

1. Introduction

Maureen McKelvey and Sharmistha Bagchi-Sen

1.1 INTRODUCTION

This book aims to provide an empirical understanding and initial conceptualization of innovation spaces in Asia, including the role of multinational enterprises, entrepreneurship and public policy. Subsequent chapters provide rich empirical illustrations about on-going processes of innovation, where the Asian context can be seen in the specific cases as having an impact upon firms and sectors with implications for economic change and socio-political transformation. This book is about Asia as the site of business, where customers, institutions and firms, both domestic and foreign, are interacting to affect global processes of innovation and production.

A few assumptions – that this book challenges – should be addressed immediately. Innovation is not necessarily high tech, such as information technology (IT) or biotechnology. The innovation process is not necessarily based on codification of knowledge with its sources in basic research. Finally, the location of innovation activities is not necessarily confined to one industry sector or one geographic region. On the contrary, innovation processes occur across different sectors and regions, and involve many different types of knowledge such as market and tacit knowledge. The innovation management literature proposes that firms in all sectors, nations and regions can engage in innovation. Moreover, business strategy is increasingly global given the increase in foreign direct investment (FDI), and there is an increasing need to improve firms' capabilities through network linkages. Therefore, this book tackles the meaning of innovation as it pertains to Asia, the processes of innovation practiced in Asia by local and/or foreign companies, and the “where” of innovation in relation to these companies' operations.

In the literature, the “where” in relation to innovation has been most profoundly explored at the regional level. A geographically centered innovation space conjures up images of regions such as Silicon Valley, Boston Route 128 and Cambridge, MA, which are all global IT and bioregions,

where brilliant minds come together to push the limits of science and technology. In the most famous American example of California (Silicon Valley), path-breaking companies such as HP, Intel, Cisco, Google, Genentech and Biogen fill our imageries of the types of companies that occupy regional hotspots. They are adaptive, highly innovative and attract much attention. Sometimes, similar patterns of regional agglomerations generating positive conditions for innovation are visible in the newly emerging Asian nations of China and India, and the multiple South and Southeast Asian countries. Some regional hotspots have developed such as Bangalore, Singapore, and Shanghai, which to some extent mimic the dominant ideal type, and imageries of Silicon Valley.

However, focusing on regional aspects in the imitation of Silicon Valley provides a very limited understanding of how Asia is impacting global innovation. This book argues that not only the regional innovation systems but also national innovation systems matter, as do networks, global innovation networks or value chains and the strategies and capabilities of firms, which are involved in one or multiple geographical contexts in Asia.

This book builds upon the proposition that changes underway in Asia will help stimulate the creation of new opportunities, by a series of socio-political-economic trends such as an increase in skilled labor, shifting customer demands, upgrading of firm capabilities, and above all, the experimentation and attempts of firms in Asia and in the West to try to innovate in reaction to these trends. The rise of Asia starting with Japan, followed by South Korea and now China and India, challenges us to rethink the role of Asia in driving innovation in a global economy. And if they are not just imitating and using Western technology, then what is going on?

The analysis of innovation spaces in this book brings in analysis that, through individuals and firms, links the Asian context with the rest of the world. The empirical studies in this book include three different types of studies, helping to define the boundaries of innovation spaces. Chapters 1 to 9 address the on-going processes within specific Asian countries and Asian firms, while Chapters 10 to 14 detail examples of Asian firms moving to Western countries. Chapters 13 and 15 to 17 also describe Western firms moving into Asia to access resources and innovate. Each chapter has a main focus as classified, and indeed, Chapter 13, on base of the pyramid, is classified twice. Moreover, all chapters emphasize the open nature of innovation and entrepreneurship, including networks and flows into and out of Asia. This is further discussed in Chapter 18.

Using one of these three approaches, each chapter in this book provides a finer grain analysis as firms explore innovation spaces into Asia – and

out of Asia through firms to the rest of the world. Many insights, empirical illustrations and data are provided in this book, and they help define the choices that innovation managers have to make, and the context within which those choices are made.

Note also that the concluding chapter of this book, Chapter 18, returns to the issues of what we have learned about a conceptualization and empirical understanding of innovation spaces in Asia, and especially the roles of multinational enterprises, entrepreneurship, and public policy.

Next, Section 1.2 explains how this book may help nuance our imagery and stereotypes about innovation in Asia, while Section 1.3 provides an overview of each chapter.

1.2 NUANCING MYTHS AND STEREOTYPES ABOUT INNOVATION IN ASIA

There used to be a perception – which is starting to fade but still persists in some circles – that Asia (excluding Japan) is not innovative. Asia imitates, but does not innovate. Asia is not involved in innovation, but still focuses upon low-cost and low-quality products, that are imitative of the West.

This perception is becoming outdated – as demonstrated in many ways in this book – for many reasons. Indeed, the end of this section stresses the emergence of new opportunities, driven by the dynamics within Asia, which are causing innovation to happen within Asia, as well as global linkages to and from Asia to the rest of the world to access knowledge, resources and market. The changes propelling innovation and entrepreneurship within innovation spaces in Asia are multi-dimensional. One aspect is rapidly shifting market demand. There is rise of the middle and upper classes across Asia but particularly in countries with large populations like China and India. These consumers are demanding state-of-the-art technologies, products and services. At the other end of the spectrum, companies are trying to innovate for the base of the pyramid, where large number of consumers have limited resources and express different characteristics of demand. Another aspect is the availability of skilled labor in these countries, and these knowledge workers are linked globally either through the networks of entrepreneurs with international experience or through the organizational structure of large multinational enterprises.

Still, this statement that Asia is not innovative helps set the scene for the contributions of this book. It reflects a common perception, albeit one which is slowly fading, that this book sets out to nuance, and perhaps debunks in some ways, given the richness of current trends and depth of transformation underway.

A few myths and stereotypes about innovation in Asia are summarized below.

- *There is a lot of talk about Asia, but it is only talk. Government policy and national institutions are not supportive of technological development and innovation:* Asian governments may talk about innovation, technology and knowledge being the key attributes driving the economy, but investments through public policy are minor and Asian institutions of the political economy discourage change. The lagging public policy and institutions negatively affect both Asian home-country firms as well as companies wishing to locate there.
- *Firms from Asia tend not to be entrepreneurial:* There is a lack of entrepreneurial firms, either due to regional and country conditions, or due to lack of resources like human capital and capital. Entrepreneurship is not expected, and especially not in high-tech industries.
- *Large firms from Asia tend not to be innovative. They focus on low cost, and not on investing in resources to compete through technology and innovation:* Large Asian firms are primarily about price competition, especially low-cost and low-quality products and services, and their main advantage is low-cost labor. Large Asian firms are primarily about latecomers, who make imitative products, generics and reverse engineered existing products – which were developed in the innovative West. The Asian firms have few capabilities or resources and do not invest in innovation processes to access capabilities internationally.
- *Western firms can easily move to outsource customer development, technological development and research and development to Asia:* Most Asian customers primarily want low-cost products. Middle-class Asian consumers want the same products and services as Western consumers, so from the global company's perspective, it is just to make more of the same through mass production and minor modifications. Western firms can move to outsource, develop technology and to innovate in Asia. This process is reasonably easy and straightforward, and can follow a plan based upon lower costs. The shifting of resources into Asia does not change the “core” qualities and structure of the firm found in the West.

Table 1.1 shows how the chapters in this book provide more nuanced and interesting insights, which in some ways call into question the various myths and stereotypes about innovation in Asia.

Table 1.1 Overview of book chapters

Chapter	Contribution
<i>Myth: There is a lot of talk about Asia, but it is only talk. Government policy and national institutions are not supportive of technological development and innovation.</i>	
Chapter 2	Analyzes the uniqueness of the Chinese model of innovation, but questions whether this model will enable China to become a world-class innovator Describes specific characteristics of China's development of its innovative capacity in science and technology and relates this to dynamic effects in the economy
Chapter 3	Explains and analyzes how the intellectual property rights systems in China and India allow us to define the contours of innovators' global linkages, including specializations and flows Analysis of flows in and out suggests the increasing importance of India and China on the global scene as well as potentially extensive international linkages of inventors as well as the most important technological classes
Chapter 4	Focuses within the Chinese innovation space, by providing a description of the patent system as well as analysis of patent pools as a consortium mechanism to understand technological competition Analyzes firms and patents involved in patent pools within the audio and video technology and the telecommunication sector
Chapter 5	Explores the development of the electrical bike in China, as a co-evolutionary process involving entrepreneurs, product innovations for niche market, and policy, where this eco-innovation meets the new demands of customers Provides insight into the overall development of e-bike industry and diffusion in China as well as the leading company Lvyuan
<i>Myth: Firms from Asia tend not to be entrepreneurial.</i>	
Chapter 6	Develops a theoretical framing of the development of innovation spaces as a relationship between entrepreneurship and national innovation spaces in China Analyzes the development of a entrepreneurial company turning into an emerging market multinational enterprise, which is active in the wind turbine industry. The case study is based upon a conceptual framing of the relationships between the individual entrepreneur, the venture turning into a multinational enterprise and the national innovation system
Chapter 7	Applies and further develops the theoretical framing of the relationship between entrepreneurship in China and innovation spaces found in the previous chapter

Table 1.1 (continued)

Chapter	Contribution
<i>Myth: Firms from Asia tend not to be entrepreneurial.</i>	
Chapter 7	Analyzes a case study of knowledge intensive entrepreneurship in nanotechnology in South Korea
Chapter 8	Analyzes the interaction between knowledge intensive entrepreneurship as a process engaging individuals and their context in China and internationally to access knowledge and resources Provides case studies of four firms in nanotechnology in Suzhou, China
Chapter 9	Role of returnees to China as entrepreneurs and their ability to access global resources in high tech sectors Examines six case study firms within IT related to internet infrastructure and services, health biotechnology, and telecommunication equipment
<i>Myth: Large firms from Asia tend not to be innovative. They focus on low cost, and not on investing in resources to compete through technology and innovation.</i>	
Chapter 10	Addresses how Indian pharmaceutical companies are expanding their innovation spaces through a variety of strategies such as partnerships and acquisitions Frames in terms of research on pharmaceutical global value chains and foreign direct investment and provides information about Indian pharmaceutical companies making advanced investments abroad
Chapter 11	Examines innovation spaces developing in Indonesia, through cases of multinational enterprises, which leverage country-specific advantages Provides case studies of the Indonesian firms Adaro Energy, Mayora, and Astra to illustrate and apply a taxonomy of firms from emerging economies
Chapter 12	Discusses the challenge and opportunities when Chinese multinational enterprises access knowledge resources in Sweden Provides case studies of two mechanisms for accessing technology from the West, namely acquisition and hiring skilled labor. The companies are in automobiles (Geely/Volvo Car Corporation), respectively telecommunication (Huawei/Ericsson)
Chapter 13	Addresses emerging innovation spaces in India, driven by new types of customer demand and markets, specifically for the poorer segments of the economy Develops an overview of the concepts and key examples, drawn from a literature review

Table 1.1 (continued)

Chapter	Contribution
<i>Myth: Western firms can easily move to outsource customer development, technological development and research and development to Asia.</i>	
Chapter 14	<p>Develops an understanding of how emerging innovation spaces are created, by focusing upon problem-solving and tasks in the Indian software industry</p> <p>Describes the global software-outsourcing industry especially the supply platform in Bangalore (India) and provide three cases in primary software industry, secondary software (automobile) and in electronics</p>
Chapter 15	<p>Analyzes how South Asia has recently become a relevant innovation space, offering a national innovation system with relevant skilled labor and knowledge assets.</p> <p>Provides a long-term case study of a Swedish company in software. This company has moved from a home-based entrepreneurial venture to a home based multinational enterprise with global links to a multinational enterprise with significant innovation in Sri Lanka</p>
Chapter 16	<p>Addresses an interactive process between headquarters, subsidiary and external conditions, when a European multinational enterprise shifts from adaptive R&D to R&D to support global markets in innovation spaces in India</p> <p>Provides a case study of the R&D unit of SKF, a Swedish-based but heavily internationalized, multinational enterprise</p>
<i>Theoretical and concluding chapters</i>	
Chapter 17	<p>Provides a conceptualization of innovation spaces</p> <p>Discusses the ramifications for understanding innovation spaces Asia, based upon an evolutionary theoretical framework for understanding how firms search within innovation spaces</p> <p>Provides insights about developing qualitative and quantitative approaches for future research</p>
Chapter 18	<p>Reflects upon the key concepts of this book, for example, innovation spaces, entrepreneurs, multinational enterprises and policy</p> <p>Revisits these concepts in light of what we have learnt from this book</p>

Indeed, one of the reasons for writing this book is that many companies and public policy-makers have found out in recent years that these myths and stereotypes do not hold in reality. Firms are struggling about how to do innovation in this new context and public policy-makers are struggling to know how to react to the on-going shifts.

So let us go further into the context of business in Asia and its effects upon global innovation. Many of the on-going trends in Asia, both negative and positive aspects, have been discussed in public debate. All major newspapers and magazines regularly run features about the changes underway. Various criticisms are often raised about the institutional structure in Asian countries. In this book, a few of the chapters include reflective comments about contended aspects of socio-political institutions such as the role of state-owned enterprises (SOEs), the role of the state, the lack of democracy and corruption.

1.3 TRENDS OF EMERGENCE OF KNOWLEDGE AND OPPORTUNITIES IN INNOVATION SPACES IN ASIA

1.3.1 Asia: Countries and Sectors in this Book

Our approach differs and chapters in this book only focus on specific contemporary processes and phenomena related to innovation and entrepreneurship, with more qualitative analysis of dynamics while quantitative data is used to capture trends in industries and nations over time. This book primarily addresses the two largest economies: China and India. The geographical region is collectively addressed as Asia in this book, and Asia as used here is a broad concept, and the concept covers many countries, including East, Southeast and South Asia. Each country is unique in its own way. Many Asian countries are not represented in this book, and indeed the Asian Development Bank (ADB 2014) provides statistics and analysis on 45 economies, which they further categorize into Central Asia, East Asia, South Asia, Southeast Asia and the Pacific. Of course, a similar problem exists with using “West” or “Western,” which here primarily refers to American and European firms. These limitations of using the concept of “Asia” and “West” are fully acknowledged.

Asia is also referred to in the chapters at various spatial scales – or geographical scales – from local to region to national, and with geographical references. Many chapters define processes at a specific scale, in order to describe trends and analyze processes related to innovation. For example, several chapters use the juxtaposition of local context and inter-

national networks and the role of national innovation systems in affecting the development of an entrepreneurial venture. Several chapters also span across an Asian country and Western country, and a few indicate processes and events from one country to neighboring Asian countries.

While geographical scale and space helps us understand the places and spaces, firms also operate across multiple types and dimensions of operational space. The firms studied here include a wide range of type. They may be multinationals from developed countries; they may be emerging market multinational enterprises; or they may be small entrepreneurial ventures.

In terms of this book, ten chapters include material relevant to innovation issues in China. China is by far the most dynamic economy at the moment, and of a size to have global impact, thereby somewhat justifying this emphasis upon China. Five chapters address innovation issues related to India, whereas one chapter each addresses issues related to Sri Lanka, Indonesia and Korea.

The chapters have only touched the surface of the very broad socio-economic trends identified below, if one considers the perspective of economic and historical analysis of each specific country. Many books with excellent country studies of Asian economies have been published by scholars. This includes books at country level (Lee 2013; Fransman 1995; Okimoto 1989) as well as cross-country analysis (Mani and Nelson 2014; Zhang and Dodgson 2007; Whitley 1992) and studies of specific countries and industries (Malerba and Nelson 2012; Amann and Cantwell 2012; Nayak 2011; Sauvant et al. 2010; Ramamurti and Singh 2009; Evans and Wurster 2000; Peng 2000). The deeper structural differences such as national institutional arrangements and areas of industrial specialization within specific Asian countries are only briefly addressed in chapters, and only to the extent that they affect innovation and entrepreneurship.

There is also the question of whether the trends identified in this book are new, or simply a continuation of historical trends. Some would argue that Asia and especially China have also historically impacted technical development, even if their industrialization and economic development followed a different path from the West (Zhang 2013; Rosenthal and Wong 2011; Needham 1969).

In terms of sectors, Table 1.2 outlines the countries and sectors discussed in different chapters.

These chapters were chosen because they could provide in-depth empirical understanding of what is happening within particular innovation spaces. The main emphasis is on describing and explaining underlying processes – such as choices, strategies and resources – that are used by the entrepreneurs and multinational enterprises.

Table 1.2 Specification of chapters addressing empirical material relevant to specific sectors and countries

Sector / Country	Sri Lanka	South Korea	Indonesia	India	China
Emerging markets of e-bike, nanotechnology wind turbine		Ch 7			Ch 5 Ch 6 Ch 8
Large-scale engineering, such as automobiles, traditional energy and ball-bearings and audio/video technology				Ch 16 Ch 14	Ch 4 Ch 12
Multiple technologies and sectors			Ch 11	Ch 3 Ch 13	Ch 2 Ch 3 Ch 17
Pharmaceuticals and health biotech				Ch 10	Ch 9
Software and IT	Ch 15			Ch 14	Ch 9
Telecommunication				Ch 14	Ch 4 Ch 9 Ch 12

1.3.2 Eight Trends

Innovation is quickly arising within Asia, and in flows between countries that are driven by entrepreneurs, multinational enterprises and public policy. Hence, an initial starting point for writing this book is to get a handle on how the multidimensional changes on-going are affecting a deeper transformation, which affects innovation and entrepreneurship, and ultimately, competitiveness and economic growth.

The hype about Asia – and especially about China and India – has almost made it a truism that emerging markets will influence economic and market growth for decades to come.

The eight trends identified below are indicative of structural transformation in the global economy. The reason why this book deals with some specific points, capturing aspects of these broader trends, is that Asian developments should affect the trajectories along which future innovations will be developed, as well as affect firm strategy and public policy initiatives around the world. Most likely, these shifts are leading to new sources of new business opportunities in Asia – and with operations and networks at the company level which link Asian firms to the rest of the world.

To analyze such issues, different theories are used, as specified in each chapter in this book. Each chapter in this book draws upon its specific theoretical framework, especially literature in innovation and entrepreneurship; international business; public policy including science and innovation policy; evolutionary economics; and economic geography. As compared to a book focused upon regional or national innovation systems, this book places individuals and firms – and firms of different types – at the center of the analysis in understanding innovation spaces. Since no standardized approach exists, different theoretical approaches to understanding individuals and the firm are developed in this book, with each chapter focusing upon a specific question. Hence, the following eight trends impact innovation.

Size and growth of Asian economies

Asia is outstanding in terms of size and growth of the economy. The expected continuing growth in the economies suggests the rising fortunes of companies either headquartered there or active there.

China and India have led productivity growth of developing countries, growing 10 percent and 6 percent, respectively, between 2003 and 2012. In high-tech manufacturing, the United States has a global share of 27 percent, closely followed by China. China's high-tech manufacturing industries have grown exponentially from a global share of 4 percent in 2000 to 24 percent in 2012 (UN 2013).

Relative importance of these economies in a global economy in crisis

There has also been a shift in recent years, with an increasing relative importance of these economies. Due to the slow-down in recent years, with the global recession, there has also been relatively more emphasis on those parts of the world that do have economic growth and market growth, and less emphasis in countries where growth is slower.

Labor productivity growth in the United States and other developed countries slowed from 2 percent in the early 2000s to negative growth during the global recession, before rising to 1 percent (UN 2013).

Increasing competitiveness of business

There is also the increasing competitiveness of business located in various countries. Business in Asia has dramatically shifted and improved in the past decades. *The Economist* (2014) analyzes many of the trends in business in Asia today. A few highlights are that Asia now accounts for 27 percent of world market capitalization, and the biggest Asian conglomerates and firms like Samsung, PetroChina, Tata and NTT Docomo are similar in size to their global competitors.

Global ties of innovation spaces in Asia

Global ties of innovation spaces in Asia are also increasing. This is visible through investment statistics as well as the role of individual entrepreneurs and companies in stimulating the flows of knowledge, resources and markets. Asian countries are attractive as destinations (inward flows) and as sources (outward flows) of FDI. The figures suggest the attractiveness of China rather than India.

The Chinese FDI is one side. China's FDI inward flows grew enormously from US\$47 billion in 2001 to US\$124 billion in 2011. Outflows of FDI rose continuously over the last decade reaching in 2012 around US\$87.8 billion representing 6.3 percent of the global outward FDI flow (UN 2013).

Indian FDI shows a different pattern and size. Inward FDI flows in India grew significantly from 2001 (US\$3 billion) onwards reaching a peak in 2011 with around US\$23.5 billion. Overall, US\$18 billion was directed towards India in 2012 which represents 1.3 percent of the global FDI inflow in 2012. Outflows of FDI rose until 2008 reaching a peak of over US\$20 billion but declined until 2012 to around US\$11 billion representing 0.8 percent of the global outward FDI flow (UN 2013).

Moreover, as demonstrated in Table 1.1, several chapters in this book provide detailed understanding of how individual entrepreneurs as well as large companies are able to navigate globally.

Growing markets and new types of demand

Growing markets are an implication of the sheer size of these potentially huge new markets, with expected future market growth in middle class as well as the lower-income segment. The possible demands of these customers and consumers are for products and services with different attributes than those mass produced in the West.

Asia is estimated to have about 56 percent of the global population, currently around 4 billion people. Many comparisons have been made between India and China. While China currently has a larger population, that is expected to reverse by around 2025 due to the aging population, one-child policy, and the surge of population in India.

There is also the focus upon the lower end, and new types of demand. New concepts like "chinnovation," "base of the pyramid," "jugaad," and "frugal innovation" are being launched to express the need to rethink the foci and outcomes of innovations, in terms of these new customers. However, there are some cautionary tales. Tata Motors launched their low-priced car Nano, which failed, as compared to US\$10 billion in profits on their luxury brands Range Rover and Jaguar (*The Economist* 2014).

Shifting positions of these countries in global value chains

There is a shift, and expected change in the future, in the position of these countries in global value chains. Asia, and especially China is thought to have opportunities to develop manufacturing and services, due to the globalization of components and growth of business-to-business sales in global value chains.

An estimated 60 percent of the total world trade of US\$20 trillion is thought to be in trade in intermediary goods and services, used in production and sales of final goods (UN 2013: 122).

In terms of domestic value-added trade shares in global value chains, China tops the league. In the top ten countries, additional Asian countries include Korea, Hong Kong, Singapore, India, Taiwan, Malaysia and Thailand (UN 2013: 133).

Increasing share of global R&D

There is an increasing share of research and development (R&D), which is a proxy for innovative activities within manufacturing. This may also have impacts upon global products and services. There are likely effects of the emergence of new types of markets on the relative share of global markets, product design and the functioning of the global political economy.

The total estimate of global R&D was US\$1.435 trillion in 2011. The United States accounts for about 30 percent of the 2011 while the East/Southeast and South Asia (including China, India, Japan, Malaysia, Singapore, South Korea and Taiwan) accounted for 34 percent in 2011. China (15 percent) and Japan (10 percent) led the Asian group. Note that Asia represents an increase of 9 percent since 2001 while the US has a decline of 7 percent (NSF 2014).

Large and growing supply of skilled labor and of scientific and technological assets

Asia is also widely identified as a large and growing supply of skilled labor and scientific and technological assets. This includes outputs measured by proxies of publications (for science) and of patents (for technology). The projected massive numbers of graduates in science and engineering will be providing an educated work force in Asia in the future.

China grew the fastest among larger developing economies, with its share rising from 3 percent to 11 percent. China has become the world's third-largest producer of scientific articles, after the European Union (EU) and the United States. In terms of the worldwide total of 5.5 million first university degrees awarded in science and engineering in 2010, the share of the EU and the United States is about 17 percent and 10 percent,

respectively, while students in China earned about 24 percent of the total (NSF 2014).

1.4 CHAPTER SUMMARIES

Taken together, our primary reason for studying innovation spaces is that Asia is – and will increasingly become – a particularly important innovation space to understand.

Chapter 2 focuses upon developments of innovation space within China, as driven by policy and the development of scientific and technological capabilities. A first-order political objective for the Chinese leadership is to become a more innovative economy. The model which has served China well so far – moving labor out of a low-productivity agricultural sector into relatively unqualified manufacturing – is not deemed long-term sustainable for growth. This chapter provides insights and critical reflections about key characteristics of innovation policy in China, which will influence domestic and foreign firms. A first characteristic is that the Chinese model seems to be the opposite of frugal innovation, and indeed “opulent innovation” describes the tendency to maximize output through maximizing inputs. A second characteristic is the focus on identified challenges and elite centers. Finally, even though China is positioned in global R&D networks, a more long-term challenge is to engage in activities that will increase the “stickiness” so that future activities and competencies remain in China.

Chapter 3 examples the development of innovation spaces in relation to intellectual property, and demonstrates the specialization of activity within China and India as well as flows between these countries and the rest of the world. A first question is: who patents in China and India? The results show that while only one-fifth of all patent applications to the Chinese Patent & Trademark Office has non-resident origin, as much as four-fifths of all applications to the Indian Patent Office has non-resident origin. The largest share (35.2 percent) of non-resident Chinese applications has Japanese origin, followed by the US (25.7 percent), Germany (10 percent) and Korea (7.2 percent). The situation in India is fairly similar. The second question is: where do Chinese and Indian inventors patent? Both countries direct a majority of their foreign patent applications to the United States Patent and Trademark Office. The third question is: what do Chinese and Indian inventors patent? A proxy was made by using Chinese and Indian inventors’ patenting in the US. China holds strong positions in patenting within computer technologies, electronics and information and communications technologies, while less

so in pharmaceuticals, biotechnologies and chemistry. Similar to China, India holds a strong position within computer technologies, but also within pharmaceuticals, chemistry and biotechnologies. In interpreting these empirical results, the increased non-resident patenting in China and India indicates their importance for innovative products globally as well as increasing technological competition in specific sectors. Identified differences exist between China and India however, leaving questions about possibly different future pathways of development of these innovation spaces on the global scene.

Chapter 4 uses intellectual property rights and patents as an empirical measure, as the source of rich data to understand how competition among countries and firms plays out globally. Their analysis of patents in China focuses upon the mechanism of technical standards, alliances and particularly patent pools, to try to gain technological capabilities, in two sectors. Two technological classes are analyzed, namely audio and video technology, and the telecommunication sector. They were chosen because Chinese domestic firms appear rather weak in the first and more successful in the second. Comparisons between sectors are made in terms of the competitive positioning of companies inside and outside the patent pools. In the case of the audio and video technology sector, members of patent pools retain their positions, despite advantageous government policy in China. In the case of the telecommunication sector, technology changes much more rapidly, leading to new generations of products. Here, three Chinese firms – DaTang, HuaWei and ZTE – are able to obtain patents in key technologies and also strengthen their competitive positions, within China and globally.

Chapter 5 addresses the emergence of a new innovation space based on a new market within China: the development of the electrical bike (e-bike) industry and a leading firm in China. This is analyzed as a co-evolutionary process involving technologies, entrepreneurs, policy, niche market and an eco-innovation meeting new demands of customers. The chapter provides an analysis of the evolution of e-bike use and industry in China, then moving on to a case study of the strategies of the lead producer, Lvyuan. The development of e-bikes in China is linked to issues of transportation and the presence of infrastructures, but also to values and practices about biking and the regulatory framework. Producers have had to meet the demand of various categories of users, thereby promoting niche markets rather than a bandwagon effect of general diffusion.

Chapter 6 first provides a theoretical framing to explicitly relate the entrepreneur (individual) with the venture (company) to the national innovation system in China. The proposed framework defines an innovation space as a multifaceted organism not restricted geographically; but rather

seen as consisting of multiple levels, including institutional, organizational and geographical aspects. This chapter also provides empirical insights of this journey from entrepreneurial venture to multinational enterprise, by focusing upon the process of expansion and internationalization of research and development of a Chinese wind turbine manufacturer. In doing so, the chapter provides a thick case description, with many details about the development of this Chinese company in the renewable energy industry. Right from its establishment in 2006, the company has been emphasizing the importance of innovation for its activities.

Chapter 7 follows the broader analytical framework developed in the previous chapter, now applied to the national context of an entrepreneur in South Korea. The framework is also further developed, in terms of process, strategy, organization and technology. A South Korean company in the nanotechnology industry is studied. The entrepreneurial venture, Park Systems, works in the manufacturing of atomic force microscopy. The chapter primarily focuses upon how this firm explores and can maneuver through innovation spaces, in an interactive process between the venture, the Korean national innovation system and global linkages.

Chapter 8 addressed an aspect of innovation spaces in China, namely the development of entrepreneurship in advanced sectors. The main focus is upon how four ventures within nanotechnology can develop, through analyzing interactions between key variables within the model of knowledge-intensive entrepreneurship. Nano represents a series of emerging technologies, and ones that are often seen to be interdisciplinary and involve a distributed form of knowledge among many different actors such as universities, existing large firms and entrepreneurial firms. The rapid development of science-based industries of nanotechnology is one based on ample technological and market opportunities, and these opportunities are being created between the entrepreneur (person), the entrepreneurial venture (organization) and the national innovation system. Analytical focus is put on the role of regional and institutional support such as the government loans and the science park as well as the specific characteristics of the founders, including international networks. The chapter focuses upon four in-depth case studies of Chinese firms, based in Suzhou Industrial Park. The firms are Beaver Nano-Technologies Co., Ltd, Poynova Materials Suzhou Ltd, Hanano and Nano-Micro Technology Company.

Chapter 9 addresses the development of global innovation spaces in Asia, by focusing upon the role of returnee entrepreneurs in developing knowledge-intensive entrepreneurship within China. This chapter demonstrates that individuals as returnee entrepreneurs – with specific skills and

networks from the West – can bridge geographical boundaries when they return to Asia, and thereby stimulate entrepreneurship as well as access global resources, especially financing and public policy. This chapter provides and analyzes six case studies of knowledge-intensive entrepreneurial ventures in China, in the high-tech sectors of internet infrastructure and services, health biotechnology, and telecommunication equipment. The ventures studied are all started by returnee entrepreneurs: Asia Info, Sohu, Baidu, Sibiono, Sandia Medi Tech and UTStarcom.

Chapter 10 examines how Indian pharmaceutical companies are expanding their innovation spaces through a variety of strategies such as partnerships and acquisitions. In doing so, the on-going evolution of emerging-market multinationals from India in the pharmaceutical industry is analyzed, with an analysis of the impact of these multinationals on patterns of outward foreign direct investment into advanced economies. These firms target high technology and advanced economies early on, and also when no conventional firm-specific advantages (FSAs) are identified. An important context is the global value chain in the pharmaceutical industry, and the positions of Indian firms. This chapter provides data and insights about the evolution of the FSAs of leading Indian pharmaceutical companies in relation to the historic context of Indian industrial development, as well as the development over time as the leading Indian pharmaceutical companies overcome barriers to entry.

Chapter 11 analyzes Indonesia as an emerging innovation space, with a particular focus upon the internationalization strategy of multinational enterprises from this emerging market. Indonesia presents a particular type of political economic market, where state-owned enterprises control most of the energy and welfare industries while multinational enterprises and domestic business control most of the trading houses and services, which are less regulated. This chapter provides three cases to illustrate the evolution of Indonesian emerging country multinational enterprises: Adaro Energy, Mayora and Astra.

Chapter 12 focuses on how firms from emerging markets can access and tap into relevant external knowledge for innovation in Western countries, and thereby stimulate flows within new innovation spaces across countries. This chapter focuses on China and Sweden, and more specifically on companies in the automobile and telecommunication industries. Chinese companies are increasingly moving abroad to access both advanced technologies and new markets. This chapter presents two case studies of Chinese firms moving into Sweden: Geely's purchase of Volvo Car Corporation in the automotive industry and Huawei's hiring of Ericsson's previous employees in the telecommunication industry. The cases represent two mechanisms for accessing scientific and technological resources,

namely foreign acquisition and employment of key individuals from competitors through the establishment of research and development labs.

Chapter 13 addresses emerging innovation spaces, driven by new types of customer demand and markets, and specifically new forms of innovations for the poorer segments of the economy. The chapter focuses particularly upon India. The idea of innovations for the poorer segments of the economy has gathered much attention, because a specific characteristic of emerging-market economies is that a considerable share of consumers belongs to the bottom (or base) of the pyramid (BOP). Though the individual purchasing power is low, the size of the BOP market segment in sum is enormous taken in aggregate, which makes it an attractive market segment. While these are incentives to access this market segment, companies struggle to deal with the specific market conditions with their traditional business and R&D models. This chapter aims to give an overview on foreign direct investment in R&D in emerging markets with a special focus on India and empirical illustrations of innovation strategies and modes of interaction.

Chapter 14 addresses global flows in the creation of new innovation spaces in India, but this time in software and usually through outsourcing and investments. India has been the foci of regional development in software around Bangalore, and this chapter tackles the issue of the nature and global distribution of innovation activity in software, which is reliant upon provision of services through skilled employees. Analysis of the software industry indicates there is considerable scope for innovation in emerging-market countries. It is possible as an incremental extension of routine outsourcing low-cost countries, using a global value chain argumentation. Three case studies are presented: primary software industry firm Digital Media Networks and the outsourcing of product development (OPD) to Aditi Technologies; secondary software industry firm Auto IT and the outsourcing of custom application development (CAD) to MindTree Consulting; and electronics firm Telecom Corp and the outsourcing of engineering services (ESO) to Sasken Communication Technologies. The case studies help to explain why innovative software activities, including problem-framing activities, are likely to follow the relocation of routine software production activities to emergent innovation spaces.

Chapter 15 explores the strategies and experiences of a small European software firm. The case study covers three phases in the development of the firm and its innovative activities in software in relation to financing and markets. During the period covered, the firm shifts from being a Western-based entrepreneurial venture started by software/engineering students, to a home-based MNE with global links to an MNE with significant innovation in Sri Lanka. The perspective here is how, over time, the firm interacts

with the national innovation system in the host nation, in such a way as to change the location of innovative activities for reasons having to do with financing, markets and crisis. Based upon the analysis of the interwoven narrative of the development of technology, markets, financing and sourcing software development, the chapter proposes three distinct periods. They are:

1. The founding phase: building the domestic R&D base in the early 1980s to the early 1990s.
2. The expansion phase: R&D internationalization through direct investments in the early 1990s to late 2000.
3. The phase of consolidation, adaptation and internationalization of innovative activities, 2000 to 2010.

The case study illustrates how the internationalization of innovation processes can be used to maintain the competitive edge of a company as well as the necessity of having a host-nation innovation system that can provide relevant skilled labor and technological assets.

Chapter 16 addresses how a European MNE can access, but is also changed by, moving into R&D to support production and new products, within an innovation space in India. The SKF Group is the leading global supplier of products, solutions and services within its five technology platforms: roller bearings, seals, mechatronics, services and lubrication systems. The case study is of the development of R&D in India for SKF. India went from being the site of a relatively small unit, with the main task to assist local production by locally adapting existing products to becoming one of two global R&D centers that perform advanced R&D, for the global market. The case provides insights, by analyzing three mechanisms identified in the literature review: headquarters assignment; subsidiary choice; and local environmental adaptation. Moreover, the chapter indicates the importance of MNEs in creating hubs of technical competencies in emerging markets. This is seen as a dynamic and evolutionary process, based on a combination of market, technological and managerial knowledge that is crucial for the subsidiaries to achieve an extension of the mandate over time.

Chapter 17 draws upon a line of research to propose a conceptualization of innovation spaces, and focuses upon the implications for Asia. The main perspective taken in this chapter – and most of the book – is the firm perspective, requiring microdata and a deep understanding set in a context, and this can be analyzed both through case studies and through quantitative data of macro trends and later, econometric techniques to test hypotheses.

Chapter 18 reflects upon the conceptualization and empirical understanding of innovation spaces in Asia, and especially the roles of entrepreneurs, multinational enterprises and policy. This includes a theoretical conceptualization as well as relating the findings in each chapter to the overall conceptualization proposed.

NOTE

1. We wish to thank the financiers, as found in the detailed acknowledgments for the book as a whole.

REFERENCES

- Asian Development Bank (ADB) (2014). *Asian Development Outlook 2014: Fiscal Policy for Inclusive Growth*. Mandaluyong City, Philippines: ADB.
- Amann E. and Cantwell, J. (2012). *Innovative Firms in Emerging Market Countries*. Oxford: Oxford University Press.
- The Economist* (2014). "Business in Asia." 31 May–6 June, 411 (8889).
- Evans, P. and Wurster, S. (2000). *Blown to Bits: How the New Economy of Information Transforms Strategy – Indonesia*. Boston, MA: Harvard Business School Press.
- Fransman, M. (1995). *Japan's Computer and Communication Industry: The Evolution of Industrial Giants and Global Competitiveness*. Oxford: Oxford University Press.
- Lee, K. (2013). *Schumpeterian Analysis of Economic Catch-Up: Knowledge, Path-Creation and the Middle Income Trap*. Cambridge: Cambridge University Press.
- Malerba, F. and Nelson, R.R. (2012). *Economic Development as a Learning Process across Sectoral Systems*. Northampton, MA, USA and Cheltenham, UK: Edward Elgar.
- Mani, S. and Nelson, R. (2014). *Trips Compliance, National Patent Regimes and Innovation: Evidence and Experience from Developing Countries*. Northampton, MA, USA and Cheltenham, UK: Edward Elgar.
- Needham, J. (1969). *The Grand Titration: Science and Society in East and West*. London: George Allen and Unwin.
- Peng, M. (2000). *Business Strategy in Transition Economies*. Thousand Oaks, CA: Sage.
- National Science Foundation (NSF) (2014). "International comparisons of R&D performance." Available at: <http://www.nsf.gov/statistics/seind14/index.cfm/chapter-6#s1> (accessed 14 October 2014).
- Nayak, A. (2011). *Indian Multinationals: The Dynamic Growth in a Developing Country Context*. New York: Palgrave Macmillan.
- Okimoto, D. (1989). *Between MITI and the Market: Japanese Industrial Policy of High Technology*. Palo Alto, CA: Stanford University Press.
- Ramamurti, R. and Singh, J.V. (2009). *Emerging Multinationals in Emerging Markets*. Cambridge: Cambridge University Press, pp. 200–225.

- Rosenthal, J.-L. and Wong, R.B. (2011). *Before and Beyond Divergence: The Politics of Economic Change in China and Europe*. Cambridge, MA: Harvard University Press.
- Sauvant, K., Pradhan, J., Chatterjee, A. and Harley, B. (2010). *The Rise of Indian Multinationals*. New York: Palgrave Macmillan.
- United Nations (UN) (2013). *World Investment Report 2013: Global Value Chains: Investment and Trade for Development*. New York and Geneva: United Nations.
- Whitley, R. (1992). *Business Systems in East Asia: Firms, Markets and Societies*. London: Sage.
- Zhang, M. (2013). "Innovation management in China." in Dodgson, M., Gann, D. and Phelps, N. (2013). *The Oxford Handbook of Innovation Management*. Oxford: Oxford University Press, Chapter 18.
- Zhang, M. and Dodgson, M. (2007). *High-Tech Entrepreneurship in Asia: Innovation, Industry and Institutional Dynamics in Mobile Payments*. Northampton, MA, USA and Cheltenham, UK: Edward Elgar.