

Servitization, IT-ization, and Innovation Models

Two-stage industrial cluster theory

Edited by
Hitoshi Hirakawa, Kaushalesh Lal, Naoko Shinkai,
and Norio Tokumaru

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This book looks at two-stage industrial cluster theory and new innovation models in the context of the IT-ization and servitization of products. The formation of industrial clusters, such as export processing zones and special economic zones, has been the preferred mechanism for developing countries to boost their industrial development and export performance for the past several decades. Existing literature related to development economics cites numerous benefits of industrial clusters, and several countries have demonstrably reaped such benefits.

The book goes beyond an evaluation of the development of traditional industrial clusters by promoting the idea of the formation of two-stage clusters. Moreover, it takes into consideration new innovation models, with ideas promoted that are based on empirical evidence available through evaluations of Chinese and Taiwanese firms in the consumer electronics and automobile sectors.

Finally, the book looks at company strategies in a new business environment dominated by the servitization of industrial products. It proposes that firms integrate manufacturing and services to a greater extent, and, to substantiate these arguments, presents empirical evidence from India, Taiwan, and Bangladesh. Furthermore, the study contends that innovation and knowledge acquisition strategies are influenced not only by the size of firms but that they also vary with market preferences.

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Acronyms and abbreviations

| | |
|-------|--|
| ASEAN | Association of Southeast Asian Nations |
| BOP | bottom of the pyramid |
| BPO | business process outsourcing |
| BRIC | Brazil, Russia, India, China |
| CCDP | centralized control distributed process |
| CMM | Capability Maturity Model |
| CMMi | Capability Maturity Model Integration |
| CMS | chemical management services |
| CoPS | complex product systems |
| DRAM | dynamic random-access memory |
| DSP | digital signal processor |
| ECU | engine control unit |
| EDA | electronic design and automation |
| EIS | enterprise innovation system |
| EMS | electronic manufacturing service; engine management system |
| EPZ | export processing zone |
| ERP | enterprise resource planning |
| EU | European Union |
| EZ | economic zone |
| FTA | free-trade agreement |
| GDP | gross domestic product |
| GIN | global innovation network |
| GIS | geographic information systems |
| GPN | global production network |
| HP | Hewlett-Packard |
| HTP | hardware technology park |
| IaaS | infrastructure as a service |
| IC | integrated circuit |
| ICT | information and communication technology |
| IDM | integrated device manufacturer |
| IITI | Institute for International Trade and Investment (Japan) |
| IP | industrial park |
| IPR | intellectual property right |

| | |
|----------|---|
| ISA | India Semiconductor Association |
| ISI | import substitution industrialization |
| IT | information technology |
| ITES | information technology-enabled service(s) |
| IZ | industrial zone |
| KPO | knowledge process outsourcing |
| KSF | key success factors |
| LCD | liquid crystal display |
| METI | Ministry of Economy, Trade and Industry (Japan) |
| MNC | multinational companies or corporations |
| MNE | multinational enterprise |
| MSMEs | micro-, small-, and medium-sized enterprises |
| NAFTA | North American Free Trade Agreement |
| NASSCOM | National Association of Software and Services Companies |
| NIE | newly industrialized economy |
| NOIDA | New Okhla Industrial Development Authority |
| NPE | non-practicing entity |
| OBM | own-brand manufacturing |
| ODC | offshore development center |
| ODM | original design manufacturing |
| OECD | Organisation for Economic Co-operation and Development |
| OEM | original equipment manufacturing/manufacturer |
| OLED | organic light-emitting diode |
| PaaS | platform as a service |
| PDA | personal digital assistant |
| PEZA | Philippine Economic Zone Authority |
| PSE | public sector enterprise |
| PSS | product service system |
| R&D | research and development |
| RTI | Right to Information |
| SaaS | software as a service |
| SDMM | solution design and manufacturing move |
| SEI | Software Engineering Institute |
| SEZ | special economic zone |
| SMEA | Small and Medium Enterprise Agency (Japan) |
| SMEs | small- and medium-sized enterprises |
| STP | software technology park |
| STPI | Software Technology Parks of India |
| TD-SCDMA | time-division synchronous code division multiple access |
| TI | Texas Instruments |
| TSMC | Taiwan Semiconductor Manufacturing Company |
| VLSI | Very Large Scale Integration |
| WTO | World Trade Organization |

1 Introduction

The economic development in Asia that was initiated by the regional development of the newly industrialized economies (NIEs) of South Korea, Taiwan, Hong Kong, and Singapore in the 1970s seems, more recently, to have nearly brought the center of global economic activity to the Asian region. In terms of its economic development pattern, Asia is not self-dependent as a region or within its constituent countries. Rather, the Asian market has been heavily dependent on markets overseas and outside of the region. Furthermore, it has been absorbed by international technology, and, as a result, Asia has achieved economic development by becoming a part of world production chain. At the same time, however, the recent economic development pattern of emerging economies in Asia can also be considered to be somewhat distinctive. For instance, there has been a shift of trajectory from economic development based on globalization of *manufacturing* to economic development based on globalization of *service* industries.

In fact, among Asian countries, patterns of economic development differ. The NIE countries, Association of Southeast Asian Nations (ASEAN) countries, and China participated in an international division of labor in the *manufacturing* industries at the time of high economic growth which went hand in hand with the de-industrialization in advanced economies (Hirakawa and Aung 2011). Conversely, in India, outsourcing from other regions in the *service* industries, such as the information technology (IT) sector, became an engine of economic growth. The current pattern of outsourcing, too, can be seen to have changed when compared to that of the initial stage of its development. “Body shopping,” based on relatively cheap labor, is found less nowadays, whereas business process outsourcing (BPO), or the outsourcing of indirect operations, and even knowledge process outsourcing (KPO), in which knowledge-intensive work such as solutions and planning is outsourced, can both now be observed in outsourced emerging countries. As far as a pattern is concerned, economic development led by the globalization of service industries is emerging for the first time in economic history. However, this pattern of development is neither widely recognized nor adequately analyzed in terms of its importance in both developing and developed countries.

There are two main research objectives underpinning this book. First, by presenting several diverse empirical research analyses of the IT service industries

2 Introduction

in South Asia, we propose to shed novel light on economic development led by the globalization of the *service* industries. Second, we attempt to assess the impact of the digitization and servitization of the economy on industrial development in those countries, such as China and Taiwan, in which economic development was led by the globalization of *manufacturing*. The reason for focusing on South Asia for the first issue is that the region is considered to be a hub of economic development led by the globalization of service industries. The globalization of the service industries can be described as a part of the servitization of the economy. It is also true that the advancement of IT has enabled the promotion of this type of globalization. For this reason, it is valuable to clarify the role of digitization and servitization in both South Asia and East Asia in order to understand the current stage of development in Asia.

Almost all of the chapters in this book are related to the concept of “industrial cluster.” Digitization and servitization may not mean that “the world is flat,” as posited by Thomas Friedman (2005), but, rather, that major knowledge and information centers reside only in a few cities and that industries are clustered in those cities. In this sense, it is believed that the present investigation of industrial clusters will offer further understanding of the development of knowledge-based industry in Asia which can play an important role in the future.

The evolution of industrial clusters is as old as the process of industrialization, within the early stage of which firms favored locations where production factors were relatively easily available. Over time, these locations became natural choices for certain industries, such as the IT industry in Silicon Valley in California, USA, and in Bangalore, India. As the process of industrialization progressed, governments in developing and developed countries realized the potential benefits of industrial clusters and conceived the idea of government-supported industrial clusters. Examples of such clusters include industrial zones (IZs), industrial parks (IPs), export processing zones (EPZs), and special economic zones (SEZs). In the case of IT, IPs can further be divided into software technology parks (STPs) and hardware technology parks (HTPs). Industrial zones in developing countries are usually clusters of small firms related to a particular industry, e.g. a cluster of footwear, garment, or electronics businesses.

There are numerous benefits of geographical clusters, including inter-firm learning, two-way flow of information, and easy availability of industry-specific knowledge. Clusters assist inter-firm learning in several ways, e.g. small firms can learn from their transactions with buyers and suppliers. Two-way flow of information, i.e. buyer to firm and supplier to firm, helps in improving product quality and product customization. Clusters also aid in the acquisition of industry-specific knowledge in diverse functional areas of business, such as procurement, financing, marketing, law, accounting, R&D, and distribution. A second advantage of clusters is attributed to learning from interaction with similar firms. The tacit knowledge of how to do things in an industry can be learnt simply by being in a geographical cluster. Geographical proximity is extremely helpful in the acquisition of tacit knowledge that depends on observation and interaction. A third benefit is the creation of an information-rich environment with specialized

labor pools. These specialist workers can help to diffuse knowledge in two ways: by communicating with one another and by working over time for more than one firm in the region. Thus, industry trends and technical innovation can be communicated quickly between firms in a cluster.

Over the years, governments in all regions of the world have been encouraging industrial clusters, and firms have been taking advantage of such initiatives. The type of clusters introduced above are regarded as first-stage clusters. Before we discuss second-stage clusters, it is important to consider the industrial organization of large and multinational firms as second-stage clusters are the consequences of their “vertical disintegration” and “vertical non-integration.” Until the liberalization of the economies of developing countries, large firms were concentrated in their home countries. Then, multinational corporations (MNCs) began to attain opportunities to set up manufacturing plants in developing countries and were highly vertically integrated. As time passed, local firms in the host countries developed capabilities to manufacture peripheral components. This happened due to the spillover effect of MNCs in the host countries. Consequently, many new, smaller firms, as well as spin-offs of MNCs, emerged in the host countries. Such firms offered products at much lower prices than had been set for those originally manufactured by the MNCs. Large companies found it more economical to outsource low-tech manufacturing activities, too, to these smaller firms, with the emergence of the semiconductor industry in Taiwan and South Korea during the 1980s being a case in point. Taken as a whole, this process resulted in the vertical disintegration of large firms.

Simultaneously, the vertical non-integration of large firms also took place, a point that is elucidated further in Chapter 2 of this book. In the new system of production, intermediate products are manufactured by independent, highly specialized firms the core competency of which is to manufacture a limited number of constituent products, e.g. printed circuit boards in the electronics industry. This production model offers several advantages, which are also discussed in Chapter 2, and the new business model leads to an emergence and agglomeration of a large number of highly specialized small firms in a particular industry. This new production system is based on the vertical non-integration of firms.

In this book, we propose the creation of clusters of such firms engaged in the manufacture of the intermediate products of a particular industry. For instance, in the IT industry, specialized firms could be engaged in writing the software programs of device interfaces, data interchange applications between asynchronous devices, and so on. The establishment of clusters of such firms near first-stage clusters of parent industry firms is expected to bring many advantages to final product manufacturing firms as well as to the consumers. These new type of clusters are conceptualized as second-stage industrial clusters. As asserted in Chapter 2, these clusters not only make a particular industry more competitive but also provide ample opportunities for innovation.

Industry-specific characteristics have also contributed to the formation of a large number of specialized small firms, e.g. the electronics industry in general and consumer electronics in particular have created numerous small firms engaged

4 Introduction

in producing embedded software systems. The degree of use of IT products in manufactured final products is defined as the extent of product IT-ization. The electronics industry has been integrating software products into final manufactured products, which has resulted in the emergence of a large number of small software firms. Hence, it can be said that the IT-ization of products has contributed to the formation of specialized firms, which, in turn, necessitated the need for second-stage industrial clusters.

Chapter 2 highlights the formation of second-stage clusters in East Asian economies that have, so far, been doing exceedingly well in international markets by forming first-stage industrial clusters, i.e. EPZs, SEZs, and technology parks exclusively for the IT sector. In the present business environment, which is dominated by globalization and intense competition, firms are not only looking for cheap labor but also for markets. This is where firms in developing countries in general and in East Asian countries in particular have great potential to promote a second-stage of industrial clusters focusing more on local market oriented innovations. NIEs are likely to succeed in the formation of second-stage clusters as they have achieved sufficient competence through the success of the first-stage clusters. The entire issue of industrial clusters is intelligently delineated in Chapter 2, the author of which concurs with the ideas of Akifumi Kuchiki, who has long been advocating a two-stage industrial cluster theory (Kuchiki and Tsuji 2011).

Two-stage industrial cluster promotes innovation. Since the new, technological knowledge is elusive and uncodified, geographic concentrations of innovative activity generate more knowledge spillovers, and, therefore, the advanced industrial clusters give rise to more innovative output. The importance of scientific technological infrastructure, advanced customer needs, and tacit knowledge of firms influences competition, which consequently leads to innovation. This is because when several firms from the same industry sector concentrate in one place, specially skilled workers gather there, too, forming a labor market from which both workers and firms gain profit. This transmission of information promotes a diffusion of new technology that further enhances innovation activities. In a two-stage industrial cluster, the most significant supply side externality, however, is the knowledge spillover that produces positive externalities related to the diffusion of knowledge between neighboring firms. The knowledge spillovers arise from industry specialization as knowledge created in one firm aids the advancement of another technologically similar firm. Geographic proximity creates opportunities for the face-to-face interactions and trust building that are essential for an effective exchange of ideas, as observed in Chapter 2.

Chapter 3 substantiates the general notion that there is no universal development model that can be adopted by all of the developing countries, but, rather, that development models are influenced by several country-specific factors. The chapter clearly sets out the models followed by the “latecomers: flying geese” and “late latecomers: compressed development” paradigms. Specifically, it focuses on business models followed by Chinese corporations in the consumer electronics and automobile industries that are based on modularity of products, production capacity, and technical capability.