehman's collapse, the opening of terminal 3 did not trigger an increase in the number of tourists but it did play a part in the recovery of tourism demand from 2009 onwards. The volume of freight transport soared from 0.193 million tons immediately after the opening in 1981 to 0.623 million tons in 1990, then to 1.682 million tons in 2000 and to 1.813 million tons (slightly less than ten times the initial volume) in 2010. These data indicate that Changi Airport is indispensable for Singapore's economy. It has created job opportunities for 28,000 people.

10.3 A Sharp Increase in the Number of Tourists, Tourism Revenue and Gross Domestic Product

This section describes the changes in the number of tourists, tourism revenue and GDP in Hong Kong and Singapore. Figures 10.1, 10.2 and 10.3 show these trends in those two countries. Meanwhile, Table 10.2 summarizes the average annual rates of increase in the number of tourists, tourism revenue and GDP of the two countries calculated by period.

Thanks to the government's adoption of the positive non-intervention policy in the 1960s and 1970s, Hong Kong received the benefits of trade liberalization and globalization of multinational companies, and, accordingly, export-oriented light manufacturing industries such as textile and plastics processing developed. By 1980, GDP had skyrocketed to

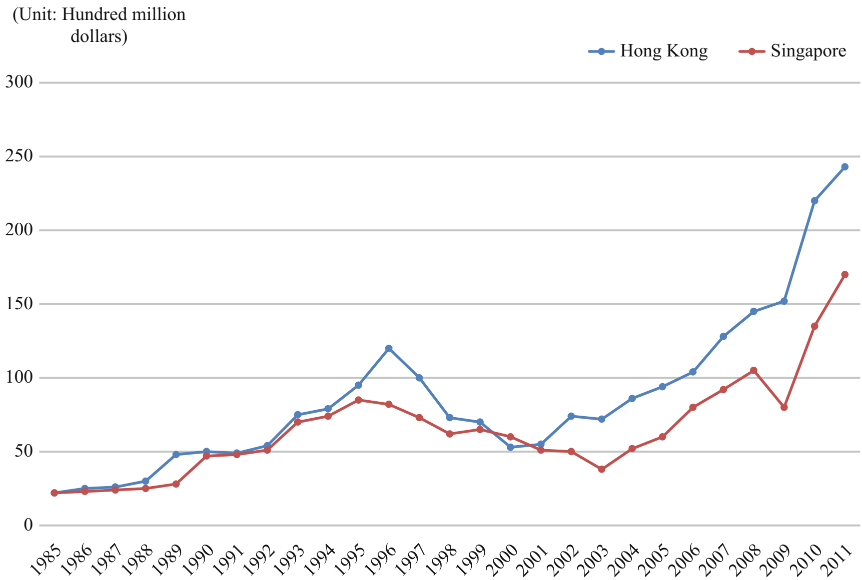

Fig. 10.1 Trend in tourism revenue of Hong Kong and Singapore, 1985–2011 (*Source*: Created by Z. Chen)

HKD28.8 billion, 5.8 times the size of the GDP in 1970. Furthermore, in line with advances in China's reform and open-door policy in the 1980s, Hong Kong's manufacturing industries crossed the border and made inroads into China. This has transformed Hong Kong into Asia's center of finance, commerce and tourism. The number of mainland Chinese visiting Hong Kong has been on the rise since the 1980s. Table 10.2 shows that in the period from 1985 to 1989 (up to the Gulf War), the average annual rates of increase in tourism revenue, the number of tourists and GDP were 27.4 %, 13.1 % and 17.9 %, respectively, all of which are the highest of all periods. From that period to 1996, both the tourism industry and the overall economy had followed a steady upward path. Adversely affected by the Asian financial crisis in 1997, the number of tourists plunged from about 13 million in 1996 to about 10 million in 1998, while GDP posted negative growth. However, in 2000 the number of tourists recovered to the level before the financial crisis and GDP bounced back to post positive growth. From then on, despite a temporary

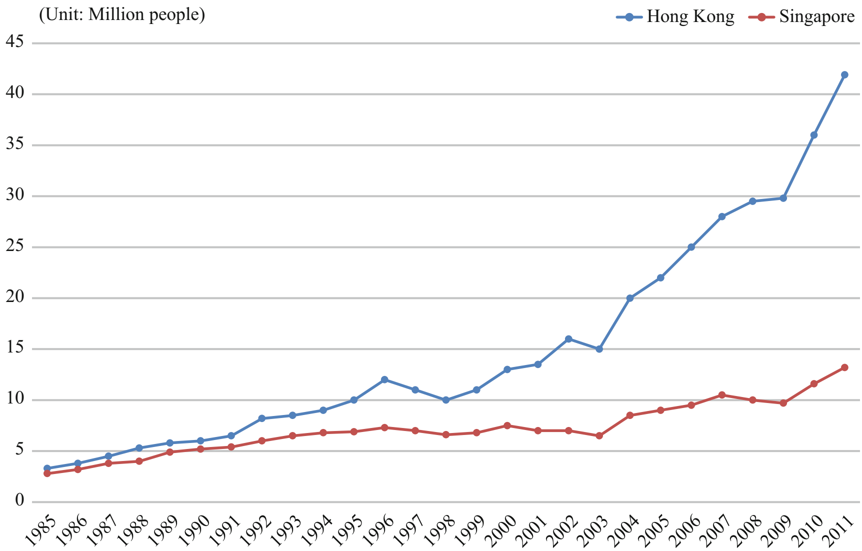

Fig. 10.2 Trend in number of tourists to Hong Kong and Singapore, 1985–2011 (*Source*: Created by Z. Chen)

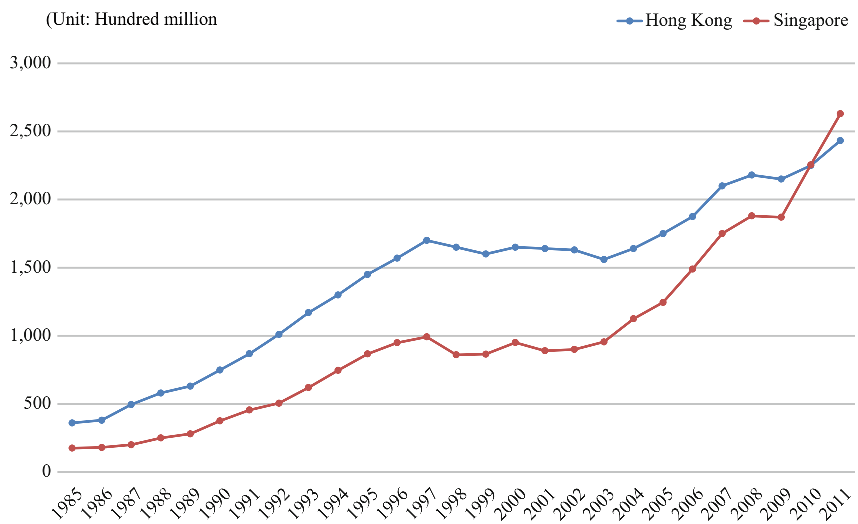

Fig. 10.3 Trend in GDP of Hong Kong and Singapore, 1985–2011 (*Source*: Created by Z. Chen)

Table 10.2 Average annual rates of increase in tourism revenue, number of tourists and GDP of Hong Kong and Singapore (%)

	Hong Kong			Singapore		
Period	Tourism revenue	No. of tourists	GDP	Tourism revenue	No. of tourists	GDP
1985–1989 (1985–Gulf War)	27.4	13.1	17.9	18.8	12.4	14.2
1990–1996 (Gulf War–Asian financial crisis)	14.1	11.7	12.7	13.4	6.1	17.2
1997–2002 (Asian financial crisis–SARS)	−8.1	4.2	0.5	−7.7	0.6	−0.8
2003–2008 (SARS–Lehman's collapse)	12.5	10.1	4.7	13.9	5.0	13.1
2009–2011 (Lehman's collapse–present [2011])	22.4	12.4	4.1	18.2	9.2	11.0

Source: Created by Z. Chen

slide in the number of tourists as a result of SARS, the expansion of the use of the new international airport coupled with the relaxation of statutory rules for individual visitors from mainland China to Hong Kong (Hong Kong free travel) significantly increased the number of mainland Chinese tourists between 2003 and 2008.

The annual number of tourists exceeded the 20 million threshold in 2004 and reached 29.5 million in 2008. During this period, the average annual rates of increase in tourism revenue, the number of tourists and GDP recovered to 12.5 %, 10.1 % and 4.7 %, respectively. After that, although the growth of the number of tourists and tourism revenue was weak for about a year because of the so-called "Lehman shock," the number of tourists and GDP in 2011 totaled 41.9 million and HKD243.3 billion, respectively.

It is assumed that the shift in industrial policies from import-substitution industrialization (from the 1950s to 1965) adopted when the country was founded to export-oriented industrialization (from 1966 to the early 1970s), the success of industrial restructuring policies launched in succession, such as capital- and technology-intensive industrialization (from the late 1970s to the early 1980s), and the promotion of the services sector (from 1986 to 1997) have been the driving force behind economic development in Singapore. In pursuit of higher added value, the country has actively promoted the high-tech, electronics and petrochemical industries since 1980, while Changi Airport has contributed to the development of such industries because its opening and expansion have improved air transport capability and enabled the transportation of high-tech and electronics products by air. The success in promotion of the capital- and technology-intensive industries helped the country's GDP to remain on an upward trend to reach SGD99.2 billion in 1997.

In tandem with economic growth, the number of tourists to, and tourism revenue of, Singapore continued growing; their average annual rates of increase remained high until the Asian financial crisis of 1997 (Table 10.2). Although the number of tourists plummeted from 7.3 million in 1996 to 6.2 million in 1998 on account of the crisis, it recovered to a record 7.7 million in 2000. The average annual rates of increase in tourism revenue and GDP have remained above the 10 % level since then. In particular, the successive opening of two integrated resorts with a casino in 2010 has accelerated the recovery of Singapore's tourism industry and economy. It had an economic impact of SGD3.7 billion or 1.7 % of GDP and created 30,300 new jobs in the first three quarters of 2010. Bolstered by the opening of the integrated resorts, the number of tourists, which dropped to 9.7 million in 2009, picked up to 11.6 million in 2010 and surpassed 13.2 million in 2011.

It appears that the tourism revenue (and the number of tourists) has been closely related to the size of the economy in the two countries. However, the causal relationship between the tourism industry and economic growth is not obvious at first glance.

10.4 Testing for Granger Causality Between Economic Growth and Tourism Revenue

This section examines the causal relationship between economic growth (GDP growth rate) and tourism revenue growth rate in Singapore and Hong Kong from a statistical perspective. We used a technique called the Granger causality test, which is often employed in the empirical analysis of causal relationships between economic variables. While the analysis used a vector autoregressive (VAR) model, we needed, as we were handling time series data, to examine whether the data subject to the analysis can be rendered approximately stationary (i.e. "stationarized") before we made a prediction. Based on the results of the examination, we assumed an appropriate forecasting model and tested the causal relationship.

We used data for the period from fiscal 1986 to fiscal 2011. GDP data were obtained from Asian Development Bank Statistics Yearbooks, and tourism revenue data from yearbooks of Hong Kong Tourism Industry Statistics and of Singapore Tourism Statistics. The statistical software R was used in the empirical analysis.

10.4.1 Models and Tests

In order to conduct causality tests between variables we assumed the following k-th order bivariate VAR (k) models:

$$g_t = \sum_{j=1}^{k} a_j g_{t-j} + \sum_{j=1}^{k} b_j r_{t-j} + \varepsilon_t \tag{10.1}$$

$$r_t = \sum_{j=1}^{k} c_j g_{t-j} + \sum_{j=1}^{k} d_j r_{t-j} + \eta_t \tag{10.2}$$

Here g_t is the year-on-year GDP growth rate and r_t is the tourism revenue growth rate at period t, while a_j, b_j, c_j and d_j are the parameters to be estimated. The time series ε_t and η_t are white noise and non-correlated. That is, $E[\varepsilon_t\varepsilon_s] = 0, E[\eta_t\eta_s] = 0, t \neq s$ and $E[\varepsilon_t\eta_s] = 0$ for all t and s.

If $b_j = 0 \cdot (j = 1, 2, \cdots, k)$, the tourism revenue growth rate is not a cause for the GDP growth rate "in a Granger sense". In other words, there is no Granger causality from tourism revenue growth rate to GDP growth rate. Similarly, if $c_j = 0 \cdot (j = 1, 2, \cdots, k)$, there is no Granger causality from GDP growth rate to tourism revenue growth rate. A causal relationship between the variables in the model (18) can be tested by an F-test, which evaluates the following hypotheses:

$$\begin{array}{l}\text{Null hypothesis } H_0: \ b_1 = b_2 = \cdots\cdots = b_k = 0 \\ \text{Alternative hypothesis } H_1: \ b_j \neq 0 \ \text{(for any } j)\end{array}$$

If the F value is significant, we reject the null hypothesis and judge that there must be Granger causality from tourism revenue growth rate to GDP growth rate. Also, with regard to the model (19), we conduct a test in a similar manner. The lag length in the VAR models is determined with reference to the Akaike Information Criterion (AIC) and BIC. We can analyze the causal relationship between the variables in this manner but the test is based on the assumption that the time series is stationary. Unless the time series can be stationarized, F-statistics do not asymptotically adhere to F-distribution and the test cannot be valid.

In cases where variables have a unit root, we can, unless the variables are in a cointegrating relationship, use a VAR model for testing causality between the first differences of the variables. However, if there is a cointegrating relationship between variables, it makes no sense to use a VAR model for testing causality even by taking differences of each series. In such a case we use a vector error correction model by taking differences of each series. To check whether time series data are stationary, here we use the Phillips–Perron (PP) unit root test, which corrects for any serial correlation among error terms. If the time series are non-stationary (if both time series are in line with the $I(1)$ non-stationarity assumption), we conduct the Phillips–Ouliaris test to examine whether or not they are cointegrated.

10.4.2 Analysis Results

Table 10.3 shows the results of the PP unit root tests conducted on GDP growth rates (g_t) and tourism revenue growth rates (r_t) for Singapore and Hong Kong. With regard to Singapore, the null hypothesis that g_t and r_t have a unit root can be rejected at the level of significance of 10 % and 5 %, respectively. Accordingly, considering that the time series are stationary, we use an ordinary VAR model for testing causality between the two variables. With regard to Hong Kong, on the other hand, we cannot reject the null hypothesis that both variables contain a unit root.

Table 10.3 Singapore level results of unit root tests

	Singapore		Hong Kong			
	Level		Level		First difference	
Variable	Test statistic	p value	Test statistic	p value	Test statistic	p value
g	−3.316	0.089	−2.277	0.467	−6.577	0.01
r	−4.016	0.023	−2.856	0.246	−7.473	0.01

Source: Created by Z. Chen

However, because we can reject the null hypothesis at a 1 % level of significance when performing the PP test on the two variables in first differences, we can determine that the first differences of these time series are stationary.

As mentioned previously, in cases where two variables are in line with the *I* (18) non-stationarity assumption, we need to examine whether they are in a cointegrating relationship. We therefore performed the Phillips–Ouliaris test to see if the GDP growth rate and the tourism revenue growth rate of Hong Kong were cointegrated. Since the tests have revealed that the test static stands at −10.219 and the p value is larger than 0.1, the null hypothesis that there is no cointegrating relationship between the two variables cannot be rejected, even at a 10 % level of significance. Accordingly, we cannot say that the two variables are cointegrated. Based on these results, we assume a VAR model by taking differences of each series (excluding the error correction terms) to analyze the causality.

Table 10.4 shows the results of the Granger causality tests conducted using VAR models. First, as for Singapore, the hypothesis that there is no Granger causality from GDP growth rate to tourism revenue growth rate is rejected (a 10 % level of significance), whereas the hypothesis that there is no Granger causality from tourism revenue growth rate to GDP growth rate cannot be rejected. Consequently we can determine that the Granger causality runs from GDP growth rate to tourism revenue growth rate. Both the AIC and the BIC have selected 1 as the optimal lag length in the VAR models for Singapore.

Note: x $\nrightarrow$ y in the null hypothesis means that "there is no Granger causality from Variable x to Variable y". Δ denotes one difference operator.

Table 10.4 Results of Granger causality tests

	Null hypothesis			F value	p value
Singapore	g	$\nrightarrow$	r	3.4343	0.0703
	r	$\nrightarrow$	g	0.0352	0.8520
Hong Kong	Δg	$\nrightarrow$	Δr	1.7985	0.1868
	Δr	$\nrightarrow$	Δg	4.3358	0.0432

Source: Created by Z. Chen

Next, as for Hong Kong, the hypothesis that there is no Granger causality from change in GDP growth rate to change in tourism revenue growth rate cannot be rejected, whereas the hypothesis that there is no Granger causality from change in tourism revenue growth rate to change in GDP growth rate is rejected at a 5 % level of significance. Consequently it is understood that the Granger causality runs from change in tourism revenue growth rate to change in GDP growth rate. We have also selected 1 as the optimal lag length in the VAR models using levels of variables for Hong Kong by reference to the AIC and the BIC.

Based on the abovementioned analysis results (estimated results arrived at by using currently available data), we can say that the tourism industry has affected economic development in Hong Kong. Thus the need for policies to boost the demand for tourism to facilitate economic development in countries with an industrial structure similar to that of Hong Kong has been justified. We find, on the other hand, that the tourism industry has been driven by overall economic growth in Singapore through the development of infrastructure and tourist resorts. By achieving prosperity of the whole economy and attracting more tourists, tourism is likely to develop further. It is understood that the relationship between the tourism industry and economic growth depends on the industrial structure of the respective countries.

10.5 Summary and Conclusion

In this chapter we have examined what impact the opening of Hong Kong International Airport and Changi Airport has had on the two countries' economies. Our conclusion follows.

The opening of the international airports has contributed in the two countries not only to clustering of the tourism industry, a key tertiary industry, but also to overall economic development. Although the opening of the airports did not immediately cause an increase in the number of tourists initially, it increased the number of scheduled flights and, eventually, the number of tourists. The factors behind the increase in tourists for the two countries have been the "relaxation of regulations" and the "opening of new tourist facilities."

The improvement of infrastructure, particularly the opening of the international airport, is crucial for the two countries as an important part of economic growth. Nevertheless, the relationship between the tourism industry and economic growth in Hong Kong is found to be different from that in Singapore. As a result of Granger causality tests, we understand that change in tourism revenue growth rate has an impact on change in GDP growth rate in Hong Kong and there is no reverse causality between them. Hong Kong made a shift in its economic policy to "positive non-interventionism," thereby achieving economic liberalization. In addition, the decline in secondary industries seriously hit by China's reform policy of opening up to the outside world resulted in the rapid development of the financial and tourism industries, which has contributed to economic growth. Accordingly, the need for policies to boost the demand for tourism to facilitate economic development has been justified.

We have found that by contrast to Hong Kong, the GDP growth rate has had an impact on the tourism revenue growth rate in Singapore and there is no reverse causality between them. In other wordss, the tourism industry has been driven by overall economic growth through the development of infrastructure and tourist resorts. In fact, in Singapore, thanks to the growth of government-owned companies and operations in which the government has a stake, the percentage contribution of secondary industries to total GDP has remained at slightly less than 20 %, and adaptation of the industrial structure to meet the needs of the times has advanced the economy. The tourism industry has developed in tandem with the growth of the economy. By achieving prosperity for the whole economy, it is expected that infrastructure and tourist resorts will further improve and the tourism industry will continue to develop. The relationship between the tourism industry and economic growth has been found to depend on the industrial structure of the respective countries.

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11

An Application of the Flowchart Approach to the Agro-Food-Processing Industry Cluster in East Asia: The Case of the Nacala Corridor Region in Mozambique

Akifumi Kuchiki and Tetsuo Mizobe

11.1 Introduction

Manufacturing industry cluster policies have been successfully implemented in East Asia, as shown by Kuchiki and Tsuji (2005). The possibility of applying the experience gained in East Asia to Africa has been examined. However, no industrial clusters, such as those observed in the Eastern Seaboard Region in Thailand and the southern China economic region, have been established in Africa. It has been difficult to introduce direct foreign investment, including automobile firms and their related suppliers, to Africa, and thereafter to agglomerate the firms.

Kuchiki and Tsuji (2008) constructed the flowchart approach to industrial cluster policy and established a model for the formation of an automobile industry as well as electric and electronics industry clusters in

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East Asia. This showed that the flowchart approach could be applied relatively easily to other regions.

The approach introduced a "time axis," in addition to geographical location, in spatial economics. The sequence of the efficient formation of the segments in a cluster is crucial to the success of industrial cluster policy. Here the segments, including roads, ports, electricity and so on, correspond to the investment environment for inviting direct foreign investment.

The purpose of this chapter is to examine whether we can establish an agro-food-processing industry cluster in Africa by using the flowchart approach constructed by Kuchiki and Tsuji (2008). The chapter will build a model of the flowchart approach to the agro-food-processing industry cluster by using the results obtained by Mizobe (2010) in the Nacala Corridor Region in Mozambique, which has one of the lowest incomes in the world.

In most African countries, agriculture is a key industry in generating employment opportunities, with the agricultural labor force representing more than 65 % of the total. It could be cutting edge to promote the development of agro-food-processing industry clusters in Africa.

Section 11.2 presents the prototype model of the flowchart approach to automobile industry cluster policy by showing the sequence of segment formation for industrial clusters. Section 11.3 compares the effects of forward and backward linkages using an international input–output table. Section 11.4 focuses on the effects of the agro-food-processing industry cluster. Section 11.5 presents a case study of an agro-food-processing industry cluster in Africa and proposes a model for such a cluster. Section 11.6 provides a summary and concludes.

11.2 A Prototype Model of Manufacturing Industry Cluster Policy

The purpose of this section is to explain our prototype model of the flowchart approach to manufacturing industry cluster policy and propose appropriate conditions for the success of an industrial cluster policy. That is, the flowchart can lead to the successful formation of an industrial cluster if the appropriate conditions set out in the flowchart are satisfied. Clustering consists of two main steps: Step I (agglomeration) and Step II (innovation), as explained in Chapter 1.

A simple version of Step I is illustrated in Fig. 11.1. First, we ask whether industrial zones have been established. If they have not been established, a decision should be made as to which actors should establish such zones. Once the actors are identified, we return to the main stream of the flowchart.

Next, the second part of Step I is segment building, which takes place after the establishment of industrial zones. We examine whether there is sufficient water supply for the industrial zones. We then proceed along the flowchart to examine whether the power supply, communication and transportation elements of the physical infrastructure are adequate.

After looking at the physical infrastructure, we examine whether appropriate institutions, laws and regulations are in place. The central

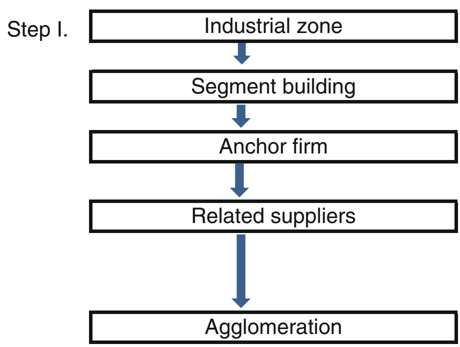

Fig. 11.1 Flowchart approach to the automobile industry cluster policy (*Source*: A. Kuchiki)

government must institutionalize national tax systems and the local government must institutionalize local tax systems for investors to invest in a timely manner.

In the area of human resource development, an abundance of unskilled labor with a high literacy rate is a necessary condition for inviting foreign investors into labor-intensive industries in East Asia. On the other hand, an industrial cluster sometimes faces a shortage of skilled labor after industrialization has progressed.

Living conditions, including entertainment facilities, international schools for children and an international-standard hospital, are crucial to attract foreign investors, and these conditions must be satisfied to bring in anchor firms. Here, an anchor firm is defined as one that "belongs to the manufacturing industry and has a high value of backward linkage in its input–output relationship."

11.3 A Comparison of the Effects of Industrial Linkages in East Asia and the USA

In 1973 the Institute of Developing Economies (IDE) in Japan launched an international input–output table for the Republic of Korea, the five ASEAN countries, the USA and Japan. In 1978 it began the construction of the 1975 multilateral input–output table for the ASEAN countries, Japan, the Republic of Korea (hereafter South Korea) and the USA. In addition, the Institute of Developing Economies - Japan External Trade organization compiled the 2000 Asian international input–output table on the linkage of Indonesia, Malaysia the Philippines, Singapore, Thailand, China, Taiwan, Korea, Japan and the USA.

Tables 11.1 and 11.2 show the effects of the industrial linkages of 24 sectors of the input–output table by country. The number of sectors in the industrial classification regarded as large is 7, with 24 regarded as medium and 76 regarded as basic. This chapter discusses the effects of the forward and backward linkages in the manufacturing and agriculture industries through the use of the input–output table for the 24 sectors regarded as medium, as shown in these tables.

Table 11.1 The average values of the effects of a forward linkage in ten economies

		Indonesia	Malaysia	Phillipinnes	Singapore	Thailand	China	Taiwan	South Korea	Japan	USA	Total average
1	Paddy	0.732	0.633	0.629	0.517	0.672	0.762	0.584	0.73	0.6	0.517	0.6371
2	Other agricultural products	0.902	0.896	0.741	0.567	0.92	1.263	0.8	0.59	0.62	1.009	0.8314
3	Livestock and poultry	0.609	0.721	0.606	0.519	0.628	0.771	0.803	0.68	0.64	0.787	0.6762
4	Forestry	0.698	0.8	0.556	0.517	0.559	0.698	0.521	0.58	0.65	0.838	0.6416
5	Fishery	0.564	0.61	0.559	0.519	0.642	0.626	0.673	0.57	0.58	0.524	0.5859
6	Crude petroleum and natural gas	1.813	1.158	0.519	0.517	0.81	1.274	0.559	0.52	0.52	1.071	0.8761
7	Other mining	1.096	0.61	0.662	0.558	0.637	1.074	0.605	0.62	0.59	0.723	0.7172
8	Food, beverages and tobacco	1.043	1.531	0.866	0.708	1.125	1.033	1.109	1.07	0.99	0.925	1.0397
9	Textile, leather and the products thereof	0.803	0.692	0.653	0.615	0.839	1.733	0.992	0.97	0.87	0.824	0.899
10	Timber and wooden products	0.675	0.734	0.602	0.577	0.6	0.72	0.564	0.68	0.69	0.755	0.6603
11	Pulp, paper and printing	0.822	0.789	0.641	0.639	0.766	0.992	0.898	1.07	1.36	1.195	0.9167
12	Petroleum and petro products	1.008	1.049	0.791	0.962	0.986	2.475	1.498	2.15	2.73	2.034	1.5685
13	Other manufacturing products	0.808	1.268	1.119	1.37	1.141	1.583	0.911	1.36	0.98	1.006	1.155
14	Rubber products	0.584	0.587	0.58	0.552	0.677	0.744	0.585	0.61	0.71	0.604	0.6226
15	Non-metallic mineral products	0.591	0.75	0.678	0.617	0.7	0.858	0.734	0.79	0.81	0.706	0.7233
16	Metal products	0.818	0.998	0.833	0.801	0.77	2.137	1.262	1.79	2.65	1.522	1.3579
17	Machinery	0.711	0.952	0.63	0.804	0.919	2.15	1.184	1.37	2.76	1.832	1.3312
18	Transport equipment	0.893	0.744	0.538	0.702	0.809	1.177	0.765	0.85	1.63	0.94	0.9048

(*continued*)

Table 11.1 (continued)

		Indonesia	Malaysia	Phillipinnes	Singapore	Thailand	China	Taiwan	South Korea	Japan	USA	Total average
19	Other manufacturing products	0.593	0.798	0.594	0.816	0.722	1.108	0.783	0.89	1.37	1.052	0.8726
20	Electricity, gas and water supply	0.737	0.908	1.072	0.629	1.09	1.778	0.67	1	1.22	1.001	1.0104
21	Construction	0.674	0.633	0.609	2.481	0.529	0.639	0.727	0.62	0.79	0.688	0.8383
22	Trade and transport	1.935	1.727	1.4	3.042	1.949	2.329	1.589	1.31	3.13	2.882	2.1289
23	Services	1.434	1.724	1.744	0.644	1.719	2.259	2.827	2.78	4.16	4.625	2.3911
24	Public administration	0.525	0.562	0.517	0.875	0.517	0.517	0.517	0.52	0.53	0.517	0.559

Source: A. Kuchiki based on IDE-JETRO

Table 11.2 The average values of the effects of forward and backward linkages

		Indonesia	Malaysia	Phillipinnes	Singapore	Thailand	China	Taiwan	South Korea	Japan	USA	Backward linkage	Backward linkage + forward linkage
1	Paddy	0.644	0.948	0.647	0.517	0.73	0.977	0.961	0.68	0.85	0.517	0.7469	0.692
2	Other agricultural products	0.678	0.765	0.693	1.142	0.768	0.957	0.863	0.78	0.84	0.975	0.8469	0.83915
3	Livestock and poultry	0.959	1.411	0.882	1.142	1.087	1.086	1.403	1.32	1.25	1.399	1.1941	0.93515
4	Forestry	0.677	0.729	0.681	0.517	0.662	0.833	0.956	0.7	0.79	0.968	0.7512	0.6964
5	Fishery	0.699	0.933	0.73	1.134	0.889	0.994	0.846	0.91	0.91	0.91	0.8952	0.74055
6	Crude petroleum and natural gas	0.637	0.694	0.761	0.517	0.753	0.904	0.634	0.52	0.85	0.822	0.709	0.79255
7	Other mining	0.707	0.897	0.811	1.062	0.802	1.165	0.779	0.83	1.04	0.934	0.903	0.8101
8	Food, beverages and tobacco	1.019	1.282	1.017	1.197	1.112	1.235	1.29	1.2	1.07	1.184	1.1606	**1.10015**
9	Textile, leather and the products thereof	1.07	1.217	1.013	1.093	1.168	1.426	1.278	1.23	1.12	1.124	1.1738	0.91705
10	Timber and wooden products	1.019	1.093	0.98	1.19	0.905	1.411	0.936	1.11	1.08	1.09	1.0812	0.87075
11	Pulp, paper and printing	0.934	1.12	0.943	1.023	0.986	1.277	1.031	1.22	1.07	1.001	1.0598	0.98825
12	Petroleum and petro products	0.944	1.234	1.067	1.053	1.067	1.402	1.15	1.2	1.14	1.053	1.1308	0.98825
13	Other manufacturing products	0.777	0.997	0.681	0.732	0.651	1.12	0.637	0.67	0.66	1.076	0.7999	1.34965
14	Rubber products	0.987	1.116	1.078	1.155	1.114	1.415	1.096	1.13	1.12	1.048	1.1264	0.8745

(*continued*)

Table 11.2 (continued)

		Indonesia	Malaysia	Phillipinnes	Singapore	Thailand	China	Taiwan	South Korea	Japan	USA	Backward linkage	Backward linkage + forward linkage
15	Non-metallic mineral products	0.942	1.106	1.107	1.118	0.997	1.368	0.987	1.11	1.04	0.973	1.0743	0.8988
16	Metal products	1.033	1.177	1.114	1.241	0.97	1.477	1.153	1.27	1.15	1.069	1.1651	1.2615
17	Machinery	1.041	1.263	1.134	1.257	1.2	1.45	1.256	1.21	1.17	1.016	1.1995	1.26535
18	Transport equipment	1.003	1.147	1.193	1.22	1.151	1.539	1.161	1.38	1.4	1.128	1.2315	1.06815
19	Other manufactur-ing products	1.048	1.105	1.004	1.107	1.062	1.435	1.203	1.26	1.16	1.003	1.1382	1.0054
20	Electricity, gas and water supply	1.009	0.838	1.008	0.947	0.91	1.206	0.54	0.84	0.88	0.952	0.9129	0.96165
21	Construction	1.019	1.139	0.874	1.116	1.093	1.434	1.115	1.09	1.04	1.032	1.095	0.96665
22	Trade and transport	0.829	0.796	0.832	0.93	0.8	1.137	0.711	0.81	0.8	0.843	0.8487	1.4888
23	Services	0.838	0.816	0.791	0.938	0.878	1.107	0.724	0.84	0.81	0.824	0.8563	1.6237
24	Public administration	0.794	0.956	0.743	0.977	1.092	1.154	0.75	0.79	0.78	0.837	0.8873	0.72315

Source: A. Kuchiki based on IDE-JETRO

The candidates for anchor firms are those in Sectors 8 (food, beverages and tobacco), 9 (textiles, leather and the products thereof), 17 (machinery) and 18 (transport equipment). The manufacturing industry with the highest value for the backward linkage effect is Sector 18 in Table 11.1. The subsectors of Sector 18 include automobiles, motorcycles and shipbuilding. The subsectors of Sector 17 include electric and electronic equipment, heavy electric equipment, metallic machines, general machines and so on. The subsectors of Sector 8 include food, milling and dairy products, and the subsectors of Sector 9 include yarn processing, fiber, sewing and apparel.

As shown in Table 11.1, the countries with a value of more than 1.0 for the forward linkage effect in Sector 8 are Malaysia, Thailand, Taiwan and South Korea. Sector 9 consists of China alone, while those in Sector 17 are China, Taiwan, South Korea and Japan, and those in Sector 18 are China and Japan.

As shown in Table 11.2, all of the countries in the table have a value of more than 1.0 for the backward linkage effect in Sector 8, with the average being 1.17. Again, all of the countries in Table 11.2 have a value of more than 1.0 for the effect in Sector 9, with the average being 1.19. All of the countries also have a value of more than 1.0 in Sector 18, with the average being 1.23.

The value of the total effects of the forward and backward linkages divided by 2 is shown in the last column in Table 11.2. The values in Sectors 22 (trade and transport) and 23 (services) are 1.488 and 1.623, respectively. These are the highest in the table. The values in Sectors 13 (petroleum and petro products), 17 (machinery), and 16 (metal products) are 1.34, 1.265 and 1.261, respectively. It can be concluded that the effect of Sector 8 is comparable to that of Sector 17 as the values of sectors 17 and 8 are 1.06 and 1.10, respectively.

11.4 A Focus on the Effects of the Agriculture and Food Industries Cluster

This section focuses on the strong effect of Sector 8 based on the results obtained in the previous section. It should be noted that the value of the effect of the backward linkage in Sector 3 (livestock and poultry) is large at 0.935. The agriculture industry includes both Sector 8 and Sector 3. In addition, it includes not only the industries associated with seeds, fertilizer, agricultural machines and equipment but also those associated with the tertiary industry of marketing and logistics as related to the process of trading agricultural products.

We found that the backward linkage effects are greater than those of forward linkage in most industries except those such as sector 22 and 23. Based on this, the flowchart approach to the agro-food-processing industry is proposed as shown in Fig. 11.2. The approach is a framework to promote and strengthen the effect of the backward and forward linkages between the agriculture, food-processing and services industries.

One point crucial to the success of industrial cluster policy when using the flowchart approach is finding an anchor firm to take on a leading role in regional development. The candidates for an anchor firm for the agriculture industry should be selected from the food industry because this has a high value for backward and forward linkage effects, as shown in the previous section.

An automobile is composed of more than 20,000 components. Anchor firms in the automobile industry need suppliers for the parts and components used in assembling cars to be located near their factories. It is a characteristic of developing countries that farmers are weak economically and usually have little ability to create capital in comparison with suppliers in the parts and components industry. As the food industry needs and depends on agricultural products for processing food as part of a primary industry, agriculture plays a key role in providing these materials. The location of the anchor firm factories in the food industry depends on the conditions related to the agricultural field ecosystem.

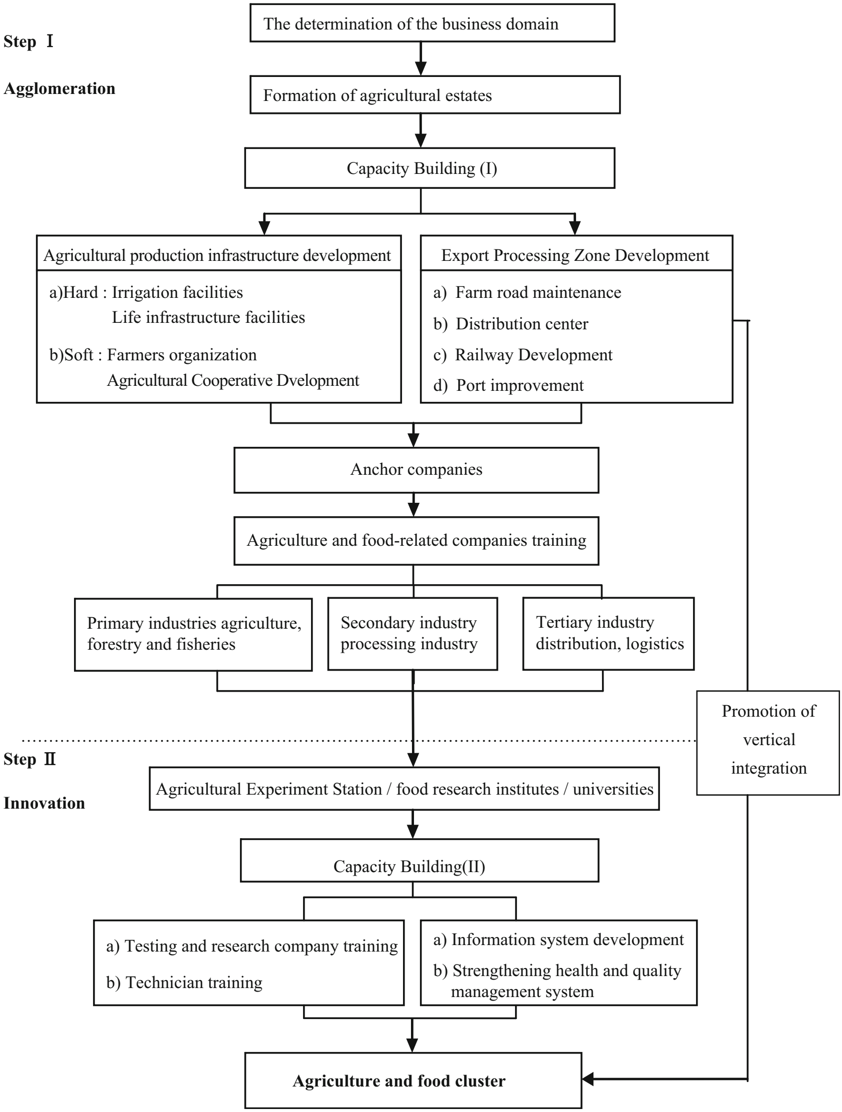

Fig. 11.2 The flowchart approach to agricultural and food cluster policy (*Source*: T. Mizobe)

11.5 A Case Study of an Agro-Food-Processing Industry Cluster in Africa

This section provides a case study of an agro-food-processing industry cluster in Africa based on the flowchart approach. The example studied here is the Nacala Corridor Region located in northern Mozambique, which has one of lowest income levels in the world.

In general, Africa has a number of agricultural advantages in that large areas of land there are suited to labor-intensive agriculture. The demand for agricultural products in African countries is also small so the products can be exported. Consequently, capacity building in the food industry cluster policy should focus on strengthening export competitiveness.

Capacity building, or segment formation, in the food industry cluster is shown in Fig. 11.2. The segments associated with the physical infrastructure include irrigation facilities, agricultural roads, railways, ports, storage and so on to strengthen export competitiveness. The other segments are human resources and institutional capacity. In terms of human resource development, the priority is given to core farmers, labor skilled in the field of agricultural processing, and professionals involved in the inspection of animals, plants and food. In terms of institutional strengthening, the priority is given to a system for financing farmers.

Cluster capacity building results in greater competitiveness in the food industry so that the products obtained from small farmers in developing countries can provide a stable supply to the food industry. It is expected that competitiveness in the agriculture sector is strengthened and that secondary industries such as the machine industry and the equipment industry, which are related to agriculture and the food industry, are developed as a result of the larger market.

The long-term development of "take-off" in Thailand led to it being termed a "newly agro-industrializing country". It takes five to ten years for the agriculture industry to contribute successfully to enhancing the per capita income to a middle-income level, as observed in the case of Thailand. Next, industrial cluster policy moves on to Step II of capacity building to activate innovation and strengthen the competitiveness of the secondary industry to generate the higher added value. The flowchart approach to the agro-food-processing industry cluster policy consists of Step I (agglomeration) and Step II (innovation), as seen in the manufacturing industry cluster shown in Fig. 11.1.

11.5.1 Increasing Population and High Poverty Line

The Nacala Corridor Region, which runs from east to west, starts in Nacala Port at the Indian Ocean and stretches to Niasa State via the capital of Nampula in Nampula State. It is 600 km long and it crosses the borders of Malawi and Zambia. The region is one of eight belts constituting the well-known Southern African Growth Belt.

Nampula State is at the center of the Nacala Corridor Region. Its population 4 million, and the average population growth rate for the ten years starting from 2011 is estimated at 2.5 %, with the total population in 2020 estimated to be 5.2 million according to the Governo da Provincia de Nampula (2007). The proportion of young people under 15 years is 45 %. The per capita GDP per year is USD202 according to INE (2007), which is lower than the national average. The unemployment ratio is 20 % according to INE (2007). There is a good deal of concern that the number of poor will increase as a result of the increase in unemployment unless additional job opportunities are generated. According to the Direccao Provincial (2009), strengthening agriculture is a priority issue because agricultural laborers represent 90 % of the total labor force in the state.

11.5.2 Small-scale Farmers

Most of the region is classified as a “torrid savanna zone.” The rainy season is from October to April and the dry season is from May to September. The area of the state is 81,000 sq. km, its agricultural area is 4.59 million ha and the cultivated area is 1.45 million ha, corresponding to 17 % of the total agricultural area according to INE (2007). There are 720,000 agricultural households located in the state, which represents 24 % of the total agricultural households in Mozambique. As shown in Table 11.3, the number of agricultural households is the highest in the

Table 11.3 Number of farm households by land area

Category (ha)	Number of farm households	(%)	Average land area (ha)
0.1–0.4	172,408	24	0.2
0.0–0.9	265,088	37	0.7
1.0–1.9	216,284	30	1.4
2.0–2.9	41,658	6	2.4
3.0–3.9	11,612	2	3.4
4.0–9.9	6575	1	5.4
10.0–49.9	285	–	20.0
>50.0	11	–	904.0
Total	720,485	100	1.0

Source: Author elaborated by INE (2002)

country. However, the average land holding per household is 1.2 ha, which is lower than the national average of 1.3 ha.

Small-scale farmers (i.e. those with less than 2 ha) comprise 91 % of farmers in the state, as shown in Table 11.3.

Table 11.4 shows the farming situation for small-scale farmers with holdings of less than 1.5 ha. The agricultural income per year is estimated to be MZN6200, or USD295, which is higher than the state average but lower than the national average according to INE (2007).

11.5.3 The Possibility of Developing a Value Chain in the Nacala Corridor Region

The number of effective consumers in Nampula State is about 250,000, located mainly around Nampula City (INE 2007). The ratio of farmers to consumers is roughly 3:1, and an excess supply of agricultural products tends to occur. The region produces the cash crops of cotton, tobacco, cashew nuts and others for processing by exporting firms. Recently, the actual production of soybeans has been increasing as a result of support by non-governmental organizations. For land-intensive agricultural development, the introduction of biofuel crops such as jatropha and sugarcane is an effective strategy.

On the one hand, agricultural products produced by small-scale farmers generate a lot of added value in their marketing and sales as final products, as shown in Table 11.5. On the other hand, sesame is

Table 11.4 Farming system and agricultural income of small-scale farmers

Land ownership scale	1.5 ha				
Labor force	Family labor force: 5–7 people; 3 employed at harvest time (minimum wages MZN45/person/day)				
Cultivation tools	Farm tools (hoe, plow, shovel), pesticide sprayer (for cotton)				
Main crops	Maize	Cassava	Cotton	Cashew nuts	Livestock
Cultivated area (ha)	0.4	0.3	0.7	40 trees	10 chickens,
Yield (ton/ha)	0.5–0.8	4.0–5.0	0.6–0.8	3–4 kg/tree	10 goats
Cropping pattern	Rotation: maize – cassava – cowpea – groundnuts			Year round	Breeding in the backyard
	Seeding: Oct–Dec Harvest: Apr–Jun		Seeding: Nov–Dec Harvest: Apr–May		
Unit price (MZN)	3.5/kg	Self-sufficiency	8–9/kg	9–14/kg	Chicken 800–1000
Gross income (MZN)	500	–	4500	1700	–
Production cost (MZN)	–	–	500	–	–
Estimated income (MZN)	6200/year (USD295)				

Source: Author, based on field survey 2010
Note: USD1 = MZN0.048 (2010)

Table 11.5 Value-added formation according to the crops unit: USD/kg

	Cotton	Cashew nut	Sesame	Tobacco	Soybeans
Farm gate price	0.40	0.50	1.02	1.20	0.50
Wholesaler price	ND	ND	ND	ND	ND
	ND	0.60	ND	ND	ND
Industry	1.20 (lint)	4.50	1.07	3.15	ND
FOB	0.70 (oil)	ND	ND	ND	ND
Final destination	Export	Export	Export	Export	Domestic

Unit: USD/kg means US dollars per kg
ND means No Data; *FOB* means Free on Board
Source: Author, based on field survey, 2010

exported unprocessed owing to a lack of infrastructure for its processing, even though value is added when it is converted to edible oil.

11.5.4 Potential for the Generation of Employment Opportunities by Food-processing Firms

Mega project firms with direct foreign investment in Mozambique develop mineral resources. Table 11.6 compares the mega project firms with the food-processing firms in the Nacala Corridor Region in terms of investment value and employment opportunities generated. On the one hand, the investment of the mega project firms is large at USD1 billion to USD2.5 billion, and the firms implement capital intensive projects in and around metropolitan Maputo. On the other hand, more than 20 small-scale agricultural processing firms in the Nacala Corridor Region produce cashew nuts, cotton, tobacco, sesame, bananas, soybeans, poultry and so on.

Although the investment of these firms in the Nacala Corridor Region is small, ranging from USD50,000 to USD80 million, the investment is labor intensive in type. A poultry firm in the Nacala Corridor Region invested USD1.3 million, and it employs 1070 workers and contracted farmers, while the Mozal aluminum refinery, the largest of the mega project firms, employs a workforce of only 1000. Moza Banana started operation to produce bananas in 2009 and it employs 18,000 people. Thus Moza's potential for generating employment opportunities is greater than that of the mega project firms.

Table 11.6 Employment potential of food-processing companies in the Nacala Corridor Region

	Mega industry company			Food-processing firm			
	Mozal	Sasol	Moma	New Horizontal	Sonil Fabrica	Condor Nuts	Moza Banana
Industry type	Aluminum	Natural gas	Metal	Poultry farming	Cigarettes	Cashew nuts	Bnanas
Investment (USD million)	2400	1200	500	1.3	–	–	80
No. of employees	1000	–	425	Factory 186 Farm 890	Factory 100 Farm 2500	Factory 750 Farm ND	Farm 18,000
Final market	Export	Export	Export	Domestic	Export	Export	Export

Source: Author, based on field survey

11.5.5 Proposed Model of the Agro-Food-Processing Industry Cluster for the Nacala Corridor Region

In Sect. 11.2 we concluded that the value of the summation of backward linkage and forward linkage effects for the machinery industry is almost the same as that for the food industry. Table 11.6 supports the fact that the food industry can generate more employment opportunities than can the mineral mining industry.

Consequently, we proposed a model of the agro-food-processing industry cluster for the Nacala Corridor Region, as shown in Table 11.7. This would be practical and easy to introduce. The agro-food-processing industry covers a range of industries which generate high value for the forward and backward linkages effects of the industries. The cluster proposed here consists of industries associated with compound feed, vegetables, fruit, wood, cotton and biofuel.

Industrial linkages can be explained as follows. The compound feed industry cluster starts with small farmers producing soybeans as a primary industry. The soybeans are then processed to give soybean oil and compound feed as a byproduct as secondary industries. The related industries, such as fertilizers, pesticides, logistics and marketing, are engaged in the exchange of compound feed. The logistics and marketing industries are tertiary industries, so that it is hoped that sextiary industry, or primary-secondary-tertiary industry, can be established in the Nacala Corridor Region.

As shown in Table 11.7, the processes promote the development of industries supporting the related industries, resulting in the emergence of a huge agriculture industry. The first row shows both the industries related to the primary industry, secondary industry and tertiary industry, as well as examples of the agricultural products, intermediate products and final products. It appears to be practical as a development strategy by which African countries can strengthen the competitiveness of their agro-food-processing industry.

11.6 Concluding Remarks

This chapter has established an agro-food-processing industry cluster policy for Africa by applying a prototype model of the flowchart approach to industry cluster policy. In particular, the cluster was modeled using our

Table 11.7 Proposed agro-food-processing cluster model in the Nacala Corridor Region

	Industry					
Cluster	Primary	Secondary	Tertiary	Crops	Processing products	Final products
Compound animal feed	Cereals, livestock products	Compound feed, Dairy products, Meat	Fertilizer, Chemicals, Storage, Marketing, Logistics	Maize, Cassava, Soybeans	Compound animal feed	Poultry, Beef, Milk
Vegetables	Vegetables	Frozen vegetables, Canned Vegetables	Fertilizer, Chemicals, Storage, Marketing, Logistics	Tomato	–	Tomato puree, fresh tomatoes
Fruit	Perennial fruits	–	Storage, Marketing, Logistics	Cashew nuts, Bananas, Oranges	–	Fruit juice, nuts, table bananas
Wood	Forestry, Kenaf production	Lumber, Plywood, Manufacturing, Paper	Storage Marketing, Logistics	Forest resources, Kenaf, Bagasse	–	Furniture, Plywood, corrugated cardboard
Cotton	Cotton products	Spinning, Textiles	Storage, Marketing, Logistics	Cotton	Yarn, Cloth	Yarn, Cloth, Clothes
Biofuel	Sugarcane, Jatropha	Refined sugar, Biofuel	Storage, Marketing, Logistics	Sugarcane, Jatropha		Biofuel products

Source: Author, based on field survey

research data on the Nacala Corridor Region in the north of Mozambique, one of the poorest countries in Africa. Based on the above, the following four conclusions were drawn.

First, the value of the forward and backward linkage effects of the machinery industry is almost the same as that of the food industry, as shown in Table 11.2. Second, a model of the flowchart approach to an agro-food-processing industry cluster was formulated and is anticipated to strengthen the input–output linkage and generate employment opportunities, as shown in Fig. 11.2. Third, it was found that, in the Nacala Corridor Region in Mozambique, the food industry can generate more employment opportunities than can the mineral mining industry, as shown in Table 11.6. That is, the research data show that small investments by food-processing businesses in the study region generated more employment opportunities than did the mega mineral mining firms in Mozambique. Fourth, the summing of the three conclusions above allowed a cluster policy proposal for the development of African regions to be constructed for improving the low agricultural incomes mainly resulting from the large number of small-scale farmers and their limited markets, as shown in Table 11.7.

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12

A Comparison of the Information Technology Industry Cluster with the Agro-Food Industry Cluster from the Perspective of the Economies of Sequence

Akifumi Kuchiki

12.1 Introduction

An industrial agglomeration helps its firms to innovate. As shown in Fig. 12.1, a cluster is defined as a combination of agglomeration (Step I) and innovation (Step II). The question is whether or not industrial cluster policy indeed helps information technology firms and research institutes to agglomerate and innovate. To address this, the sequence in which to implement industrial cluster policy to foster industrial clusters is discussed using the flowchart approach.

Johnston and Sundararajan (1999) discussed the sequencing of monetary policies. The flowchart approach in this chapter is designed to examine the sequencing of policy measures, or the segments of industrial clusters.

Romer (1990) showed that spillovers could be strong enough to outweigh the drag caused by decreasing returns on capital and to sustain

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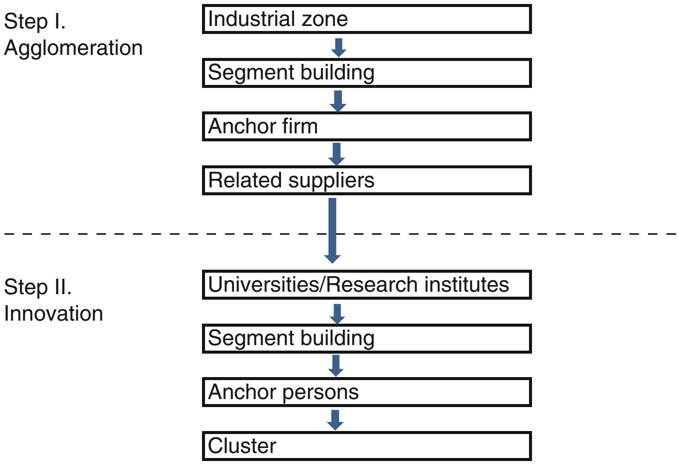

Fig. 12.1 The Flowchart approach to the electronics industry cluster policy (*Source*: Developed by A. Kuchiki)

growth in per capita output. Arnold (1994) argued that endogenous growth models are so abstract that they do not yield specific policy prescriptions. The approach presented here indicates concrete policy measures for industrial cluster policy to foster an industrial cluster.

The purpose of this chapter is to propose a hypothesis for a flowchart approach to agglomerate and innovate firms in the information technology industry. A flowchart for agglomerated firms to innovate at Step II is hypothesized. The hypothesis is one of conditions sufficient to ensure that industrial cluster policy leads firms to agglomerate and innovate.

In 1988 the State Council approved the establishment of the Beijing New Technology Industrial Development Trial Zone (the predecessor of the ZSP). The plans were finalized at an interview on the information technology industry cluster at the ZSP in Beijing, China in 2006. When the information technology cluster of ZSP is compared with similar clusters in other countries, the sheer magnitude of ZSP is easily understood. Silicon Valley in the USA has about 5000 firms. and the Software Technology Park in Bangalore, India, has 6121 registered firms (as of October 5, 2004). There are 1750 firms in the information technology cluster in Austin in the USA is and 1250 firms in the biotechnology cluster in Cambridge in the UK. The number of firms in the ZSP is about 17,000. In 2010 the gross income of enterprises in the ZSP reached CNY1.59 trillion (USD245 billion), taking up about a seventh of all high- and new-tech zones in China. In 2013 the ZSP gathered nearly 20,000 high and new-tech enterprises.

There are two conclusions that can be drawn from the flowchart for the information technology industry clustering in Beijing. First, the existence of universities with human resources is a precondition for clustering of this industry. Second, the leadership of the ZSP Management Committee plays a crucial role in agglomerating information technology firms in the science park. The flowchart elucidated the mechanism that linked universities and firms in the ZSP as well as the organizational structure of the ZSP Management Committee. It should be noted, however, that the flowchart differs between the manufacturing industry and the information technology industry.

According to Humphrey and Schumitz (2000), innovation is defined as follows:

1. *Process upgrading*: more efficient transportation of inputs into outputs through recognition of the production system;
2. *Product upgrading*: product sophistication to increase the unit value of products;
3. *Functional upgrading*: acquisition of new, superior functions in the value chain (e.g. design or marketing) and/or abandonment of existing low-value-added functions;
4. *Intersectoral upgrading*: expansion into a new sector with competence acquired in a given function.

Section 12.2 explains the flowchart approach. Section 12.3 derives a flowchart of the information technology industry based on the ZSP in Beijing. Section 12.4 analyzes Step II (innovation) in the flowchart approach to the ZSP. Section 12.5 concludes.

12.2 The Flowchart Approach to Industrial Cluster Policy

As shown in Fig. 12.1, this section proposes a general model of the flowchart approach to industrial cluster policy. A sufficient condition for the success of industrial cluster policy is to satisfy the following conditions in the proper order: (1) industrial zones, (2) capacity building and (3) anchor firms (Kuchiki 2007; Kuchiki and Tsukada 2008).

Many industrial clusters in East Asia have satisfied the conditions above. A local government first constructs an industrial zone to attract foreign investors. Next, the government builds capacity to improve the business and living conditions for foreign investors. The elements of capacity building include (1) constructing physical infrastructure, (2) building institutions, (3) developing human resources and (4) creating living conditions amenable to foreign investors.

1. Physical infrastructure refers to roads, ports, communications, electricity, water supply and so on.
2. Institutional building, also crucial to success in inviting foreign investors, includes streamlining investment procedures through one-stop services, deregulation of laws and introduction of preferential tax systems.
3. Concerning human resource development, an abundance of unskilled labor with a high literacy rate is the necessary condition to attract foreign investors in the labor-intensive industries. On the other hand, an industrial cluster may face a shortage of skilled labor after industrialization has progressed. Universities and on-the-job training centers for innovation are then needed for further development.
4. Living conditions are crucial to attracting foreign investors. Staff members of investor companies will have incentives to work hard if they are enjoying their lives. It is necessary to create satisfactory conditions with regards to housing, schools, hospitals and so on. This is the last condition that must be satisfied before anchor firms can be invited.

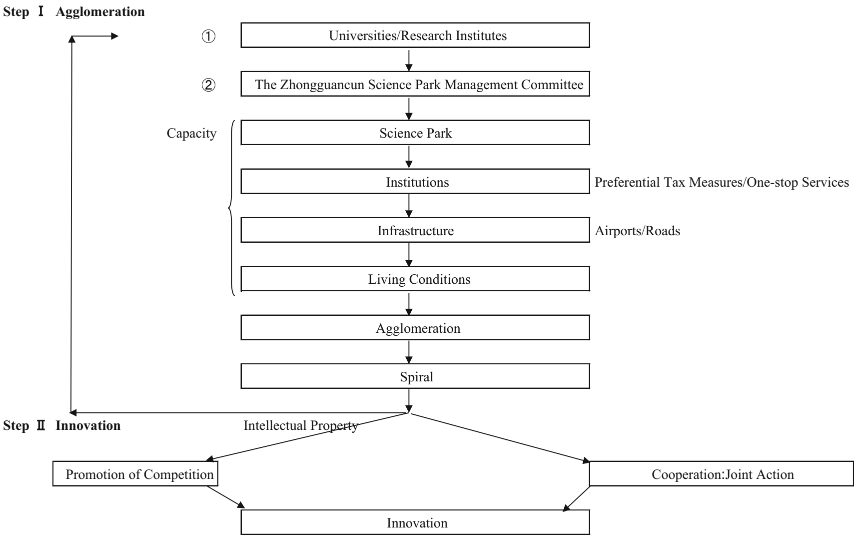

Fig. 12.2 The industrial cluster in Zhongguancun Science Park (*Source*: Developed by A. Kuchiki)

Figure 12.2 is explained as follows. The first priority is to specify a leader and make clear their incentives for Step I (agglomeration). Second, enforce intellectual property rights for innovation. The preconditions for Step II are as follows: (1) related services: finance and insurance, logistics, marketing companies, repair shops and used car shops; (2) professional and other services: lawyers, restaurants, retail shops and tourism.

As shown in Fig. 12.3, the processes of innovation are a flowchart approach to Isaksen (2003) and Schmitz and Nadvi (1999), and as follows:

1. Joint action:

   a. facilitate cluster skill centers;
   b. create business associations;
   c. establish collective projects;

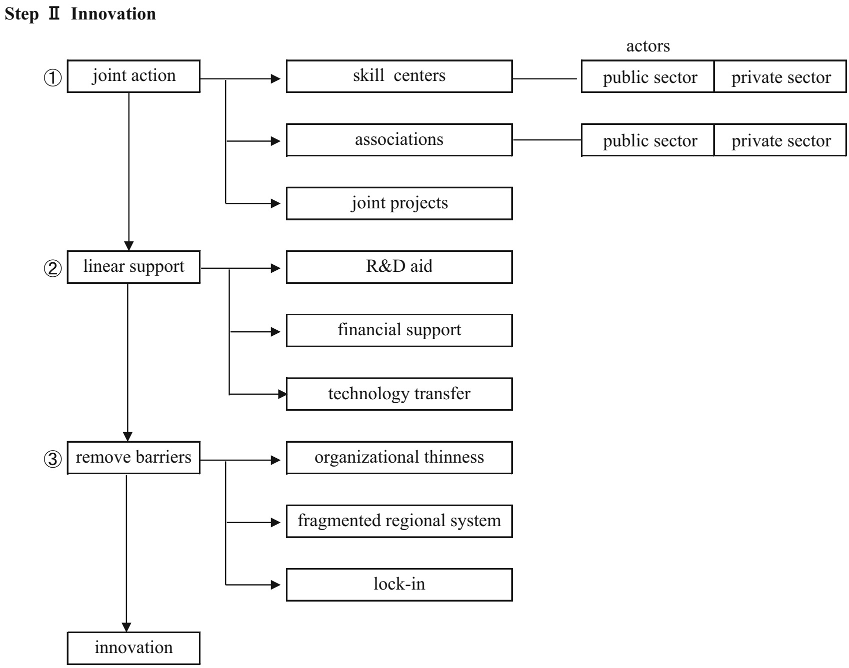

Fig. 12.3 A hypothesis on the flowchart for innovation (*Source*: Developed by A. Kuchiki)

2. Linear instruments:

   a. direct R&D aids;
   b. financial support;
   c. transfer of research-based knowledge to firms;

3. Remove barriers to innovation:

   a. organizational thinness;
   b. fragmented regional system;
   c. lock-in effects.

12.3 The Flowchart Approach to the Information Technology Industry in Beijing

Beijing, together with Tianjin, is a core city in the Bohai Bay-rim economic region. It is the capital of China and a center of education for science and technology, economic policy, information dispatch, and politics and culture. The ZSP in Beijing is a strategic region in the twenty-first century together with the Tianjin Binhai New Area, following the Shenzhen Special Economic Zone in the 1980s and the Shanghai Pudong Development Area in the 1990s. The academic members of the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE) in Beijing accounts for 37 % of the total Chinese academic members in China.

The flowchart approach to industrial agglomeration policy at a hi-tech park presupposes the existence of universities and research institutes. Beijing city is abundant in human resources as there are 39 universities and 213 research institutes (December 2006). Two-thirds of PhD holders. in China are located in Beijing. We explain below that Peking University, Tsinghua University and the CAS played a central role in developing the ZSP. The ZSP Management Committee is leading the development of science park. A sufficient condition of segment building to invite investors is a flowchart for the construction of a science park, institution building, construction of traffic infrastructure and provision of good living conditions.

The flowchart makes it possible for firms in the hi-tech industry to agglomerate. As is shown in Fig. 12.2, industrial agglomeration, Step I in the flowchart, was facilitated by (1) the existence of universities and research institutes, (2) the establishment of the ZSP Management Committee and (3) segment building. The characteristics of the ZSP include its partnership between firms, universities and governments, and the partnership between the ZSP and Silicon Valley in the USA. Tsinghua Science Park is under the management of Haidian Science Park. These three parks have been effective in agglomerating firms in the hi-tech industry.

12.3.1 The Beijing Municipal People's Government and the Zhongguancun Science Park Management Committee

The leadership of the Beijing Municipal People's Government plays a key role in promoting the agglomeration in the hi-tech industry in the ZSP. The head of the ZSP Group is a mayor, and the members of the group number 18, including the presidents of Peking University and Tsinghua University. The ZSP Management Committee rather than the Beijing Municipal People's Government manages the Zhongguancun Science Park Group. The Management Committee also plays a significant role in the industrial agglomeration at the ZSP. It was established in 2000 and started to manage five subparks. The ZSP consisted of seven subparks in 2005 and ten in 2006, and each sub-park has its own management committee.

There are 39 universities, 700,000 students, 75 national engineering research institutes and 71 nationally important laboratories in the ZSP. The 17,000 firms there employ 690,000 people and earn CNY480 billion (about USD60 billion). The total road length is 130 km. The largest subpark in the ZSP is Haidian Science Park (217 sq. km in 2005), while others include the Electronic Zone, Fengtai Park and Changping Park.

Table 12.1 shows the seven parks of the ZSP.

The other parks are very small in area. Table 12.2 shows the distribution of human resources in the ZSP. Haidian Science Park has the largest number of research institutes and researchers. Table 12.3 makes clear the rapid growth of the ZSP since 2002, partly as a result of the establishment of the ZSP Management Committee in 2000. The number of firms was about 9500 in 2002 and increased to 17,000 in 2005. The number of employees was about 400,000 and increased to 690,000 during the same period. Other figures for industrial output, foreign currency earned by exports and total tax payments also grew very rapidly.

In 2013 the number of subparks was 16.[1] Two towns and two belts of the ZSP are as follows: Zhongguancun Science Town, S&T Future

[1] http://www.ebeijing.gov.cn/feature_2/ZhongguancunSciencePark/

Table 12.1 Data on the seven parks in the ZSP

	Park	District	Surface area (km^2)	Number of companies
1	Haidian Park	Haidian District	217.0 (planned)	>10,000
2	Changping Park	Changping District, northern outskirts of Beijing	5.0	>1300
3	Fengtai Park	Fengtai District, south outskirts of Beijing	5.0	>2700
4	Yizhuang Park	Southeast of Beijing, inside the Beijing Economic-Technological Development Area	7.5	>1000
5	The Electronic Zone	Jiuxianqiao, Chaoyang District, eastern outskirts of Beijing	10.5	>440
6	Desheng Science and Technology Park	Xicheng District	6.0	145
7	Jianxiang Science and Technology Park	Chaoyang District	4.2	–

Source: A. Kuchiki based on the ZSP Management Committee, 2006

Town, Northern Development Belt and Southern Development Belt. The eight kinds of industries clusters are aerospace, electronic information, new material, new energy vehicles, biology, equipment, culture and creative, and new energy, energy conservation and environmental protection.

The roles of the ZSP Management Committee in the agglomeration of firms in the ZSP is clarified as follows. The Beijing Municipal People's Government enacted a municipal ordinance on the ZSP at the end of 2000. It arranges tours for oversea inspection. Regarding its main development promotion policy, the ZSP ordinance prescribes (1) providing financial support, (2) attracting human resources, (3) offering a preferential land policy and (4) offering a preferential tax policy, as follows:

1. It supports technological innovation for small and medium-scale enterprises by providing funds. The Beijing Municipal People's

Table 12.2 Human resources in the ZSP

Park	Research institutes/ universities	Researchers	Notes
Haidian Park	Research institutes: 232 Universities: 73	Researchers: 378,000 University students: 300,000	
Changping Park	Scientific research institutes: 114 Universities: 14	Researchers: 15,000	
Fengtai Park	Scientific research institutes: 60	Researchers: 70,000	Located close to Lugu where many affiliated electronic research institutes of the Ministry of Information Industry are concentrated
Yizhuang Park	–	–	
The Electronic Zone	Electronic research institutes: 4 Electronic universities: 5	–	One of the major construction projects in the 10th Five-Year Plan
Jianxiang Science and Technology Park	CAS institutes: 12	CAS academic members: 44 CAE academic members: 5 TWAS academic members: 5	
Desheng Science and Technology Park	Research institutes: 6 Universities: 8	–	

Source: A. Kuchiki based on the ZSP Management Committee, 2006
Note: TWAS: Third World Academy of Science

Table 12.3 Development of the ZSP

Feature				
Economic index	2002	2003	2004	2005
Number of firms	9567	11,529	13,957	17,000
Total revenue from technology trade (CNY100 million)	2394.8	2886.4	3692.2	n/a
Total industrial output (at cost; CNY100 million)	1477.2	1607.8	1876.1	n/a
Foreign currency earned by exports (USD100 million)	28.8	32.9	53.6	n/a
Total tax payment (CNY100 million)	98.8	120.1	141.7	n/a
Number of employees (millions)	40.4	48.9	55.7	69.0
Gross profit (CNY100 million)	96.6	161.5	256.6	48.0

Source: A. Kuchiki based on the ZSP Management Committee, 2004, Beijing New Technology and Industry data, Zhongguancun Science Park, 2004 Economic Development Review
Note: Interview by A. Kuchiki in 2005

Government established professional funds such as development funds for the information technology, new technology and software industries in the ZSP. It subsidizes the interest rate by 1.5 % for credit on items of integrated circuits (ICs).

2. Regarding the attraction of human resources, preferential treatment for those on the family register is available. Persons whom the Beijing Municipal People's Government identifies as professional technicians and managers required for information technology in new firms and for information technology in a new industry can have temporary proof of residence for employment after the municipality's ratification is provided with the same conditions as residents of Beijing. Someone who has worked for three years whom the government recommends can establish themselves on the family register in the Beijing Municipality. New students who graduate from universities and research institutes of science and technology and apply to information technology in new firms located in the ZSP can establish themselves on the permanent family register in the Beijing Municipality. This policy resulted in the invitation of 7400 persons and the establishment of 3200 firms in the ZSP up to 2006.
3. Regarding preferential treatment from the nation's land policy, the charge for the use of land in the ZSP is reduced. When joint ventures and firms with 100 % capital ownership obtain land in the form of a

transfer, the local municipality charges them 75 % of the value of the land transfer and half the rate for the cost of urban infrastructure construction and municipal government administration.

4. Regarding the policy of reduction and exemption on income taxes, new technology firms in the ZSP must pay income tax at a rate of 15 %. They do not need to pay tax for three years from the day of establishment. Firms that the Beijing Municipal People's Government designates must pay income tax at half that rate for three years following the three years at zero tax mentioned above.

Table 12.3 summarizes the policy measures of the ZSP Management Committee, which are effective in the industrial agglomeration of the ZSP

12.3.2 Haidian Science Park

About 10,000 firms have moved into Haidian Science Park (HSP), with 217 sq. km in area and a comprehensive science park directed at uniting high technologies, such as electronics, information technology, optical mechatronics and new materials. It is center for information technology R&D and business. There are 20 subparks, including Tsinghua Science Park (THSP) and Peking University Science Park.

The following statistics describe HSP[2] as of 2004. There was a high concentration of human resources with 348,300 jobholders. Among these, 32,000 held a master's degree and 6000 had a PhD. There were more than 10,000 hi-tech enterprises, and 63.3 % of them were electronic information enterprises. There are branches of world-class enterprises such as IBM and Microsoft. There were 81 enterprises with registered capital of more than CNY50 million. Some 41 Fortune 500 companies had invested in the park. HSP had the nation's largest trading market for electronic products with a trade value of technology reaching CNY24,055 billion, which was 18 % of the national figure.[3]

[2] http://61.49.38.5/docs/investdoc/Haidian%20In%20General/20060126/113828100, accessed July 12, 2006.

[3] http://61.49.38.5/docs/investdoc/Haidian%20In%20General/20060126/113828100, accessed July 12, 2006.

12.3.3 Tsinghua Science Park

THSP, a holding company for Tsinghua University, covers 250,000 sq. km. It was established in 1994 and evaluated as first class by the nation in 2003. One of its characteristics comes from the fact that the Chinese returned from Silicon Valley in the USA and established a lot of firms in THSP.

THSP Company is a state-owned holding jointly initiated by Tsinghua Holdings Company, Beijing Zhongguancun Science & Technology Development, Beijing State-Owned Asset Operation, Tsinghua Tongfang and Tsinghua Unisplendour. Its predecessor was the Tsinghua Science Park Development Center, which was founded in 1994. A service platform for hi-tech companies was established, and IC Design Park began operation in 2005.

Hi-tech enterprises are an important part of the business scope of THSP. The management talent there makes the park one of the most valuable partners for venture capital organizations, not only in China but around the world.

THSP has advanced its cooperation with other venture capitalists around the world and boosted the establishment of venture capital funds. It has more than 400 customers, categorized into four types: (1) R&D centers of multinational corporations represented by Procter & Gamble, Sun Microsystems and NEC; (2) research facilities of major domestic technology enterprises represented by Tsinghua Tongfang and Tsinghua Unisplendour; (3) technological small and medium-sized enterprises; (4) agent service companies, such as venture capital management, banks and consulting companies.

THSP is independently managed and plays an important role in helping venture capital start-ups. It has attracted human resources to the park from Silicon Valley in the United States (see Table 12.4).

12.3.4 Segment Building to Foster a Science Park

Capacity building means improvement of infrastructure, institution building, human resource development and providing of satisfactory

Table 12.4 Preferential policies of the ZSP

Area	Preferential policy
Company registration	When enterprises to be established in the ZSP apply for registration at the Department for Industry and Commerce Administration, they do not need to specify a category of business; they can choose it for by themselves
	Hi-tech enterprises may determine the proportion of an enterprise's registered capital
Taxation	Beginning from the date of its establishment, a new technology enterprise is exempted from income tax for three years. For the period from the fourth to the sixth year, income tax is collected at a rate of 7.5 %
	Corporate income tax for new technology enterprises is collected at a reduced rate of 15 %. On the output value of export products of an enterprise that account for over 40 % of the total output value for the current year, the income tax is collected at a reduced rate of 10 %
	Factories and bonded warehouses are exempted from import tariffs on raw materials and value added tax on their products
	New and hi-tech enterprises that obtain land directly in the form of land transfers are exempted from fixed asset investment orientation regulated tax; the fee for the transfer of the land use right is collected at a rate of 75 %; and the urban infrastructure "four-utility" construction fee is charged at half the rate
Financing	New and hi-tech enterprises may accept priority support from state funding for new and innovative technology, risk investment and a guarantee fund
	Risk investment institutions may take the form of limited liability partnerships.
	Beijing Municipality may provide subsidies for the projects of the state. The amount of each subsidy is equal to the amount of the subsidy of the state with a limit of CNY10 million
	Subsidies of up to 50 % of the interest on loans will be provided
	Small loans to enterprises which were established by students returning from overseas are in principle secured with a limit of CNY1 million
	Incubator fund: Hi-tech enterprises, which were established within the past three years, are invested in with a limit of CNY3 million

(*continued*)

Table 12.4 (continued)

Area	Preferential policy
	Integrated Circuit Design Enterprise Loans are secured to support IC design enterprises in Beijing to solve the difficulties in financing
	Current expenditures on offshore development enterprises are secured. They enjoy the benefit of the state's and the city's preferential policies for export enterprises
Accounting	The period of depreciation of equipment and instruments used for new and hi-tech industry development may be shortened as defined
Industrial policy	For an ordinary value added tax payer who sells software products and IC products, the portion which exceeds the actual tax burden by 3 % is refunded immediately after collection
	For key software enterprises covered by state planning, business income tax is collected at a reduced rate of 10 %
	Software enterprises whose registered capital exceeds CNY1 million can decide to export their software products
	Software export enterprises may apply to the Foreign Economic Relations and Trade Commission for funding support and cost support for certification
	Software exports enjoy credit support at preferential interest rates
	When software enterprises and IC enterprises establish R&D institutes in Beijing, the charge for the land is collected at 75 %
Human resources	High-tech enterprises may give residency permits in Beijing to the Chinese persons studying abroad or technical and managerial talents from other provinces or cities
	Qualified personnel from other provinces or cities may be registered as permanent residents of the Beijing Municipality, and their children will be admitted to schools to receive compulsory education
	High-tech enterprises may invite newly graduated students from colleges and universities, who are in urgent need of technological assistance for enterprises, to Beijing
	Special funds to be arranged in the municipal financial budget will be used for financial subsidies for senior managerial personnel and technical personnel in software enterprises and IC enterprises
	Teachers and students may set up new and hi-tech enterprises in the ZSP.

(*continued*)

Table 12.4 (continued)

Area	Preferential policy
Company activities	The government may provide funding support, interest subsidies for loans and export encouragement to new and hi-tech projects In the ZSP, organizations and individuals may engage in any activities except those businesses that are prohibited by laws and regulations When enterprises purchase real property, contract tax is refunded after collection

Source: Developed by A. Kuchiki based on the ZSP Management Committee (2002).

living conditions, as mentioned in Sect. 12.2. We explain the situation of physical infrastructure and living conditions of the capacity in Beijing below. Transportation—physical infrastructure to carry passengers—plays an important role in developing the software industry.

A case of the ability to invite investors to HSP is illustrated here. HSP is 150 km from New Tianjin Port, 45 km from Beijing Capital International Airport, and the roads in HSP link to the third belt highway around Beijing. Thus the park is located in a convenient place for communications.

The living conditions are very convenient since HSP is located in Beijing, the capital of China. The park has residential housing for foreigners, many restaurants (including Japanese), entertainment facilities and five-star hotels. The movement of the key firms (e.g. IBM, Microsoft, Samsung, HP, Motorola, Bell and Siemens) into HSP helped Beijing to build capacity sufficient to invite research institutes of multinational corporations. Japanese firms such as NTT, Canon, Panasonic, Hitachi and NEC established their research institutes in the park. A characteristic of the ZSP is that CAS, Peking University and Tsinghua University are in close partnership with Chinese firms such as Lenovo and Red Flag Software. Peking University invests in the Beijing Founder Group and Beijing Beida Jade Bird Group. Tsinghua University invests in Tsinghua Tongfang and Tsinghua Unisplendor. Partnerships between firms and universities/research institutes help to ensure innovation.

12.3.5 Innovation by Partnerships Between Firms and Universities/Research Institutes

This section shows that partnerships between universities and firms in the ZSP play a crucial role in the agglomeration of firms in the hi-tech industry. The methods of partnership include firms contracting research to universities, joint research between universities and firms, internships for university students in firms and university funding for firms.

Table 12.5 shows the well-known companies that are invested in by research institutes and universities. Lenovo Group Ltd is one of China's leading firms. As shown in Table 12.5, Peking University is related to Founder Group Corporation and Beida Jade Bird Group, while Tsinghua University is related to Tsinghua Tongfang Co. Ltd and Tsinghua Unisplendour Co. Ltd. All of the companies have grown very rapidly.

The innovative partnerships between universities and firms in July 2006 are described by the following examples of Company A, Company B, Tsinghua Tongfang, and the CAS.

1. Company A

Partnerships between Company A and universities take the following three forms. First, Company A entrusts Beijing University and Tsinghua University with research. Second, Company A offers university students internships. Third, Company A conducts joint studies with CAS.

2. Company B

There are 70 researchers at Company B's research institute in the ZSP, consisting of graduate students from Peking University, Tsinghua University and Peking University of Post and Telecommunications. The institute in ZSP is a base to develop Company B's televisions and it asks Peking University, Tsinghua University and Beijing University of Post and Telecommunications to study television development.

Table 12.5 The relationship between research institutes/universities and enterprises in the ZSP

Research institutes/ universities	Name of enterprise	Notes
Institute of Computing Technology, CAS	Lenovo Group Ltd.	Leading enterprise in development, manufacture and sale of computer products
Software Research Institute of CAS	Red Flag Software Co., Ltd.	Linux OS developed by the company is at the highest level in China. The Ministry of Information Industry invested CNY100 million in CAS Red Flag in 2001
CAS	China Sciences Group (Holdings) Corporation	Consists of over 40 enterprises, such as Zhong Ke San Huan, Zhong Ke Hope Software, Shanghai China Science, Dayang and CSCA Technology
	China Daheng Group Inc.	Manufacturer of optical components. Ranked in China's Top 100 Electronics Enterprises
Peking University	Peking University Founder Group Corp.	Second largest enterprise for computer and multimedia products (after Lenovo). Leading position in the field of Chinese character laser-typesetting systems
	Beida Jade Bird Group	Software production, mainly software development, systems integration and computer security
Tsinghua University	Tsinghua Tongfang Co. Ltd.	Computer products (personal computers for home and business, servers and laptops; application information systems; digital television systems; and civil nuclear technologies)
	Tsinghua Unisplendour Co. Ltd.	Pioneer in Chinese character recognition technology. Leading enterprise in China's environmental protection industry

Source: A. Kuchiki based on JETRO Beijing (2005), "Outline by JETRO Beijing"

3. Tsinghua Tongfang

Tsinghua Tongfang is one of the holding companies for Tsinghua University. Its president is a researcher at Tsinghua University and one of its vice-presidents is a professor at the university. There are about 100 researchers and professors at Tsinghua Tongfang. Graduate students from Tsinghua University participate in research activities for the company, carry out practical studies and write papers. Tsinghua Tongfang sends some staff to Tsinghua University to obtain master's degrees. Many of the technologies developed at Tsinghua University are used for goods manufactured by Tsinghua Tongfang. The company implemented 863 projects in 2006. Examples include work on desulphurization equipment and air conditioners. In addition, researchers who returned to Tsinghua Tongfang from Silicon Valley in the USA invented a product for the E-zone platform.

4. The Chinese Academy of Sciences

CAS plays an important role in planning science technology policies. Its Institute of Policy Management (IPM) was established in 1985. It was formed by consolidating four former CAS subsidiaries: the Office of Policy Research, the Division of Management Science, *Journal of Dialectics of Nature* and the Section for Optimization and Overall Planning.

IPM encourages students studying abroad to come back to the ZSP. It implemented a plan to return 100 researchers to the ZSP and exceeded the target. The plan strengthened the network between the ZSP and Silicon Valley.

IPM has mainly engaged in theoretical, methodological and applied research into strategic, policy and management issues arising from national science and technology (S&T) development. It offers a variety of high-level research and consultancy services to the central authorities and local governments to help them with their decision-making regarding S&T development, social and economic progress, and S&T administration and management of enterprises. It focuses its research on development strategy, S&T policy, management of science and engineering, and S&T management.

IPM has master's, doctoral and postdoctoral courses in management science and engineering, and a master's program in technology economics and management. Since 1995 it has recruited 192 graduate students and 62 doctoral students.

12.4 Innovation

As mentioned in Sect.12.2, Fig. 12.2 is a summary of the flowchart approach to the hi-tech industry cluster policy in the ZSP. First, the existence of universities and research institutes is a precondition of the flowchart approach to industrial cluster policy. Second, the existence of the ZSP Management Committee is effective in implementing the industrial cluster policy in the ZSP. Third, the science parks in the ZSP are needed in order to attract information technology firms. Institution building and the construction of infrastructure are also needed to build capacity. Preferential treatment to attract human resources to the ZSP is crucial to the success of the industrial cluster policy. One of the treatments is to offer workers a permanent family register, which is effective in persuading Chinese students who have studied overseas to return to the ZSP.

In general, Step II (innovation) in Fig. 12.2 is not active in the ZSP. Enforcement of intellectual property rights is a precondition for innovation for firms in the ZSP. At Step II, firms innovate partly because they agglomerate and produce competitiveness between them. There is little joint action for firms in the ZSP to cooperate on innovation.

Figure 12.3 illustrates the establishment of skill centers and associations, and implementation of joint projects as joint actions. Direct support for innovation by government includes aid for R&D, financial support and technology transfer. Furthermore, it is necessary to remove barriers to innovation. Examples of such barriers are a lack of organizational depth, a fragmented regional system and lock-in effects. This is the hypothesis behind Step II, but the ZSP has not yet reached this step.

Step I in the flowchart in Fig. 12.3 starts with the presence of universities as a precondition. The flow proceeds to the next box if there are human resources at the start. Next an economic agent is needed as a leader for agglomerating information technology firms. The Management Committee plays the role of the leader in the case of the ZSP. The THSP is managed on a self-paying basis.

The public sector has built capacity in both preferential treatment and infrastructure construction that is crucial to success in the ZSP. In addition to segment building, information technology firms agglomerate if the living conditions are satisfied. The ZSP has satisfactorily reached this stage.

The flow proceeds to Step II (innovation). Firms can innovate if they agglomerate and compete with each other. Joint action by firms is needed for innovation when they agglomerate and cooperate with each other. Examples of joint action are skill centers, associations and joint projects, as shown in Fig. 12.3. However, the ZSP is not at the stage of innovation in which firms cooperate but at the stage of competition in innovation.

As shown in Fig. 12.4, the link between universities and firms in Beijing are as follows. Professors and students at universities establish

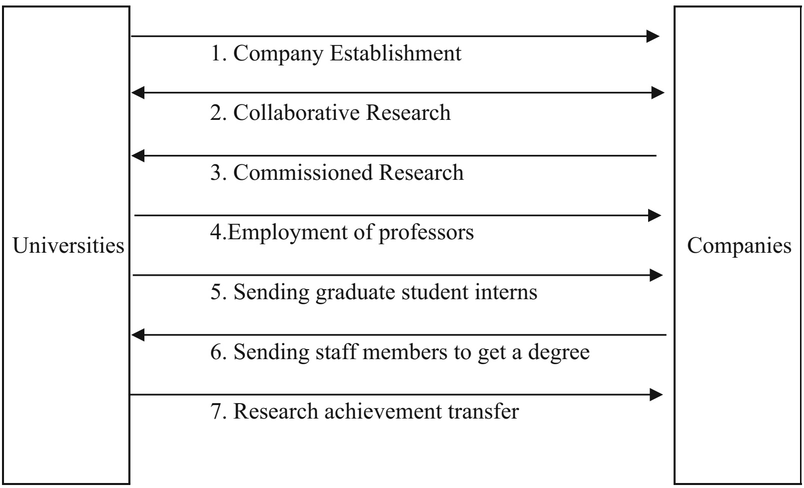

Fig. 12.4 Partnerships between universities and enterprises in the ZSP (*Source*: Developed by A. Kuchiki)

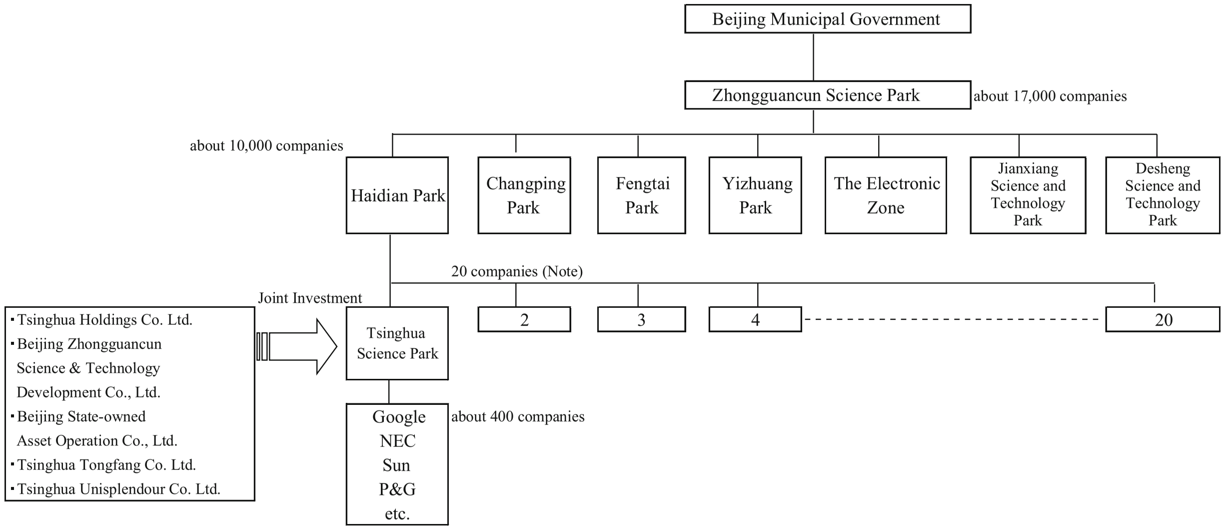

Fig. 12.5 Management structure of the ZSP. *Note*: 20 companies: 1. Tsinghua Science Park, 2. Zhongguancun Environmental Protection Park, 3. Yongfeng High Technology Industrial Base, 4. Zhongguancun Life Science Park, 5. Space Flight City, 6. Zhongguancun Software Park, 7. Peking University Biotechnology City, 8. Zhongguancun International Commerce and Trade City, 9. Shangdi Information Industrial Base, 10. Xierqi Intelligence Residential Area, 11. Peking University Science Park, 12. Zhongguancun West Zone, 13. Zhongguancun Science City, 14. Shangzhuang Town, 15. Agriculture and Forestry Science Park, 16. Sujiatuo Town, 17. Zhongguancun Culture and Education Base, 18. Zhongguancun New Medicine Park, 19. Wenquan Town 20. Xibeiwang Town (*Source*: Developed by A. Kuchiki)

firms, then universities and firms conduct joint studies. The firms contract the universities for the invention of new products. Universities send their graduate students to the firms as interns, and the firms, in turn, send their staff to the universities to obtain degrees. The universities provide the firms with research results. Successful firms associated with Peking University are the Founder Group and Beijing Beida Jade Bird Corporation, and those associated with Tsinghua University are Tsinghua Tongfang and Tsinghua Unisplendour.

As summarized in Fig. 12.5, the ZSP Management Committee was key to the success of the industrial cluster policy for Beijing's hi-tech industries. The committee under Beijing Municipal People's Government supervised ten science parks in 2006. Each has its own management committee. About 17,000 firms operated in the ZSP in 2006, and the number of tenants has been increasing. HSP is the largest of the seven parks consisting of 20 districts, including THSP. The THSP Company is a joint venture involving Tsinghua University Holdings Company, Beijing Zhongguancun Science & Technology Development, Beijing State-Owned Asset Operation, Tsinghua Tongfang and Tsinghua Unisplendour. About 400 firms have moved into THSP, including Google, NEC, Procter & Gamble and Sun Microsystems.

12.5 Conclusions

This chapter has proposed a flowchart approach to the information technology industry cluster policy to sequence the formation of the segments of clusters. For the information technology industry clustering in Beijing, industrial cluster policy requires the involvement of universities, and the policy's success depends on the leadership of the ZSP Management Committee.

The two cases of economies of sequence were suggested concerning the information technology industry clustering in Beijing, China. First, priority in the sequence of the information technology industry cluster policy should be given to nominating the leadership of the ZSP Management Committee of Beijing Municipality as the master switch. Second, the next priority should be given to the existence of universities as a precondition for university–industry linkages in the industrial cluster policy.

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13

Appendix: Introduction to an Application of Biology to the Formation of Segments in an Industrial Cluster

Akifumi Kuchiki

13.1 Introduction

Biology can be applied to the analysis of industrial clusters. The concept of genetic modification in genetic engineering may be applied to industrial cluster policies. Phylogenesis is organic evolution and ontogenesis is the process of an individual organism growing organically.

Spatial economics by Fujita et al. (1999) introduce "space" to economics. Schumpeter (1912/1934) introduced evolution theory in biology to economics. Fujimoto (1997) classified genetics into phylogenesis and ontogenesis to analyze the organizations in the automobile industry. This chapter makes clear the relationship between the genes of human beings and the dynamic formation processes of industrial clusters as Kanai (2012) emphasized the importance of the formation processes of industrial clusters on a time horizen. In sum, this chapter adds a "time horizen" as the fourth dimention to "space" in spatial economics as a third dimention to make industrial cluster policy more practical.

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The chapter regards the formation process of an industrial cluster as a form of ontogenesis, analyzes the formation process of segments of an industrial cluster and examines the sequence of formation. A segment is a part of the body that performs a specific function. Hox genes in genetic engineering play a leading role in forming the segments of an industrial cluster. The sequence of Hox genes determines the sequence of segment formation.

The chapter aims to analyze the sequence of segment formation of an industrial cluster and to show the existence of the economies of sequence in forming the segments of such a cluster by examining the results of industrial cluster policies as Kuchiki et al. (2013) tried to demonstrate. The economies of sequence, corresponding to the economies of scale in economics, are defined as a concept by which the costs of forming an industrial cluster are most efficiently controlled by optimally sequencing the order of segment formation in the industrial cluster.

There are three points on the time horizon in the formation of an industrial cluster: (1) ex ante the formation (planning time before the formation of an industrial cluster); (2) the process of the formation of an industrial cluster; and (3) ex post the formation (completed time after the formation of the cluster). The subjects of this study are industries such as the food, manufacturing, information technology industry and tourism industries. The segments of an organism are the head, breast, legs and so on. I view the segments of an industrial cluster as roads, ports, institutions and so on.

The chapter focuses on the manufacturing industry in the processes of forming an industrial cluster. The method is characteristic in applying the concept of Hox genes to the processes of industrial cluster formation. An industrial cluster will be successfully formed when the sequence of Hox genes is in the appropriate order. The indices for measuring the result of the economies of sequence in the manufacturing industry cluster are the number of firms agglomerated and the number of jobs created.

The chapter is organized as follows. Section 13.2 explains the concept of economies of sequence. Section 13.3 applies the sequence analysis in genetic engineering to industrial cluster policy. Section 13.4 concludes and summarizes the chapter.

13.2 Explanation of the Economies of Sequence

This section illustrates and defines the concept of the economies of sequence, much as the economies of scale and the economies of scope are defined in economics. The concept of economies of sequence dictates that the costs of forming the segments of an industrial cluster are minimized when the sequence of forming the segments is correct, but they are huge if the sequence is wrong. The sequence of forming segments is crucial to the normal birth of an organism. An organism develops from head to heart and legs in a particular order. The sequence of Hox genes determines the sequence of segment formation. I illustrate the economies of sequence with the following examples. First, a plastic model of a car should be assembled according to the construction manual to ensure that each part is added in the correct order. Second, in the case of cooking, the ingredients should be combined in a particular order or the recipe won't work.

The economies of sequence can be explained as follows. Suppose there are three periods: the first, second and third. Let us examine two examples of segment formation sequencing in an industrial cluster. Policy measures form an organ, and there are two candidate sequences of policy measures: A and B. Suppose that a cluster consists of three segments $\{s_1, s_2, s_3\}$. The difference between A and B lies in the ordering of s_2 and s_3. In A, the sequence of segment formation is supposed to be $\{s_1 \rightarrow s_2 \rightarrow s_3\}$, and we can suppose that the sequence of policy measures to form a production function in A is $\{s_1 \rightarrow s_2 \rightarrow s_3\}$. A and B can be notated as follows:

$$A = \{s_1, s_2, s_3\},$$

$$B = \{s_1, s_3, s_2\}.$$

13.3 An Application of Sequence Analysis in Genetic Engineering to Industrial Cluster Policy

This section makes clear the following three points on genetic analysis. First, deoxyribonucleic acid (DNA) is the sequence of four kinds of bases. Second, a segment of an organism is a segment such as head, breast or belly. The sequence of Hox genes determines the sequence of the expression of segments, or the formulation of segments. Third, a Hox gene plays a role of a switch in controling to start forming a segment of an industrial cluster. Particularly, the first Hox gene is a master switch for the first segment of an idustrial cluster and a key to the success in industrial cluster policy.

13.3.1 DNA, RNA and Amino Acids

This section applies sequence analysis in genetic engineering (Nirenberg and Matthaei 1961) to showing that the genes of human beings design the dynamic formation processes of industrial clusters on a time horizen. The sequence of policy measures determines the cluster design just as nucleotides determine the nature of the human gene. Physical infrastructure, institutions, human resources and local culture are basic building blocks (equivalent to nucleotides) in the cluster "genome." A cluster is designed using the nucleotides in the cluster genome. Sequence analysis in industrial clustering tries to find the successful genetic sequence of a cluster genome.

The concepts of sequence are useful in achieving successful industrial cluster policies. Ribonucleic acid (RNA) contain genetic information in the human genome. RNA molecules guide the synthesis of molecules of protein. In RNA transformed from DNA, four different bases are found: adenine (A), guanine (G), cytosine (C) and uracil (U). The bases form nucleotides, and three consecutive nucleotides form a codon. Each codon forms a unit of genetic code in DNA or RNA, and specifies either one amino acid or a stop to the translation process.[1]

Now we apply the results of ontogeny, or studying the process of an individual organism growing organically, to the analyses of the processes in segment formation in an industrial cluster.

The genes of an organism design a human being as is shown above. Human beings form and manage organizations including an industrial cluster. Hodgeson (1993) supposes that the genes of organizations are human beings. So that, we can denote the RNA of the human beings who are members of an industrial cluster. Here we assume that an industrial cluster consists of two persons. Then, their sequences of bases are denoted as follows:

$$\begin{aligned} K_1 &= \{\text{ATGGGACTACGA --- TAA}\}, \\ K_2 &= \{\text{ATGTACGAGTC --- ATG}\} \end{aligned} \tag{13.1}$$

Next we explain the DNA of industrial clusters, name them icDNA denoting in the case of a cluster consisting of K_1 and K_2.

$$\text{icDNA} = \{K_1, K_2\},$$

or

$$\text{icDNA} = \{\{\text{ATGGGACTACGA --- TAA}\}, \{\text{ATGTACGAGTCG --- TAA}\}\} \tag{13.2}$$

[1] RNA is a linear polymer of the four different nucleotides of A, G, C and U. The number of possible combinations of the three consecutive nucleotides (a codon) is 4 × 4 × 4 (64), from AAA, AAG, AAC and AAU to UUA, UUG, UUC and UUU. Examples of the triplets are GAA, GAG, GAC and GAU starting from G, and CAA, CAG, CAC and CAU starting from C. Not 64 but 20 different amino acids are found in proteins. The sequence of nucleotides is read consecutively in groups of three. The nucleotide sequence of a gene is translated into the amino acid sequence of a protein by rules that are known as the genetic code. Note that the successful sequence for industrial clustering is not one pattern but may be several different ones, just as the combinations of arginine in an amino acid are of four types: CGU, CGC, CGA and CGG. This means that the first sequence of C and G is crucial to the combinations of arginine, but that the third nucleotide of the sequence is insignificant in determining arginine. The successful sequence of industrial cluster policy is not fixed but "flexible". This chapter hypothesizes steps I and II of industrial clustering in the labor-intensive manufacturing industry.

In general an industrial cluster consists of not two persons but m persons. Its DNA, or icDNA, is denoted as

$$\text{icDNA} = \{K_1,\ K_2,\ \text{---},\ K_m\} \tag{13.3}$$

$$\begin{aligned}\text{icDNA} = \ &\{\{\text{ATGGGACTACGA -- TAA}\},\{\text{ATGTACGAGTCG -- TAA}\},\\ &\text{--},\{\text{ATGGCACTACGA}\}\}\end{aligned} \tag{13.4}$$

The icDNA of the industrial cluster is Eq. (13.3), and each K_i has the same structure of DNA in Eq. (13.1).

Equations (13.3) and (13.4) imply the following: first, the sequence of K_i determines the sequence of the formation of segments of an industrial cluster; and, second, the sequence of bases of K_i determines the efficiency in forming the segments of an industrial cluster. The two implications are refined in the next section using the concepts of Hox genes and single nucleotide polymorphism (SNP).

13.3.2 The Sequence of Segment Formation in an Industrial Cluster

The segments of an industrial cluster are composed of an industrial zone, a port and highways as is shown in Table 13.1, while the segments of an organizm are composed of a head, legs, heart, and so on. The sequence of the Hox genes of an organism determines the sequence of forming its segments on a time horizon.

For example, a fruit fly has eight Hox genes. We can write the sequence of a fruit fly as follows:

$$C = \{(H_1,\ H_2,\ H_3,\ H_4,\ H_5,\ H_6,\ H_7,\ H_8)\}.$$

Here ic-genome (ic: industrial cluster) denotes the genome of an industrial cluster. The differences between the organism-genome and the ic-genome are as follows:

(a) The genes of ic are human beings (L_i) who constitute the genome of ic. The conditions of nature (B_j) and culture (K_q) are given.

(b) Hox genes of ic are the first genes of segments of roads, institutions and so on. HL_{ik} represent the genes of ic. This chapter assumes that policy measures such as roads correspond to the segments of an organism.
(c) The sequence of Hox genes cluster is that of forming the segments of an industrial cluster.
(d) We illustrate the case of roads in the manufacturing industry cluster as a policy measure for industrial cluster policy. Roads are the segment of an industrial cluster. The production function of forming a segment is as follows. We assume that the primary production factor is human beings given the conditions of nature and culture. G_k represents roads. The genes of human beings translate into a segment. The segment functions as the roads of an industrial cluster. That is,

$$\begin{aligned} G_k &= f_k(\{HL_{1k},\ L_{2k},\ L_{3k},\ \text{--}\ ,L_{mk}\},\ \{B_{1k},\ B_{2k},\ B_{3k},\ \text{--}\ ,B_{nk}\}) \\ &= f_k(\text{Hox genes, Other genes}), \end{aligned}$$

where HL_{1k} represent the segments of Hox genes:

$$k = 1,\ 2,\ \text{---}\ ,\ 15.$$

HL_{11} is positioned at the head of all genes of an industrial cluster and plays a crucial role in the success of industrial cluster policy.

Table 13.1 shows the segments of the manufacturing industry cluster. Policy measures, or segments, are represented by

$$\begin{aligned} C_M = (\{&G_1,\ G_2,\ G_3,\ G_4,\ G_5,\ G_6,\ G_7,\ G_8,\ G_9,\ G_{10},\ G_{11},\ G_{12}, \\ &G_{13},\ G_{14},\ G_{15}\}). \end{aligned}$$

Segments are built as follows. Physical infrastructure refers to ports, roads, communications and so on. Institutional building, which is crucial to attracting foreign investors, includes the streamlining of investment procedures through one-stop services, the deregulation of laws and the introduction of a preferential tax system. Human resources include unskilled labor, skilled labor, managers, researchers and professionals. The living environment includes the provision of hospitals and international schools in order to invite foreign firms.

Table 13.1 The segments of an industrial cluster and the conditions of nature and culture

The segments of an industrial cluster	
Capacity	Segments
Infrastructure	Roads
	Railways
	Airport
	Port
	Communication
	Water
	Electricity
	Industrial zones
Human resources	Unskilled labor
	Engineers
	Managers
Institutions	Laws and regulations
	Land ownership
	Foreign exchange system
	Political system
The conditions of nature and culture	
Weather	Rainfall
	Temperature
Geographical features	
Geographical location	
Cultural conditions	

Source: Developed by A. Kuchiki

This chapter examines the sequence of segment formation using the examples in the process and ex post. We assume that the sequence of segment formation in the manufacturing industry cluster starts from forming a port, as shown in Table 13.1. The sequence of Hox genes corresponds to the sequence of segment formation. Its ordering of $H_{1,}$ $H_{2,}$ ---, and $H_{15,}$ is denoted as

$$H_{ic.Hox} = (\{H_1,\ H_2,\ H_3,\ H_4,\ H_5,\ H_6,\ H_7,\ H_8,\ H_9,\ H_{10},\ H_{11},\ H_{12},\ H_{13},\ H_{14},\ H_{15}\}) \qquad (13.5)$$

In summary, Eq. (13.1) is the DNA of human beings, Eq. (13.2) is the DNA of a manufacturing cluster, or icDNA. Equation (13.5) shows the sequence of Hox genes. We reach two conclusions by using the concept of Hox genes. First, we achieve economies of sequence as is defined in Sect. 13.2. Second, H_1 of a Hox gene positioned at the head of all Hox genes in the sequence of Eq. (13.5) plays the role of a master switch to initiate cluster formation in the correct order.

Hypothesis 1 There are economies of sequence in the process of forming an industrial cluster.

Suppose that K_1 and K_2 constitute the sequence of forming an industrial cluster. That is,

$$\mathrm{icDNA} = \{K_1,\ K_2\},$$

or

$$\mathrm{icDNA} = \{\{\mathrm{ATGGGACTACGA\ ---\ TAA}\}, \{\mathrm{ATGTACGAGTCG\ ---\ TAA}\}\}.$$

Then the order of K_1 and K_2 changes, or

$$\mathrm{icDNA}' = \{\{\mathrm{ATGTACGAGTCG\ ---\ TAA}\}, \{\mathrm{ATGGGACTACGA\ ---\ TAA}\}\}.$$

The latter case does not proceed to the next step in forming segments, which means that there are economies of sequence between K_1 and K_2.

Suppose that there are economies of sequence between H_1 and H_2 in the case of forming an industrial cluster. That is, first,

$$H_{ic.Hox} = (\{\underline{H_1},\ \underline{H_2},\ H_3,\ H_4,\ H_5,\ H_6,\ H_7,\ H_8,\ H_9,\ H_{10},\ H_{11},\ H_{12},\ H_{13},\ H_{14},\ H_{15}\}).$$

Then, by changing the sequence between H_1 and H_2,

$$
\begin{aligned}
& H'_{ic.Hox} \\
& = (\{\underline{H_2},\ \underline{H_1},\ H_3,\ H_4,\ H_5,\ H_6,\ H_7,\ H_8,\ H_9,\ H_{10},\ H_{11}, \\
& \qquad H_{12},\ H_{13},\ H_{14},\ H_{15}\}).
\end{aligned}
$$

H_1 proceeds to H_2 while the formation of H_2 does not proceed to H_1.

This case shows the existence of economies of sequence.

We examine the case of clustering in the automobile industry by constructing a port and roads when firms in this labor-intensive industry invest. An automobile consists of more than 20,000 parts. Mitsubishi Automobile invested in the Eastern Seaboard of Thailand and imported many parts, mainly from Japan, since few were produced locally. Its factory operated by importing materials using the port of Leamchabang, as well as roads (Kuchiki et al. 2013). In general, this successful sequence is inviting to an anchor firm preceded by capacity building in the automobile industry cluster. The anchor firm has high value of industrial linkage and invites its related suppliers to join it. There are thus economies of sequence between capacity building and an anchor firm, and between an anchor firm and its related suppliers.

Now we compare the case of organisms with that of industrial clusters in segment formation. First, the switches of organisms are Hox genes, much like those of industrial clusters. Second, the information of organisms is carried by genes, while that for industrial clusters is human beings. Third, the clearest difference is in sequencing. The sequence of the formation of organisms is cyclical and fixed, while that of industrial clusters is not cyclical and the ordering is changeable.

In the case of a fruit fly, the sequence of H_i is fixed, as shown above. Note that economies of sequence do not exist among all H_i. We can facilitate water supply, electricity supply and communication system in parallel. The ordering of their implementation can be flexibly changeable. Figure 13.1 shows the grouping of the sequence of the 15 Hox genes mentioned above. This case is noted as

$$
\begin{aligned}
& G_{ic.Hox} \\
& = (\{(G_1,\ G_2,\ G_3,\ G_4),\ (G_5,\ G_6,\ G_7),\ (G_8,\ G_9,\ G_{10},\ G_{11}), \\
& \qquad G_{12},\ (G_{13},\ G_{14},\ G_{15})\}). \qquad (13.6)
\end{aligned}
$$

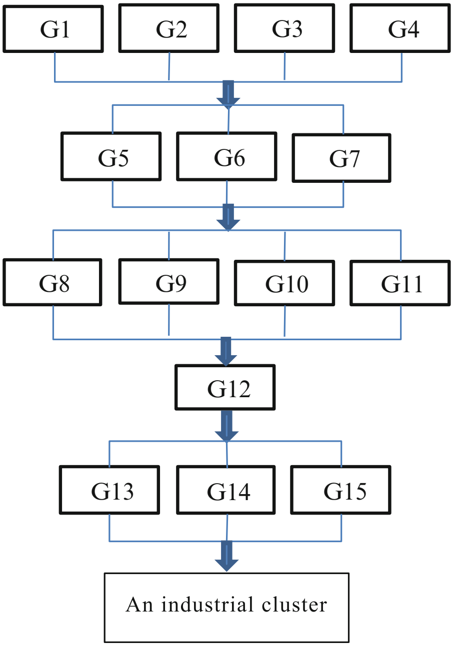

Fig. 13.1 A segment building process of an industrial cluster (*Source*: Author)

We denote the parallel case of G_1, G_2, G_3, G_4 as (G_1, G_2, G_3, G_4). This notation is applied to the case of G_5, G_6, G_7 as (G_5, G_6, G_7):

$$G_{ic.Hox} = (\{(G_5,\ G_6,\ G_7),\ (G_1,\ G_2,\ G_3,\ G_4),\ (G_8,\ G_9,\ G_{10},\ G_{11}),\ G_{12},\ (G_{13},\ G_{14},\ G_{15})\}) \tag{13.7}$$

Once first Hox gene exists and functions, the formation of a segment of an industrial cluster starts. We may find a base, or SNP, that is significantly related to a capable leader. This is a precondition to succeed in the formation of an industrial cluster: that the first Hox gene has the SNP. We have the following two hypotheses.

Hypothesis 2 First, the first Hox gene of H_1 is a master switch to start forming the first segment of an industrial cluster. Second, the human of H_1 might have a base, or SNP of DNA, as a good leader.

Comparison of the formation processes of industrial clusters with those of organisms is summarized as follows. The switches of forming segments are Hox genes in both cases. The information stock on forming segments consists of genes in the case of organisms and humans in the case of industrial clusters. The important difference in the formation processes is in their sequence. The sequence of organisms is cyclically fixed while that of industrial clusters is cyclically flexible, and conceivable to be parallel and exchangeable in its sequence by introducing human as Hox genes. The sequence of industrial clusters is shown in Fig. 13.1.

On the relationship of economies of sequence with the flowchart approach, Kuchiki and Tsuji (2008, 2011) found the hypothesis for the success of the automobile industry cluster policy in Step I (agglomeration). The basic factors or nucleotides in genetic engineering of capacity building at Step I (agglomeration) include the construction of physical infrastructure, institutional building, human resource development and the facilitation of living conditions amenable to foreign investors.

13.4 Summary and Conclusions

We applied developmental biology to the process in the formation of segments of an industrial cluster. The segments of an organism are the head, breast, legs and so on, while those of an industrial cluster are capacity building, such as physical infrastructure of road construction, electricity supply and so on, and institutional building. An industrial cluster is built by humans who are composed of four kinds of bases. The sequence of Hox genes of human is described as $\{(H_1, H_2, H_3, H_4, H_5, H_6, H_7, ---, H_{15})\}$.

Two conclusions are as follows. First, there are economies of sequence, such as $H_i < H_{i+1}$, on Hox genes. The economies of sequence determine the efficient sequence of segment formation in an industrial cluster in the flowchart approach to industrial cluster policy of Kuchiki and Tsuji

(2008). Second, the first Hox gene of H_1 is a master switch to start forming the first segment of an industrial cluster. The human of H_1 might have a base, or a SNP of DNA, as a good leader.

This chapter has analyzed the sequence of segment formation in an industrial cluster and showed the existence of economies of sequence in forming industrial clusters by examining the results of industrial cluster policies. The economies of sequence, corresponding to the economies of scale in economics, are defined as a concept by which the costs of forming an industrial cluster are most efficiently controlled by optimally sequencing the order of segment formation in the industrial cluster . There are economies of sequence in the labor-intensive manufacturing industries at export processing zones in Asia. The sequence is the order of the establishment of industrial zones, the construction of a port and the invitation of an anchor firm.

Every region in East Asia faces difficulties in shift from Step I (agglomeration) to Step II (innovation), as Kuchiki and Tsuji (2011) found. Further work is needed to find the successful sequence of policy measures for Step II.

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Note: Page number followed by 'n' refers to notes.

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