China's Evolving Role in Global Value Chains: Upgrading Strategies in an Era of Disruptions and Resilience

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1 Introduction

Globalization has linked the growth prospects of national economies and regions to the international trade and production networks associated with global value chains (GVCs) from the 1960s to the present. For most of this period, the expansion of trade and foreign direct investment (FDI) grew steadily, and a country's level of development was closely tied to the nature of its participation in GVCs (World Bank 2020). Indeed, the belief that export-oriented industrialization was the best way for large and

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small developing countries alike to achieve rapid economic growth and increase per capita incomes became the dominant development orthodoxy in the 1980s (Gereffi 2014). However, the global recession of 2007–2008 disrupted this rosy view as economic slowdowns slashed imports in the most developed nations of North America and Western Europe, which caused exports in the most dynamic economies of East Asia, Latin America, and Africa to fall dramatically. Within a few years, export growth after the "great trade collapse" began to rebound (Baldwin and Taglioni 2009; Cattaneo et al. 2010) but confidence in the export-oriented model of development was badly shaken. Subsequently, more serious challenges to the stability of the global economy have emerged. Most recently, the COVID-19 global pandemic brought dramatic shortages of medical supplies needed to treat the novel coronavirus. Unprecedented spikes in demand in 2020 were coupled with industry shutdowns that disrupted global trade flows, curtailing the availability of a wide variety of goods and services, from essential medical and food supplies to everyday commodities like toilet paper, and most public transport and retail services. The alleged culprit ranged from overly rigid modern supply chains (O'Leary 2020; O'Neil 2020; Shih 2020) to concern that we may have reached the end of globalization as we know it (Farrell and Newman 2020).

This book examines China's new development strategies within this changing global context. In the past two decades, China has surged to become the leading global export economy in 2020 with its exports reaching US$ 2.6 trillion, ahead of the United States (US$ 1.43 trillion) and Germany (US$ 1.38 trillion) (WTO 2022). However, understanding China's rise in the global economy as well as its future development trajectory raises a series of fundamental issues that we analyze in this book. These include the changing geopolitical realities in the post-Washington Consensus era; the unique role played by the Chinese state and varied forms of industrial policy that reorient China's development strategy toward advanced technologies and its giant domestic market; and the implications of the emerging digital economy and the so-called Fourth Industrial Revolution for China's potential to become a global technological leader in the twenty-first century.

For major industrialized countries and regions, global supply chains have become strategic policy concerns (O'Neil 2021), and these economic powers are devising strategies to improve their resilience to trade shocks. The United States launched the "Building Resilient Supply Chains" initiative to identify supply-chain vulnerabilities and to develop a set of recommendations for strengthening the "resilience" of critical U.S. supply chains (The White House 2021). The EU is applying a policy mix that aims to increase domestic capacity, diversify suppliers and support the multilateral rules-based trade environment (European Parliament 2021). The notion of resilience implies the ability of an organization or a system to adapt to shocks and disruptions. However, it is a multidimensional concept that has different meanings across three interconnected levels: *the firm* (operational efficiency versus risk management options to achieve flexibility); *global industries or GVCs* (appropriate governance structures to organize networks of firms in distinct industrial and geographic configurations); and *the nation-state* (national security and long-term economic, social, and environmental goals) (Gereffi et al. 2022).

For China, global supply-chain disruptions also have strategic implications. In the 1990s and 2000s, the acceleration of China's export-oriented industrialization model allowed it to become the "world factory" across a diverse range of low-tech, mid-tech, and high-tech products and industries. China exemplifies the phenomenon of "compressed development" since it accomplished in just 40 years what took centuries for earlier industrializers to attain (Whittaker et al. 2020). China's impressive economic performance has been achieved through clear and active national policy goals formulated by the central government (controlled by the Chinese Communist Party), operationalized in ambitious Five-Year Plans, and implemented through local government initiatives. Over the past decade, however, China's ambitions to become a technological superpower have clashed with protectionist U.S. policies to limit China's imports, and broader concerns among advanced industrial economies over the implications of China's rising prominence in core technologies. This has led to U.S. and European campaigns against Chinese technology companies such as Huawei and ZTE, and sparked an innovation race in numerous high-tech fields such semiconductors, artificial intelligence, cloud and quantum computing, electric vehicles and self-driving cars, and clean energy *(Foreign Policy* 2021; Jin 2022; *The Economist* 2021).

In the context of these debates, this book uses the GVC framework to unpack how China has so successfully inserted itself into the global economy, and more importantly, to assess recent efforts to fundamentally reorient its development strategy to focus on advanced manufacturing and indigenous innovation with a greater emphasis on the domestic economy.

To analyze these objectives, we distinguish between two broad orientations in China's new development strategies, namely upgrading from above and upgrading from below.

Upgrading from above refers to the major policy initiatives and reforms launched by China's central government since China's "Open Door" policy initiated by Deng Xiaoping in 1978 to open China to international trade and foreign businesses that wanted to invest in the country. Our focus in this book will be on the recent policies aimed at upgrading from above, which include the Made in China 2025 initiative launched in 2015, the Belt and Road Initiative (2015), the Dual Circulation policy (May 2020), and the 14th Five-Year Plan (2021–2025) published in 2021. Together, these plans outline the country's goals for a new development agenda to upgrade China into higher value, advanced technology industries that focus on the domestic economy. These objectives are summarized in the "Dual Circulation" concept introduced in China's 14th Five-Year Plan: "It targets the expansion of domestic demand through strengthened supply chains supported by industrial policies, indigenous innovation, and increased domestic consumption. This approach envisages less reliance on heavy industries by proposing a new target to increase the share of the strategic emerging industries (i.e., advanced manufacturing, including high-end machinery and equipment, advanced materials, and electric vehicles) from 11.5% of GDP in 2019 to over 17% by 2025" (Asian Development Bank 2021).

Upgrading from below refers to the wide variety of local policies, institutions, firm strategies, and labor market shifts that allow us to understand how China's top-down programs translate into industrial growth on the ground. To assume that China's central government initiatives automatically translate into dynamic and diversified export industries and technological progress based on a large labor pool and a strong domestic market is simplistic. It ignores the heterogeneous and fragmented nature of the country's industries and provides little basis to interpret how China's policies might impact the global economy in the future. Most of the chapters in the book focus on the manifold mechanisms of upgrading from below in China in recent decades with an emphasis on changes since 2010. The main drivers of upgrading from below highlighted in the book include: (1) *local government policies*, which are a major driver of change and vary by region, by sector, and over time in China; (2) *foreign direct investment (FDI)*, which has been a critical element in the upgrading of technological capabilities for export-oriented production in different localities and industries; (3) the rapidly growing *domestic market*, which has facilitated upgrading in both the upstream and downstream stages of GVCs in China, particularly after the change in regulations in 2008 that allowed export-oriented firms to sell products on the domestic market; and (4) a small but *growing focus on innovation* at the firm level that helped drive upgrading into new high-tech industries.

The remainder of this chapter is organized as follows. Section 2 outlines why the GVC perspective is a critical analytical tool to help us understand China's evolving role in the global economy, and Section 3 provides additional details on China's development strategies since 1978. Section 4 further unpacks the upgrading from above and from below perspectives based on selective findings from the book, while Section 5 describes the organization of this volume and the contributions of its individual chapters. Section 6 concludes with some reflections on the relevance of our analysis of China's development for other countries in the world.

2 Global Value Chain Perspective

Over the past three decades, GVCs have become an integral part of the global economy, reshaping the traditional patterns of international production and trade. Participation in GVCs has contributed to economic growth and development in both advanced and developing economies around the world. Insertion into GVCs alone, however, does not necessarily translate into positive gains from FDI or trade. To benefit from GVC participation, countries must be able to sustain and upgrade their competitiveness over time, mainstream trade into their broader national development goals, build internal capacity, and generate more and better jobs. Thus, it is not only a matter of whether to participate in the global economy but how to do so gainfully.

The GVC framework, which was developed in the early 2000s, focuses on how the structure and dynamics of global industries shape the upgrading options for countries and firms in the global economy (Gereffi 2018, Chapter 1). Thus, it draws together the macro (global), meso (industry and country), and micro (firm and community) levels to understand the challenges of development at different spatial scales. Given the immense complexity of today's cross-border supply chains, the GVC methodology is a useful tool to trace the shifting patterns of global production within and across multiple industries in developed and developing economies alike.

2.1 What Are GVCs?

The value chain describes the full range of activities that firms and workers perform to bring a product from its conception to end use and possible reuse through the circular economy. This includes activities such as research and development (R&D), design, production, marketing, distribution, and sale to the final consumer. The activities that comprise a value chain can be contained within a single firm or divided among different firms around the world (Gereffi and Fernandez-Stark 2011). In the context of globalization, the activities that constitute a value chain have generally been carried out in inter-firm networks on a regional or global scale.

GVC analysis provides a holistic view of global industries—both from the top-down (e.g., examining how lead firms "govern" their global affiliates and inter-firm supplier networks) and from the bottom-up (e.g., examining how business decisions affect the trajectory of economic and social "upgrading" or "downgrading" in specific countries and industries) (Gereffi and Fernandez-Stark 2016). These form the two main conceptual pillars of the GVC framework: governance structures and upgrading trajectories.

Governance of GVCs is the key concept for the top-down view. GVC governance is defined as "authority and power relationships that determine how financial, material, and human resources are allocated and flow within a chain" (Gereffi 1994). It focuses mainly on lead firms and the organization of international industries. While GVC analysis shares a firm-centric approach with the international business literature, it goes beyond the hierarchical governance of a firm (i.e., vertical integration and headquarter–subunit relations), and extends to various forms of contractual and relational coordination between independent companies that span international borders. In addition to these corporate forms of governance, the GVC approach also pays attention to public and social governance and the institutional factors that shape them (Gereffi et al. 2005; Mayer 2014; Gereffi and Lee 2016).

Upgrading is the main concept for the bottom-up perspective. In contrast to governance's focus on the power of lead firms, upgrading looks at the bottom-up strategies used by countries, firms, and workers to maintain or improve their positions and outcomes in the global economy. It refers to "a process of improving the ability of a firm or an economy to move to a more profitable and/or technologically sophisticated capital- and skill-intensive economic niche" (Gereffi 1999), or more simply put, "to move from low-value to relatively high-value activities in global production networks" (Gereffi 2018). The GVC approach does not simply assume that integration to GVCs leads to economic upgrading through positive spillovers, but seeks to establish under what conditions, particularly under what GVC governance arrangements, upgrading (or downgrading) is likely to occur (Humphrey and Schmitz 2002; Barrientos et al. 2011).

Traditionally, a firm/country could upgrade its participation in a production model in four distinct ways: (1) *product upgrading*—the shift to make a higher value product; (2) *process upgrading*—improving the efficiency of production systems, for example, by incorporating more sophisticated technology; (3) *functional upgrading*—moving into higher value stages in the chain that require additional skills; and (4) *chain or intersectoral upgrading* – entry into a new value chain by leveraging the knowledge and skills acquired in an existing chain (Humphrey and Schmitz 2004). For example, functional upgrading can be seen in the trajectory of manufacturing or export roles such as assembly, original equipment manufacturing (OEM), original brand manufacturing (OBM), and original design manufacturing (ODM) that characterized East Asian producers in apparel and a variety of other industries (Gereffi 2019). While this early typology is quite resilient and widely used, it is relatively static. It does not tell us how these types of upgrading might be linked or evolve over time.

Early use of GVC methodology focused mainly on economic competitiveness, but more recently social and environmental dimensions have also been incorporated. GVC research is now exploring new topics such as labor regulation issues, workforce development, the greening of value chains, and gender (e.g., (Barrientos et al. 2011; Gereffi et al. 2021b; De Marchi et al. 2019; Ponte 2019; Barrientos 2019; Gereffi et al. 2011). Today, GVC analysis is one of the preferred methodologies for examining global industries, international trade dynamics, and how vulnerable economic actors engage in supply chains that are frequently subject to disruptions and acute shortages, as typified by the COVID-19 global pandemic (Gereffi and Lee 2012; Barrientos et al. 2011; Gereffi 2020; Gereffi et al. 2022).

2.2 GVC Framework and Development Policy

The comprehensive nature of the GVC framework allows policy makers to answer development questions largely ignored by previous paradigms. As policy makers and researchers alike have become aware of the pros and cons of globalization, the GVC framework has tackled novel topics such as the role of emerging economies like China, India, and Brazil as drivers of GVCs, the proliferation of private regulations and new product and process standards, and increased attention to social and environmental upgrading (Lee 2010; Mayer and Gereffi 2010). Over the past two decades, numerous international development organizations have adopted the GVC framework to understand how countries can better engage in global trade (World Bank 2020; African Development Forum and World Bank 2021).

GVC industrial policy differs from previous approaches (Rodrik 2007; Kaplinsky and Morris 2016; Baldwin 2014; Gereffi and Sturgeon 2013) in which industrialization involved building relatively complete supply chains at home. Considerably more nuanced than blunt trade policy instruments that can have unintended consequences (Gereffi et al. 2021a), such as tariffs or trade bans, GVC-oriented policies operate within the geographic and organizational complexity of globalized industries. GVC-oriented policies are designed to deepen the ties countries have within these chains and to increase the gains from GVC trade over time. These include human capital development, standards compliance, investment strategies, local firm development, trade policy, and infrastructure improvement, among others (Bamber and Fernandez-Stark 2019).

3 China's Evolving Role in the Global Economy

Since China's economic reform and opening in 1978, China's role as the "world's factory" has catapulted it to the position of the second largest economy in less than half a century. While China's growth has inevitably slowed over time as the economy matured, it remained impressive at 5.9% in 2019 prior to the coronavirus pandemic (2022 goal: 5.5%). With a gross domestic product (GDP) of US$ 14.7 trillion in 2021, most analysts expect China to overtake the US as the world's largest economy (GDP 2021: US$ 21 trillion) during the course of the next decade (World Bank 2022).

China's economic growth was spurred by significant inbound foreign investment, but outbound investment has also become important as China positions itself abroad. By 2020, China was the world leader in both global inbound and outbound FDI. Inbound FDI grew significantly after the country's ascension to the WTO in 2001; since the turn of the last century, more than US$ 3 trillion have flowed into China, accounting for approximately 9% of world FDI flows (Paterson 2021). In 2020, it was the second largest recipient of FDI, after the United States, attracting close to US$ 150 billion in investment despite the dampening effect of the global pandemic (UNCTAD 2022). In 2020, the country also topped the list of outbound FDI with US$ 132 billion (UNCTAD 2022).

China has become the world's top exporter (US$ 2.6 trillion, 2020) and the second largest importer (US$ 2.1 trillion, 11.5%). In just 40 years, the country's exports have grown from a negligible base to account for 15.2 % of world merchandise trade, almost as much as the next two largest exporters - the US (8.4%) and Germany (8.1%)—combined (WTO 2022). In imports, it trails only the United States (US$ 2.4 trillion, 13.5%) and is already twice the size of Germany (6.6%) (WTO 2022). Trade has not been limited to final goods; in its role as a major assembler, it has become the second largest importer of intermediate goods, continuing to gain market share from 9.5% (2005) to 14.4% in 2019. At the same time, there is tremendous growth in intermediates goods exports, with its global share doubling from 6.7% (2005) to 13.4% in 2019 (WTO 2022). Finally, the country has also become a major contributor of global services trade and is now the fourth largest exporter of commercial services (WTO 2022).

China's dominance in trade covers multiple industries and partners. The country ranks among the top five importers and exporters in most sectors from light manufacturing (e.g., textiles and apparel), to automotive and heavy industry, including iron and steel and chemical production. Notably, it is also among the largest importers of commodities, food, fuel and mining products (WTO 2022). China has become a major trading partner for numerous countries, accounting for significant shares of their exports. This is true not just for regional partners, but also raw material suppliers from further afield. Australia, the Democratic Republic of the Congo, Namibia, Brazil, Myanmar, Republic of Korea, New Zealand, Japan, Viet Nam, Uruguay, Indonesia and Qatar are among those that export more than 10% of their outbound trade to China (UN Comtrade 2022).

These changes to China's participation in the global economy have been characterized by three stylized phases of development:

1. **Export-oriented industrialization**—Following China's economic reform and opening up, the country became an important destination for FDI. Its competitiveness was built primarily on China's endowments of labor and natural resources, supported by low wages, worker migration from the interior to coastal provinces, and growing economies of scale. By the late 1990s, foreign enterprises accounted for about half China's exports. By 2006, the number had risen to 60% (National Bureau of Statistics of China 2022).
2. **Shift toward domestic markets and investment**—Following the 2008 global economic crisis, slowing global demand disrupted the export-oriented model that had driven China's growth for the prior three decades. At the same time, changes to the labor laws contributed to a significant rise in costs at home and impacted Chinese manufacturing competitiveness in the shrinking global market. This period also corresponded to the maturing of China's domestic market, which was booming in the early 2010s thanks to rising purchasing power of Chinese consumers and the strengthening of local suppliers. These shifts were visible in both trade intensity and the relative importance of FDI in China. The trade to GDP ratio fell steadily from its pre-crisis peak of 64% (2006) to 34% in 2020 (World Bank 2022). FDI's relative importance to China's economy diminished substantially as domestic sources of investment expanded. Although FDI inflows to China tripled in absolute terms between 2002 and 2019, its share of China's total gross fixed capital formation fell from 10.3% to just 3% of total investment (Paterson 2021). By 2019, foreign enterprises accounted for just 39% of China's exports (National Bureau of Statistics of China 2022).
3. **Advanced manufacturing, indigenous innovation, and the expanding global footprint of Chinese lead firms**—By 2015, under the leadership of President Xi Jinping, China began to promote initiatives to reduce its dependence on producing cheap low-tech products and to highlight instead the production of high-tech goods and services associated with the digital economy, including those designed in China and under Chinese brands.

During this period, China's R&D expenditure increased significantly, reaching US$ 462 billion in 2018, a nearly 12-fold increase since 2000 (OECD 2022). Chinese firms accounted for 14.5% of PWC's Global Innovation 1000 ranking, up from 2.5% in 2012 (PwC 2022). Almost half of the patents in the world were filed by China, twice as many as the United States (WIPO 2020). By 2019, China (119) was virtually tied with the United States (121) in terms of the number of firms listed among the 500 largest MNCs in the world (Mourdoukoutas 2019). One in three global "unicorns" (startups valued at $1 billion or above), many linked to the digital economy, were based in China (trailing only the US, which had one-half of unicorns) (MGI 2017). Innovative Chinese firms now include global household names such as Alibaba, BYD, Didi, Huawei, Midea, and Shein, and China is one of the world's largest outbound investors. The Belt and Road Initiative, underway since 2015, has sought to connect outbound FDI to new markets, while strengthening trade routes with mature markets.

4 Upgrading from Above and from Below

As discussed earlier, the chapters in this volume explore how China's development strategies have evolved through a combination of both top-down and bottom-up initiatives that we label "upgrading from above" and "upgrading from below," respectively. The chapters contain empirical details that are particularly useful in analyzing the upgrading from below perspective, which is often lacking in discussions of China's rapid economic growth in recent decades. In this section, we highlight how some of the findings from chapters in this volume contribute to a deeper understanding of upgrading dynamics in China.

While the central government sets out the pillars for future growth, it is generally at the local level—be it municipal, city, or provincial—that these pillars are effectively put into practice with specific policy instruments regarding investment, human capital, and public–private cooperation among others. Each local government interprets, adopts, and adapts the central government's guidelines based on its own competitiveness factors and local economic development goals. Individual firms respond to these local policies and incentives based on their own strategies and the opportunities for growth that they identify.

Much of China's progress in GVCs has occurred via *process* and *product* upgrading. These upgrading activities have mainly focused on improving production efficiency in manufacturing, labor issues, and product quality control and testing. By 2020, *process* upgrading included the digitalization of factory operations and the installation and use of intelligent manufacturing systems. The first industries to incorporate automated technologies in their operations in China were the mobile phone and automotive sectors (IFR 2022). The need to reduce costs and enhance reliability of output was prevalent in the operations of both local and foreign firms in the country. Chapter 6 analyzes the evolution of upgrading among foreign (Taiwanese) subsidiaries in the electronics sector, while Chapter 7 examines the paths taken by multiple Chinese suppliers in the LED and mobile terminals industries in Huizhou City (PRD).

Since 2010, *functional* and *market* upgrading trajectories have become more prominent as firms have shifted to serve both foreign and domestic markets; this dual strategy is practiced across various industries in China (Butollo and Ten Brink 2018). The disruption to export-oriented demand caused by the 2008 global economic crisis forced firms to pivot to the domestic market to ensure sales. New capabilities were developed in marketing and sales and new brands were created for the Chinese market. Many of the factories operating across China, accustomed to responding to orders from foreign buyers, lacked marketing departments with skills to promote domestic sales. For example, Chapter 7 provides a detailed case study of Ledman LED's pivot toward the domestic market. In the LED industry, domestic distribution channels had not even been established by 2008, and firms such as Ledman LED were forced to create markets by working on government-led energy-saving projects or participating in public construction supply chains. In light manufacturing industries, such as apparel, the demand for these downstream capabilities helped to drive the growth of platform firms such as Alibaba, which connect the host of smaller manufacturers in China directly with potential markets (Chapter 3).

For *intersectoral upgrading*, firms have leveraged existing technological capabilities to upgrade into new emerging sectors as first movers. For instance, BYD, traditionally a lithium battery supplier for consumer electronics firms, personal computer (PC) manufacturers, and mobile phone makers, used this battery knowledge to jump-start its position in the electric vehicle (EV) sector. Having entered the sector in 2003 with the purchase of a small domestic car brand, BYD became a leading global EV firm by 2020 with products in multiple end-market segments across the globe, from passenger cars to electric-powered buses and trucks to even trams for the public sector (Chapter 7). Likewise, component manufacturers serving the PC industries in Kunshan and Dongguan shifted their output to serve the growing smart phone segment in order to survive (Chapter 6). The reorientation of many of these suppliers would play a major role in helping drive the rapid rise of China-produced smartphones (Lee and Gereffi 2021).

Other firms focused on *upgrading into higher value industries* by entering directly into high-tech value chains, including industrial robots, medical devices, and information and communication technologies (ICT). These firms serve the large Chinese domestic market. As with high-tech and emerging GVCs around the world, new firms typically pursued vertical integration strategies that allow for full control and coordination across their supply chains. Upgrading is achieved through internal capabilities in upstream components manufacturing and major investments in R&D. Company cases include Estun (industrial robots), Huawei (ICT) and Neusoft (high-tech medical devices), which focused on avoiding dependence on foreign component imports and controlling their cost competitiveness (Chapter 8). Estun and Neusoft's R&D intensity (R&D spending as a share of income) is similar to that of leading firms abroad (PwC 2022).

In a variety of sectors, the rise of digital technologies has fostered *functional upgrading into high value services* operations. Digital platforms, both production and distribution, have risen rapidly in China serving light and heavy manufacturing value chains alike. Distribution platforms, such as Alibaba and Shein, provide extensive services in downstream e-commerce and upstream product design and development (Chapter 3). Others provided a similar service for product development in exchange for a percentage of final sales (Chapter 7). In addition, a host of industrial firms leveraged their pioneering experiences in digitalizing and automating production to become services providers for platform-based manufacturing (Chapters 2 and 10).

Upgrading from below in China has been driven by a combination of factors.

First, ***local government policy*** is a major driver of change. While broadly framed by the policies outlined by the central government, industrial policy by local governments is key to upgrading success. This is illustrated by the diverse range of business-government relationships in different localities in the country. The role of the local state has become considerably more proactive as states compete for investment and job creation (He 2007). Local governments actively managed industrial policies, such as income tax breaks, rebates of value-added tax and import duties for equipment purchases, low-priced land in special development zones, and cash payments to firms based on exports and innovation performance (Barbieri et al. 2012).

The rules of the game and objectives established by local governments influence the types of firms and investments that are attracted. For example, clear rules regarding property rights, combined with a strong FDI attraction unit and a commitment to public-private coalitions to overcome potential barriers to growth positioned Kunshan as a key player in PC manufacturing (see Chapters 5 and 6). Forming multistakeholder coalitions at the local level that draw together firms and universities with private and public research organizations are necessary to support China's goals to focus its GVC participation on indigenous innovation (Chapters 8 and 10).

Regional differences in China also shape its development. Two of the best-known cases of inter-regional competition for investment in China involve the Pearl River Delta (PRD), which contains nine municipalities under the jurisdiction of Guangdong province (including Guangzhou, Shenzhen, Dongguan and Huizhou), and the Yangtze River Delta (YRD), whose administrative sphere encompasses 16 cities in Jiangsu province (such as the prefecture city of Suzhou and the county-level city of Kunshan) and Zhejiang province (such as Hangzhou and Ningbo), as well as the centrally governed municipality of Shanghai ((Yang 2009). The PRD and YRD are prime examples of "globalizing" regional development (Coe et al. 2004) because they compete intensely for FDI inflows from both nearby Asian economies (such as Hong Kong, Taiwan, Singapore, Japan and South Korea) as well as advanced Western economies. In recent years, regional competition in China has extended to the interior provinces, such as Foxconn's megafactories in "iPhone City" in Zhengzhou, the capital city of Henan province, which are successfully luring new investments in high-tech sectors like smartphones and cloud computing because of rising costs and labor shortages in China's coastal provinces in the PRD and YRD (Barboza 2016).

Second, ***FDI has been a critical element in the upgrading of technological capabilities for export-oriented production***. Through instruments such as joint-venture requirements, FDI has created spillovers of knowledge and technology into the local economy, including a network of international contacts and the knowledge of how to produce for foreign buyers. In 2015 alone, foreign companies set up more than 6,000 new joint ventures in China, accounting for $27.8 billion of FDI (NBER 2018). For example, Taiwanese investment provided the main impetus for capability development in China's electronics sector. Through entrepreneurship, former line workers from foreign factories set up their own operations. Over half of the founders of Chinese manufacturing firms in the electronics sectors started out as line workers in Taiwanese and Hong Kong enterprises (Chapter 6). In the case of medical devices and industrial robots, the presence of FDI from some of the world's leading firms, including robot manufacturers, FANUC and Yaskawa, provided a different impetus; these firms forced local firms to produce higher quality equipment to remain viable (Chapter 8).

However, the governance structures of these FDI-dominated chains often prevented local suppliers from upgrading further. Lead-firm management kept these suppliers separated from product design and downstream customers, limiting their profit margins and potential growth opportunities (Murphree and Breznitz 2020). As a result, many firms opted for a dual strategy of maintaining some sales to foreign operations, while diversifying downstream into new product segments and buyers in the domestic and regional markets (Chapters 6 and 7).

Third, the ***rapidly growing domestic market has facilitated upgrading into both upstream and downstream stages of the chain***, particularly after the change in regulations in 2008 that allowed export-oriented firms to sell products on the domestic market. This proved critical for enabling Chinese manufacturers to pivot away from exclusively foreign-led GVCs where they were locked into the midstream positions in the chain (Chapter 7). Manufacturers were able to leverage their considerable production capabilities combined with their knowledge of local consumer preferences to carve out local market share. Over time, China's large domestic demand allowed the local producers to grow and accumulate capital, technologies, and experiences, and gradually upgrade and provide innovative products of higher quality (Chapter 8). In the mobile phone segment, for example, the domestic firms initially provided slightly lower quality but much cheaper alternatives to foreign-produced high-end phones, but later on, domestic firms made significant product improvements and become internationally competitive (Gereffi et al. 2021a).

Forth, a small but ***growing focus on innovation*** at the firm level helped drive upgrading into new high-tech industries. An emerging set of firms within the country directly pursued R&D and innovation. R&D intensity (the share of R&D spending to sales) was high—even by Western standards—at firms such as Huawei (ICT), Neusoft (high-tech medical devices), Estun (industrial robots) and Goodbaby (baby products). These firms also tapped into foreign innovation hubs, either by establishing local R&D centers or purchasing innovative foreign firms to gain access to critical technologies for upgrading, such as Midea's 2016 purchase of Germany's leading robot firm, Kuka (Chapter 2).

4.1 Implications of Upgrading from Above and Below for Human Capital Development

As China upgraded along these multiple dimensions, there were new opportunities and challenges for the labor force. During the export-oriented stage of GVC engagement, on-the-job training was sufficient for most workers to support process and product upgrading. Yet there were concerns over poor working conditions and an unsustainable pace of work. The 2008 Labor Laws began to require both social security benefits and severance contributions for workers. This coincided with rising labor costs to force Chinese firms to upgrade into higher value activities where they could remain competitive.

The functional upgrading required to perform these higher value activities also entails an increase in the skills need to carry out these activities (Gereffi et al. 2011). The ability to do this at scale depends on the widespread availability of workers and educational institutions to undertake this skills development. Higher education in China has risen significantly, with over half of young people gaining a higher education degree (Chapter 10).

However, training the workforce for the digital economy that China wishes to lead is just part of the challenge. Recruiting and retaining these skilled digital workers has become a major difficulty globally. China's growth has brought big challenges for its high-tech sector. Despite objective gains in salaries and working conditions, it is not uncommon for workers to be unsatisfied with their jobs (Chapter 4). Both globally and in China, worker expectations for their quality of life have shifted as they rise into more highly skilled jobs and the pandemic has only underscored these concerns. In late 2021, Gartner estimated that approximately one-third of IT workers in developed countries actively sought new jobs (Carnegie 2022). With strong demand for skilled workers around the world, retention is increasingly difficult; companies in China and aboard will need to adjust how they recruit and retain their workforce.

5 Contributions of this Volume

The three sections of this book highlight China's ambitious agenda and uneven progress toward becoming an emerging superpower in the global economy. In Part I, Chapters 2–4 outline the implications of China's new platform-based concepts of production, which push beyond the cost-driven efficiencies and global economies of scale of its diversified export-oriented industrialization model to confront the challenges and opportunities of innovation-oriented development in the digital era of the twenty-first century. In Part II, Chapters 5–8 challenge the paradigm of top-down control by China's central government, and instead reveal the key role played by local industrial policy through Chinese city and provincial governments and the growing participation of Chinese suppliers in industries that increasingly serve China's large domestic market. Finally, in Part III, Chapters 9–10 document China's shifting position within East Asia's regional value chains, but stress the considerable variation across products and segments within value chains. Below is a brief note on each chapter.

5.1 Part I: Digital Technologies and China's New Development Strategies

Central to China's new development agenda is a heavy emphasis on the digital economy. A key consequence of China's reliance on the digital economy is the emergence of platform-based manufacturing as a business model that relies on the internet to transform the social and economic hierarchies across key industrial sectors. China has become the world's largest and most diversified testing ground for new platform-based concepts of production. At the national level, the Made in China 2025 program promoted this transition using a strategy for the Industrial Internet of Things (IIoT). Although China has spawned numerous IIoT pilot platforms in specific manufacturing industries and local clusters (Chapter 2), large individual companies have also pioneered this concept. E-commerce giant Alibaba's distribution-centered platform tries to restructure the subcontracting networks in China's light industries such as apparel (Chapter 3), while a dominant firm in the ICT sector has attained firm-level upgrading through indigenous innovation, but this leads to disjunctures between objective and subjective social upgrading criteria for the firm's highly skilled young tech workers (Chapter 4).

5.1.1 Chapter 2: China's Industrial Internet: Platform-Based Manufacturing and Restructuring of Value Chains (Boy Lüthje)

The chapter provides a conceptual framework to understand the rapid development of China's IIoT strategy. It reviews both the top-down Chinese policy approach to enhancing automation and digitalization of production platforms within key manufacturing sectors, and the bottom-up evolution of firms and other actors engaged in bringing this vision to fruition. The author's unique position as a German researcher with long-standing ties to academic institutions within China affords him insights into policy development that are often not visible to international scholars. Lüthje debunks the notion that Chinese digitalization policies are driven by creating large state-owned enterprises, and instead highlights the diversity of business models and private sector actors that promote these efforts at the production level.

5.1.2 Chapter 3: Alibaba's Distribution-Driven Approach Towards the Industrial Internet: A Chinese Approach to Industry 4.0? (Lea Schneidemesser and Florian Butollo)

The authors of this chapter add to the framework proposed in Chapter 2 by analyzing the IIoT model of China's largest e-commerce company, Alibaba. In contrast to the production-centered approach of platform-based manufacturing in the industrial internet, this chapter focuses on Alibaba's new distribution-centered model. Specifically, the authors examine the case of Alibaba's industrial internet platform, Tao-Factory. They highlight how, by lowering transaction costs and improving the flexibility of sourcing, Alibaba is restructuring the subcontracting arrangements in China's domestic light industries, but question whether the positive effects of this system in expanding access by small producers in China could be undercut by intense price competition and a race to the bottom in the long run.

5.1.3 Chapter 4: Subjective Social Upgrading and Downgrading of Technical Workers in China's High-Tech Economy: A Company Case Study (Xia Yan)

The author's focus on the objective and subjective dimensions of the social upgrading of workers at a leading Chinese ICT firm provides rare insights into how the efforts of China's high-tech firms to reach the global technology frontier is viewed from a labor perspective. Technological upgrading in China places a premium on the need for highly skilled workers, yet the author's empirical research indicates that these workers subjectively view their roles as having steadily deteriorated over time despite unambiguous objective gains in terms of salaries, career development, skill improvement, and benefits such as improved work facilities. Using over 70 interviews with middle managers, human resource personnel and other professionals, the chapter traces the evolution of working conditions at the firm as it rose from a reseller of imported products to become a leading icon of China's innovation and technological progress. Yan's findings have important implications for the retention and recruitment of high-tech workers by other companies in China in terms of tangible as well as non-tangible benefits.

5.2 Part II: Active Local Governments and Firm Upgrading in China

With the growing success of China's export-oriented development model in the 1990s and 2000s, attention has shifted to the sectoral, regional, and local context of industrial upgrading in the country. New empirical research is providing a more variegated and nuanced picture of key determinants and novel trajectories of China's economic growth, relying on both comparative and longitudinal analyses. The Pearl River Delta in southern China and the Yangtze River Delta near Shanghai in the east have displayed significant regional differences in the timing and sectoral orientation of their export patterns, which is explored in this volume through a series of detailed city and industry case studies. Cities like Dongguan (in the PRD) and Kunshan (YRD) have emphasized the ICT sector and active local governments in their export growth but show divergent trends in the current period (Chapter 5). Taiwanese FDI played a key role in the development of the PC industry in both Dongguan and Kunshan, but the shift from export-led growth to the domestic market in the 2010s has provided new opportunities for Chinese domestic suppliers and weakened the position of Taiwanese firms in China (Chapter 6). To identify and better understand diverse pathways for upgrading from below by local manufacturing firms, it is useful to compare multiple industries and company case studies within a single manufacturing hub (Huizhou City in the PRD) to understand how firms climb technological and market ladders in GVCs (Chapter 7). The same logic of comparing advanced manufacturing sectors (industrial robots and high-tech medical devices) as well as individual company cases also helps us understand the varied impact of central government versus local government policies in achieving industrial upgrading (Chapter 8).

5.2.1 Chapter 5: Active Local Governments and New Chinese Firms in Emerging Industries in Kunshan and Dongguan (Xun Zhang, Gary Gereffi, and Cassandra Wang)

This chapter analyzes China's involvement in GVCs from the bottom up rather than the top down. It contends that industrial policy in China is not merely a tool of the central government, but that local governments are also very important actors in the industrial landscape of China. Using city-level case studies of Kunshan and Dongguan, the chapter highlights different patterns in the evolution of active local governments in China, which reflect both the timing of development and the regional location of these industrial hubs. Kunshan, a county-level city in Jiangsu province, fostered an evolutionary coalition at the onset of its industrial experience, but later it was able to use local Taiwanese investors to catapult to a world leadership role in the laptop computer GVC. Dongguan, a prefecture-level city and industrial cluster in central Guangdong Province, China, started from a more generalized base in the highly manufacturing-oriented Pearl River Delta (PRD). Its upgrading path led to greater diversification in the information and communication technology (ICT) sector and a local government that learned how to play a more active role in nurturing local firms. Currently Dongguan may have the upper hand as China shifts to a more inward-oriented development model that emphasizes industrial upgrading from below with Chinese suppliers joining local supply chains oriented to the domestic market.

5.2.2 Chapter 6: Whither GVCs: The Shifting Role of Taiwanese FDI in Mainland China (Michael Murphree)

The chapter highlights the evolving role of Taiwanese investments in China's entry and technological upgrading within manufacturing GVCs.

Initially these investments facilitated China's entry into the information technology (IT) GVC via the production of electronic components and final-product assembly needed for export-oriented markets. In the aftermath of the global financial crisis of 2007–2008, China's position in GVCs evolved with an increasingly important role for indigenous firms as China diversified into high-technology sectors and advanced manufacturing programs oriented to China's large domestic market. The overall decline in Taiwanese investment in China's manufacturing sector raises important challenges and opportunities for local suppliers, while Taiwanese FDI in high-tech digital services has steadily increased over the past 15 years.

5.2.3 Chapter 7: Industrial Upgrading from Below: Can Chinese Local Manufacturing Firms Reconfigure GVCs? (Wei Zhao)

Based on empirical firm-level studies of three industrial sectors—LED lights, mobile terminals, and new energy vehicle batteries—in the manufacturing region of the Pearl River Delta in China, the author identifies the main traits of industrial upgrading that reconfigure, restructure, and even create new sectors. Specifically, the chapter discusses distinct upgrading trajectories followed by local firms in Huizhou City. In mature industries with established governance patterns, it is very difficult for Chinese suppliers to alter or reconfigure existing power structures or capture higher value. In sectors such as mobile terminals, suppliers must "sustain" process, product and market upgrading to remain competitive within the chain. However, in emerging high-tech industries where governance dynamics remain highly fluid, Chinese firms that have been willing to make significant market, technological and organizational changes can establish themselves as global lead firms. The chapter supports this framework with detailed case studies for three key firms in Huizhou City: Huayang General in the mobile terminals sector, Ledman LED in the LED sector, and BYD in the electric battery sector.

5.2.4 Chapter 8: Upgrading of Chinese Domestic Firms in Advanced Manufacturing: Evidence from Industrial Robots and High-Tech Medical Devices (Jing Zhao and Gary Gereffi)

Based on diverse qualitative and quantitative evidence from two sectors—industrial robots and high-tech medical devices—that were included in both "Made in China 2025" and the 14th Five-Year Plan, this chapter identifies and discusses the driving forces behind the upgrading trends of Chinese domestic firms, including the national and local policies supporting these upgrading efforts. Although moving up in advanced manufacturing GVCs is China's policy priority, very few empirical studies analyze the success of this initiative in specific industries and with an emphasis on firm-level characteristics, including ownership and market orientation. This chapter fills this gap and thus contributes new insights to discussions of GVC upgrading in China's advanced manufacturing sectors. The chapter includes case studies of two key firms—Estun in the industrial robot sector and Neusoft Medical Systems in the high-tech medical device GVC—examining their upgrading pathways and impact within these emerging high-tech sectors.

5.3 Part III: China's Shifting Role in Regional and Global Value Chains

The rise of China and other emerging Asian economies transformed how the Asian region was connected internally and externally, which underscores the need to highlight the dynamics of regional value chains (RVCs) and not simply GVCs. In the electronics sector, intra-Asian trade grew faster since 2007 than extra-regional trade, and intra-Asian trade linkages are stronger in intermediate goods (electronics parts and components) than final goods. At the country level, China has improved its position significantly in the division of labor within Asia, but the centrality of China is greater in finished goods trade than intermediate goods and is much stronger for specific products like mobile phones (where China is the world's largest exporter) than for critical inputs like semiconductors (Chapter 9). In looking at how China could accelerate the combination of digital technology and traditional industries, various policy options have been identified that prioritize digital platforms as a strategic sector and target human resources and key domestic institutions to strengthen the development of digital industrial value chains (Chapter 10).

5.3.1 *Chapter 9: China's Shifting Roles in Asian Electronics Trade Networks: Implications for Regional Value Chains (Joonkoo Lee)*

This chapter examines the changing dynamics of Asian production networks and China's shifting position therein over the last decade focusing on the electronics sector, which has been a centerpiece of East

Asia's industrial growth. The chapter analyzes inter-regional and intra-Asian trade networks, using international trade data from 2007 to 2018. The analysis confirms the region's rising importance in GVCs and highlights a shift in the division of labor between China and other Asian countries across different products. Overall, the nexus of FDI, international trade, and fragmented production has generated and strengthened inter- and intra-regional connections and interaction in the Asian electronics industry. Although East Asia is the world factory of electronics goods, the factory is run through a regional division of labor trading parts and components among regional neighbors. This trade pattern has been strengthened in the aftermath of the global economic crisis of 2007–2008.

5.3.2 Chapter 10: The Reconfiguration of GVCs in the Digital Economy: Recent Trends and China's New Agenda (Ying Qiu)

The chapter examines how the reconfiguration of digital GVCs could impact China's role as the factory of the world. Drawing on input-output tables and data on value-added trade as well as direct insights from firms, the author argues that the digital economy threatens China's role as a manufacturer by encouraging the regionalization of production, while at the same time creating new opportunities to foster upgrading into high-technology sectors. These opportunities include China leveraging its current role as a digital leader of Asian value chains as well as fostering its digital capabilities and platforms to become a global services provider. The chapter presents a series of policy recommendations to support China's potential upgrading path along these lines.

6 Conclusion

China's role in GVCs has changed fundamentally. It is no longer aiming to compete solely as an export platform or outsourcing destination for low-priced and low-tech consumer goods. Instead, China now seeks to become a leader in high-technology sectors linked to advanced manufacturing, cloud computing, artificial intelligence, electric vehicles, and new e-commerce and internet-related production networks, while lessening its dependence on the U.S. and other traditional export markets by focusing on its domestic market and emerging regional markets. China's size, ambitious national goals, and growing technological capabilities have permitted it to enter new and innovation-oriented industries in the global economy very rapidly and in dramatic fashion while continuing to leverage its production dominance in traditional industries to move to higher-value upstream (R&D, design) and downstream (own brands) activities in GVCs.

What China has achieved, and aspires to, is now clear. Less well understood is how China has managed this dramatic transformation. This volume seeks to answer that question by introducing the distinction between two types of drivers of China's development trajectory: upgrading from above and upgrading from below. The upgrading from above category includes the relatively familiar set of programs introduced by China's central government through its major reforms and Five-Year Plans that chart strategic shifts and new goals for the economy as a whole. However, this top-down view of China's development strategies is only part of the story. Perhaps equally significant but less appreciated are the diverse set of local policies and firm-level activities that are required to implement and institutionalize these national programs and policy directives. Collectively these actors and actions are what we refer to as ungrading from below. In illustrating how upgrading from below works in different industries and places, the chapters of this book reveal the forces that simultaneously create dynamism and uneven development in China. More generally, the competition among local governments to implement China's national plans and the interplay between foreign investors and domestic Chinese suppliers in the process of building new industries and local industrial capabilities show that China's economy is not simply the product of a master plan issued by the central government. The keys to its success are the intense competitive forces that play out at the provincial, regional, and municipal levels in China.

The Chinese model revealed in this book has important implications for other countries as well. As China moves up to higher-value activities and new industries in the global economy, this creates opportunities for developing economies to enter lower-value sectors and activities in the export-oriented GVCs that China is de-emphasizing. An important corollary is that being economically competitive is no longer sufficient for GVC success. Greater attention needs to be given to social and environmental upgrading objectives as a complement to economic upgrading.

Finally, the supply-chain vulnerabilities revealed by the COVID-19 global pandemic have not disappeared. Indeed, the search for options to create more resilient supply chains will only intensify. For many countries including the United States, there is a great pressure to make supply chains more domestic through reshoring production or building national stockpiles of essential products. Other options include making supply chains shorter (e.g., through nearshoring or strengthening regional value chains) as well as making supply chains more diversified (e.g., by reducing dependence on dominant foreign suppliers such as China, or by seeking strategic partnerships with trusted suppliers in different regions of the world). Given the many advantages of international production, sourcing, and innovation networks, we are unlikely to see a full-scale retreat from globalization. But various forms of re-globalization or reorganizing GVCs are likely, and China's evolving role in the global economy will continue to shape the decisions of policymakers and businesses around the world.

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