

Strategy for Cluster-based Industrial Development in Developing Countries

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In this short article we formulate an endogenous model of cluster-based industrial development based on case studies in Japan, Taiwan, and China. In this model, the initiation phase is followed by a quantity expansion phase through imitation and subsequently by a quality improvement phase through innovation. We argue that such a process of industrial development is supported by the development of market transactions among assemblers, parts-suppliers, and merchants, as well as the stimulation of innovation made possible by the benefits of industrial clusters arising from a large number of enterprises and a variety of human resources being concentrated in a small geographical area. Based on this understanding, we argue that if we provide training programs in management and marketing for enterprise managers in stagnant industrial clusters, which are often found in developing countries, such clusters may be able to grow sharply; these training programs should stimulate innovation, which should encourage growth for the clusters.

1. Introduction

In order to reduce poverty and to achieve equitable and sustainable development, we have to develop industries that provide increased employment opportunities for the poor. Therefore, the development of labor-intensive industries ought to be a central theme of development economics and a central focus of development policies. Yet, there has been a sheer lack of empirical studies inquiring into the process of industrial development in developing economies; this lack has led to the absence of strategic industrial development policies in developing countries. Thus, we do not know the answers to even simple and fundamental questions on industrial development, such as what types of entrepreneurs initiate new industries, what institutions support the subsequent development of such industries, and under what conditions new major innovations

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take place. Without answering these questions, it is difficult to formulate appropriate policies to nurture new industries or to accelerate the development of existing industries.

This study presents an attempt to uncover the common processes of successful industrial development based on the case studies of selected industrial clusters in China, Taiwan, and Japan, as well as other case studies in Vietnam, Bangladesh, Kenya, Ethiopia, and Ghana. We focus on industrial clusters not only because many of them are found in developing countries, but also because industrial clusters have clear advantages, particularly in developing countries where markets are less developed.

The organization of this article is as follows. The next section synthesizes our case studies conducted in Japan, Taiwan, and China. Section III goes on to identify the causes of the success in East Asia. In Section IV, we reexamine the conventional understanding of the advantages of industrial clusters in light of our case studies. Finally, Section V concludes the paper by drawing implications for strategy to develop industries.

2. A Synthesis of East Asian Studies

A review of the literature on industrialization in Japan, Taiwan, and China as well as an examination conducted by Sonobe and Otsuka (2006a, 2006b) of township-level industrial data over time in the three East Asian countries revealed that industrial clusters have made significant contributions to industrial development in these countries. We visited a large number of manufacturing enterprises in the major industrial clusters to identify the main features of the development process through open-ended interviews with enterprise managers, engineers, and public-sector administrators followed by formal questionnaire surveys of a large number of enterprises.

To gain insights into an East Asian model of cluster-based industrial development, we decided to make a pair-wise comparison of the same or similar industries: (1) the garment clusters in Hiroshima prefecture in Japan and that in Zhejiang province in China (Yamamura, Sonobe, & Otsuka, 2003; Sonobe, Hu, & Otsuka, 2002); (2) the motorcycle industry in Japan and that in Chongqing, China (Yamamura, Sonobe, & Otsuka, 2005; Sonobe, Hu, & Otsu-

ka, 2006); (3) the machine tool industry in Taichung, Taiwan, and the low-voltage electric machinery industry in Wenzhou, China (Sonobe, Kawakami, & Otsuka, 2003; Sonobe, Hu, & Otsuka, 2004); and (4) the printed circuit board industry in northern Taiwan and that in Jiangsu province in China (Sonobe & Otsuka, 2006b).¹

Despite significant differences in political regimes and stages of economic development among the three countries and in production methods and skill requirements across the selected industries, we found extremely similar processes of industrial development across the eight cases. Thus, these processes may be termed “An East Asian Model of Cluster-Based Industrial Development.” We characterized the development processes into three distinct phases: (1) initiation, (2) quantity expansion, and (3) qualitative improvement (see Table 1 for a summary of the endogenous model of industrial development).

Table 1. An endogenous model of industrial development

Phase	Prior experience of managers	Education	Innovation, imitation, and productivity growth	Institutions
Initiation	Merchants / Engineers	Low	Imitate foreign technology directly or indirectly	Internal production of parts, components, and final products
Quantity Expansion	Spin-offs and entry from various fields	Mixed	Imitate imitated technology; stagnant productivity; declining profitability	Market transactions; division of labor; formation of industrial cluster
Quality Improvement	Second generation of founders and newcomers with new ideas	Very High	Multi-faceted innovations; exit of many enterprises; increasing productivity	Reputation and brand names; direct sales; sub-contracts or vertical integration; emergence of large enterprises

If the production method is simple but selling the products is not easy, as in the case of the garment industry, merchants are likely to be the ones who establish the new enterprises. They do so often in the suburbs of large cities or villages not too far away from large cities, taking advantage of their

¹ In the studies referred to above, we employed rigorous statistical techniques to test a number of empirical hypotheses. In this article, we do not discuss the technical aspects of the statistical analyses. We focus here on the ideas and logic behind the rigorous statistical analyses.

experience in commercial activities in other industries. If the production method is complicated, engineers tend to be the new entrepreneurs. Once they succeed in producing new products, often after long trial and error processes, a swarm of imitators appears, as envisaged by Schumpeter (1912) in his theory of economic development.

The imitators are often spin-offs, i.e., those who have worked for the founding enterprises and initiated own enterprises by imitating production methods and products. Because most enterprises produce the same (or almost the same) low-quality products using the same low-quality materials and parts, anonymous market transactions develop; this reduces the entry barriers for new firms. Indeed, new firms can easily procure all the required materials and parts and sell their products through merchants, and they can recruit workers with desired skills from inside the cluster while investing in a few pieces of indispensable equipment. Low consumer income means high demand for low-quality products in the domestic markets. This is a clear advantage of initiating new business in developing countries; the founders of new industries earn huge profits owing to the large demand for their low-quality products. This attracts entry of new enterprises.

The active entry of numerous new enterprises results in geographical concentration of enterprises, which attracts traders, parts-suppliers, skilled workers, and engineers to the industrial cluster. An industrial cluster expands in this way. Up to this point in the cluster's development, productivity growth is modest or could even be negative, as imitation does not improve the production efficiency even though the quantity of production registers impressive growth. Typically enterprises at this stage are very small and use labor-intensive production methods.

Active entry increases the supply of products to markets sharply, thereby reducing output prices and, hence, the profitability of producing low-quality products. This triggers new competition centered on product improvement. At this stage, innovative entrepreneurs begin employing a larger number of engineers and designers to improve their products. They often start developing long-term subcontracts with specific parts-suppliers to acquire firm-specific and high-quality parts. However, improving product quality alone does not ensure high profits for innovative enterprises; to differentiate their new high-

quality products from the low-quality products produced by the majority of other enterprises, these entrepreneurs must establish a reputation as high-quality producers, develop their own marketing channels using their own marketing agents, and manage their own retail shops in order to sell their products directly to consumers and users of their products.

If they are successful, they tend to absorb those enterprises that fail to innovate and let these enterprises to produce products with the same brand names of the successful enterprises. Many enterprises that cannot catch up with innovative enterprises have to exit the industry. In our observations, it is at this stage when the production efficiency of the industry a whole visibly improves. The size of successful enterprises grows and many of them begin to export. Another important point is that the industrial cluster sets the stage for innovation towards quality improvement by attracting a pool of human resources useful for improving the product quality and improving the marketing efficiency of improved products. To use the observation by Schumpeter (1912), innovation is nothing but a new combination of the existing resources, including engineers, designers, parts-suppliers, and merchants. To realize such innovation potential, high-quality entrepreneurial ability is found to be indispensable. In other words, successful entrepreneurs at this stage are highly educated almost without exception, unlike founders of the industry, who are often uneducated but endowed with skills and ambitions.

Because we failed to collect long-term data of sample enterprises in many cases, we cannot directly trace the whole process of industrial development from the initiation to the quality improvement phases in all the case studies in East Asia. Nonetheless, all the case studies consistently provide evidence in support of the common endogenous process of industrial development described above. Therefore, we have developed a rigorous model of the endogenous industrial development process in Sonobe and Otsuka (2006b).

3. Why Is East Asia So Successful?

A critical question is why East Asian economies have developed so successfully. Like China for the last 28 years, the Japanese economy had grown at a rate of about 10% per year during the “miraculous growth periods” from

the late 1950s to the early 1970s. The growth rate of the Taiwanese economy has been no less rapid than in Japan in the past and in contemporary China. Furthermore, the patterns of industrial development among the three countries are more similar than they are dissimilar. In our view, the successful imitation and assimilation of foreign technologies, the formation of geographically dense industrial clusters consisting of a large number of small enterprises producing similar and related products, and the advent of multifaceted innovations leading to a great leap forward in the industrial structures are three of the important ingredients of the East Asian model of cluster-based industrial development.

Learning from successful experience of other countries was also likely to be the key to the success, even though it is extremely difficult to quantify this effect. During our surveys, we repeatedly heard that Taiwanese enterprise managers learned a great deal from the Japanese experience. Similarly, Chinese enterprise managers seem to have learned a number of lessons from both the Taiwanese and Japanese experiences. While it is difficult to answer the question of why Japan was successful in the transition from the quantity expansion to the quality improvement phases in much earlier years, it seems clear that the successful development of the Japanese industries became the model of the industrial development in other East Asian countries.

We believe that the successful development of the shoe industry in Ethiopia was due prominently to the repeated visits of Ethiopian entrepreneurs to Italy to learn designs, production methods, and marketing skills (Sonobe, Akoten, & Otsuka, 2006). We were also told by producers of knitwears in the rural cluster in northern Vietnam that visiting China is critically important to improve their technology and management. The development of the huge garment cluster in Dhaka owes its remarkable success to the transfer of technology and management know-how from Korea.

Foreign technologies were imitated in different manners among the three countries in the postwar periods. Since the inception of modern economic development in the late 19th century, Japan had been making every effort to catch up with the West in industrial technologies by setting up modern government-supported plants modeled after advanced factories in the West, providing general education and vocational training for workers and engineers, and so on (see, e.g., Otsuka et al., 1988; Hayami & Godo, 2005). Although such processes

were disrupted by World War II, they resumed immediately after the war. The cases of the garment and motorcycle industries examined by Sonobe and Otsuka (2006b) are two of the early examples of successful industrial development based on foreign technologies in postwar Japan.

In the case of Taiwan, foreign joint ventures, foreign trading companies, and the Industrial Technology Research Institute (ITRI), a leading national research and development center founded in 1973, played major roles in introducing new technologies from abroad starting in the 1960s. Spin-offs from the joint ventures and those who were trained at ITRI often became the founders of new enterprises in this country. In the case of China, state-owned enterprises (SOEs) were the main sources of human resources, industrial technologies, and managerial know-how for the development of collective township and village enterprises (TVEs) and private enterprises. Thus, SOEs played the role of model plants. According to Otsuka et al. (1998), SOEs were inefficient in management due to regulations but were knowledgeable about modern technologies. Moreover, SOEs had established marketing channels. Thus, the assimilation of technologies and management know-how from SOEs, as well as the use of SOEs' marketing channels, were the major means for collective TVEs and private enterprises to improve the efficiency of production and management.

The three countries differed little in the process of quantity expansion, which led to the formation of industrial clusters consisting of small enterprises. Setting up industrial zones by the government is useful and common. While marketplaces set up by the local governments played important roles in the improvement of marketing efficiency in China, the same purpose was achieved by the densely clustered wholesalers dealing in industrial parts in Taiwan and the active network of merchants in Japan.

The successful implementation of multifaceted innovations by highly educated entrepreneurs in the three countries, which has led to the quality improvement phase, seems common. According to our recent studies on industrial clusters in Sub-Saharan Africa (i.e., the shoe industry in Ethiopia by Sonobe, Akoten and Otsuka (2006), the garment industry in Kenya by Akoten, Sawada and Otsuka (2006), and the car-repair cum metal processing industrial complex in Ghana and Kenya), the industrial clusters producing low-quality products often remain in the quantity expansion stage and fail to innovate,

which, we believe, is a distinguishable feature of industrial clusters in Sub-Saharan Africa.² In East Asia, the entrepreneurship of highly educated managers leads to introduction of improved production methods, initiation of the use of brand names to strengthen their images, development of new marketing channels, and establishment of long-term subcontract systems.

An interesting question for less industrialized countries is whether the transition from the quantity expansion to the quality improvement phases can be facilitated and shortened by participating in global value chains organized by global-scale retailers or joint ventures with manufacturers in developed countries. These global-scale retailers and manufacturers provide improved production technologies, marketing channels, and new management methods to small enterprises in developing countries. The answer is affirmative, as far as upgrading product quality is concerned. Yet it is highly questionable whether such technology transfer leads to sustainable cluster-based industrial development. Because the source of new information is foreign buyers and manufacturers, not neighboring enterprises producing similar products within the cluster, there is no strong incentive for local enterprises to form industrial clusters. This means that the forces within the cluster leading to the transition to the quality improvement phase are absent in industrial development led by global buyers and foreign ventures. Furthermore, the ability to innovate may not be nurtured if local enterprises depend entirely on the global buyers and foreign ventures. All these considerations suggest that learning from foreign companies is most effective when the industry is in the transition from the quantity expansion phase to the quality improvement phase; by that point, the industrial cluster can provide the opportunity to innovate further, and the innovative entrepreneurs have acquired the experience needed to innovate (Sonobe & Otsuka, 2006b).

Although our study does not provide ample evidence supporting the above argument that the global value chain is not a panacea, there are several relevant observations. In the case of the motorcycle industry in China, although the joint ventures between the SOEs and Japanese enterprises contributed to the early part of the quantity expansion phase, their growth performance in the quality improvement phase has been mediocre (Sonobe, Hu, & Otsuka, 2006).

² An exception is the case of the shoe industry in Ethiopia, which has been growing fairly rapidly.

In the case of the printed circuit board industry in China, there is no clear evidence that local enterprises have learned much from foreign ventures: the technology level of the former is far lower than that of the latter, so direct technology transfer or learning is not yet feasible (Sonobe & Otsuka, 2006b). In all other cases we studied, it was the ingenuity and innovation of local entrepreneurs that brought on the transition into the quality improvement phase.

Our arguments are clearly supported by the case study of the leather shoe cluster in Brazil conducted by Bazan and Navas-Alemán (2004), who find that those shoe makers supplying their products not only to global buyers but also to the domestic markets and neighboring countries surpassed those who specialized in export to global buyers in the process of quality upgrading. Based on this finding and the results of other case studies, Humphrey and Schmitz (2004) conclude that enterprises in developing countries cannot learn much about how to achieve qualitative upgrading from global buyers. Likewise, some empirical studies point out that little benefit of positive externality comes from foreign ventures. Thus, the opportunities of participating in global value chains and transacting with foreign ventures can be utilized most effectively if the industry has reached the last stage of the quantity expansion phase, where some enterprises are ready to innovate.

4. Agglomeration Economies Reconsidered

Since the seminal work of Marshall (1920), three major advantages of industrial clusters have been recognized conventionally: (1) information spillovers, (2) the specialization and division of labor among enterprises, and (3) the development of skilled labor markets. While we do not have major objections to the importance of these three advantages, our analysis suggests room for reconsideration.

We agree that information spillovers are common and important in the cluster. For example, in the garment clusters in both Japan and China, if a new design introduced by an enterprise turns out to be popular, many other enterprises copy it within a few days. But information spillovers, which are essentially imitation, are not always that simple. In our observation, less simple imitation takes place through the spin-offs and recruitment of workers from

other enterprises, which is intensively discussed in our study on the motorcycle industry in Chongqing. In the case of the printed circuit board enterprises in Suzhou, a group of spin-off enterprises, whose managers used to work at the same founding enterprises, employ the same technology to produce the same products. Thus, information spillovers in the industrial cluster are inseparably related to the development of skilled labor markets, wherein skilled workers move from one enterprise to another. According to our respondents, assemblers develop long-term contracts with parts-suppliers to reduce the risk of the parts-suppliers leaking new ideas to other assemblers. If this is the case, the division of labor among manufacturing enterprises is also closely related to information spillovers.

Another important aspect of the industrial cluster is that it reduces transaction costs. Transaction costs have been neglected in the literature on economic geography and spatial economics, where the role of transport costs has been discussed extensively. Transaction costs arising from moral hazard and hold-up problems are low in the industrial cluster because rumors of such opportunistic behaviors quickly become public knowledge by word of mouth in the cluster. We believe that this is the major reason why the division of labor develops in the industrial cluster. To use the observation of Hayami and Godo (2005), the community mechanism of contract enforcement, which was originally applied in rural communities, works well in the industrial cluster as well.

It is one-sided to emphasize the importance of information spillovers as an advantage of the industrial cluster if the role of the cluster in promoting innovation is not equally appreciated. Marshall (1920) argues that information spillovers become a source of innovation: “if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas.” Based on our empirical findings, we can add to his argument the hypothesis that the industrial cluster provides a hotbed of innovation, as it accumulates a variety of human resources useful for new innovation. We believe the validity of this hypothesis is worth investigating in other case studies.

To sum up, our analysis indicates that the major advantages of clusters are: (1) the development of markets, which facilitates transactions among manufacturers, merchants and workers, and (2) the promotion of innovations by

attracting useful human resources.

5. Concluding Remarks

Although effective policies to promote the development of SMEs have been seriously sought in many developing countries, economic theories that can guide such policy have been absent. Some economists seem to assume that the market works so well in the industrial sector that government intervention is unnecessary. Our analysis strongly indicates that the market works fairly well *in industrial clusters* because dishonest behaviors potentially arising from imperfect information are reduced to a significant extent by the informal contract enforcement mechanisms, e.g., gossip through word of mouth. This explains why people behave honestly in industrial clusters and why industrial clusters are so prevalent in developing countries. It also suggests that the market tends to fail in allocating resources efficiently in the absence of industrial clusters. In industrial clusters, marginal and small-scale enterprises (MSEs), which provide ample employment opportunities for unskilled workers, play a critical role, particularly in the early phases of industrial development. Thus, there are good reasons for the government to support the formation of industrial clusters by setting up model plants to train potential managers and workers, industrial zones to attract MSEs producing similar and related products, and marketplaces to facilitate transactions of parts, intermediate products, and final products among manufacturers and merchants.

It is well-known in the economics literature that the market generally fails in the transaction of information, particularly if the information is not patentable or the patent protection is ineffective. This is the case for “imitative innovation,” which is critically important for the development of industrial clusters in low-income countries. It is obvious that because of imitation or information spillovers, investment in innovation falls short of the social optimum. Therefore, it makes sense to support activities leading to innovation in industrial clusters by means of providing training programs for technological, managerial, and marketing advancement. Our analysis strongly indicates that such an attempt is likely to be effective when the cluster is in transition from the quantity expansion to the quality improvement phases. As our analysis

implies, technical training alone is not sufficient to stimulate the transition because what is required is multi-faceted innovations in areas including technology, production organization, and marketing.

A number of industrial clusters have formed in low-income countries including South Asia and Sub-Saharan Africa. In many cases, however, they fail to enter the quality improvement phase and hence remain in the quantity expansion phase. A good example is the garment clusters in Nairobi, where a large number of small workshops, consisting of three to four workers, produce low-quality products (Akoten, Sawada, & Otsuka, 2006). Another interesting case is the shoe cluster in Addis Ababa, where a handful of educated managers are attempting multi-faceted imitative innovations by learning from the experience of Italy (Sonobe, Akoten, & Otsuka, 2006). In all likelihood, these industrial clusters will be able to take off if appropriate training programs are provided.

Appropriate policies to promote labor-intensive industries are badly needed to reduce the widespread poverty in low-income countries. We believe that the appropriate policies for such industrial development must support the formation of industrial clusters and their transition from the quantity expansion phase to the quality improvement phase.

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