

SHIFTING GEARS IN INNOVATION POLICY

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STRATEGIES FROM ASIA

Edited by Yong Suk Lee, Takeo Hoshi, and Gi-Wook Shin

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Abbreviations

A*STAR	Agency for Science, Technology and Research
API	application programming interface
ARTC	Automotive Research and Testing Center
ASEAN	Association of Southeast Asian Nations
ASIC	application-specific integrated circuit
B2C	business-to-consumer
BIRDC	Bicycle R&D Center
C2C	consumer-to-consumer
CMC	Computer Maintenance Corporation
DLT	distributed ledger technology
DOE	Department of Electronics
DOS	Department of Statistics
DRAM	dynamic random-access memory
DSO	Defence Science Organisation
ECIL	Electronics Corporation of India Limited
EDB	Economic Development Board
ESVF	Early Stage Venture Fund
FEC	Future Economy Council
FOB	Free on Board
FTRC	Footwear Technology Research Center
GDP	gross domestic product
GRI	government research institution
GVC	global value chain

HGF	high-growth firm
HHI	Herfindahl-Hirschman Index
HRS	household responsibility system
HSIP	Hsinchu Science-Based Industrial Park
IC	integrated circuit
ICO	initial crypto-token offering/initial coin offering
ICT	information and communication technology
IDB	Industrial Development Bureau
I IPL	Infocomm Investments Pte Ltd
IIT	Indian Institute of Technology
IMDA	Infocomm Media Development Authority
IPO	initial public offering
ISIC	International Standard Industrial Classification
IT	information technology
ITRI	Industrial Technology Research Institute
KEONICS	Karnataka State Electronics Development Corporation
LE	large enterprise
MAS	Monetary Authority of Singapore
METI	Ministry of Economy, Trade, and Industry
MEXT	Ministry of Education, Culture, Sports, Science, and Technology
MIRDC	Metal Industries Research and Development Center
MNC	multinational corporation
NASSCOM	National Association of Software and Services Companies
NCI	Network Concentration Index
NRF	National Research Foundation
NTP	Networked Trade Platform
NTU	Nanyang Technological University
NUS	National University of Singapore
OECD	Organisation for Economic Co-operation and Development
OEM	original equipment manufacturing
ICQ	Open ICQ, predecessor to Tencent QQ
P2P	peer-to-peer
PIDC	Plastic Industry Development Center
PMC	Precision Machinery Research and Development Center
PRC	People's Republic of China

PRI	public research institute
R&D	research and development
RIE	research, innovation, and enterprise
SEEDS	Startup Enterprise Development Scheme
SEZ	special economic zone
SME	small- and medium-sized enterprise
SOE	state-owned enterprise
TCS	Tata Consultancy Services
TIFR	Tata Institute for Fundamental Research
TIS	Technology Incubation Scheme
TPS	Toyota Production System
TSMC	Taiwan Semiconductor Manufacturing Corporation
TSR	Tokyo Shoko Research
TVE	town-village enterprise
UNESCO	United Nations Educational, Scientific and Cultural Organization
USPTO	U.S. Patent and Trade Office
VC	venture capital

Preface

This volume is based on papers presented at a conference held at Stanford University in October 2017. The event was part of the Shorenstein Asia-Pacific Research Center's ongoing Asia-Pacific Innovation Project, which aims to produce academic and policy research that will help promote innovation and entrepreneurship in Asia. The project's research has examined the impact of public education and financial policies pursued by Asian countries to promote innovation and entrepreneurship. We have also explored how demographic changes, especially aging populations, affect the labor force and productivity, and the ways in which population aging and technology can influence each other.

At the October 2017 conference and in this book, we focus on national and regional innovation systems and policies. In particular, we ask a number of interrelated questions: How do institutions and policies affect the incentives for innovation and entrepreneurship? Are Asia's innovation systems similar to or different from those of other countries, especially Silicon Valley, that they try to emulate? If so, what has worked and what has not? Going forward, are there promising strategies to promote innovation? In addressing these questions, we have compared the policies and practices of Japan, Korea, China, Taiwan, India, and Singapore.

My colleague Yong S. Lee led this part of the project. I am very grateful to James Chen of D&C, China, for his generous support of the conference. Shorenstein APARC's Kristen Lee provided administrative support for the event and George Krompacky assisted in editing and publishing this volume.

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SHIFTING GEARS IN INNOVATION POLICY

Shifting Gears from Industrial to Innovation Policy

An Overview

Yong Suk Lee, Takeo Hoshi, and Gi-Wook Shin

More than ten years ago, in response to wide interest in the state of Asia's technology sector, Stanford University's Shorenstein Asia-Pacific Research Center convened scholars to conduct a collaborative study of information technology (IT) in Asia. The culmination of this effort was the book *Making IT: The Rise of Asia in High Tech*, edited by Henry S. Rowen, Marguerite Gong Hancock, and William F. Miller (Stanford University Press, 2006). The book discusses the then expanding influence of Japan, Taiwan, Singapore, South Korea, China, and India in the IT sector, and the progress they had made up to the early 2000s.

The domestic and international context has changed considerably since then. Manufacturing, which once drove the economic growth of these countries, has started to lose momentum in some industries. Aging has considerably changed the demographic structure of the labor force. An elderly population above 65 now comprises more than one-quarter of Japan's population, and a rapidly increasing share of South Korea's. The international attitude toward the export-led growth model, which the East Asian economies pursued successfully for several decades, had turned less favorable even before the risk of trade wars heightened in 2018, when the United States and China started to raise tariffs on each other's products. In

short, the catch-up phase of economic growth has ended or is ending for high-growth economies in East Asia.

The rapid growth of these economies was achieved by importing new technologies from advanced economies, using them more effectively, and expanding exports. Abundant labor forces that were young, well educated, and relatively cheap helped this strategy. Now that many East Asian economies have successfully caught up to the technological frontier, they need to come up with their own innovations in order to continue growing. Indeed, governments in Asia have recently put forward various policies related to innovation. Related programs and goals include Mass Innovation and Entrepreneurship in China, Innovation Japan under “Abenomics,” and the Creative Economy in South Korea.

Recognizing the importance of innovation and entrepreneurship for future economic growth in Asia, in 2018 the Shorenstein Asia-Pacific Research Center again convened scholars to assess their status and the policies some countries are using in pursuit of these goals. This book, the first in a series that examines innovation and entrepreneurship in Asia, focuses on national and regional innovation systems and policies. The definition of innovation used here is intentionally broad to incorporate a wide variety of perspectives as well as the different institutional settings of the countries discussed. Some chapters focus on patents, which is a rather narrow measurement of innovation. Others consider broader issues concerning entrepreneurship and innovation, such as changing mindsets to foster creativity and risk-taking.

A common line of inquiry seen across many chapters is how institutions and policies affect the incentives for innovation and entrepreneurship. Are Asia’s innovation systems different from those of other regions? If so, what has worked and what has not? How can we tell? Are there any strategies aimed at promoting innovation that appear promising? These are among the questions asked in this volume.

This study focuses on six Asian countries: China, India, Japan, Singapore, South Korea, and Taiwan. These countries have successfully achieved high levels of growth in many industrial sectors, a large share of which are already at or near the technological frontier. At this stage, relying on past strategies will not guarantee new growth, especially when both the domestic and global contexts are changing. These six countries are at a critical juncture and will likely need to seek out new strategies for economic growth through innovation and entrepreneurship. In this overview, we will examine the specifics of each country, followed by comparative analyses. Before we discuss the key findings and suggestions put forward in each chapter, however, let us first elaborate on this turning point for economic growth in Asia and the heightened importance of innovation and entrepreneurship for future growth.

Nothing Short of a Miracle

One of the most dramatic events in economic history has been the rapid rise of income and living standards in East Asia. Japan after World War II, South Korea in the later decades of the twentieth century, and most recently China in the twenty-first century have all sustained high levels of economic growth, ranging from 6 percent to 10 percent per year, over decades. Similar patterns of economic growth may be seen across the region, from Singapore, Hong Kong, and Taiwan to Malaysia, Indonesia, Thailand, and Vietnam. Once devastated and poor cities of Asia are now gleaming with high-rises and connected with the fastest broadband wireless networks in the world. Studies of average wireless connection speeds across the world find those in Singapore and South Korea among the fastest. The people of Asia are now among the longest living and healthiest. According to the World Health Organization, average life expectancy in Japan, Singapore, and South Korea is among the longest in the world. Such accomplishments have been primarily achieved through catch-up economic growth, fueled by rapid learning and emulation of technologies and industrial production (Birdsall et al. 1993). Countries in the region were good at adopting the best practices of more developed countries. This strategy was particularly successful in East Asia in part due to a well-educated labor force, effective industrial policy, and export promotion. Catch-up growth, however, has already run its course for many East Asian countries. Income levels in Japan and South Korea rose rapidly and then closed in on the most developed countries in the world. China, the largest high-growth performer, is showing signs of a slowdown, with annual growth rates steadily declining since 2010.

In order to continue growing past this point, these countries need to have indigenous innovation and technological progress; they can no longer just rely on foreign technologies. For many East Asian economies, however, indigenous innovation was not an important factor of the catch-up phase. For example, Kim and Lau (1994) and Young (1995) show that the miracle growth of the then “newly industrialized” East Asian countries—such as Hong Kong, Singapore, South Korea, and Taiwan—was driven more by factor accumulation than by total factor productivity growth, in a setup that Paul Krugman calls an “input-driven economy.” These countries were good at working long hours, copying products and technologies, and putting capital to work in increasingly productive sectors, but less so at innovating and creating breakthroughs. The findings of these statistical studies also fit casual observations. There have been many innovative companies in Asia—think of Sony or Samsung, for example—but compared with Apple, Microsoft, or Google, their innovations seem incremental.

Just when the catch-up phase of economic growth was coming to an end in many East Asian countries, several factors supporting that growth started to disappear. On the global stage, East Asian countries had benefited from stable (and somewhat undervalued) foreign exchange rates and a reduction in barriers to trade after World War II. At home, they benefited from young and well-educated workforces. Both of these conditions started to change as early as the 1970s, and the changes have intensified in the twenty-first century.

Evolving Global and Domestic Contexts

International trade has played an important role in the growth of many Asian economies since World War II. Global trade was expanding during this period and many Asian countries promoted exports as a means to expand beyond their domestic markets. The relatively open North American and European economies and their consumers embraced the lower-priced yet high-quality goods that were being produced in Asia.

The postwar international currency regime that came to be known as the Bretton Woods system also helped the export-led growth strategies of Asian economies by providing them with stable and somewhat undervalued currencies. Although the Bretton Woods system formally ended in the 1970s and the currencies of advanced economies started to float, many Asian countries were able to retain fixed exchange rates against the U.S. dollar by imposing capital controls and accumulating U.S. dollar securities as foreign reserves. Dooley, Folkerts-Landau, and Garber (2004) call this regime “Bretton Woods II.” It allowed these countries to continue export-led growth strategies.

Export-led strategies, however, could not be sustained past the catch-up phase of growth. For one, successful growth made East Asian economies such as Japan too big to continue relying primarily on external demand. Perhaps more important, an export-led growth strategy has a problem of distancing the process of resource allocation from market forces, as Rajan (2010) points out. The cost of ignoring market signals (other than those in export markets) may be small when an economy is catching up with more advanced economies, as it is relatively clear which industries and export products to promote. As the economy matures, however, the role of well-functioning markets in distinguishing efficient production arrangements from inefficient ones becomes essential. The same problem applies to industrial policy, which we discuss in the next section. The problem gets especially severe for nontradable services that are not exported.

Meanwhile, a recent rise in antiglobalization sentiment, especially in the United States, could directly limit Asian exports. As of this writing, a

tariff war between the United States and China, the two largest economies in the world, had started to brew and was likely to have ramifications for many countries. Moreover, with the United States drawing back from many of its roles as a global superpower, other countries, notably Russia and China, have become more assertive in international economic affairs. In this changing geopolitical landscape, traditional alliances have become weaker, and such changes could have considerable impact on international economic transactions.

Though the West, especially the United States, remains an important market for Asia, its importance has declined, and Asian firms are increasingly looking into opportunities within Asia, as well as other parts of the world. Asia itself has become more important for the global economy, and consequentially the economy of each country within Asia. China's economy continues to grow and is expected to take over as the largest economy in the world. Meanwhile, China's regional leadership can be seen in initiatives such as the Asia Infrastructure Investment Bank and One Belt, One Road, and the nation is increasingly engaging the international community.

Asian economies are also facing the challenges of a stark demographic change, amid rapidly aging populations and low birth rates. The drastic decline of Japan's population, ongoing for several years, is the first of its kind not caused by war or disease in the modern world. Korea's labor force started to shrink in 2018 as well. China's huge population will start to age soon, even as a large share remains poor.

Many Asian countries are facing the challenges outlined above, with various responses. Japan was the first to achieve rapid economic growth and the first to face these challenges. Japan's catch-up phase of economic growth ended by the end of the 1980s (or probably earlier, as Hoshi and Kashyap [2011] have pointed out). After years of stagnant growth, Japan is seemingly back on track to a more vibrant economy. Unemployment is low, economic growth has been picking up, and Japanese investment has increased globally. Whether this growth recovery trend will continue remains to be seen.

Many South Korean firms have been successful over the past decades, establishing themselves as leaders in their fields. However, South Korea's reliance on a small number of large conglomerates has put its economy in a precarious situation. The value added by the four largest conglomerates amounted to nearly 10 percent of the nation's gross domestic product in 2015. Some industries, such as shipping, have faltered, and there are increasing signs that even the nation's prized manufacturing sector is strained. In 2018, one of the largest automobile manufacturing plants operated by General Motors in the country shut down, sending shockwaves in the local economy and furthering a rise in unemployment. The economic conditions in South

Korea seem particularly susceptible to the country's political situation, especially in relation to developments in North Korea. Political ideology strongly influences economic policies, and economic policies—especially those connected to the support of large business—swing from left to right and back again following presidential elections.

East Asia's traditional economic hubs—including Singapore, Hong Kong, and Taiwan— remain vibrant. Singapore's economic and political stability continues to render it one of the most business-friendly countries in the world. Hong Kong is a key global financial hub, though this remains to be seen in light of recent conflict with Beijing, and Taiwan continues to be a leading manufacturer of high-tech products. India, under relatively new leadership, is actively reaching out to East Asia for collaborative economic partnerships. Both South Asia and Southeast Asia, with large and young labor forces, possess the potential to drive the region's future economic growth.

North Korea remains a big unknown; how its relations with South Korea, the United States, and the international community will pan out remains to be seen. Southeast Asia is a diverse region with Buddhists, Christians, Hindus, and Muslims all living close together. Whether it will be able to maintain harmony without falling into the factional conflicts and terrorism that inhibit the Middle East will be a critical test for the region's ability to sustain economic growth.

Today Asia is at a juncture. According to the October 2018 edition of the International Monetary Fund's *World Economic Outlook*, East Asia (Mongolia; South Korea, Japan, and China, including Hong Kong, Macao, and Taiwan) alone has a greater real economic output than North America. East Asia's share of global gross domestic product, based on purchasing power, was 25.78 percent in 2018; North America's was 18.54 percent. East Asian countries are at the technological frontier. South Asia and Southeast Asia, meanwhile, possess enormous economic potential due to their sheer size and natural resources. Furthermore, the countries of Asia are becoming more connected by both trade and diplomacy. It is at this juncture that we examine and reassess Asia's innovation.

From Industrial Policy to Innovation Policy

Asian governments have long emphasized innovation as part of their economic policies. However, most focus on the high-tech sector, and the major policy tools used to promote it are the traditional ones originating in industrial policy. Governments have typically identified promising high-tech industries and then tried to promote them. Through direct subsidies, tax breaks, and

preferential financing, domestic firms were encouraged to import essential technologies from more advanced economies, improve them, and succeed in global markets.

As we outlined above, the catch-up phase of economic growth is over or ending for many East Asian countries. They can no longer merely emulate the technologies of more advanced countries; they need to come up with indigenous innovations. Traditional policies targeting specific industries will not be effective, either, because it is very difficult for policymakers (or anyone in general) to predict which industries will be the successful ones.

Asian governments now seem to understand the importance of specifically indigenous innovation. Recent administrations in China, Japan, and South Korea have all put forward innovation and entrepreneurship as their primary economic policy goals. It is less clear if they appreciate the necessity of breaking away from traditional industrial policies that pick promising industries and divert resources to them. The literature that examines the determinants of East Asian economic growth has focused on their industrial policy as well. For instance, Lin and Chang (2009) agree that industrial policy was critical for East Asia's growth, but debate whether East Asia's industrial policies conformed to or defied comparative advantage. If the focus was on innovation, it was often confined to the industrial policies supporting the IT sector, as observed in the 2006 book *Making IT*. To be successful, the Asian model of innovation and entrepreneurship (if such a thing emerges) has to diverge from the Asian model of development of the past.

This book, we believe, is the first to critically examine this point and reassess what type of innovation policy Asia should pursue. Recognizing the limitations of past industrial policies, Choi, Lee, and Shin (2018) underscore the importance of social innovation surrounding immigration, education, and business policy for postindustrial growth, but their focus is on South Korea. Here, we address the larger Asia-Pacific and focus on national innovation strategies and regional cluster policies that can promote entrepreneurship and innovation. We neither blindly advocate for replicating Silicon Valley nor for a government-driven industrial-focused innovation policy. We will be neutral as to the importance of large corporations versus start-ups for innovation in Asia. The main contribution of this book is in this critical approach to seeking out a fresh direction for innovation and entrepreneurship in the context of Asia today and the near future. With this background, we now turn to the key findings of the individual chapters in this volume.

National Innovation Policies

In chapter 2, Edison Tse discusses how disruptive innovation can be initiated through platforms that link different economic agents in China. Tse explains how China's rapid economic growth can be traced to the two disruptive innovations (in contrast to "incremental" innovations) it underwent in the past 36 years. The first began in 1978 with China's reform and opening-up policy, and the second started in 2005 with China's internet wave. Today, as China and other Asian countries seek a new round of disruptive innovation that can sustain and spur growth, a general aversion toward entrepreneurship, especially among the educated, remains a key challenge. Ostensibly safe and stable jobs are still often preferred over the risky path taken by entrepreneurs and inventors. Such occupational preferences are rooted in long-established institutions and cultural norms, and also in people's perceptions of entrepreneurship. Tse presents a novel viewpoint that what is most crucial to disruptive innovation in China is the transformation of mindsets. However, he underscores the difficulty of such a transformation: "It cannot be achieved through rational argument, because mindsets are usually based on myths, dogma, ideologies, and past experiences. It can only be achieved gradually after people have positive experiences with the change." He also argues that government can effectively initiate the process. Echoing Deng Xiaoping's gradual modification of Chinese attitudes toward capitalism, beginning in 1978, today the Chinese government intends to change attitudes toward entrepreneurship, and announced "Mass Innovation and Entrepreneurship" as a new engine for Chinese economic growth in September 2014. This broad set of government-supported guidelines resulted in the setup of more than 2,000 incubators and accelerators from 2014 to 2016. Indeed, a top-down method of changing mindsets seems to be working in China, and the successes of companies like Alibaba, Tencent, and Baidu are motivating young people to become entrepreneurial.

Based on this and other recent government initiatives, Tse believes that China is ready to implement a three-pronged strategy to spur disruptive innovation: (1) creatively imitate IT-related disruptive innovations that have been successful in the United States, (2) transform traditional businesses by adapting new technology and business model innovations to ease the pains introduced by rapid economic development, and (3) creatively imitate China's first disruptive innovation in developing countries in support of the Belt and Road vision.

There is no one perfect way to foster national innovation, however, and the successful recipe for one country will likely differ from that needed in another. In chapter 3, Dinsha Mistree discusses India's national innovation

policy in relation to its software industry and examines the government's role in creating a successful cluster of firms. Observers often describe the recent success of some Indian industries as a result of the adoption of a *laissez-faire* policy approach. The Indian government used to promote state-owned enterprises and a few large private-sector businesses through heavy-handed industrial policies. Then, in the 1980s, the government started to liberalize industries, and some, such as the software industry, flourished. However, Mistree points out that policy toward the software industry after liberalization was *not* *laissez-faire*. Instead, the Indian government, at the federal and state levels, adopted a broad set of measures fostering an innovation-friendly environment for its growing software industry. This was in sharp contrast to traditional industrial policy, which tries to identify promising industries and pick winners among them. Policies for the software industry included investment in technical education, development of telecommunications infrastructure, and creation of technology parks. Although Mistree does not directly assess the effectiveness of government policies in creating an innovation-conducive environment—we cannot predict the outcome if technology parks had *not* been created, for example—he presents a careful case study of India's software industry. Economic liberalization in India did not mean a shift from social planning to a *laissez-faire* market. The Indian government maintained an active industrial policy even after industrialization, but it promoted the entire software industry rather than targeting a few winners, and it was successful. Many would point out Japanese industrial policies were often like this, especially after the 1970s. It is worth noting that industrial policy, but with an emphasis on promoting foundations, may still play an important role in developing innovative sectors as it did for the Indian software industry.

While the first two chapters examine innovation strategies in the two most populous economies in the world, chapter 4, by Poh Kam Wong, assesses Singapore's innovation and entrepreneurship ecosystem. Wong, one of the contributors to *Making IT*, focuses on the changes in Singapore since the early 2000s. One of the most important points, which resonates in many other countries in Asia, is that government initiatives to promote entrepreneurship and innovation have increased start-ups in the internet, mobile, and IT services sectors, but not in "deep technology" sectors. Wong's deep-tech sectors are those that may incur high fixed research and development (R&D) costs but have the potential for greater payoffs in the future (e.g., biomedical, clean tech/energy, and advanced engineering). In fact, these are sectors where government investment in R&D can be best put to use. Long-term projects that lack immediate payoffs can have difficulty attracting adequate market financing. Many of the most impactful innovations in the world, such as the

internet or GPS technology, were initially funded by the U.S. government for many years before becoming commercialized. However, government policies promoting innovation and entrepreneurship often seek out immediate accomplishments at the cost of more fundamental long-term objectives.

Wong highlights that, despite the increase in the number of start-ups, the pace of innovation has been slow in Singapore. He stresses the importance of promoting indigenous private innovation. Government-linked corporations compose a relatively large part of Singapore's economy but they are slow to innovate or to invest in innovative capabilities. Singapore's unique context as a small city-state with a high reliance on foreign investment and trade can offer insight into other small developing economies, and Wong presents some useful policy advice in this regard. He emphasizes the need to (1) promote technology entrepreneurship, not simply IT service-oriented entrepreneurship; (2) balance the promotion of innovative capability between incumbent firms and start-ups; (3) develop international connections to draw talent and capital, and enter larger markets; and (4) support universities to serve as local incubators.

Overall, the first three chapters indicate that governments still play an important role for innovation and entrepreneurship in Asia. However, the findings suggest that future national innovation policies need to differ from industrial policies of the past. If the latter involved direct administrative guidance by picking industries and national champions, innovation policies going forward should focus less on the specifics and more on promoting and establishing an ecosystem and environment that can help foster innovative firms, people, and ideas. Disruptive innovation is about finding new values, and because it is impossible to reliably predict the next "big thing" in advance, the best the government can do is to educate people and to create an environment conducive to entrepreneurship and innovation.

Networks and Regional Clusters

Taking a network approach to understanding innovation and entrepreneurship, Michelle Hsieh (chapter 5) shows how innovation occurs through collaborative learning and technology diffusion, using the case of Taiwan's small- and medium-sized enterprises, which complement one another and tap into external economies. In what she calls "a less-celebrated model," these initiatives tend to be invisible and decentralized in the sense that they deploy relatively flattened resources and low budgets. This is contrary to common policy practices that focus on inducing innovation by increasing investment in R&D subsidies to selected firms (as in Japan), or policies that

induce entrepreneurship by increasing the number of firms in targeted clusters or government subsidies to a growing number of start-ups (as in Singapore). In the less-celebrated model, building capability is a matter of bridging different production networks to induce technological advancement along the entire supply chain, and sustaining clusters. Therefore, what makes a cluster tick is not the size of the firms in it, but the specific ways in which the network of firms and public research institutes are linked in a decentralized system. Each actor is connected in multiple ways to tap into external economies so as to pursue collaborative learning; this kind of flexible and dynamic ecosystem enables some clusters to remain resilient, territorially rooted, and globally connected in the face of globalization.

Governments around the world have created regional clusters to promote industries and R&D. As Toshihiro Okubo illustrates in chapter 6, Japan has a long tradition of regional cluster policies. However, Okubo sees problems with the assessment of these policies. In an extensive survey of the empirical research on the efficacy of Japan's regional cluster policies, Okubo finds that these policies did successfully increase the number of firms and industrial clusters, but the resulting firms were neither highly productive nor innovative. In particular, Japan's industrial clusters were the least likely to be successful. Promoting a certain industry by encouraging firms within the same industry to locate closer together actually attracted less productive firms. These types of regional cluster policies are quite expensive from the taxpayer's point of view. However, governments, preoccupied with designing, implementing, and administering such policies, often placed a low priority on careful evaluation of their causal effects. Okubo notes that government officials in Japan are now realizing the importance of rigorous econometric analysis of innovation and cluster policies, and academics have recently been involved in using microdata and advanced econometrics to measure the impact of cluster policies on productivity and firm location. Governments in Asia have generally been hesitant to collect data and assess the policies they implement. Japan's willingness to invest in examining the efficacy of policies is a change in the right direction. Okubo suggests that rather than a top-down fully funded approach to regional cluster policies, Japan should implement a matched scheme where the government matches 50 percent of the funds. Such schemes provide better incentives for firms to become productive and innovative and have been found to be effective in other countries.

The efficacy of regional innovation clusters depends not only on the performance of each constituent but also on how the actors interact with one another. Chapter 7, by Injeong Lee and Wonjoon Kim, examines the connections among three key actors—universities, industries, and government research institutions—and their roles in two representative innovation

clusters of South Korea and Germany (i.e., Daedeok Innopolis and Silicon Saxony). Their comparative analysis of patent applications, utilizing social network theories, provides several interesting insights. Silicon Saxony's economic contribution to Germany's national economy is substantially larger than Daedeok Innopolis's contribution to Korea's. However, the quantity of interactions among organizations in producing patents is larger in the Korean example, and interactions are not concentrated in as small a number of organizations as they are in Germany. Universities and government research institutions play a more central role in South Korea, whereas industrial firms play the central role in Germany. Concentrated collaboration led by a smaller number of firms seems to be related to better overall economic performance, rather than diffused collaboration among a large number of actors within the cluster. In other words, there seems to be a quality-quantity trade-off. Lee and Kim argue that, when promoting joint R&D activities among entities within a cluster via subsidies or other policies, governments should incentivize entities to strengthen and deepen their collaboration rather than promote the overall quantity of R&D collaborations. Another related problem the authors point out, especially relevant for South Korea, is the government's emphasis on measuring the number of patent applications as an output of universities and government research institutions. Counting numbers is an easy way to measure an organization's performance, but simply linking government funding to the number of patent applications distorts incentives and results in ineffective technological knowledge creation.

Looking Ahead

Governments of many countries have been trying to nurture innovation but have often failed. In chapter 8 David Lee Kuo Chuen points out the problems of top-down national innovation strategies, especially pertinent to many developing countries, and finds a more promising approach in decentralized innovation policies and distributed innovation models. Usually, proponents of government-led innovation argue that a top-down approach is necessary because developing countries lack human capital and organizational capacity in the private sector. Lee turns this argument around and points to a lack of human capital and organizational capacity in the central government as the key problem. Although it is hard to prove which view is right—both may be, in fact—this is a novel point worth pondering. Another key argument from this chapter is that recent technological development itself, especially blockchain technology, can help solve the problem of technological progress in developing countries by allowing innovation to progress in a decentralized

and distributed fashion. This is a reasonable conjecture, although no country is there yet, as Lee's case studies of China and Singapore show. Asian countries have been active in utilizing blockchains and cryptocurrency. Inherent to blockchain technology are small start-ups working separately but directly exchanging ideas with one another. However, even with such a decentralized technology, the government can still often play a role. Whether central governments can help small start-ups utilizing decentralized technology to thrive will be critical in how Asia operates on this new technological frontier.

The final chapter, by Hwy-Chang Moon and Yeon W. Lee, posits an interesting question: What drives innovation in Asia—large businesses or small businesses and start-ups? Should governments work to create an environment more amenable to one versus the other? A prevailing notion, especially related to places like Silicon Valley, is that start-ups are the drivers of innovation. However, Moon and Lee argue that this is not necessarily so, and suggest that governments and the media have unjustly criticized the growth of large enterprises without providing accurate evidence of their contributive economic role, especially with regard to innovation. They argue, using case studies of small, medium, and large enterprises, that there is little relationship between firm size and the health of the national economy. Indeed, even in Silicon Valley, it seems that behemoths like Google, Apple, and Facebook are driving the region's economic growth, rather than the nimble and small start-ups. Silicon Valley is an ecosystem where the large innovators and small innovators feed off one another. The giant tech firms produce innovation but also acquire small companies. At the same time, employees at these large businesses eventually become entrepreneurs and investors who further foster the innovation and entrepreneurship of start-ups.

Moon and Lee emphasize that enterprises of all sizes—small, medium, and large—contribute, albeit differently, to economic growth, and that innovation policy should emphasize the cooperation and harmony among them rather than trying to implement a one-sided policy that favors one over the others. The Asian economies that Moon and Lee survey have developed despite significant differences in their political institutions and histories. As the authors ultimately emphasize, they have all succeeded in maintaining growth and competitiveness by being a part of the global economy. This point seems quite relevant going forward. Industries and international and domestic contexts have evolved since East Asia's hyper-growth years. However, what remains the same is that Asian countries should continue to be active members of the global economic system for their innovation and entrepreneurship policies to be successful going forward.

Currently, there is a big push for innovation and entrepreneurship in Asia. A universal lesson in effective management is to not micromanage. This is

something that will be especially relevant for successful innovation policy in Asia. While each government's active encouragement of innovation is welcomed, the lessons from this book are that innovation is unlike industrial growth, and rather than defining narrow policy goals or trying to pick winners, innovation policy should focus on a fostering environment. There is evidence that Asia's current wave of innovation policies have increased the quantity of start-ups and knowledge sets. We believe the suggestions outlined in the following chapters—changing mindsets, promoting technical education, embracing investment in deep technologies that may require higher initial costs and long-term investment, embracing new cutting-edge technologies like blockchain, implementing matching funds for start-ups, encouraging a holistic approach to collaboration involving the global value chain—will further help Asian countries to generate more disruptive and impactful innovation that can sustain economic growth and distributed wealth to their citizens.

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