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GLOBAL VALUE CHAINS AND INDUSTRIAL DEVELOPMENT

Lessons from China, South-East and South Asia

INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

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FOREWORD

The reorganization of production processes into vertically specialized stages that are carried out by companies in different countries has become a defining feature of the global economy. Increasingly, international production, trade and investment are inextricably being tied to global value chains (GVCs). GVCs have made industrialization easier in some ways, and more challenging in others. Countries can industrialize by producing intermediate goods or by performing specific activities during a particular stage of production, instead of having to possess all necessary industries to produce and export end products. However, the technology requirements for entering into GVCs are more demanding than ever. At the same time, concerns abound regarding the depth of industrialization in the long run if countries remain trapped in lower value-added activities along the GVCs. The rise of GVCs has enormous implications for UNIDO's work in terms of supporting inclusive and sustainable industrial development (ISID) in developing countries.

UNIDO has always taken a holistic approach to GVCs and development, emphasizing collaboration with different stakeholders, the importance of on-the-ground knowledge, and technical rigour in research and policy advice. Building on past works of UNIDO and its partners, this report moves into new directions by focusing on the evolution of global and regional value chains in Asia, and by providing insights that warrant some fresh thinking on policy.

The report shows that Asia has become an important player in manufacturing alongside North America and Europe. Asia's integration into GVCs over the past two decades is particularly pronounced for backward linkages, reflecting the region's expanding role in assembly stages of production. The development trajectories and outcomes of GVC participation vary significantly at the country and sectoral levels. Micro-level analysis using case studies and firm-level data from China, India and Southeast Asia suggests that GVC participation not only shapes industrial competitiveness. It highlights that the causal relationship also holds true in the reverse and that countries must reach a certain threshold in industrial competitiveness to be able to participate in GVCs. Moreover, diverse policy characteristics across countries and industries may explain the variations in subsequent trajectories and outcomes. Taken together, the insights of this report provide the basis for a two-pronged policy approach. First, to increase industrial competitiveness making GVC participation possible, and secondly, to continue focusing on industrial competitiveness to improve the volume and quality of GVC participation over time.

This report is the result of a joint effort by UNIDO and the University of International Business and Economics (UIBE), China, as part of a long-standing commitment by UNIDO to support ISID through GVCs.

I am certain that the findings in this report will inspire debates and initiate collaborations between our Member States and institutional partners to achieve our common objectives, in particular Goal 9 of the 2030 Agenda for Sustainable Development.

LI Yong
United Nations Industrial Development Organization
Director General

FOREWORD

In a world characterized by resource and endowment heterogeneity, specialization plays a fundamental role in the market economy through the division of labour and capital. Adam Smith used the example of pin-making to underscore specialization's role in the production process. One of the defining features of today's world economy is the globalization of production and trade, creating what we refer to as 'global value chains' (GVCs). That is, that the production process is broken down into several stages which are located across different parts of the world. Many other terms have been used to describe this phenomenon, including fragmentation, fractionalization, dispersion, disintegration, unbundling, outsourcing, etc.

Although there is broad consensus that countries in Northeast Asia, Southeast Asia, and to some extent South Asia, particularly China, are the primary beneficiaries of GVC participation and its contributions to industrial development and economic growth, solid empirical evidence of this is still lacking. More importantly, how GVC participation has benefited these countries, the lessons learned from their experiences at both the macro and micro level, and the policy implications for developing countries remain largely unanswered in the literature.

The University of International Business and Economics' (UIBE) cooperation with the United Nations Industrial Development Organization (UNIDO) in spearheading this study is one small step towards understanding these major developments. UIBE has been involved in GVC studies for quite some time and stands at the forefront of research on the GVC phenomenon in relation to international trade and economic growth. In fact, UIBE established the first research institute worldwide (the Research Institute for Global Value Chains, RIGVC) in 2015, which focuses exclusively on GVC-related research in economics and statistics. RIGVC aims to develop a comprehensive GVC framework to integrate research from multiple disciplines, including management science, economic theory, statistical methods, geography, sociology and other social sciences to provide interdisciplinary policy research, in particular related to international trade negotiations, industrial structural change and upgrading, as well as strategic decision making in enterprises. This report may well be viewed as one of the offshoots of our continuous research efforts in that direction. We are especially grateful for the financial support we have received from MOFCOM, China.

This report presents findings on recent GVC developments by researchers at UNIDO and its partner institutions, including RIGVC, to enhance public awareness of the contributions of GVCs to international production and income distribution, particularly in Asia. It also provides a wealth of information and key policy recommendations. We have, for example, uncovered the factors that drive integration in GVCs and ways towards successful industrial upgrading. We have therefore compiled evidence-based policy recommendations that should be shared with the entire world.

Although we are excited about releasing this report, we are also well aware of the fact that GVCs are undergoing tremendous changes, especially in the context of Corporate China's rapid global expansion and outward FDI movements into many developing countries. World institutions and the global governance system are facing challenges as a result of foreign policy shifts in some of the world's major players. We continue to learn and seek to respond to these seismic changes in the world economic order. I hope the readers will find this report fruitful, and that their countries will thrive economically from the many momentous opportunities the GVC phenomenon generates.

Professor Zhao Zhongxiu, Ph.D
Founding Director, RIGVC at UIBE
Vice President of UIBE

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LIST OF ABBREVIATIONS

3Cs	Computers, Consumer electronics, and Communications and networking
ASEAN	Association of Southeast Asian Nations
CBDR	Common but Differentiated Responsibilities (on climate change)
CIP	UNIDO's Competitive Industrial Performance index
CO_2	Carbon dioxide
CSR	Corporate Social Responsibility
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
EMS	Electronics manufacturing services
EU	European Union
FDI	Foreign direct investment
FTA	Free trade area
GDP	Gross domestic product
Gt	Gigaton, equal to one billion metric tons or 1,000,000,000,000 kilograms.
GVC	Global value chain
ICT	Information and communications technology
I-O table	Input-output table
ISO	International Organization for Standardization
ITA	Information Technology Agreement (WTO)
ITU	International Telecommunication Union
MFA	Multifibre Arrangement
OECD	Organisation for Economic Co-operation and Development
OECD ICIO	OECD Inter-country Input-Output tables
OEM	Original equipment manufacturer
PV	Photovoltaic Cells
RCEP	Regional Comprehensive Economic Partnership
RVC	Regional value chain
TFP	Total factor productivity
TiVA	Trade in value added
TPP	Trans-Pacific Partnership (superseded, without the USA, by the CPTPP)
UAE	United Arab Emirates
UIBE	University of International Business and Economics (Beijing)
VLSI	Very large-scale integration
WIOD	World Input-Output Database
WTO	World Trade Organization

PREFACE

The fragmentation of production along global value chains has been recognized as a significant feature of the twenty-first century global economy with its epicentre in Asia. Research on GVCs is, however, characterized by a lack of consensus over definition and measurement. The increasing availability of integrated input-output data and the development of appropriate indicators to measure GVC participation have allowed researchers to delve more deeply into empirical regularities surrounding integration and upgrading within GVCs. Combining findings from firm-level surveys and case studies, the geography of GVCs in Asia can be mapped and the determinants of successful participation and upgrading in global and regional chains identified. This volume brings together the findings from a series of studies carried out for a joint project of United Nations Industrial Development Organization (UNIDO) and the University of International Business and Economics (UIBE).

Part One takes a macro perspective, in which linked input-output tables are used to map participation of the Asia region in value chains over time. Further analysis at the macro level identifies factors associated with successful integration into GVCs, the impact of GVC participation on economic performance, whether participation in GVCs has led to structural change, and the impact of GVCs on the environment through changes in emissions. In Part Two, firm-level surveys and case studies of individual firms and GVCs from China, India and Viet Nam are analysed to further understand the drivers and consequences of successful integration and upgrading. To deepen our understanding at the firm level, the project focussed on the electronics and apparel industries, which have been at the foundation of Asian GVCs.

The key issues project participants addressed were the determinants of GVC participation and the drivers of successful upgrading within GVCs. Part Three presents the main conclusions on these issues and policy implications drawn therefrom.

The background papers are listed at the end of the report. Although the report also draws on the wider literature on GVCs, we generally do not repeat all references found in the background papers.

EXECUTIVE SUMMARY

A striking feature of the twenty-first century global economy is the fragmentation of the production process along global value chains (GVCs). This is primarily a feature of the manufacturing sector and an important element of international cooperation on industrial capacity. Despite being called "global", the chains are often regional, with three main centres in North America, Europe and East Asia, of which the latter has witnessed the most dramatic GVC development, giving rise to the concept "Factory Asia".

Research on GVCs has been characterized by a lack of consensus over definition and measurement. The December 2015 UNIDO Report on *Global Value Chains and Development* addressed these issues, but also concluded that GVCs are heterogeneous and that a more disaggregated analysis is necessary to arrive at a deeper understanding.

The increasing availability of integrated input-output data and the development of appropriate indicators to measure GVC participation have allowed researchers to delve more deeply into empirical regularities surrounding integration and upgrading within GVCs. Combined with information from firm-level surveys and case studies, it is possible to map the geography of GVCs, and also to identify determinants of both successful participation and upgrading in global and regional value chains. This volume brings together the findings from a series of studies undertaken for a joint project of the United Nations Industrial Development Organization (UNIDO) and the University of International Business and Economics (UIBE), which focussed on participation of Asian economies in internationally fragmented industrial production.

Part One takes a macro perspective using linked input-output tables to map participation in value chains over time for the Asian region. Further analysis at the macro level identifies the factors associated with successful integration into GVCs, the impact of GVC participation on economic performance, whether participation in GVCs has led to structural change, and the impact of GVCs on the environment through changes in emissions. While trade liberalization and reduced transport costs are prerequisites for the fragmentation of production along GVCs, the macro analysis reveals considerable variety across countries and industries with infrastructure and institutions as well as industrial competencies and skills influencing which countries participate in GVCs.

In Part Two, firm-level surveys and case studies of individual firms and GVCs from China, India and Viet Nam are analysed to better understand the drivers and consequences of successful integration and upgrading. To deepen our understanding of the firm level, this project focused on the electronics and apparel industries, which have been at the centre of Asian GVCs. Although some evidence suggests that investment incentives and the creation of special economic zones may encourage GVC participation, the role of foreign investment varies from country to country and decisions to invest depend more strongly on factors such as good infrastructure, cheap but skilled labour and other determinants. A recurring finding is that although GVC participation can improve industrial competitiveness, there is a strong reverse causality; a pre-existing competitive industrial sector may be a prerequisite for GVC participation. The micro data also highlight the heterogeneity of GVCs and of modes of participation in GVCs.

The main policy conclusion to be drawn from our findings on heterogeneity is that GVCs provide increased opportunities for building up manufacturing capacity. At the same time, policymakers cannot assume that participation in GVCs will automatically bring about such structural change. The outcome hinges on the country-specific position within GVCs and within the product quality spectrum. It is essential to establish a policy environment that is favourable to the acquisition of skills and other features associated with successful economic development within or outside GVCs. In sum, GVC participation is a handmaiden of development rather than a shortcut to success, and GVC upgrading occurs in environments favourable to development and not independently of such environments.

It is also important for policymakers to not perceive GVC participation or upgrading within GVCs as targets to be achieved at all cost. A balanced assessment should weigh the advantages and disadvantages. Lead firms may be tempted to draw countries with laxer environmental standards into GVCs as suppliers of pollution-intensive activities. Such outcomes can add to growth and manufacturing employment while leaving host countries further from achieving important Sustainable Development Goals.

What Drives Integration into GVCs?

The GVCs phenomenon has been strongly associated with trade and investment liberalization, and a reduction in the costs of international trade. However, a host of other factors may influence a country's prospects for GVC integration, including infrastructure, the availability of financing, the existence of skilled labour, and more importantly, manufacturing competitiveness. Integration is not automatic, but minimum conditions must be present and might even shape the trajectory of upgrading.

Trade Liberalization Helps. GVCs, by definition, operate across borders and therefore rely on trade as a tool for integrating dispersed activities. Trade liberalization makes the international movement of goods easier, less costly and faster by relaxing tariff and non-tariff barriers to trade. Lower trade barriers through multilateral and bilateral agreements encourage integration into GVCs. As tariff levels have fallen, increased attention is being paid to trade facilitation and behind-the-border obstacles to trade. In an already largely liberalized trade environment, variables such as the competitiveness of local manufacturing and the extent of workers' skills have become increasingly important determinants of which countries integrate into GVCs.

Big Geography Matters. Proximity to an economic hub increases the prospects of integration into a GVC that operates around that hub. Proximity leads to lower transport costs and accelerates delivery, while the existence of common ethnic networks or shared norms and institutions can improve trust and reduce transaction costs. The story of Asia's integration into GVCs, captured by the 'flying geese' model, is one of export-oriented industrial activities flowing from more advanced countries in the region to less economically developed countries in geographic proximity; the Republic of Korea and Taiwan Province of China were integrated into Japanese GVCs, China relied on its connection to Hong Kong SAR China and Singapore

was initially a hub for Malaysia and Indonesia. Value chains are often organized regionally rather than globally. Several studies in the project find that India and Viet Nam increased GVC participation within chains that end in Southeast Asia and China. Regional and bilateral trade and investment agreements can be an important tool to reduce trade-related costs and to hence facilitate GVC integration.

Small Geography Matters, Too. Special industrial zones can attract GVCs by providing a local environment with a more liberalized regime than the rest of the country, and thereby providing benefits associated with clustering. Locating within a zone may improve access to specialized infrastructure, trained labour and other shared resources such as technical institutes or environmental infrastructure and encourage participation in formal and informal knowledge exchanges. China and more recently Viet Nam have, with some success, created special zones to attract foreign firms. However, background studies on Viet Nam find that firms in industrial zones tend to generate fewer backward linkages with domestic firms, suggesting that while zones may be effective in attracting investment, more attention should be paid to increasing domestic firms' participation in zones or improving linkages between zone and non-zone firms.

Investment Incentives Should Not be Overestimated. The emergence and expansion of GVCs has been linked to offshoring of industrial activities by lead-firms in the United States, Japan, Europe and recently from emerging countries like China. To attract such activities, several low-wage countries, predominantly in East and Southeast Asia and in Central America, offer generous investment incentives, including but not restricted to lower income tax, lower or no import duties, and subsidized utilities and land costs in special zones. Despite case study evidence from China and Viet Nam broadly supporting the expectation that investment incentives are positively associated with integration into GVCs, cross-country econometric analyses using macro-level data do not support this hypothesis. This may be because the importance of foreign investors in GVCs varies from country to country (e.g. it is high in Viet Nam and lower in India) or because foreign investment is related not only to the policy package, but also to the supply of cheap but skilled labour, reliable infrastructure and other determinants. More generally, there is no single determinant of GVC participation, but rather a wide array of conditions.

Building Up Manufacturing Competitiveness Comes First. GVC integration may improve industrial competitiveness through technology transfers and other types of learning, but there is also a reverse causality that developing a competitive industry may be a prerequisite for successful GVC integration. The latter mechanism is consistent with GVC theories according to which suppliers' capabilities relative to their cost is a factor that pushes lead firms to outsource or offshore production. Domestic firms' lack of competitiveness can pose a problem for integrating into GVCs. In Viet Nam, domestic firms have low participation rates in GVCs because foreign firms cannot find domestic suppliers to match their quality requirements, and production linkages between foreign firms are much denser than between foreign and domestic firms. That is, while the development of linkages within GVCs can be of relevance for upgrading, some industrial capacities are necessary to establish linkages in the first place.

Integration Requires Investment, Investment Requires Financing. Integration into GVCs requires the establishment of manufacturing facilities, and upgrading implies investments in tangible (capital equipment, technology licenses) and intangible (better educated employees, training, learning-by-doing) assets. Financial development, by easing access to capital, can improve firms' capacity to participate and upgrade in value chains.

What Drives Successful Upgrading?

If successful GVC participation depends on the presence of certain minimum conditions, including the development of manufacturing capacities, successful upgrading is even more contingent on a broad package of support. A strong message from the background studies is that securing GVC integration does not suffice to guarantee upgrading, which depends on the absorptive capacity in firms and in the economy as a whole.

Integration does not automatically lead to upgrading. The development of production linkages between firms in the context of GVCs, can be a significant source of knowledge, leading to successful upgrading. While this is an important feature of GVCs that should be harnessed to facilitate structural transformation, the research carried out for this project indicates that the benefits are not automatic and have varied substantially in Asia. GVC participation has a small positive effect on structural transformation; the benefits are larger when countries participate in the high-quality segment of exports. The benefits from GVC integration can vary strongly, and this is reflected in the different trajectories of countries post-integration; only a handful of countries have made considerable progress over time in expanding domestically produced value added among the countries covered in the project, most notably China.

There is a High Road and a Low Road to Integration. Developing skills and investing in R&D are important drivers of upgrading within GVCs, but outcomes vary depending on the nature of GVC participation. The level of skills is significant when it comes to forward integration, which entails the production of more advanced products that are used in other countries' exports, but it is not significant for backward integration such as in assembly work. A country can expand its overall value added in GVCs by increasing assembly work, which relies on low skills and on a continuous cutting of costs, possibly by not respecting basic labour rights and working conditions and by skirting environmental regulations. Another strategy is to extract more value added from production through improvements in productivity, relying on skill formation and innovation. They represent the 'low road' and the 'high road' to integration, respectively. The high road provides a sustainable pathway to upgrading through continuous investments in developing technological capabilities.

Different Chains Have Different Potential for Growth. The GVCs Asian economies participate in differ significantly in terms of size, organization, degree of internationalization and rate of growth. Moreover, different industries experience technological change differently, which creates various opportunities and challenges for suppliers. In GVCs characterized by fast

technology cycles (e.g. mobile phones), it may be more difficult to upgrade and catch-up than in chains that rely on slower growing technologies (e.g. textiles).[1] In other words, there is substantial variation. In the cases of Viet Nam, China and India, small but growing GVCs and new GVC industries have offered the best opportunities to expand the countries' value added.

GVC Participation Must be Socially and Environmentally Sustainable.

A focus on industrial upgrading at all costs may distract from the aims of inclusive and sustainable industrial development. Integration into GVCs may expand job opportunities in the formal sector, which can be beneficial for social upgrading, e.g. in Viet Nam, foreign subsidiaries have created more formal jobs for unskilled female workers helping to close the gender gap for unskilled workers. Since GVCs involve fragmentation of production across countries, the new configurations of trade and production could impact overall emissions production, as different countries have different environmental standards; some countries and their suppliers of intermediate inputs may have weaker environmental regulations, with implications for emissions-related trade. Given the ramifications for both global climate change and environmental resources, countries should avoid GVC integration through expanding production in polluting activities. However, as illustrated by China, the regulatory situation can change rapidly.

Evidence-based Policies Can Assist GVC Integration and Upgrading.

The GVC phenomenon does not overturn ideas about industrial development, but offers a convenient entry point for industrial development insofar as producers need only to specialize in one task rather than establish capabilities in all aspects of production from raw material requisition to marketing the final product. Desirable development prerequisites of human capital, infrastructure and macroeconomic stability remain important.

Public policy can facilitate GVC entry by a country's producers. Trade is facilitated by introducing low informal and formal trade barriers, by establishing good transport infrastructure to the border or port, and simplifying and minimizing behind-the-border regulations. Favourable locations for GVC participants can be created by building industrial parks with reliable (and preferably eco-friendly) utilities and transport, and depending on the circumstances, by establishing special economic zones that bring exemptions from customs duties, taxes and regulations.

1 Lee (2013) argues that industries characterized by short cycle of technological changes provide greater opportunities to latecomers for technological catch-up. However, further research may be required to see whether this is also the case for firms in developing countries operating within a global value chain.

Instruments to guide investment into GVCs may be useful, but even more so than in a 'non-GVC world', implementation needs to be handled with care. The empirical evidence highlights the heterogeneity of GVC success stories, not only across countries and industries but even among firms within industries. Policymakers can realize the benefits of a stable playing surface (e.g. in terms of providing industrial zones) while recognizing the risks of supporting both efficient and inefficient producers (e.g. through industry-wide subsidies) and being aware of the indirect effects of policies (e.g. local content rules may encourage upgrading within GVCs and positive cross-industry linkages, but could also protect inefficient input suppliers and reduce the competitiveness of input users).

The evidence generally substantiates the impact of GVC participation in generating employment and increasing incomes. In low-income countries, the ensuing growth has often been inclusive, reducing poverty and increasing gender participation and equity in the workplace. Certain pitfalls should be avoided, such as getting trapped in low value added activities along the low road to integration or accepting the role of pollution haven along a GVC. The empirical studies in this report indicate that pitfalls can be avoided and benefits realized by astute policymakers, open-minded managers and entrepreneurs and a responsive workforce.

PART ONE

MACRO PERSPECTIVES

CHAPTER 1

INTRODUCTION

In the period of globalization that followed the first Industrial Revolution, the link between production and consumption was unbundled. Production of modern manufactured goods became concentrated in integrated factories in high-income countries and the goods were traded worldwide. In the final decades of the twentieth century, a new aspect of globalization, namely the fragmentation of production across national borders, emerged as the production process itself was unbundled (Baldwin, 2017).

Initial signs of coordinated cross-border production included the 1965 US-Canada Autopact in North America, the establishment in 1973-6 by Ford Motors of a factory in Spain to assemble the Ford Fiesta using components from across Europe, and the decision by Fairchild (later National Semiconductor) to move the assembly stage of semiconductor production to Singapore in 1968. Transnational firms and international buying houses also exploited differences in wages and other costs to source supplies from the new industrializing economies of East Asia for department stores and other retailers in high-income countries. In the 1980s and 1990s producers in Hong Kong SAR China and Singapore faced rising wages and rents and began moving parts of their production process to lower wage locations across borders in the Pearl River Delta or the Sijori (Singapore-Johor-Riau) triangle. As the yen rapidly appreciated after 1985, Japanese carmakers countered declining competitiveness by shifting assembly operations offshore, initially to Thailand.

Awareness of the ubiquity of production fragmentation had emerged by the 1990s. In North America, it was institutionalized within the framework of the North American Free Trade Area. In Europe, the process was accelerated by the fall of the Berlin Wall and EU accession of Eastern European countries with very different cost structures to Western European EU members. The process in Asia was bottom-up, reinforced by trade agreements after the turn of the century. This process accelerated most rapidly in Asia.

1.1 How Important are Global Value Chains?

The unbundling or fragmentation of production had many names, and some consensus around the term ‘global value chains’ (GVCs) was only reached around 2000. In such chains, production is coordinated across borders in a way that entails more than simply importing raw materials for use in the production process, although it is difficult to agree on what degree of organizational complexity is necessary to qualify as a GVC. A considerable variety of forms

of GVC have been described (see, for instance, Baldwin and Venables, 2013) while others speak of global production networks rather than "chains". It also became apparent that many GVCs were regional rather than global. This factor along with difficulties in defining GVCs has resulted in a variety of approaches to the measurement of GVCs and hence to determining their significance.

Early approaches to the analysis of GVCs were based on in-depth examinations of specific products, such as the Barbie doll (Tempest, 1996), Apple's iPod (Linden et al., 2009), HP and Lenovo's notebook PCs (Dedrick et al., 2010) and Nokia's N95 Smartphone (Ali-Yrkkö et al., 2011). Building on private consulting firms' teardown reports, these case studies sought to determine where value is added in the production of a specific good within complex cross-border business networks. Though insightful, such case studies are typically very demanding and their results difficult to generalize. Moreover, they tend to only look at one level upstream from final assembly, hence disregarding important information on the purchase of components that might be taking place in a third country, e.g. the Thai hard drive in a computer assembled in China may itself have been constructed along a GVC.

In parallel to product-level studies, a second strand of contributions analysed GVC integration by focusing on trade data and examining gross exports and imports of intermediate goods. These contributions document an increase in trade in intermediates or intra-sectoral trade, providing further evidence on the growing role GVCs have played since the 1980s.[2] One important limitation of these contributions is that by looking at gross trade, they are unable to distinguish between the flow of intermediate goods and the location of value added. Since it is generally not known how imported inputs are used in specific products or how they are combined with domestic inputs and value added, it is not possible to assess in what countries value has been added.

Gross trade data not only include traded inputs, but may also result in extensive double-counting as inputs cross borders several times at different stages of production. To deal with the limitations associated with gross trade data, researchers began analysing GVC participation using input-output tables. On the input side, these tables record the industries and countries from which inputs are sourced to produce output in a given industry and country. On the output side, they record the destination of these goods. By combining this information and applying the Leontief input-output model, final goods shipments can be used to trace back different countries' and industries' value added in the production of every good (Johnson, 2014).

Johnson and Noguera (2012b) linked input-output tables from 42 economies, accounting for over 90 per cent of global GDP and 80 per cent to 90 per cent of global trade. For Asia, their preferred measure VAX (the share of domestic value added in gross trade flows) declined in 1975-85, flattened in 1985-95 and declined significantly in 1995-2005. This is consistent with a narrative of GVCs emerging in the early 1980s and becoming increasingly important after 1995. The reduction in VAX in Asia after 1995 was larger than in any other region, supporting the hypothesis that Asia led the way in GVCs, a hypothesis popularized through the concept of "Factory Asia".

2 The approach was pioneered by Yeats (2001) and Ng and Yeats (2005), and has been applied by Athukorala (2005), Brülhart (2009) and Sturgeon and Memedovic (2010).

1.2 Challenges of Macro Analysis

While the principles are straightforward, the construction and application of multi-region input-output (I-O) tables is difficult. As two of the leading practitioners (Escaith and Timmer, 2012) caution: "Any 'measurement' of trade in value-added should be treated as an 'estimate', rather than a 'measurement', as most flows are not directly observable." Indeed, it is worth bearing in mind that all entries in national accounts or trade statistics are estimates, as anyone who has worked with mirror trade statistics knows.[3] Due to the difficulties of combining national I-O tables with different definitions of industries, Johnson and Noguera (2012b) used I-O tables involving only four industries. The exercise was pioneering, and highlights the misleading picture provided by data on gross exports, but at a level of aggregation that overlooks much of GVC activity.[4] The Institute of Developing Economies in Tokyo developed I-O tables linking ten Asian economies at five-year intervals since 1975. The results were useful, but the small number of countries limited their generality.

Maintaining a large internationally consistent I-O database is challenging. The global datasets currently preferred are the World Input Output Database (WIOD) and the OECD's Inter-Country Input-Output tables that underpin the OECD-WTO trade in value added (TiVA) database, both of which are designed to analyse trade flows.

The TiVA data highlight the growing significance of GVCs since 1995 (the first year of the dataset) and the increasing importance of services as inputs into traded goods, a process referred to as servicification. At a minimum, services are necessary to coordinate the links in a GVC, but improvements in logistics, information technology and other business and financial services have played an important role in increasing the attractiveness of production along GVCs. A drawback of the TiVA data is that although it is global, the focus is on OECD members and only includes 18 manufacturing industries.

The WIOD project, initiated in 2009 and completed in 2012 by 11 universities and research centres, linked a set of harmonised national supply and use tables with bilateral trade data in goods and services. Value added is directly traced from where it is generated along the GVCs, in contrast to earlier approaches that deducted the domestic value-added component from exports by tracking direct and indirect imports of intermediate goods and services (Timmer et al., 2013). The WIOD project was path-breaking in that it also included environmental and socioeconomic indicators such as industry-level data on capital stock, investment, wages and employment by skill type. An early and influential example of using labour market data was to illustrate that although global demand for German vehicles nearly doubled between 1995 and 2008, associated employment in Germany only increased by about one-fifth, and the increase was concentrated at medium and high-skill levels, while five-sixths of the additional 1.5 million jobs were created elsewhere, mainly in Eastern Europe (Figure 1.1). Thus, just as GVC income breaks down the gross value of a product into the value added by all factors in all

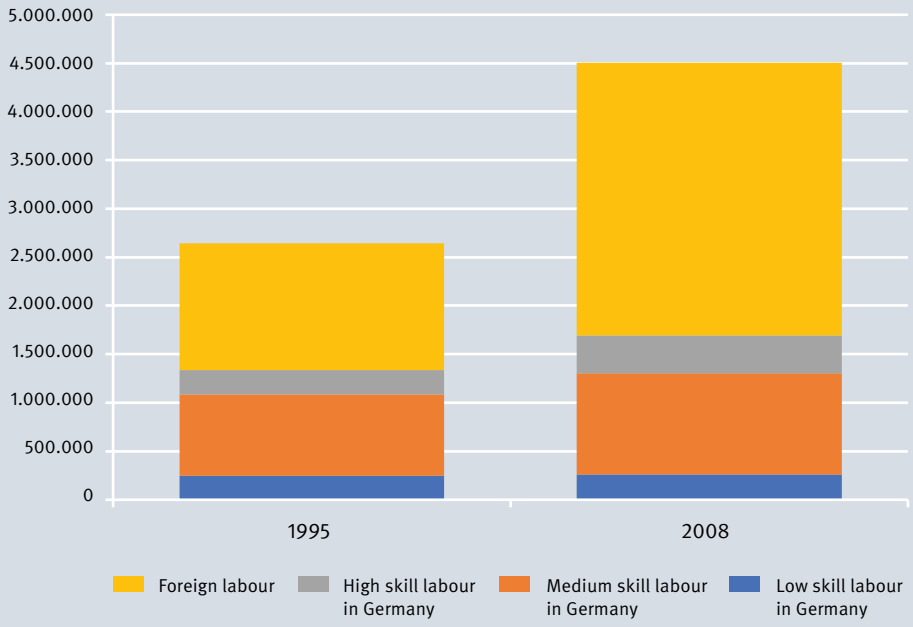
3 Bilateral trade flows, when reported using the same indicators (e.g. free on board) should be the same for the importer and the exporter, but the reported figures never are. Globally, reported total imports and exports are not balanced, as they should be by definition.

4 Johnson and Noguera (2012a) drew on the I-O tables of the GTAP database, which covers 129 economies and 57 industries, but is poorly suited for GVC analysis because the tables were devised as an adjunct to CGE modeling rather than for use with trade data.

countries involved in the production process, the WIOD socioeconomic indicators can be used to measure GVC-related jobs in all countries involved in the production process.[5]

A limitation of the WIOD is the restricted number of economies covered (40) of which only six belong to the region we are interested in here. The OECD Inter-Country Input-Output tables provide larger coverage (61 economies), including 13 economies from South and East Asia[6]. Hence, the OECD ICIO is the primary source used in the present study.[7]

Figure 1.1
German Transport Equipment: Direct and indirect jobs, 1995 and 2008



Source: UNIDO elaboration based on Timmer, Stehrer and de Vries (2013).

5 Miroudot (2016) conducted a similar analysis of the impact of GVCs on jobs using the OECD's TiVA data.

6 Brunei Darussalam, Cambodia, China, Hong Kong SAR China, India, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan Province of China, Thailand and Viet Nam

7 This source has been complemented by the Asian Development Bank database (an extension of WIOD to include more Asian economies) which was used in Zhao et al. (2018) background paper.

1.3 Macro Indicators for GVC Analysis

Since the seminal paper of Hummels, Ishii and Yi (2001), macro analysis has addressed GVCs in terms of vertical integration of production processes. Based on more detailed input-output tables, the background papers of the present study decompose GVC trade into backward linkages (foreign value added exported by domestic producers) and forward linkages (domestic value added embodied in other countries' exports). A recent trend is to view these linkages as production components rather than trade concepts, with the objective of correctly allocating value added in GVCs to the economy where that value was added. Following the lead of Koopman, Wan and Wei (2014), the background papers carefully consider the imported or exported value added only, to avoid double-counting.

The specific measures of backward and forward linkages in the background papers vary. Kummritz and Lanz (2018), for example, uses narrow measures of foreign value added in a country's exports (backward linkages) and of a country's value-added contribution (through the export of intermediates) to other countries' exports. In addition to similar narrow measures of backward and forward linkages, Stöllinger (2018) uses a broader measure of GVC participation, which in the forward perspective includes inputs into foreign production for domestic consumption (and not only for the foreign country's exports), and includes imports of intermediates in the backward perspective used in production for the domestic market as well as for exports.

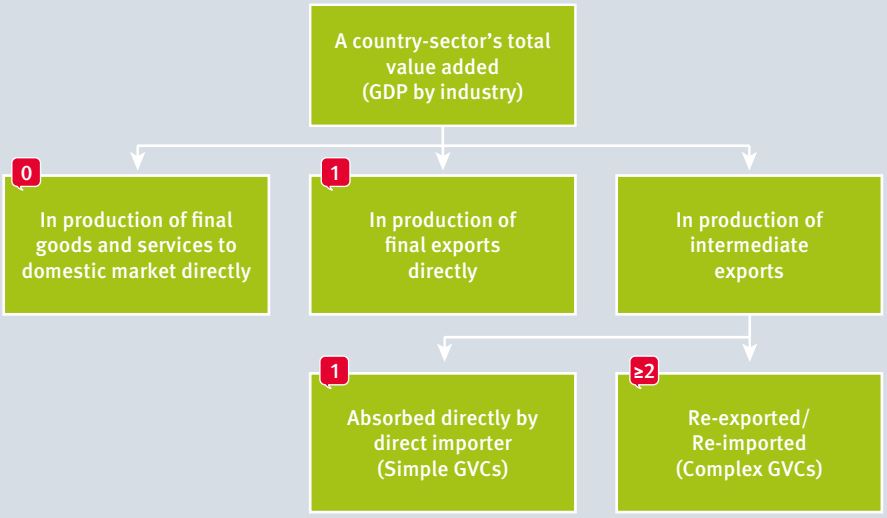
Taborda and Lavopa (2018) focuses on countries' participation in individual GVCs rather than in GVCs *in toto*. Thus, a country's contribution to GVCs is measured by exports allocated to specific GVCs. It is a forward measure using a backward perspective from the product at the end of the GVC.

Zhao et al. (2018) uses GVC participation indexes that have been formalized in two papers by Wang et al. (2017 a and b) (see Figure 1.2). Their GVC forward participation index (V_GVC) reflects the share of a country's GDP generated in activities that are part of GVCs, while the GVC backward participation index (Y_GVC) reflects the share of final good production that has been sourced from GVC activities. According to the authors, these indexes include all forms of cross-border production-sharing activities.[8] Zhao et al. background paper further distinguishes between simple GVC activities that only cross one border and complex GVC activities that involve more than one border crossing. For both forward and backward linkages, a country-sector's value added is decomposed into four categories: pure domestic production, production for traditional trade, simple GVCs and complex GVCs.

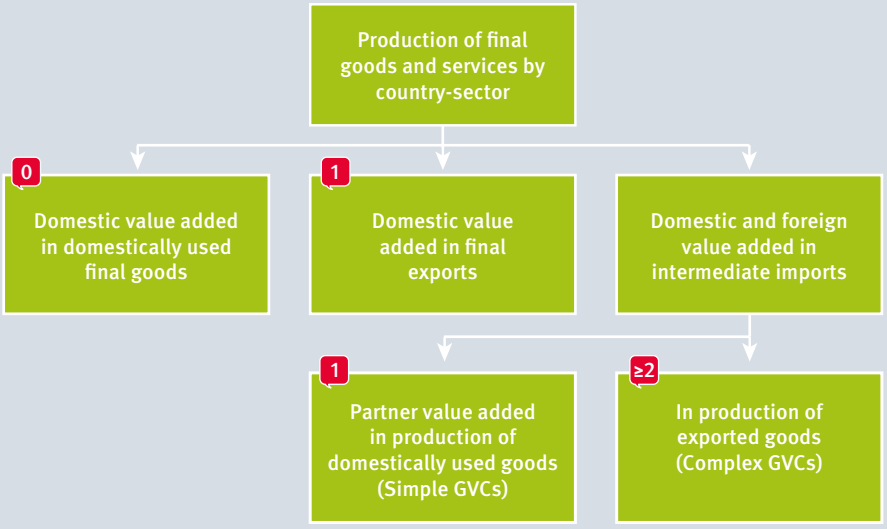
8 The authors also caution against using gross exports as the denominator, in which case the forward linkage ratio might be extremely high for industries with few direct exports but large indirect exports, particularly service industries whose direct exports are small and whose value-added is embodied in other industries' exports.

Figure 1.2
Which GDP Activities Belong to GVCs?

a. Forward Linkage-based Decomposition: Producer Perspective



b. Backward Linkage-based Decomposition: User Perspective

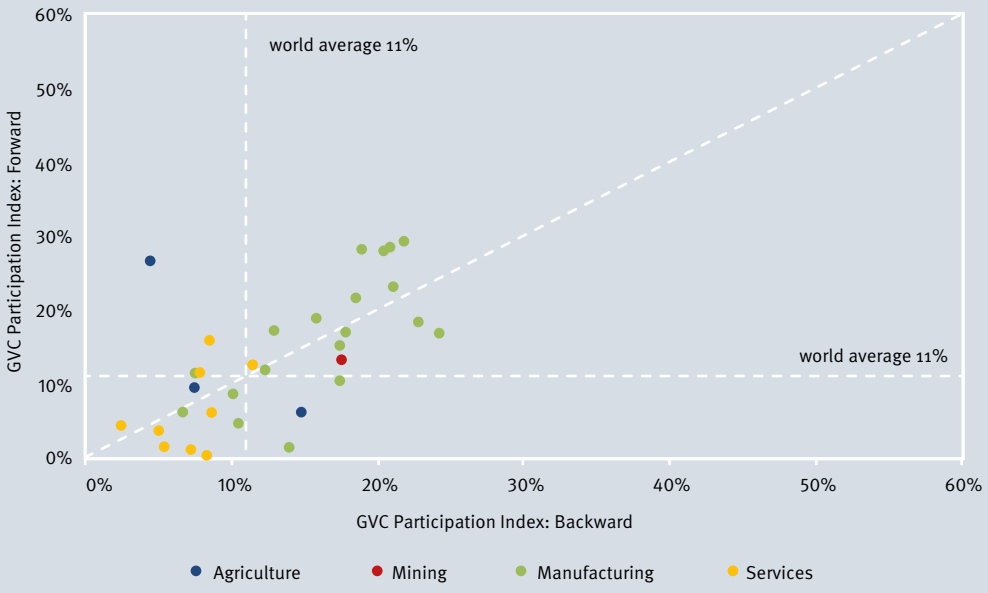


Source: Zhao et al. (2018) background paper, based on Wang et al. (2017a).
Note: The numbers on top of each box indicate how many times the corresponding flow of value added crosses the national borders.

1.4 Descriptive Statistics on Value Chain Integration[9]

All macro datasets that disaggregate by industry clearly demonstrate that the leading GVC industries are found in manufacturing (Figure 1.3). As compared to other sectors, manufacturing industries tend to show higher levels of GVC participation (see green dots in the figure). This confirms all other approaches that point to a handful of manufacturing industries playing the lead role in GVC integration and which remain at the forefront of the phenomenon. The exact ranking by industry depends on definitions and level of aggregation applied, but invariably includes cars, electronics and apparel as GVC leaders.

Figure 1.3
GVC Participation Indexes by Industry in 2015



Source: Zhao et al. (2018) background paper, based on ADB Multi-regional Input-Output database and UIBE GVC Index System.

The OECD Inter-Country Input-Output tables highlight that growth within GVCs has outperformed other trade growth since 1995. Manufacturing exports within GVCs increased at an annual growth rate of 8.5 per cent reaching US$ 3,416 billion in 2011. In 2011, more than one-third of world manufacturing exports took place within GVCs compared to 28 per cent in 1995.

Asia is the region with the highest degree of GVC integration, and this is more pronounced for backward linkages, reflecting Asia's dominant position at the assembly stages of value

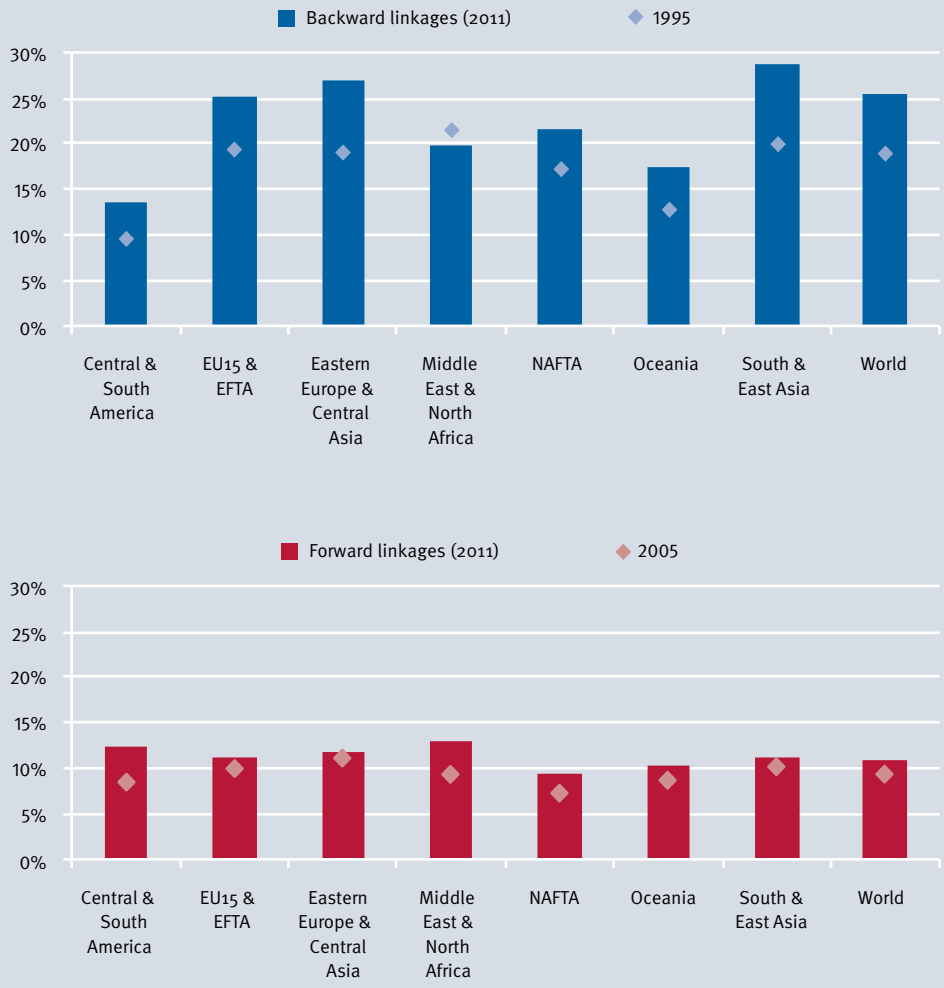
9 Based on Kummritz and Lanz (2018), Taborda and Lavopa (2018) and Söllinger (2018) background papers, which use the OECD ICIO for the period 1995-2011, and Zhao et al. (2018) background paper that uses Multi-regional Input-Output tables developed by the Asian Development Bank covering 35 industries in 45 economies over the period 2000-2015.

chains. The top panel of Figure 1.4 illustrates that backward linkages in 2011 accounted for 29 per cent of manufactured exports from South and East Asia, higher than for any other region, and that the region also registered the greatest increase in backward linkages since 1995. For the majority of Asian economies, backward linkages accounted for more than 30 per cent of manufactured exports, compared to the world average of 25 per cent. Backward linkage shares in 2011 were highest for Cambodia, with more than 50 per cent manufacturing exports. The high backward linkages and low forward linkages of Cambodia and Viet Nam reflect their position in the assembly stages of GVCs which involves relatively less domestic value addition. While backward linkages in GVCs have increased for the region as a whole since 1995, they declined for several economies; notably, China's backward linkages decreased from over 40 per cent of manufactured exports in 1995 to 32 per cent in 2011. Taking into account that during the same period China's forward linkages increased from 6 to 8%, this could be taken as evidence of China's upgrading in GVCs from simple assembly of final products to more complex domestic value addition.

The bottom panel of Figure 1.4 shows that the backward linkages in manufacturing are higher than the forward linkages. The domestic manufacturing value added of Asian economies in other countries' exports in 2011 represented around 11 per cent of Asian manufactured exports, which was similar to the world share. In contrast to backward linkages, the relative importance of forward linkages has increased only slightly in the twenty-first century. In the Asia region, forward linkages are highest for the Philippines and Japan, accounting for about 19 per cent of their manufactured exports, and generally tend to be higher for more developed economies (including Japan, Taiwan Province of China , the Republic of Korea and Singapore), which supply inputs for assembly elsewhere. For countries such as Indonesia and Brunei Darussalam, relatively strong forward linkages are linked to natural resource exports as is the case in the Middle East (Figure 1.4).

Kummritz and Lanz further decompose GVC participation into intra-regional and extra-regional linkages. Regional value chains are strongest in the European single market and in South, Southeast and East Asia. In 2011, intra-regional backward linkages accounted for nearly 12 per cent of Asian manufactured exports, while extra-regional backward linkages represented close to 17 per cent. Asia also has relatively more intra-regional forward linkages compared with other regions. However, extra-regional linkages dominate forward linkages in all regions. An implication is that although regional value chains dominate extra-regional GVC links, a non-trivial share of intermediate inputs into Asian assembly operations and of Asian exports of intermediate goods to GVCs cross regional boundaries. The question whether and why GVCs are regional rather than global will be addressed in Chapter 2.

Figure 1.4
Backward and Forward Linkages by Region, 2011

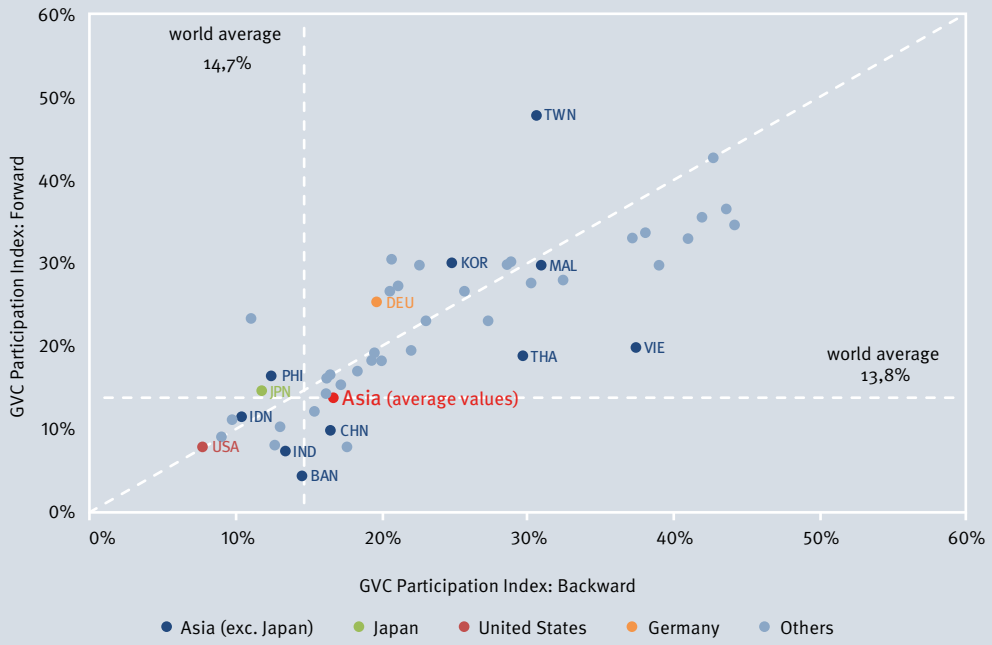


Source: Kummritz and Lanz (2018) background paper, based on the OECD ICIO tables.

GVC participation, measured as a share of manufactured exports, is especially important for smaller countries. In his background paper, Stöllinger uses a composite measure of the two linkage effects and finds that of the 61 economies in the OECD database, seven Asian economies rank among the top 20 economies by importance of GVC participation for their manufactured exports; the Asian economies are Cambodia, Singapore, Republic of Korea, Taiwan Province of China, Malaysia, Thailand and Viet Nam. Using a different input-output database, Zhao et al.

(2018) background paper presents a similar picture of high GVC participation rates in Taiwan Province of China (TWN), Republic of Korea (KOR), Malaysia (MAL), Thailand (THA) and Viet Nam (VIE) in 2015 (Figure 1.5). Note that although the percentages are lower for the larger Asian economies, the absolute values of GVC activity in China (CHN) or India (IND) are higher.

Figure 1.5
GVC Participation Indexes in Manufacturing Industries, by Economy (2015)

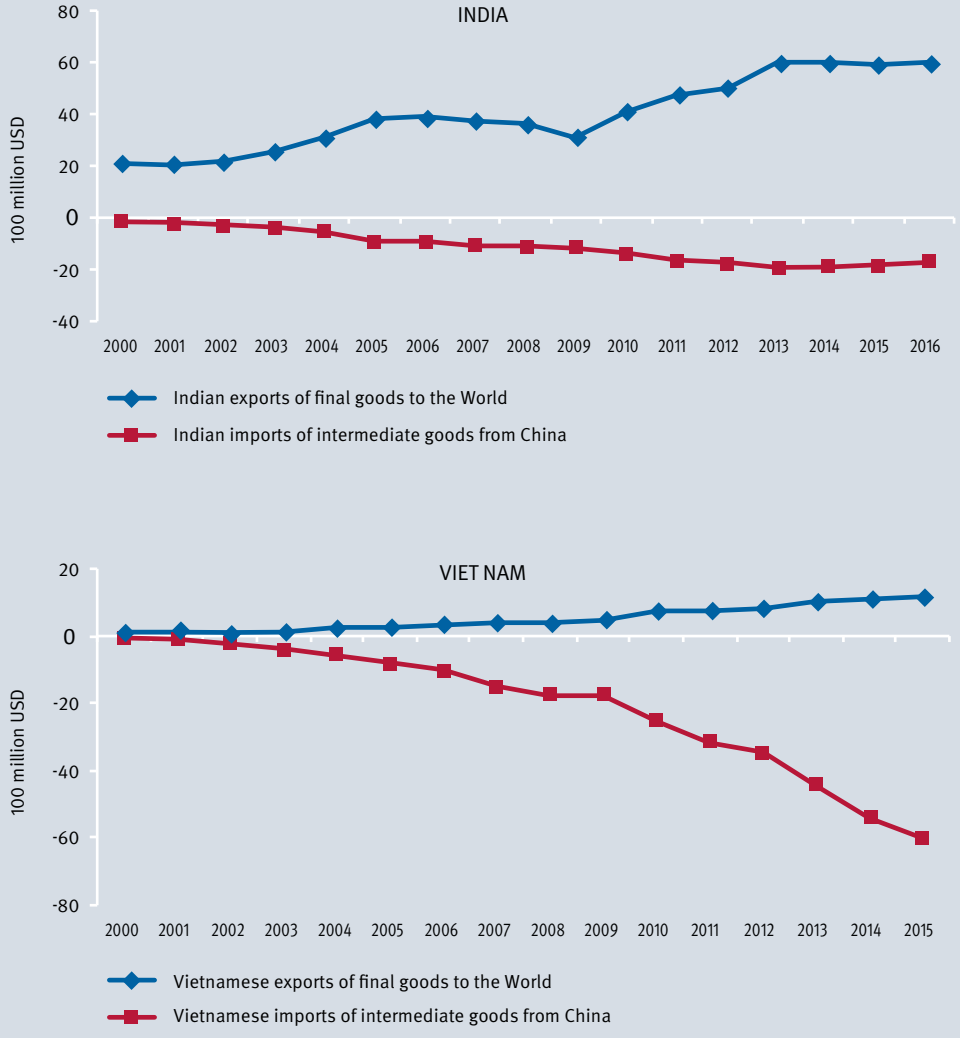


Source: Zhao et al. (2018) background paper, based on ADB Multi-regional Input-Output database and UIBE GVC Index System.

Variations across countries stand out, even at the macro level. For Viet Nam, the share of simple GVCs involving a single border crossing is higher than for India or China, but that share is lower for Viet Nam than for the other two countries for backward linkages. This means that Viet Nam uses more intermediate imports in export production, but its GVC exports tend to be for final consumption, i.e. Viet Nam is more like an assembly centre. By contrast, China has undergone a substantial shift away from assembly to more complex GVC activities, especially since 2008-9.[10] The shift is most evident in GVC trade in the electronics industry involving China, India and Viet Nam; exports from India and Viet Nam took off after 2008/9 at the time imports of intermediates from China increased (Figure 1.6).

10 Some authors attribute this to an adjustment to the greater volatility of international markets illustrated by the global crisis, but it could reflect the dynamics of China's rapid economic development.

Figure 1.6
Intermediate imports and final good exports in the Computer, Electronic and Optical value chain; India and Viet Nam, 2000-15



Source: Zhao et al. (2018) background paper, based on the OECD Bilateral Trade Database by Industry and End-use (BTDIxE), ISIC Rev.4.

1.5 Inside Factory Asia

Taborda and Lavopa present the big picture of production fragmentation at industry level (34 industries) in South, South-East and East Asia. Their results mostly confirm the general trends found in the literature. During the 1995-2011 period, Japan lost its lead role in the creation of value added in Asia's manufacturing sector. China developed into a major source of value added, and the role of China, the Republic of Korea and Taiwan Province of China as suppliers of intermediate inputs in medium high-technology-intensive industries increased. Although the specialization of Viet Nam and India in low technology-intensive industries increased, they recorded higher growth rates in medium technology-intensive industries.

A more in-depth analysis of performance in individual value chains by Taborda and Lavopa identified China, India and Viet Nam as successful cases of GVC integration in the region. The three countries accumulated gains in most of the key manufacturing value chains and registered high growth rates in nearly all of them. Regional value chains presented a safe bet for India and Viet Nam to increase participation in low-tech industries, and in medium- to high-tech industries for China. Global value chains opened up growth opportunities for China and Viet Nam in medium high-tech industries, while India joined expanding GVCs in medium-tech activities.

An analysis of country performance at the level of individual chains revealed major differences in the GVC portfolios of Asian economies. In China, India and Viet Nam small but growing value chains offered the most valuable opportunities for countries to increase their participation in GVCs. Taborda and Lavopa's results suggest that initial participation and later expansion within global and regional value chains are mediated by two important factors: the capacity to create value in specific industries and the existence of relationships with other countries involved in the value chain.

Value chains in which individual countries were able to successfully integrate seem to be grouped around particular production partners either upstream (contributing most of the value) or downstream (a specific location of completion). China, for example, achieved larger and faster improvements in GVCs, either completed or with a high share of value added in the United States, Japan and Germany. India, on the other hand, had a better performance in Asian regional value chains and chains completed in emerging economies. Finally, Viet Nam expanded its participation faster in Chinese value chains and in other chains in which China also expanded at high speed.

At least four different factors could explain the clustering of value chains. The first relates to the choice of production partners or offshoring locations; firms choose export locations by exploiting their existing network of contacts (Chaney, 2014). The second factor refers to the influence vertical linkages have on the choice of input sources; both at the industry and firm level, producers are more likely to source intermediate inputs from places that are already being used by their suppliers (Carvalho and Voigtländer, 2015). A third factor relates to the specificity of inputs; inputs that are not relationship-specific are more likely to be sourced from a larger range of regions (Furusawa et al., 2015), and less generic inputs tend to be either

sourced domestically or in geographical proximity. The last factor relates to the existence of specific consumer markets; the location where their final products are consumed might bring diverse value chains together.

1.6 Use of Macro Analysis

The next two chapters illustrate how input-output analyses can shed light on key features of GVCs in Asia. These features are the determinants of integration into GVCs, whether and why GVCs are regional rather than global, the impact of GVC participation on sectoral structural change (e.g. does GVC participation promote manufacturing activity?), and the environmental implications of GVCs (specifically, the impact on greenhouse gas emissions and climate change). These chapters highlight the heterogeneity of sectoral and firm behaviour, paving the way for the analysis in Parts Two and Three.

CHAPTER 2

DETERMINANTS OF GVC PARTICIPATION

The rapid expansion in the number and quality of international input-output databases is increasing our understanding not just of the characteristics of GVCs, but also of their diversity. GVC participation varies greatly by country and industry, and there is no single explanation for participation. Initial recognition of the GVC phenomenon, often referred to in the late twentieth century as 'subcontracting' or 'offshoring', emphasized reduction in trade barriers and transport costs as facilitating specialization on the basis of comparative advantage within the production process, rather than trading products such as wine for textiles as in classical trade theory. More recent literature has also identified country-specific determinants of GVC participation such as infrastructure and institutions or skills and technical capabilities.

It is useful to distinguish between backward and forward linkages in GVCs, as in Figure 1.2 above. Using the OECD TiVA database, Kowalski et al. (2015) found that countries with a high share of imports covered by trade agreements and open to FDI are characterized by stronger backward linkages, while no significant relationship is observed for forward linkages. Countries with a large domestic market, and which are remote from manufacturing hubs, tend to have fewer backward linkages, while large countries are associated with stronger forward linkages. Kowalski et al. (2015) also found that a gravity model for value added trade highlighted the importance of logistics performance, intellectual property protection, the quality of infrastructure and the quality of institutions for developing countries' integration into GVCs. More generally, the domestic production structure, including a country's productive and technological capabilities, is a significant determinant of GVC participation.

Given the importance of time, factors such as quality of transport infrastructure, logistics services and trade facilitation are determinants of both GVC formation and the geographic footprint of an individual GVC. Lanz and Piermartini (2016) find that countries with better transport infrastructure and trade facilitation tend to specialize in both time-sensitive and supply chain-intensive industries. This is consistent with the findings of Hummels and Schaur (2013) who show that the industries which are most sensitive to time as a trade cost are those in which GVCs are a prominent feature.

The two-way relationship between GVCs and a country's innovation system is emphasized by Pietrobelli and Rabellotti (2011). On the one hand, integration into GVCs can lead to

increased learning and upgrading through pressure to achieve international standards or learn from the value chain leader. On the other hand, a sound innovation system can help reduce the complexity of transactions and enable transactions based on relational forms of GVC governance. The productive and technological capabilities of countries also determine their position in value chains; countries with lower probabilities of making mistakes at all stages specialize in later stages of sequential production chains (Costinot et al., 2013).

The level of a country's financial development and firms' access to finance are important determinants of trade and export specialization. Countries with stronger financial development, e.g. better access to credit, export more in financially vulnerable industries (Manova, 2013). Financial frictions also affect the location decision of multinational enterprises, with financially more developed countries attracting more multinational activity for vertical integration and export-platform motives (Bilir et al., 2016). Using Chinese customs and firm-level data, Manova and Yu (2016) find that credit constraints restrict firms to low value-added stages in GVCs such as pure assembly; more complex links in a GVC involve higher upfront costs and require more working capital.

Despite the common use of the term GVC, international production-sharing predominantly takes the form of regional value chains rather than global value chains.[11] Baldwin and Lopez-Gonzalez (2015) argue that value chain trade mainly takes place within three blocks that could be called Factory North America, Factory Europe and Factory Asia, where four production hubs (the United States, Germany, China and Japan) account for about 60 per cent of world GDP. Southeast Asian economies source over 40 per cent of their foreign value added in exports from Asian partners, and Lopez Gonzalez (2016) characterizes them as factory economies that specialize in manufacturing activities and have strong backward linkages with regional hubs or to headquarter economies such as China and Japan.[12]

Many of the macro results from the present project are, reassuringly, consistent with the literature on the determinants of aggregate GVC integration. Trade liberalization and trade facilitation, hard and soft infrastructure, behind-the-border ease of doing business and so forth all have a predictably positive impact. Large countries in terms of GDP tend to have lower backward linkages, and economies that are distant from the three main GVC hubs (Germany, Japan and the United States) tend to have significantly lower intra-regional forward linkages. The results of this project highlight the heterogeneity of determinants of GVC participation, whether across countries or between backward and forward linkages, or large and small countries, or intra-regional and extra-regional connections. A general observation is that the estimated models have more explanatory power for intra-regional linkages as compared to extra-regional linkages.

11 Johnson and Noguera (2012) show that the ratio of value added trade to gross trade, i.e. the "VAX ratio", is lower for trade inside regions than outside regions, indicating that intra-regional trade is more fragmented. In East Asia in 2005, the VAX ratio for intra-regional trade was 0.61 compared to 0.79 for extra-regional trade. Furthermore, they provide evidence that the fragmentation of production increased faster over time for proximate countries.

12 Services trade is less regionalized, which might be because the international fragmentation of services has thus far been less pronounced than in the case of goods (Lanz and Maurer, 2015).

2.1 Trade-related Determinants of GVC Participation[13]

The reduction of trade barriers and low costs of international trade are necessary conditions for the emergence of GVCs and for national participation in GVCs. Transport costs may also encourage reliance on neighbours for collaboration in GVCs. The macro studies of this project indicated that tariffs have a significantly negative effect on forward linkages, in particular for intra-regional linkages, although the effect of tariffs does not significantly differ from zero for backward linkages.

As expected, economies with a higher share of trade that is covered by trade agreements are more integrated into regional value chains through both backward and forward linkages. Since trade agreements tend to be regional, this result may reflect trade creation within regional value chains and trade diversion from countries outside the region. Regional trade agreements are relevant for integration into regional value chains and might divert GVC trade away from extra-regional partners. The background papers identify a role for bilateral or regional initiatives, which help strengthen informal links and facilitate the development of regional value chains.

One striking feature in Asia is that regional trade agreements followed GVC creation rather than preceding them as was the case in the European Union or North America. The waves of customs unions and free trade areas in the second half of the twentieth century were notably absent from East Asia (Pomfret, 2011). The main exception, the Association of Southeast Asian Nations (ASEAN), was initially a security organization and had minimal impact before the turn of the century. In South Asia too, regional trade agreements were notable for their weakness. By contrast, EU enlargement to the south in the 1980s and to the east in the 2000s was a major stimulus for the establishment of European regional value chains, as were the 1965 Autopact, the 1987 Canada-US free trade agreement and the 1993 North American Free Trade Agreement for North American regional value chains.

2.2 Infrastructure and Institutions[14]

Firms that engage in trade or participate in value chains conduct economic transactions which are subject to transaction costs. Legal institutions are a determinant of transaction costs as they affect monitoring and contract enforcement costs. Better legal institutions facilitate transactions between firms as they reduce insecurity and risks. Institutions are determinants of comparative advantage (Nunn, 2007; Levchenko, 2007), and countries with better legal institutions tend to specialize in products or industries that require relationship-specific investment.[15]

Institutions are particularly relevant for GVC integration in terms of their effect on the hold-up problem. If an input requires relationship-specific investment and contracts cannot be fully

13 This section is based mainly on Kummritz and Lanz (2018) background paper.

14 This section is based mainly on Kummritz and Lanz (2018) background paper.

15 Nunn and Trefler (2014) survey the literature on the role of domestic institutions as a source of comparative advantage.

enforced, the buyer of the input has an incentive to renegotiate the contract with the supplier once the investment has been made and the input is being produced, because the value of the input is lower outside the relationship. Similarly, if an input supplier is critical to a GVC and no competing suppliers are readily available, the supplier may be tempted to demand better terms with the threat of delaying the entire production chain. Institutions that facilitate better contract enforcement mitigate the hold-up problem, and countries with better institutions tend to export more in GVC-intensive manufacturing industries (Lanz and Piermartini, 2016).

Property rights, used as a measure of quality of legal institutions, matter for forward integration into extra-regional value chains, but are not significant determinants of intra-regional forward and backward linkages. These results are consistent with evidence that formal institutions can be substituted by informal institutions, such as trust or personal networks, which tend to be stronger for countries within a given region. Hence, developing economies with less developed formal institutions, such as Viet Nam, can rely on informal institutions for regional integration, but may need to improve their legal institutions to better integrate into extra-regional value chains.

Transaction costs are affected not only by formal institutions related to the rule of law and contract enforcement, but can also be determined by informal institutions. Specifically, informal institutions such as reputation built through repeated interactions, networks and trust can substitute for formal institutions and facilitate trade (Nunn and Trefler, 2014). Yu et al. (2015) found that bilateral trust has a positive effect on bilateral trade and that this effect becomes weaker the better the rule of law in the importing country becomes relative to that of the exporting country.

The importance of informal institutions such as trust for economic transactions has two implications for GVCs. First, if residents of nearby countries trust each other more than residents of distant countries, then GVC integration will be easier at the regional level. Second, formal institutions and trust are likely to be substitutes; if a country has strong legal institutions, the role trust plays is lower as contracts are enforceable through the legal system. If trust is stronger among firms operating in a given region, then good legal institutions will be more important for integration into extra-regional value chains. This implies that developing economies with less advanced legal systems can initiate GVC participation by using linkages to neighbouring countries.

Financial development has a significantly positive impact on backward integration into value chains, in particular for regional integration. However, results for investment freedom are surprisingly weak, which may reflect data issues. Alternatively, foreign investment as a determinant of GVC participation may be less important than other variables, or FDI may be important for some countries, but not for others.

2.3 Skills and Industrial Capabilities[16]

A unique contribution of the present project is the examination of industrial capabilities as an important determinant of GVC integration. This is achieved by including UNIDO's Competitive Industrial Performance (CIP) index into the econometric analysis.[17] The results from the CIP index indicate that countries with greater industrial competitiveness tend to be more integrated in regional value chains in terms of both backward and forward linkages. By contrast, the coefficients for the CIP index are not significant for extra-regional value chain integration, although this result is sensitive to the classification of regions. Thus, while we can establish a general positive link between industrial competitiveness and value chain integration, the results do not point to a clearly differentiated impact between intra-regional and extra-regional integration.

Broader skills as captured by years of schooling, have a significant and positive effect on extra-regional GVC integration. For intra-regional value chain integration, on the other hand, the coefficients are significant and negative, although this difference in result between intra-regional and extra-regional integration is not robust to the geographic definition of regions. The finding on the relationship between skills and backward and forward integration is more interesting. Skills have a significant and positive effect on overall forward linkages. For overall backward linkages, on the other hand, the coefficient is negative, although not statistically significant. This pattern supports the hypothesis that backward linkages are related to low-skilled tasks such as assembly, while forward linkages are highest for advanced countries such as the United States, Japan or Finland.

The key elements of industrial competitiveness include the ability to meet quality standards and to have access to capital. Outward FDI from economies that have passed through the stage that another economy is now reaching can be important facilitators for the transition to increased competitiveness. In East Asia, investors from Hong Kong SAR China and to a lesser extent Taiwan Province of China and the Republic of Korea played this role in China during the 1980s. More recently, Thai firms have been increasing the competitiveness of Cambodian, Lao and Myanmar workers by establishing production facilities in border economic zones that are part of regional value chains (ADB, 2016).

The findings on skills and industrial competitiveness are consistent with existing literature about the importance of favourable pre-existing domestic conditions. They are novel in providing empirical evidence of the link between industrial competitiveness and GVC participation, and in particular, the connection between skills level and forward linkages. Competiveness and skills level may also help explain how GVC participants move from regional to global integration, especially as input suppliers, although these findings are less statistically robust.

16 This section is based mainly on Kummritz and Lanz (2018) background paper.

17 The CIP index, published in UNIDO's annual *Competitive Industrial Performance Report*, benchmarks countries' ability to competitively produce and export manufactured goods. The index is based on eight normalized quantitative measures such as manufacturing value added per capita, share of manufacturing value added in GDP and the country's share of global manufactured exports.

2.4 Which Factors Explain the Regional Nature of Value Chains?

A number of factors can explain the preponderance of regional value chains. Geographic proximity is associated with lower transport costs as the distance between countries is smaller. Baldwin (2017) emphasizes the importance of the option of face-to-face contact; in a GVC, it may be important to be within a few hours' travel time of suppliers and customers so that any problem can be resolved the same day by a trouble-shooter. Also, regional trade liberalization has progressed at a higher pace than multilateral trade liberalization, resulting in lower trade policy barriers at the regional level.

Information costs provide another explanation for the significance of regional value chains. Information frictions, which increase with distance, limit firms' ability to create an international network of exporters (Chaney, 2014). Such frictions also contribute to uncertainty, which might hamper just-in-time delivery and minimal inventory stocks necessary for successful GVCs. The findings of studies such as Defever et al. (2015), where uncertainty and information costs related to input suppliers or regulatory requirements are correlated over space and are lower for proximate countries, can easily be translated into a GVC context.[18]

Time as another component of trade costs plays a key role in GVC formation and explains the proximity of certain production stages. Time-related trade costs have two dimensions: the time it takes to deliver (speed) and the ability to deliver on time (predictability). Fast delivery is important in GVCs characterized by demand fluctuations, perishability of products or rapid technological change. Predictability is crucial in GVCs characterized by high inventory costs or just-in-time production, where further processing or assembly depends on the punctual arrival of intermediate inputs.

Time affects the location of production stages in GVCs and the feasibility of fragmentation of production. Evans and Harrigan (2005) show that the production of time-sensitive U.S. apparel imports had shifted to nearby countries. Djankov et al. (2010) estimate that each additional day of transport reduces exports by at least 1 per cent and that the importance of time is greater for time-sensitive goods in manufacturing and for perishable agricultural products. Hummels and Schaur (2013) estimate that each day in transit is equivalent to an ad valorem tariff of between 0.6 per cent and 2.1 per cent, and that parts and components have a 60 per cent higher time sensitivity than other goods.

18 Using customs level data for Chinese exporters, Defever et al. (2015) find that the probability of exporting to a country increases by two percentage points for each existing export destination that has a common border with the country.

2.5 The Role of Regional Trade Agreements

Although effective regional trade agreements were conspicuously absent from East and South Asia before 2000, this situation has changed in the twenty-first century, with many bilateral trade agreements being signed, ASEAN moving towards deep integration in the ASEAN Economic Community and countries participating in negotiations of mega-regionals such as the Trans-Pacific Partnership Agreement (renamed the Comprehensive and Progressive Agreement for Trans-Pacific Partnership following the United States' withdrawal in January 2017) and the Regional Comprehensive Economic Partnership (RCEP). At the time of signing in March 2018, the CPTPP includes Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Viet Nam. RCEP is still being negotiated by the ten ASEAN member states (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam) and their six FTA partners (Australia, China, India, Japan, New Zealand and the Republic of Korea).

The Asian country with the most trade agreements is Singapore, with 20 agreements signed and in effect, two signed but not yet in effect, and nine under negotiation at the end of 2017 (Table 2.1). Singapore is followed in number of trade agreements by China (17), the Republic of Korea (16), Japan (16), Malaysia (16), Thailand (13) and India (13). Of course, not all trade agreements are of equal importance, but this list roughly aligns with the main GVC participants (Viet Nam has signed 11 trade agreements). It is striking that Singapore, whose tariff regime is close to a free trade model without any bilateral agreements, has signed the most "free trade" agreements. The reason is that these agreements go beyond the twentieth century definition of a free trade area based on removing tariffs on partners' trade.

Twenty-first century trade agreements typically cover trade facilitation and a broader set of behind-the-border measures related to services trade, investment, intellectual property rights and domestic regulation (Mattoo et al., 2017). Some agreements have been negotiated as plurilateral commitments by a subset of WTO members; the 82 signatories of the 1997 Information Technology Agreement (ITA), e.g. have committed to the removal of all tariffs and equivalent taxes from a specified list of electronic goods.[19] The WTO's 2017 Trade Facilitation Agreement aims to ease the flow of goods and services within GVCs by establishing principles of trade facilitation that are binding on all members, but the agreement is short on specifics, reflecting the difficulty of achieving consensus among 164 economies.

19 The signatories from East and South Asia include China, Hong Kong SAR China, Macao SAR China, Taiwan Province of China, India, Indonesia, Japan, the Philippines, the Republic of Korea, Singapore, Thailand and Viet Nam. Signing the ITA is practically a *sine qua non* for participation in electronics GVCs.

Tabele 2.1
Trade Agreements Involving ASEAN+6 Countries, 2017

	Framework agreement	Under negotiation	Signed, but not in force	Signed and in force
Singapore	0	9	2	20
China	0	7	1	16
Rep. of Korea	0	10	0	16
Japan	0	8	1	15
Malaysia	1	5	2	14
Thailand	1	9	0	13
India	1	14	0	13
Australia	0	7	2	12
New Zealand	0	6	2	11
Viet Nam	0	5	1	10
Indonesia	0	7	1	9
Brunei Darussalam	0	2	1	8
Lao PDR	0	2	0	8
Philippines	0	3	1	7
Cambodia	0	2	0	6
Myanmar	1	3	0	6

Source: UNIDO elaboration based on Asia Regional Integration Center at https://aric.adb.org/fta - Table 6 FTA Status by Country (accessed 1 January 2018)

Bilateral agreements tend to be more limited and are more easily negotiated and implemented. Although items included in an agreement will be of particular interest to the signatories, measures such as reducing paperwork at the border or removing regulatory barriers are typically non-discriminatory, and hence unlikely to lead to the trade diversion associated with twentieth-century trade agreements. The drawback of bilateral agreements is that they can lead to proliferation of regulations and standards that are confusing to traders and inconvenient for GVC coordination. One important aspect of mega-regionals such as the Trans-Pacific Partnership (TPP/CPTPP) or Regional Comprehensive Economic Partnership (RCEP) with many participants and lengthy negotiations, is that they create common practices and rules. There is a trade-off between the difficulty of reaching agreement among many countries and the network benefits of common standards that become more useful as they cover more partners.

The proliferation of bilateral, regional and wider trade agreements in Asia in the twenty-first century is related to GVCs as both cause and effect. Tariffs and non-tariff barriers are clearly inimical to the fragmentation of production across borders. Deep trade agreements further facilitate the flow of goods and services within GVCs, even though other factors such as industry competitiveness, skills and R&D intensity affect GVC integration. If a country wishes to be a GVC participant, the government will want to facilitate trade, and once in GVCs, the government will be lobbied for further specific measures to facilitate trade or to make it easier to do business.

2.6 Conclusions

Determinants of GVC participation include global and national, or even subnational determinants, that vary over time and by product. The global phenomenon has been driven by falling trade barriers and costs of international trade. Lower trade costs relate to money, time and uncertainty, all of which are crucial for successful GVCs. At the same time, only a small number of the world's countries participate in GVCs, indicating that national characteristics are also important determinants of GVC participation. These characteristics include not only directly trade-related aspects such as port infrastructure, but also institutions and capabilities.

The significance of regional value chains is clear, and up to a point easy to explain. However, a number of more in-depth questions remain unanswered. For example, is there a sequential pattern in terms of countries first increasing their participation in RVCs before moving towards GVCs once they become sufficiently competitive? One policy issue is whether RVCs or GVCs provide better opportunities for upgrading. Unfortunately, the evidence on this is still inconclusive. Historical evolution may start to blur the distinction between RVCs and GVCs if trade costs, and especially virtual face-to-face contact to resolve problems continue to improve.[20]

Finally, the heterogeneity of determinants places inevitable limits on macro explanations of GVC participation. As input-output datasets have improved, macro analysis has broadened our understanding, which can be complemented by industry or firm-level micro analysis (see Part Two). Before turning to the micro perspective, we will first examine the macro evidence on outcomes of GVC participation.

20 The catalyst for the development of rail services between China and the EU since 2011 was the objective of leading automotive and electronics companies to link their European and Asian value chains, with EU car manufacturers sending components to joint venture factories in China and electronics firms sending laptops and printers from China to EU distribution centres (Pomfret, 2018).

CHAPTER 3

OUTCOMES OF GVC PARTICIPATION

This chapter assesses outcomes of GVC integration from the perspective of low- and middle-income Asian countries that participate in GVCs. Some of the outcomes are self-evident or follow from the analysis of the previous chapter and from ongoing expansions of GVCs and efforts by countries to join GVCs or upgrade within them. GVC participation creates jobs and value added within participant countries, although it is necessary to ask whether this is added value or crowding out, i.e. a reduction in policy space or path dependency issues that inhibit long-run economic performance. One important question concerns the possibility of upgrading within GVCs; when a country's producers enter a GVC performing low value-added tasks with low-wage unskilled labour, what determines their success or failure in increasing the skills level and moving up to higher value-added activities?

The first section examines the evidence on the more immediate measures of economic performance, such as income and employment. The next section focuses on structural change, and the third on the environmental impact of GVC integration.

3.1 GVC Participation and Economic Performance

A common empirical result when controlling for country and industry characteristics is that GVC participation is positively correlated with the domestic sector's value-added growth for both developed and developing economies. The correlation is stronger for developed economies but still statistically significant for developing countries.[21] The correlation between complex GVCs and manufacturing value-added growth is even stronger, whether for developed or developing countries. Due to the potential endogeneity problem, these findings may not indicate strong causal relationships, but they do indicate correlations between GVC involvement and economic growth, as well as a difference in impact on developed and developing economies. Kummritz (2016) estimates that a 1 per cent increase in GVC participation causes a rise in domestic value added within the range of 0.1 per cent and 0.6 per cent and in labour productivity of 0.3 per cent.

A number of recent studies has investigated how integration into GVCs is related to upgrading. Lopez Gonzalez (2016) assesses the determinants of GVC upgrading in terms of domestic value added in exports with a focus on Southeast Asian economies. He finds that the use of foreign value added complements domestic value added in exports, and that foreign services

21 See, for example, Table 1 and Table 2 in Zhao et al. (2018) background paper.

value added has a stronger effect on domestic value added in exports as compared to foreign manufacturing value added. This in particular benefits manufacturing industries, as the effect of foreign value added on domestic value added in exports is higher for domestic manufacturing value added than for domestic services value added.

Kummritz et al. (2016) explore the interaction of policy factors with GVC integration for economic upgrading as measured by domestic value added. Not surprisingly, they find that factors such as connectivity, education and skills, and standards have a stronger association with domestic value added through forward linkages than through backward linkages.

As the skills level of a country's workforce improves, it moves up the value chain and strengthens its forward linkages at the expense of its backward linkages by contributing more domestic value added, including services value added, to its manufacturing exports. This is also reflected in the finding that countries at higher levels of development as measured by GDP per capita tend to have fewer backward linkages.

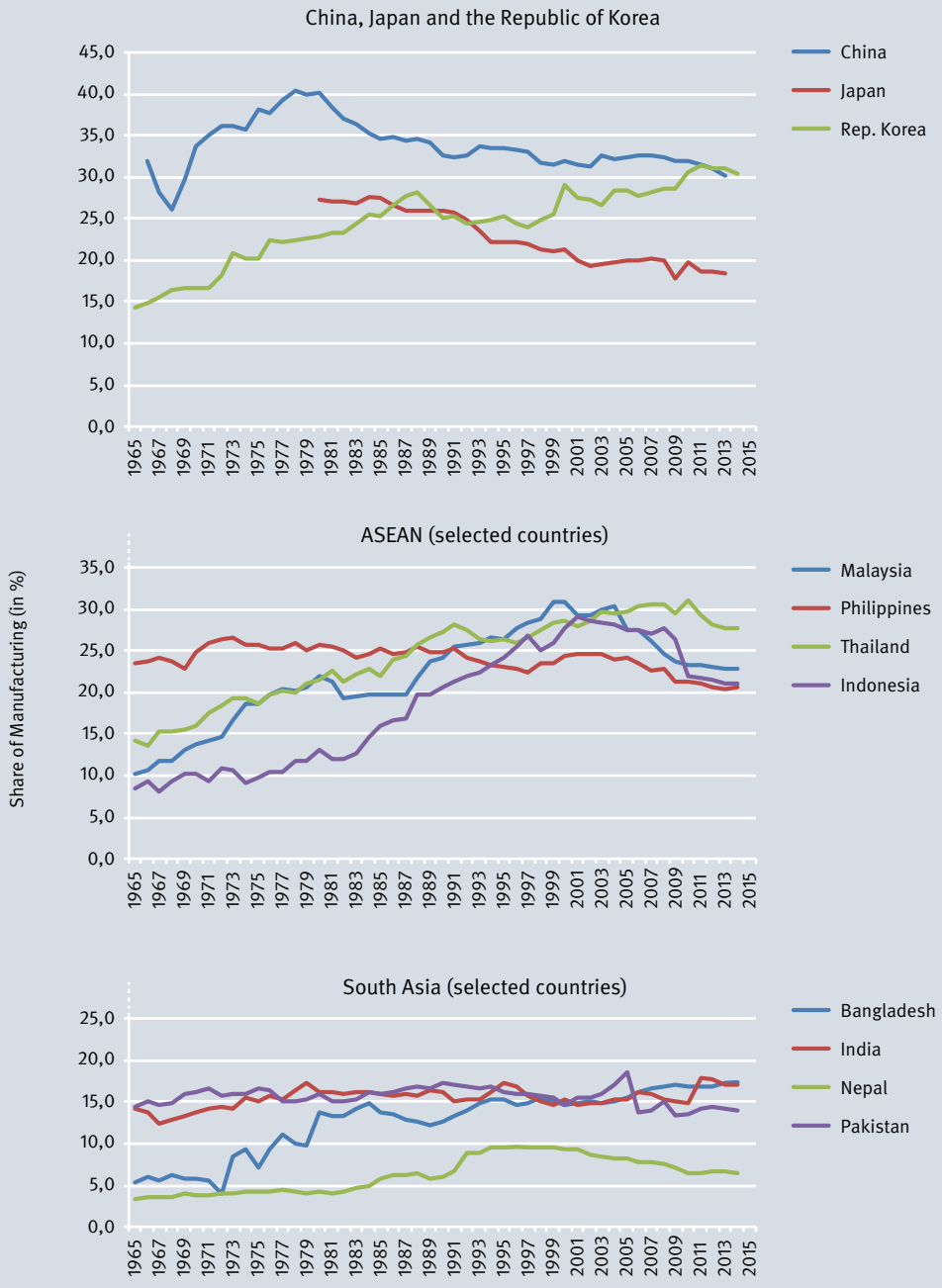
3.2 GVC Integration and Structural Change[22]

The Asia region has achieved significant structural changes over the past 50 years as countries industrialized to varying degrees. By and large, these structural developments followed a common pattern of an inverted U-shaped relationship between the manufacturing sector's share of value added and per capita income. In East and Southeast Asia, shifts towards the production of manufactured goods often occurred relatively early in the development process, e.g. in China, the manufacturing share reached its maximum at around 1980 and has been constant or slightly declining since. Later in the development process, manufacturing shares declined as services increased in importance, although declines in Asia's manufacturing share were relatively moderate compared to the global average over the period 1995-2011.

The value-added share of manufacturing is a useful performance indicator when assessing structural change in low- or middle-income countries. This is based on the assumption that manufacturing acts as the main engine of growth due to its higher productivity growth. In support of this assumption, Figure 3.1 illustrates the higher manufacturing shares in high-income and fastest growing Asian economies (Japan, the Republic of Korea and China) compared to the middle-income Southeast Asian countries and the poorer South Asian countries.

22 This section is mainly based on Stöllinger (2018) background paper.

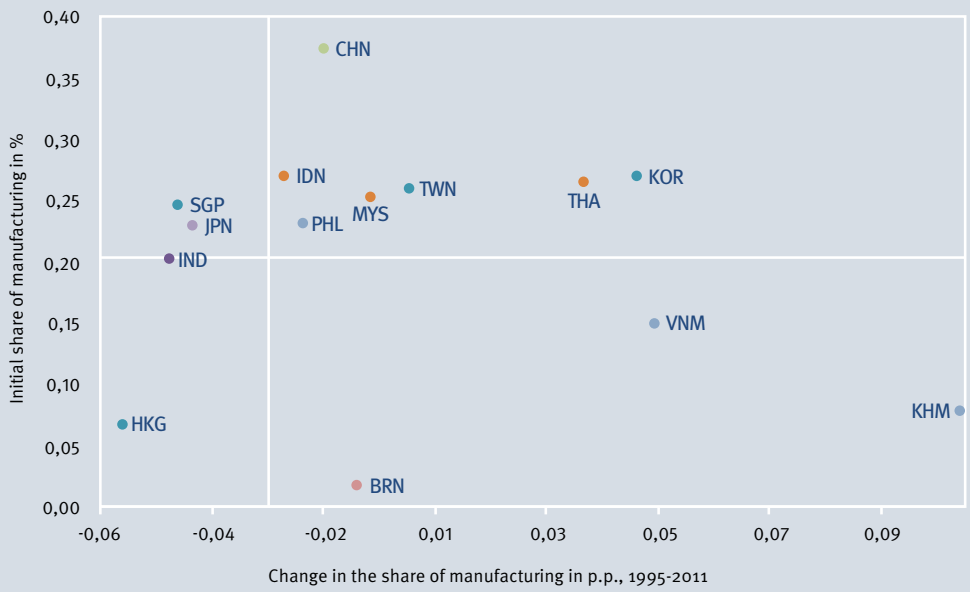
Figure 3.1
Manufacturing Shares in in Selected Asian Countries, 1970-2014



Source: Stöllinger (2018) background paper, based on World Bank (2017).

Ten of the 14 Asian economies included in the OECD input-output tables show above world average change in the share of manufacturing in GDP between 1995 and 2011 (see countries positioned to the right of the vertical line in Figure 3.2). The horizontal line indicates the global average manufacturing share in 1995; ten of the Asian economies (not the same ones) lie above this global reference line, illustrating that most of the South and Southeast Asian economies already had a relatively high manufacturing share in 1995. Seven economies, including China, combine both characteristics: a high manufacturing share in 1995 and an above average increase in that share between 1995 and 2011. The only economies in the region that experienced a stronger than average structural decline related to manufacturing are the higher income economies in East Asia (Japan, Singapore and Hong Kong SAR China) and India. Over this period, Cambodia (starting from a very low level), Viet Nam and the Republic of Korea experienced the greatest structural change in favour of manufacturing.

Figure 3.2
Manufacturing Shares in Selected Asian Economies in 1995 and Change in Shares 1995-2011



Source: Stöllinger (2018) background paper, based on OECD ICIO Database.

Note: Colour codes: dark violet = South Asia (India), dark blue = SEA Tigers: Hong Kong SAR China, Singapore, Korea, Taiwan Province of China; dark orange = ASEAN wave 1: Indonesia, Malaysia, Thailand; light blue: ASEAN wave 2: Cambodia, Philippines, Vietnam; pink: Others (Brunei Darussalam).

To analyse the relationship between GVCs and structural change, Stöllinger derived a comprehensive GVC participation measure, roughly equivalent to summing the backward and forward integration measures from the OECD Inter-Country Input-Output tables. In terms of intensification of GVC integration in Asia, two broad groups of economies can be identified. The first group comprises, among others, Japan, the Republic of Korea, Taiwan Province of China, China and Thailand, economies in which comprehensive GVC integration continued to increase between 1995 and 2011. In the second group, consisting of many ASEAN countries including Malaysia, Indonesia, the Philippines and Viet Nam, GVC participation seems to have peaked between 2000 and 2005.[23]

The global relationship between manufacturing-specific structural change and GVC integration is positive. Stöllinger's estimated coefficient suggests that a 1 percentage point increase in the GVC participation rate is associated with an increase of 0.1 per cent in the share of manufacturing. While this has a modest effect, it is plausible that the global effect of GVC integration is relatively small given that many other factors influence manufacturing share. Other variables that determine changes in the share of manufacturing include initial manufacturing shares and the real exchange rate; a large initial manufacturing share is associated with a more pronounced decline in the share as per capita GDP increases and an overvalued currency hampers the development of tradables in general.[24]

To capture potential heterogeneity in the relationship between GVC integration and changes in manufacturing share, Stöllinger introduced interaction terms between the GVC integration measure and the Asian economies. The results suggest that four East Asian economies overproportionately benefited from integration in GVCs in terms of manufacturing-specific structural change: the Republic of Korea, Thailand, and to a lesser extent, Singapore and Taiwan Province of China. There are also two surprising findings. Firstly, a negative relationship between comprehensive GVC participation and manufacturing-related structural change is found for Malaysia, whose manufacturing share declined slightly between 1995 and 2010, from 25.3 per cent to 24.9 per cent, while its GVC participation rate is comparatively high (44 per cent in 2010) but has steadily declined since 2000. The second surprising result is that manufacturing structural change in China did not gain from the intensification of GVC integration; if anything, the structural effect of comprehensive GVC participation was negative.

The country-specific effects vary across GVC integration measures. China strengthened its manufacturing sector via forward production integration, while the opposite applied to its backward production integration. Forward integration in Thailand, Malaysia, Viet Nam and India also gave positive impetus to the manufacturing share. Backward integration contributed to a softening of the negative manufacturing-related structural change Japan experienced between 1995 and 2010, as Japanese manufacturers benefited from increasingly sourcing inputs from abroad. For Taiwan Province of China, the Philippines and especially China, greater backward integration was associated with a decline in manufacturing share. The only countries reporting

23 This may be misleading for Viet Nam. The micro analysis in Part Two indicates that a single firm which started operations in 2009 had a massive impact that may not be picked up in an analysis that ended in 2011.

24 The initial GDP per capita is also statistically significant, which may be attributable to the fact that domestic demand conditions in increasingly open economies decrease in importance, or because economies increasingly shift towards services as income grows, which implies a negative relationship between GDP per capita and the value-added share of manufacturing.

consistently positive effects on manufacturing structural change from production integration using all three measures were the Republic of Korea and Thailand.

Taking into account the product quality dimension within value chains proxied by unit value ratios does not influence the main effect of GVC integration on manufacturing-related structural change. However, countries that specialize in high-quality segments benefit more strongly from backward production integration in terms of increased manufacturing activity as a share of GDP, whereas countries operating in the low-quality segment of GVCs gain comparatively more from forward production integration. Producing high quality implies high capabilities in the economy. In such circumstances, offshoring frees domestic resource that can be shifted to other, higher value added activities in the manufacturing sector while benefiting from cheaper inputs sourced from low-wage economies. Countries operating in the low-quality segments, in contrast, lack this flexibility and therefore shifting value added activities abroad may also reduce the domestic manufacturing sector. These countries benefit more than proportionally from forward integration because this allows them to sell domestic value added on international markets.

An alternative differentiation of GVC participation can be made between regional and global value chains. Stöllinger found that the positive structural effects on manufacturing share come about through the extra-regional component of GVC participation. The finding that it is global rather than regional value chains that matter for manufacturing-specific structural change could partly be driven by the fact that only the most productive firms within a country engage in extra-regional trade. At the same time, this is at odds with the empirical fact that international value chains are still predominantly regional. This result is less robust than the others, and may be an artefact of the investigation period when regional value chains were already well established while extra-regional value chains were only just gaining momentum. A substantive explanation could be that extra-regional GVC trade for the sample economies occurred with relatively more high-income economies than was the case for intra-regional trade, and technological spillovers could be higher in the context of extra-regional value chains, leading to a positive impact on manufacturing-specific structural change.

Similar analyses were carried out at industry level for textiles and apparel, electronics and motor vehicles.[25] At this more disaggregated level, the GVC indicators could not pick up strong structural effects and the results are rather inconclusive. The international input-output data and the derived indicators are essentially not precise enough to reveal structural impacts at this more disaggregated industry level. At the level of individual industries, firm-level data and case studies are more suitable for analysing the effects of GVC integration.

The main policy conclusion to be drawn from the heterogeneous outcomes is that GVCs provide increased opportunities for building-up manufacturing capacity. At the same time, policymakers cannot take for granted that participation in GVCs will automatically bring about such change, because the outcome hinges on the country-specific position within GVCs as well as within the product quality spectrum.

25 For the motor vehicles industry, the effects of country-specific structural change are positive only for the Republic of Korea and Thailand. This result implies that although the automotive industry has been a global leader in GVC creation, motor vehicle GVCs have a very uneven impact in Asia. In the sectoral analysis in Part Two, the focus will be on the other two major GVC industries, apparel and electronics.

3.3 GVCs and the Environment

Understanding how a country's participation in GVCs affects the environment and how environmental regulations and policies influence the country's participation and firms' activities in GVCs, is important for both economic and climate change-related policymaking and business practices. As an increasing number of countries has been joining GVCs, there has been a rapid rise in greenhouse gas emissions and pollution associated with GVC-related activities. The transfer of emissions via international trade increased from 0.4 Gt of CO_2 in 1990 to 1.6 Gt in 2008, which exceeds the total emissions reductions achieved under the Kyoto Protocol (Peters et al., 2011).

Meng and Tang (2018) background paper applied a GVC-based accounting framework to examine the evolving relationship between CO2 emissions and international trade for China. Their main finding and policy implication is that in order to successfully achieve the global emission reduction target, measures must be taken to curb the increasing carbon leakage via GVCs.

Helping developing countries set an appropriate target for emission peaks in terms of self-responsibility-based emissions is a constructive way to restrain the rapid increase of global carbon emissions. There is a consensus in the international community on the "Common but Differentiated Responsibilities" (CBDR) for climate change. However, challenges remain on how to ensure effective CBDR implementation, especially with respect to the treatment of historical responsibility for climate change related to the accumulation of CO2 emissions generated in the era of western countries' industrialization. It may be easier to achieve consensus on control of self-responsibility-based emissions in advance, i.e. of emissions generated within a country and for the country's own final demand, without involving any international trade according to our GVC-based definition. Such emissions have increased rapidly in developing countries over the last two decades.

Using an augmented Chinese input–output table that reports firm ownership and size, Meng and Tang (2018) background paper identifies firms and industries that should be targeted to reduce China's carbon emissions. Their analysis shows that 54 per cent of emissions embodied in Chinese exports in 2010 were induced by foreign-owned enterprises in their GVCs, but the greatest sources of these emissions upstream were large electricity generators and SMEs producing non-metallic mineral products.

More recently, and in particular since 2013, China has addressed this issue by moving towards more market-based prices and introducing taxes that internalize environmental damage caused by economic activities. The conclusions of Meng and Tang remain relevant for developing countries participating in GVCs.

3.4 Conclusions

While the macro data helped strengthen and broaden our understanding of the determinants of GVC participation and, to a lesser extent, of upgrading within GVCs, they are less conclusive when analysing outcomes. The more obvious outcome of job creation and GDP impact follow from the previous chapter's findings. The impact on industrialization is a little more complex, depending on the combination of initial domestic conditions and the balance of forward and backward linkages. The analysis of environmental impacts is a healthy reminder that negative environmental effects can arise from the input structure of producers in GVCs, rather than directly from GVC trade.

Many outcomes from GVC participation are too fine-grained to be captured through macro analysis, given the industry coverage of currently available input-output tables. The macro data are poorly suited to answer important questions such as the inclusiveness of GVC-generated economic growth or gender aspects of GVC participation, and these will therefore be addressed using micro data in Part Two.

PART TWO

FIRM-LEVEL PERSPECTIVES ON GVC PARTICIPATION AND UPGRADING

CHAPTER 4

NATIONAL VARIATION IN GVC INTEGRATION AND OUTCOMES

Part One highlighted five key messages on global value chains (GVCs) based on a macro perspective:

1. GVCs are a major component of the global economy and their importance is increasing.

2. GVC participation hinges on low trade barriers and trade costs, but also on domestic conditions.

3. GVCs have been regional rather than global, and Factory Asia is the prime example of this.

4. GVC integration increases incomes and employment, and is a driver of structural change.

5. GVC integration may have adverse environmental effects if participation entails laxer environmental protection laws.

These messages are robust. The macro analysis reinforces existing knowledge, especially with regard to the first three messages, and produced new findings, especially with regard to points 2, 4 and 5, although at times country- or industry-specific variations undermine the generality of our results.

There is some controversy on the long-term impact of GVCs on incomes, depending on the country's ability to upgrade within GVCs. This question cannot be easily tackled using input-output-based macro data. Part Two complements the macro results by using firm-level data to enhance our understanding of the determinants and effects of GVC participation. It sheds light on issues such as inclusive growth or gender impacts that are difficult to address at the macro level. GVCs differ across industries of the economy, which is an additional reason we complement our macro analysis with micro evidence, and Part Two focuses on two industries that have been at the forefront of Asian GVCs: apparel and electronics.

One feature of international trade theory in the twenty-first century is an increased emphasis on firm-level analysis driven by empirical findings that not all firms export or fail to compete with imports, even in areas of strong comparative advantage or disadvantage. More efficient firms

are more likely to export, and exporting firms tend to be more efficient, although the direction of causality is disputed.[26] It is also clear from the macro analysis that GVC participation and impacts differ across different industries and firm-level data permits disaggregation to allow for such variation.

To address the probability of firm heterogeneity the project included contributions based on large firm-level datasets from China, India and Viet Nam. This chapter compares the data and GVC structures of the three countries. It focuses on sectoral variations in GVC participation and outcomes in apparel and electronics. The firm-level data is supplemented by case studies of individual firms participating in GVCs.

China and India are the world's most populous countries, and both have played a role in GVCs, as already illustrated in Part One. However, their overall GVC experience has been very different. China has played a major role in the development of Asian GVCs, epitomized by the ubiquitous "*Made in China*" label, while India has been a latecomer, specializing in design and other services rather than in manufacturing. Viet Nam is a recent but active GVC participant in which foreign investors have played a salient role. Although there are inevitable differences in sample size, firm-level data brings out both national variations in GVC participation and outcomes as well as common features.

4.1 Firm-level Datasets from China, India and Viet Nam

China, India and Viet Nam have good firm-level data. None of the datasets contains direct information on GVC participation, and researchers have to construct GVC variables, typically a taxonomy with GVC participants subdivided into high, medium and low GVC participation according to specified objective criteria. The Viet Nam dataset is the smallest but was custom-designed to answer GVC-related questions and to distinguish differences in GVC impact on domestic and foreign-invested firms.

The Chinese dataset includes 40,828 firms that trade and 37,508 that do not.[27] The econometric analysis in the background paper of Girma (2018) is based on a sub-sample of matched firms for which data on all variables necessary for the econometric estimation were available over the period 2002-2005. The data-filtering process resulted in a total of 48,842 firms, 12,966 of which were involved in some form of exporting activity; the matched firms exported about US$ 52 billion and imported US$ 45 billion, amounting to about 30 per cent of total recorded trade, and employed 23 million people in 2005. Girma distinguishes between ordinary exports and processing exports, with the latter representing GVC participation and the share of processing exports in a firm's total exports determining whether the firm is a moderate processing exporter, a high processing exporter or a 100 per cent processing exporter (Table 4.1a).

26 Melitz and Redding (2014) review the heterogeneous firms literature.

27 This dataset draws on two sources: the firm-level production data available from China's Annual Survey of Industrial Firms (CASIF) and the transaction-level trade data from the Chinese Customs Trade Statistics (CCTS). The two source were linked over the period of 2002-2005.

The Indian dataset is smaller than the Chinese, with around 12,000 large and medium-sized firms, but covers a longer period, namely the quarter century from the late 1980s onwards.[28] The Indian dataset does not include a direct GVC variable. The background papers of Meyer (2018) and of Aggarwal and Steglich (2018) use a taxonomy of high-, medium- and low GVC participation based on trade ratios and investment links (Table 4.1b).

For Viet Nam, UNIDO collected a sample of 1,493 foreign and domestic firms in nine provinces in 2010. In contrast to the Chinese and Indian data, Viet Nam's Industry Investment Survey contains detailed information on firms' internationalization strategies typically related to GVC participation, e.g. imports of parts and components, exports of intermediate or finished goods, outsourcing and backward linkages to foreign and domestic firms. Thus, Coniglio (2018) background paper's classification of high, intermediate, low or no GVC participation (Table 4.1c) is more precisely linked to GVC-relevant criteria than the similar classifications in the Chinese and Indian studies. Another difference is that by tailoring the survey to GVC issues, the Viet Nam survey is not nationally representative. The nine selected provinces are among the most dynamic in Viet Nam, and the weight of foreign firms (defined as firms for which 10 per cent of equity or more belongs to foreign owners) is greater than in Viet Nam's 2009 census.[29] However, the range of questions permits in-depth analysis of gender and environmental issues in Chapter 7.

Table 4.1
Definitions of GVC Participation Levels

(a) China Firm-level Study (Girma, 2018)

		What type of exports?		Firm Type	
		Ordinary Exports	Processing Exports	GVC participation?	Type of GVC Participation
Does the firm export directly?	Yes	100%	0%	No	Ordinary exports only
		50-99%	1-50%	Yes	Moderate processing exporter
		1-50%	50-99%	Yes	High processing exporter
		0%	100%	Yes	100% processing exporter
	No	-	-	No	

28 The source of data is the Prowess database collected by the Centre for the Monitoring of the Indian Economy (CMIE). Prowess contains information primarily from income statements and annual reports of publicly listed companies. The data spans from 1989 to 2013 and provides detailed firm-level information for a panel of medium and large manufacturing firms accounting for around 70 percent of economic activity in India's formal industrial sector.

29 Of the 1,426 manufacturing firms, 836 are foreign and 590 are domestic. Coniglio cautions that Viet Nam has a large informal sector; the surveyed firms all belong to the formal sector and are relatively large, with an average of 425 employees in domestic manufacturing firms and 708 employees in foreign manufacturing firms.

Table 4.1 (continued)
Definitions of GVC Participation Levels

(b) India Firm-level Study (Meyer, 2018)

			No use of imported inputs	Low use of imported inputs (< 1/3 of inputs)	High use of imported inputs (> 1/3 of inputs)
Is the firm majority foreign owned or has majority stakes in companies abroad or is part of an international orientated Business Group?	Yes	No Exports	Low	Low	Intermediate
		Low Export Ratio (< 2/3 of sales)	Low	Low	Intermediate
		High Export Ratio (> 2/3 of sales)	Intermediate	Intermediate	High
	No	No Exports	Non-GVC	Limited	Low
		Low Export Ratio (< 2/3 of sales)	Limited	Limited	Low
		High Export Ratio (> 2/3 of sales)	Low	Low	Intermediate

Table 4.1 (continued)
Definitions of GVC Participation Levels

(c) Viet Nam Firm-level Study (Coniglio, 2018)[30]

			High use of locally sourced Inputs (› 1/3 of total costs)	Low use of locally sourced Inputs (‹ 1/3 of total costs)	
				Low use of Imported Inputs (‹ 2/3 of inputs)	High use of Imported Inputs (› 2/3 of inputs)
Is the firm a long-term supplier to an MNE?	Yes	Low Export Ratio (‹ 2/3 of sales)	High	Low	Low
		High Export Ratio (› 2/3 of sales)	High	Low	Intermediate
	No	Low Export Ratio (‹ 2/3 of sales)	Non-GVC	Low	Low
		High Export Ratio (› 2/3 of sales)	High	Low	Intermediate

In sum, the three countries' datasets vary by size and sampling criteria, time periods and questions, and by the constructed categories of GVC participation. Thus, direct comparisons of numerical results must be viewed with caution. Nevertheless, the detail of the surveys, which individually are each of high quality, allows for much finer calibration of the analysis than in Part One.

4.2 China

The processing of imported intermediate inputs for re-export has been at the heart of Chinese trade and industrial development policy in the late twentieth and early twenty-first century. This policy has encouraged processing for exports through tax exemptions on imported

30 The taxonomy in Coniglio (2018) background paper differs from that used in the China and India studies, most clearly by including relationships with multinational enterprises, so that "high" GVC participation may indicate being a long-term supplier to a multinational enterprise. The background paper of Tusha et al. (2018) has a different focus (linkages between domestic and foreign firms); when referring to firms participating in GVCs, it uses the simpler definition that a GVC firm both imports and exports. These differences reflect the difficulty of defining "GVC" and how modalities may vary across countries, with FDI playing a much more important role for Viet Nam than for India.

intermediate inputs and favoured foreign-affiliated firms because FDI was deemed to be an engine of trade and a channel of technology transfer, especially in the 25 years following the 1978/9 reforms. Sourafel Girma (2018) background paper quantifies the effect of different degrees of GVC participation on firm-level performance with respect to employment, wages, sales and total factor productivity growth.

Girma's dataset matched firms and customs transaction-level data from China over the period 2002-5. Girma divided firms into three levels of GVC participants, namely "ordinary exporters" and a control group of firms with no exporting activity, which represents the counterfactual outcome had GVC firms not been involved in some form of exporting activity. Over the sample period, 20 per cent to 24 per cent of the firms surveyed were involved in some form of GVC activity, overwhelmingly in the processing of imported inputs for export.

Location matters in that non-GVC firms are proportionally more common in provinces without export processing zones. This suggests the importance of including an indicator of special zones in the analysis of determinants of GVC participation, although care must be taken not to confuse the presence of special zones with other favourable location-related features such as being located in a coastal province.

Firm ownership also plays an important role. Private firms account for more than 71 per cent of non-GVC firms, while over 90 per cent of firms engaged in 100 per cent export processing are foreign-owned or foreign affiliated. Foreign ownership is a statistically and economically significant determinant of GVC involvement.

The relationship between GVC participation and productivity is complex. Among GVC firms, export processing-intensive firms tend to be in low- to medium-tech industries, and firms engaged in 100 per cent export processing registered the lowest productivity level in 2002. [31] Overall, the relationship between the degree of GVC participation and total factor productivity (TFP) is not significant, but the marginal effect on TFP of being a 100 per cent export processing firm is negative. When allowance is made for sectoral conditions, non-GVC firms are on average smaller, less productive and more leveraged than GVC firms.

From simple summary statistics of the outcome variables by GVC level, GVC firms performed significantly better than their non-GVC counterparts in terms of employment, wages and sales growth. In terms of TFP growth, only firms with "ordinary exports" experienced positive average changes, although quantile analysis reveals beneficial TFP effects among moderate and high export processing firms, especially at the lower end of TFP growth distribution. However, such unconditional relationships should be treated with caution, as they are influenced by many factors unrelated to GVC integration. Multivariate analysis reinforces some of these observations, and the results will be discussed in Chapter 7.

31 This result replicates the finding of Dai et al. (2016), using 2000-6 firm survey data, that firms engaged in export processing only registered an especially low productivity rate. They concluded that exemptions from tariffs on inputs and eligibility for income tax benefits encourage export processing. They also found a dynamic effect that simple processing may be entry-level exporting from which firms tend to graduate, although it is difficult to test this hypothesis with the short time-span of their as well as Girma's datasets.

4.3 India

Evidence of GVC participation by Indian firms is sparse. The background papers of Meyer (2018) and of Aggarwal and Steglich (2018) both use the Prowess database. Using this database, Goldberg et al. demonstrated in two articles published in 2010 the importance of access to capital and to imported inputs in explaining successful performance by Indian firms. However, this success has rarely been achieved within GVCs.

The background papers use data on firms' exports/sales and imports/sales ratios and foreign investment links to classify firms' GVC participation as high (meeting all three criteria), intermediate (meeting two of the three criteria), or low (meeting one criterion), while firms meeting none of the three criteria were either limited GVC participants or non-GVC firms (Table 4.1b). Aggarwal and Steglich show that only 4 per cent of surveyed firms had high or intermediate participation. Meyer breaks down the sectoral distribution; over 15 per cent of firms in apparel and leather, electronics and motor vehicles were in the top two categories of GVC participation. From the findings in Part One on sectoral concentration of GVCs, this distribution is unsurprising, though the numbers in the motor vehicles category are very small (thirteen firms). This finding reinforces our choice of the electronics and apparel industries for a more detailed industry-specific analysis later in this report.

The most striking results in the background papers on India relate GVC participation to variables capturing competitiveness or innovation, and to scale. The direction of causality is difficult to disentangle. Aggarwal and Steglich argue that more productive firms are more likely to participate in GVCs. Meyer provides evidence of GVC participation leading to process and product innovation. The overall impression is that in a country in which the majority of firms are still at an early stage of GVC participation, the GVC option has helped more dynamic firms and has probably increased their competitive edge. This is in contrast to the finding from China that export processing firms tended to have lower productivity and that the impact on productivity of such firms' participation in GVCs was negative compared to the productivity performance of less extreme participants in export processing or ordinary exporters.[32]

4.4 Viet Nam

Viet Nam's integration into GVCs is more recent than China's, and foreign investors have played a higher profile role, in some cases explicitly shifting activities from China to Viet Nam in response to increasing costs in China. The UNIDO survey highlights the bipolar phenomenon of firms being strongly involved in GVCs or not involved at all. Coniglio reports that 21 per cent of domestic firms and 41 per cent of foreign firms in Viet Nam have high or intermediate GVC participation levels, while 64 per cent of surveyed domestic firms and 27 per cent of foreign firms have no participation.

32 A similar finding is described in Dai et al. (2016).

Coniglio's principal findings relate to the scale of operation and nationality of ownership. Firms involved in GVCs in Viet Nam, especially foreign firms, are larger than non-GVC firms. GVC firms provide more jobs, but workers in GVC firms are less productive and receive lower average wages than workers in non-GVC firms. The modest quality of jobs is attributable to the low capital intensity and skill intensity of GVC activities in Viet Nam. As in the other countries, high and intermediate GVC participation is most common among firms in the textiles, garments and leather industries and in electronics, although the nature of GVC participation (e.g. backward or forward linkages and regional or global value chains) varies across industries.[33]

4.5 Conclusions

The firm-level data highlight national variations in the determinants and outcomes of GVC integration.

The GVC phenomenon has been particularly strong in China, especially since the turn of the century, though it is difficult to isolate policy impacts. However, policies encouraging GVC participation appear to have succeeded to the extent that in the early 2000s, GVC firms performed significantly better than non-GVC counterparts in terms of employment, wages and sales growth. The findings point to the conclusion that at least in the immediate years that followed WTO accession in 2001, China's policy produced a substantial number of winners, measured by higher wages or firms' sales.

In India, a striking feature of the firm-level data is how few manufacturing firms are integrated into GVCs. The sectoral distribution reveals substantial variation, with greater GVC integration among firms in apparel and leather, wood products and furniture, electronics and motor vehicles, although the figures of the automobile industry are very small. More productive firms are more likely to participate in GVCs and there is evidence of GVC participation leading to process and product innovation. It seems that in a country where the majority of firms is still at an early stage of GVC participation, the GVC option has helped more dynamic firms and probably increased their competitive edge. This is in contrast to the finding from China that export processing firms tend to be engaged in lower productivity activities and that the impact on productivity is difficult to disentangle.

In Viet Nam, GVC participation has been more significant than in India, but started much later than in China, boosted by the normalization of trade with the United States in 2001 and WTO accession in 2007. GVC firms provide more jobs, but their workers are less productive and receive lower average wages than workers in non-GVC firms; this is attributable to the low capital intensity and skill intensity of GVC activities in Viet Nam. As is the case in the other countries, high and intermediate GVC participation is most common among firms in the textiles, garments and leather industries and in electronics. Local conditions are important determinants for the location of GVC participants, although unlike in China incentive packages provided by the government for investors in industrial and export processing zones have only played a limited

33 In Viet Nam, there are also a few dozen high GVC-participation firms in the wood, wood products and furniture industries.

role in attracting firms. In all industries, Viet Nam's role in GVCs is primarily labour-intensive assembly. The Viet Nam data focus on the relationship between foreign and domestic GVC participants, which has been important in areas such as technology transfer, skills upgrading or export market access, factors that could pose potential obstacles to GVC latecomers. Firm-level analysis for Viet Nam reinforces the finding from Part One that domestic conditions, such as excessive bureaucracy and regulation, play an important role in determining the extent of GVC integration.

CHAPTER 5

SECTORAL VARIATION IN GVC INTEGRATION AND OUTCOMES

The GVC phenomenon is not evenly spread across industries of the economy. Although GVCs can be observed in nearly all subsectors of manufacturing, agriculture and services, research has identified apparel, cars and electronics as the activities in which modern global value chains first developed and also developed fastest. For the three countries considered in the previous chapter, automobile GVCs have played a relatively minor role compared to Thailand, the EU or North America.[34] Significant differences arise in the apparel and electronics GVCs from the nature of production and the role of non-tangible activities such as design, branding and marketing, and subsectors within these industries also differ in terms of GVC-relevant characteristics.

5.1 The Apparel GVC[35]

A large part of apparel production (e.g. cutting, sewing and finishing) is labour-intensive with low fixed costs and simple technology, while textile production is more capital-intensive with economies of scale. The different factor proportions explain why the industry was an early adopter of GVCs, with apparel production relocating to low-wage countries in the 1960s while textile production remained in high- or middle-income countries. Initially, high-wage countries attempted to regulate the process by enacting special tariff provisions for imports using inputs from the importing country. Furthermore, world trade in apparel was regulated by the 1974 Multifibre Arrangement, which permitted a complex web of bilateral quotas on imports from low-wage countries. Such arrangements have mostly disappeared as world trade has been liberalized and trade negotiators have acknowledged the difficulty of micromanaging GVC trade.[36]

34 Automobile and auto components GVCs were the subject of a research project coordinated by the Economic Research Institute for ASEAN and East Asia (ERIA) and Waseda University, including studies on China (Li, Kong and Zhang, 2015), Viet Nam (Nguyen, Nguyen, Nguyen and Nguyen, 2015) and India (Agustin and Schröder, 2014).

35 This section draws on Frederick (2018a) background paper.

36 The Multifibre Arrangement was terminated with a ten-year transition period in the Uruguay Round of multilateral trade negotiations that ended in 1994 and established the WTO. A side agreement to China's WTO accession in 2001 extended the transition period for imports from China to 2008. Some vestiges of micromanagement remain in the rules of origin, e.g. the NAFTA "yarn-forwarding" rule that favours US clothing imports from Mexico that use US textiles.

Today, textile production has to a large extent also relocated from high-income countries, but companies in those countries have retained lead-firm status in many apparel GVCs through their control over brands and marketing. Apparel (and textile) GVCs can be broken down into four stages:

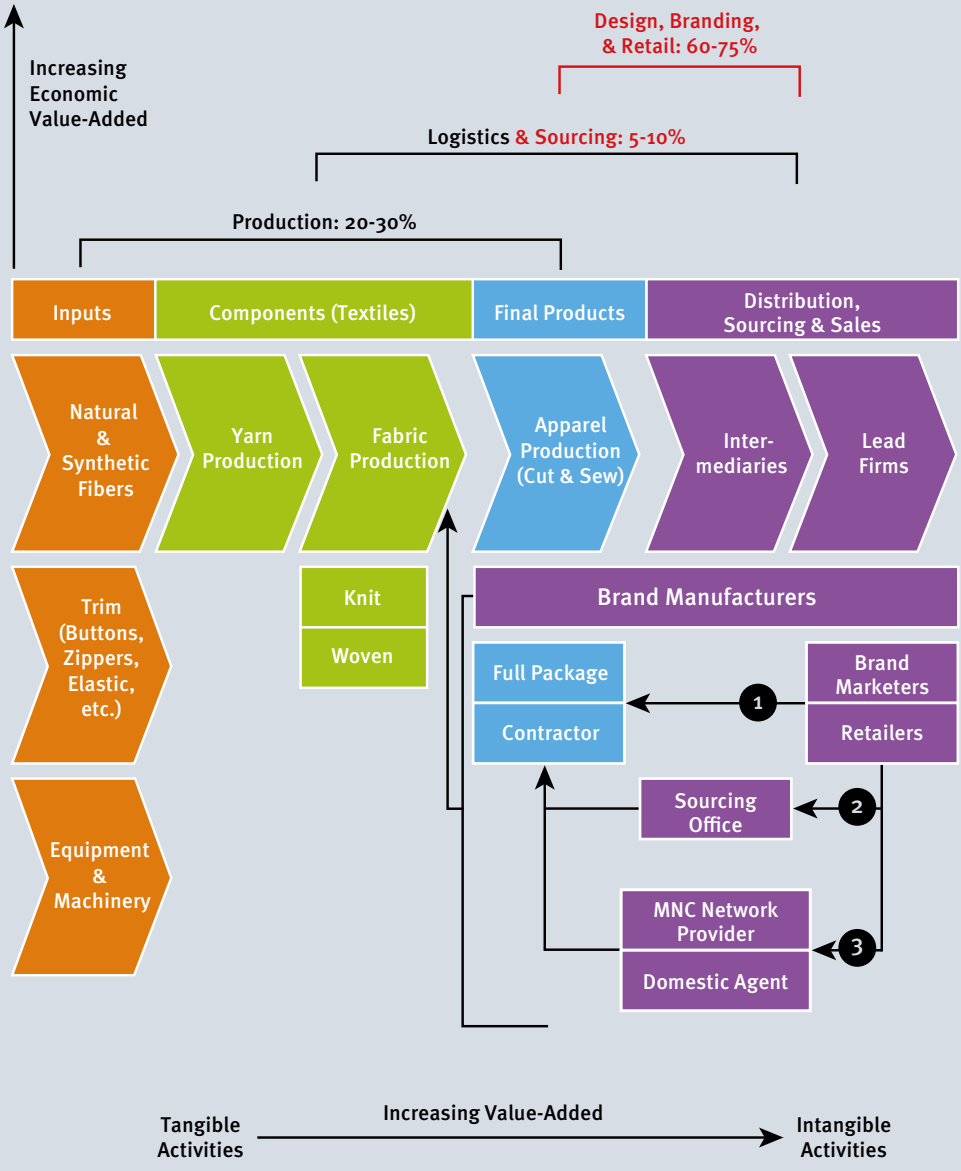
- lead firms - global clothing brands, retailers or wholesalers;
- first-tier suppliers – apparel final production manufacturers and intermediaries;
- textile suppliers – producers of yarn and fabric;
- raw material and other ancillary suppliers.

The main stages of production are set out in Figure 5.1. There is some institutional variation in arrangements among lead firms and first-tier suppliers as regards product development, logistics and sourcing, branding and retail. These are the activities in which most of the value added occurs.[37] Less than 30 per cent of the retail selling price accrues to manufacturers and raw material suppliers. Given the location of many of Asia's manufacturing operations, there are locational advantages for first-tier firms to locate in the region, e.g. the Hong Kong SAR China-based company Li and Fung coordinates the production in most jeans GVCs.

In 2014, the global retail market in apparel amounted to approximately US$ 1,380 billion. The liberalization of world trade in apparel generated rapid growth in import demand, especially by markets in Asia, Latin America, the Middle East and North Africa, although the EU, North America and Japan still accounted for 70 per cent of apparel imports in 2014. On the supply side, the termination of the Multifibre Arrangement in 2004 led to increased competition among producing countries and consolidation in East and South Asia of production for export. World trade in apparel in 2014 amounted to US$ 402 billion, with Chinese exports accounting for US$ 152 billion, up from US$ 72 billion in 2004. Bangladesh increased its apparel exports from US$ 8 billion in 2004 to US$ 29 billion in 2014, ranking third behind the EU. Viet Nam was the fourth largest apparel exporter with US$ 22 billion in 2014, up from US$ 4 billion in 2004, and India ranked sixth (behind Turkey) with US$ 16 billion.

37 They also include areas of the greatest financial risk, as shifts in fashion can leave retailers with stock that must be highly discounted and brands can become obsolete.

Figure 5.1
The Apparel Global Value Chain



Red indicates highest value-added activities + control/power over the chain
Percentages represent relative shares of apparel retail selling price attributed to value-adding activities

Source: Frederick (2018a) background paper.

5.2 The Electronics GVC[38]

The electronics industry consists of three main groups of actors:

- lead firms and first-tier suppliers to non-electronics end-users;[39]
- contract manufacturers;
- component suppliers.

Lead firms focus on marketing, branding, research, design and new product development. Some lead firms assemble products in-house, but the strong trend over the past three decades has been for them to focus on intangible high value-adding activities without worrying about production efficiencies. Apple is the prime example of a company associated with manufactured electronic consumer goods that is not engaged in manufacturing, delegating the assembly of Apple products primarily to Foxconn.

Different skills are required in logistics, production and testing activities – often referred to as electronics manufacturing services (EMS). Contract manufacturers may attain economies of scale by supplying a number of lead firms or they may specialize in niche markets.

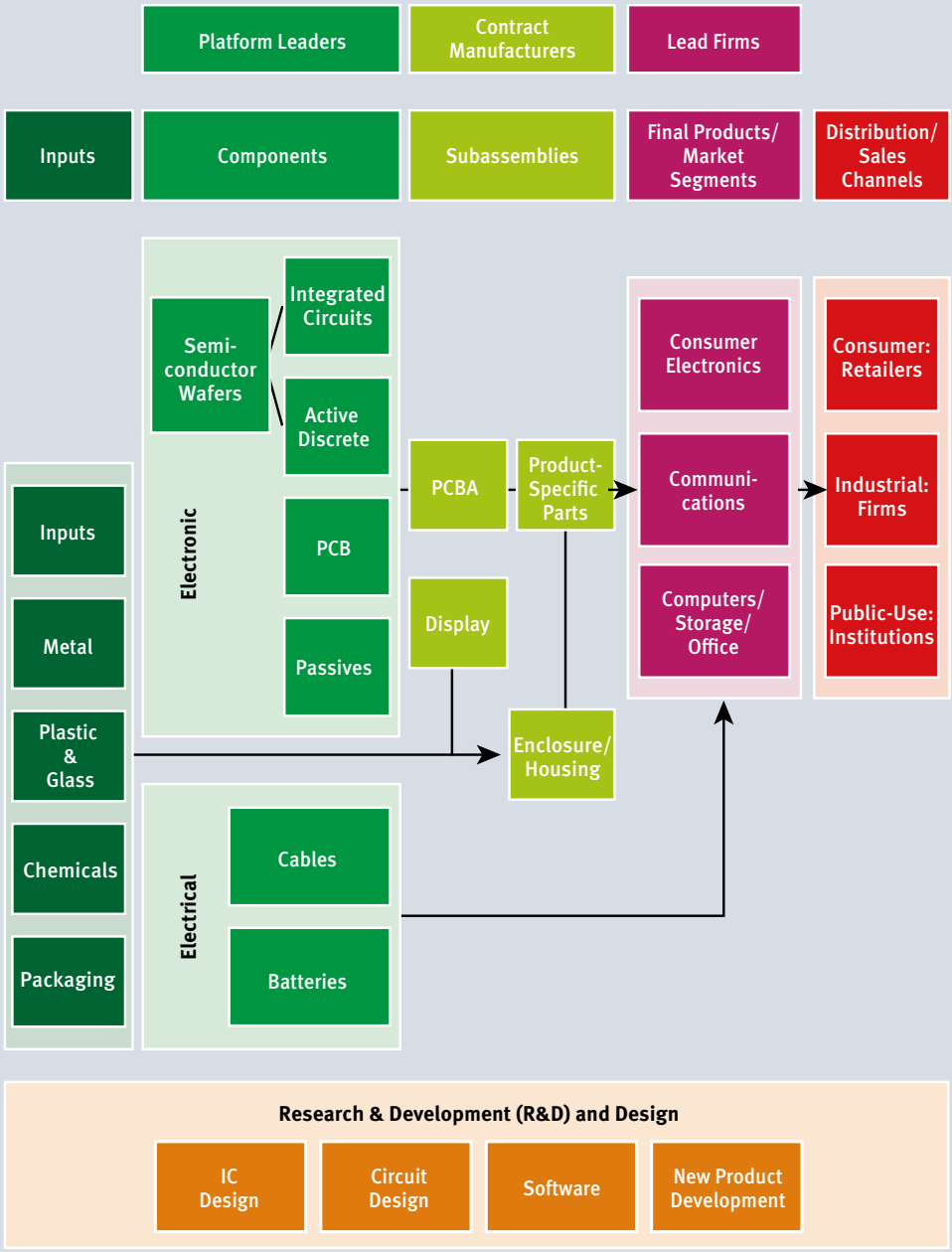
The largest components companies are headquartered in the United States, Japan, EU, the Republic of Korea or Taiwan Province of China. Most of their production is located in low-wage countries through subsidiaries, joint ventures or subcontracting. This is characteristic of the semiconductor segment in which the eight leading companies from the United States (Intel, Qualcomm, Micron, Texas Instruments), the Republic of Korea (Samsung, Hynix), Taiwan Province of China (TSMC) and Japan (Toshiba) had combined revenues of US$ 239.7 billion in 2014. Given the technological complexity and cost of the most sophisticated semiconductors, negotiations are typically concluded directly with lead firms rather than with EMS firms. Contract manufacturers' market power is low compared to both lead firms and component suppliers, and their profit rates are much lower than those of lead firms or first-tier suppliers.

The three principal end-market segments, computers, consumer electronics and communications and networking (the 3Cs) had a market value of over US$ 1,000 billion in 2014. The focus of the present project is on the 3Cs, often referred to as electronics and ICT, without analysing other end users for whom electronics inputs are important but not the main component. The 3C global value chain is illustrated in Figure 5.2.

38 This section draws on Frederick (2018b) background paper.

39 The leading car companies, for example, source an increasing share of components from a small number of first-tier suppliers such as Robert Bosch or Continental in Germany, Denso or Yazaki in Japan, Magna or Johnson Controls in North America, Hyundai Mobis in the Republic of Korea, and Faurecia or Valeo in France. These first-tier suppliers organize GVCs among their own suppliers. Denso, originally part of the Toyota Group, has a name derived from the two Japanese words Den-Ki (electric) and So-Chi (equipment), but today supplies far more than just electronic components.

Figure 5.2
Electronics 3C GVC



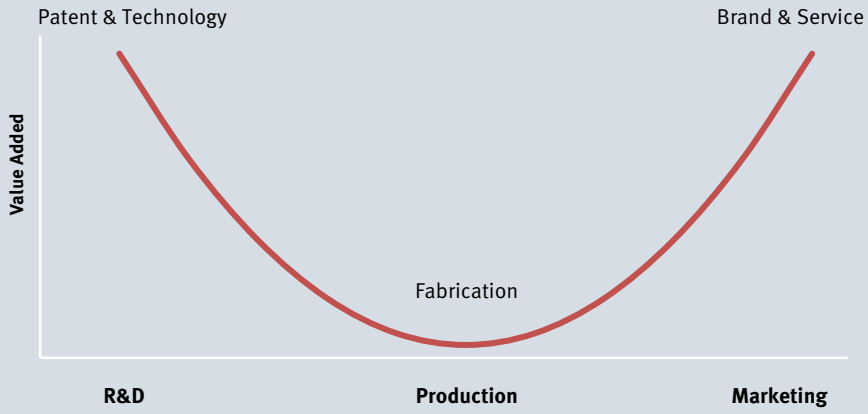
Source: Frederick (2018b) background paper.

The computers and office equipment segment is dominated by a handful of lead firms and contract manufacturers. The composition of the market leaders is volatile. In 2015, the top three computer and peripheral firms (Apple, HP and Samsung) held 37 per cent market share. In 2007, the top three computer and peripheral firms held a similar 35 per cent share, but consisted of HP, Dell and Acer. In the mobile phones segment, only one of the top three brands in 2007 (Nokia, Motorola and Samsung) belonged to the top three in 2015 (Samsung, Apple and Huawei); Nokia and Motorola had in the meantime been absorbed by other companies. The leading EMS firms in the 3C market are from Taiwan Province of China (Foxconn, Pegatron, Quanta, Compal), with main assembly facilities in other parts of China.

Apart from the 3Cs, additional important end-users include automotive, medical, industrial and aerospace/defence industries, with a combined market value of just under US$ 500 billion in 2014. The experience of the Indian company Hical Technologies (Box 5.4; see also Appendix, Case Study 5) illustrates the potential for specializing as a niche supplier. Hical has since 1997 grown rapidly as a manufacturer of high-quality electromagnetic components for British Aerospace, Boeing, Lockheed Martin and other U.S. and EU aerospace firms.

Important segments of the electronics industry are characterized by modularity that is congenial to the formation of GVCs. Semiconductor production, for example, can be broken down into five modules with different factor intensities: research and design are skilled labour-intensive, components production is capital-intensive, assembly is unskilled labour-intensive, testing is capital-intensive and marketing is skilled labour-intensive. Semiconductor firms that led the way in terms of relocating assembly to low-wage locations in the late 1960s and 1970s gained a competitive edge that was facilitated by the high value-weight ratio of semiconductors and was further honed by institutions favouring ease of shipment across borders.

Figure 5.3
The Smile Curve



Source: UNIDO elaboration

This feature has been popularized by the Smile Curve (Figure 5.3), attributed to Stan Shih, founder of Acer. Shih observed that the two ends of the personal computer GVC, i.e. R&D and design at one end and marketing and sales at the other end, generated a larger share of value added than the assembly stage. When drawn with value added on the vertical axis and sequential links in the chain on the horizontal axis, the curve represents a smile. The Smile Curve illustrates the high value added at each end of the production process and the lower value added in the middle. Shih implemented the concept by designing, branding and marketing Acer computers rather than assembling computers sold under other brand names.

The adoption of product and process standards through industry bodies such as the International Electrotechnical Commission and through the International Organization for Standardization (ISO) and the International Telecommunications Union (ITU) facilitated the electronics industry's modularity and use of GVCs. Companies are certified through accredited certification organizations, and certification must be renewed regularly. Certification of suppliers is often required by lead firms, which may also require that suppliers meet environmental management ISO 14000 standards.

The industry's use of GVCs is also facilitated by the WTO Information Technology Agreement, a voluntary plurilateral agreement that only applies to WTO members who choose to sign it. The ITA was initially adopted in 1996 and now has 82 signatories, including China, India, and all ASEAN members except Lao PDR and Myanmar. The ITA requires all signatories to set customs duties and equivalent taxes at zero for a list of products. In 2015, the list was extended. One objective is to extend the ITA to cover non-tariff barriers in listed electronics products. Being an ITA signatory tremendously increases a country's credible commitment to the unimpeded movement of electronic goods, including components, across borders. One consequence is that the relevance of regional trade agreements decreases for firms involved in the production of goods covered by the ITA.

5.3 China's Apparel and Electronics GVCs[40]

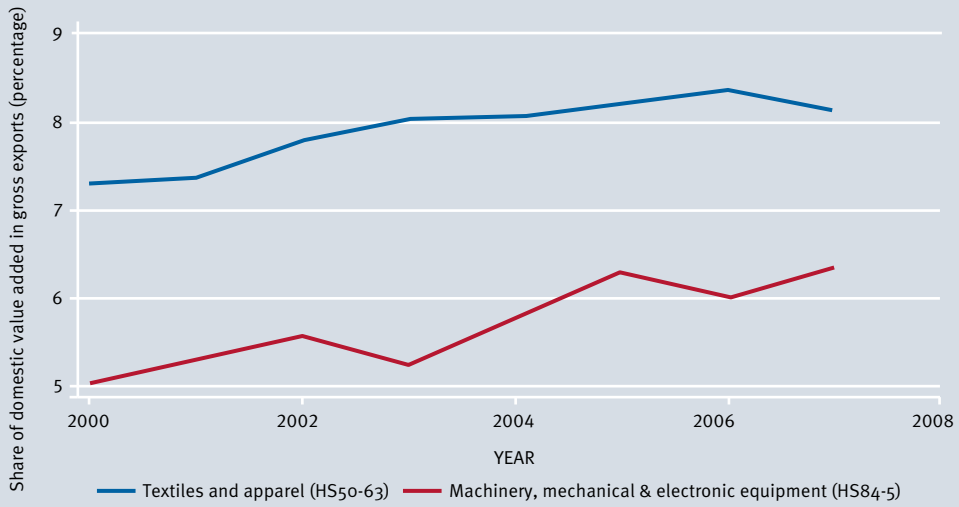
One striking feature of China's trade in the twenty-first century is the increase in the domestic value-added component of exports. Kee and Tang (2016) find evidence of this across all manufacturing industries. The apparel and electronics GVCs illustrate this phenomenon (Figure 5.4). Between 2000 and 2007, the domestic content in China's textiles and apparel exports increased from US$ 0.73 to US$ 0.81 cents, and from US$ 0.50 to US$ 0.63 for machinery, mechanical and electronic equipment exports.

This may be related to upgrading. In electronics, Chinese firms have taken lead-firm status in many domestic and global value chains. The large and booming domestic market helped; at least two-thirds of 3C electronics goods sold in China in 2015 were Chinese brands. From that springboard, Chinese brands have moved into global markets; 21 per cent of mobile phones sold worldwide in 2015 were Chinese brands (up from 1 per cent in 2007) and 21 per cent of

40 This section draws on Frederick, Tang and Qi (2018) background paper and the published paper by Zhang, Kong and Ranu (2016).

televisions (up from 11 per cent in 2007). However, this does not seem to be the whole story, and does not appear to have changed much in apparel export composition over this period.

Figure 5.4
Domestic Value-Added in China's Apparel and Electronics Exports, 2000-7



Source: Frederick, Tang and Qi (2018) background paper, based on data from Kee and Tang (2016).

Inputs are increasingly being obtained from domestic suppliers. Although the share of services in gross exports from the apparel and electronics industries remained around 35 per cent between 1995 and 2011, the domestic share of services increased (Table 5.1). In electronics, the gross export value of the share of domestic services increased from 1 per cent in 1995 to 11 per cent in 2011, while the value added of foreign services fell from 34 per cent to 25 per cent. In apparel, the share of domestic services increased from 10 per cent to 18 per cent while that of foreign services fell from 25 per cent to 13 per cent. Frederick and Tang conclude that Chinese apparel and electronics firms assumed greater responsibility for sourcing inputs instead of depending on a foreign services provider to coordinate the value chains in which they participated. SJET Technology is an example of a Chinese electronics firm whose supply chain coordination business had become successful enough by 2007to be separated as a new company, SJET Supply Chain Co (see Appendix, Case Study 1).

Table 5.1
Services Content of China's Exports of Apparel and Electronics Goods, percentage of value added, 1995 and 2011

	1995		2011	
	Domestic service suppliers	Foreign service suppliers	Domestic service suppliers	Foreign service suppliers
Electronics	1	34	11	25
Apparel	10	18	25	13

Source: Frederick, Tang and Qi (2018) background paper.

5.3.1 Apparel

China's apparel industry has undergone several phases since the establishment of the People's Republic in 1949. During the pre-reform central planning era (1949-78), the apparel industry was under strict government control and considered a non-strategic industry. Following the agrarian reforms of 1978-9 and release of rural labour, many township enterprises were established to satisfy domestic demand for textiles and apparel, and clothing production grew rapidly, with an average annual growth rate of 14 per cent from 1978 to 2000. During that same period, trade was liberalized with the open-door policy and foreign investment permitted. With the international transfer of labour-intensive industry in the mid-1980s, the output of China's sewing industry increased dramatically.[41]

China's open coastal cities became not only the main foreign investment destinations, but also the hotbed for domestic township enterprises to manufacture clothing for sale to foreign buyers who would market the goods under their own label. With government support and abundant labour, Chinese enterprises successfully engaged in low-end OEM apparel manufacturing.[42] Rapidly increasing demand for OEM during the 1990s provided domestic enterprises located in coastal regions, including Red Collar (Box 5.1; see also Appendix, Case Study 2), with the opportunity to transition from small township workshop producers to mass producers as they accumulated capital and expertise in apparel manufacturing.

41 The transfer of manufacturing capacity by entrepreneurs from the earlier newly industrialized economies of Hong Kong SAR China, Taiwan Province of China and the Republic of Korea was particularly important, and they continued to supply managerial and export marketing expertise. The links between Hong Kong SAR China and Guangdong Province were especially strong due to common language and easy transportation links in the Pearl River Delta.

42 In the OEM (original equipment manufacturer) model, a producer is responsible for designing and making a product according to its own specifications, and then selling the product to a buyer who markets the product under its own name.

Box 5.1
Upgrading Along the Apparel GVC: Red Collar (China)

Many township enterprises responded to the opening of the Chinese economy after 1979 to produce clothing for the domestic wholesale market. The Red Collar Group was established in Qingdao from one such enterprise in 1995. In addition to operating its private brand domestically, the Group produced apparel for foreign brands under an OEM model.* Red Collar invested heavily in world–class processing equipment, imported fabrics and accessories to ensure high quality, and invited designers from Italy in order to promptly follow global fashion trends. In the early 2000s, Red Collar sold to well-known brands from the United States, Italy, Germany and other EU countries, and OEM revenues far exceeded sales to the domestic market.

A second turning point came in 2003, when information technology began flourishing in China. Red Collar explored the digitalization of the manufacturing process to become a mass customizer through a platform in which the firm directly interacts with end customers. For example, a customer buying a suit in a department store can use a portable system provided by a salesperson to complete the design process and transmit the customer's data to Red Collar's manufacturing plant. Customization was initially limited to a small scale for the New York market, while OEM remained Red Collar's principal business, but by 2015, revenue from apparel customization accounted for 96 per cent of Red Collar's total sales of RMB 1.1 billion (approximately US$ 180 million), with a net profit margin of 25 per cent. Most of Red Collar's sales are to major retail chains or tailors, with 70 per cent of customized orders in 2015 placed by the United States, Canada, Italy and other EU countries. Tailored suits, can be delivered within seven working days.

Red Collar's initial development was based on abundant rural labour. In the twenty-first century, university graduates with backgrounds in science and technology have become integral to Red Collar's transformation to mass customization. China's increased pool of skilled labour provided Red Collar with the human capital to enable the company to move from the low end of the GVC to high value-added production.

Source: Appendix, Case Study 2

Note: * An original equipment manufacturer (OEM) designs and makes a product to its own specifications and sells to a buyer who markets the product under its own name.

While surplus rural labour laid the foundation for development, government policies to encourage human capital formation enabled companies like Red Collar to upgrade their operations. Since the late 1990s, the Chinese government has implemented a university enrolment expansion policy to meet the growing demand for highly qualified manpower. Graduates from higher education institutions provided a talent pool for the sustainable development of enterprises such as Red Collar; during Red Collar's period of transformation to mass customization, graduates with backgrounds in science and technology became integral to the development of relevant data algorithms as well as information systems. The increased pool of skilled labour enabled the transformation of apparel companies' business models and helped firms like Red Collar accumulate the human and intellectual capital that enabled the company to move up from the low end of the GVC.

During the 1990s, the application of high-tech in apparel manufacturing was emphasized by the government. In addition to the training opportunities and encouragement to import high-tech equipment, the government and relevant associations established a series of projects to improve industry standards and to satisfy the international requirements of apparel manufacturing. The rapid growth of production capacity and the impact of the 1997/8 Asian crisis brought a glut of goods, which caused fierce competition among companies operating as OEMs, and declining exports of textiles and apparel. The Chinese government immediately raised the tax rebate rate for the export of textiles and apparel exports. Some Chinese apparel enterprises began transforming from OEMs to designing and manufacturing in accordance with other companies' specifications. Exports resumed growth in 2000. By 2000, China accounted for one-fifth of the global apparel market, largely based on private entrepreneurs and integrated production systems.

After WTO accession in 2001 and the liberalization of global textile and apparel markets, Chinese exports continued to grow. China was a major beneficiary of the end of the Multifibre Arrangement, and its share of global apparel exports increased from 28 per cent in 2004 to 38 per cent in 2014. Chinese firms sought to add value through original design and materials research, and the 2008-9 downturn in world trade stimulated China's apparel enterprises to focus on brand operation, design and other profitable activities. In the 2010s, buyers sought to diversify their supply sources, including finding lower cost locations outside the Chinese coastal provinces where wages had increased substantially. Despite these aims and perceptions, the data (at least up to 2015) show little sign of increased unit values or of a declining global market share.

China's apparel industry is concentrated in coastal provinces; Guangdong, Zhejiang, Jiangsu, Shandong and Fujian accounted for 69 per cent of output in 2011. There are historical reasons for this concentration, and in the early reform period, local clusters and specializations were established (e.g. socks in Zhejiang and underwear in Guangdong).[43] The concentration in these provinces has scarcely changed in the twenty-first century, despite rising wages and other costs as well as government programmes promoting the relocation of industries to non-coastal provinces. This suggests the strength of the agglomeration effect (i.e. economies of scale external to the firm) and the long-lasting consequences of product-specific connections and logistics infrastructure. Qualitative explanations for locational stability include the emergence of a more fashion-conscious population in the higher-income coastal areas. There is also evidence of producers resorting to greater use of piece rates to circumvent rising formal wages.

The textile industry is also concentrated in the coastal provinces, especially in Jiangsu and Zhejiang. China's import tariffs on yarn and fabric average 9.6 per cent, which is higher than in Cambodia or Sri Lanka and similar to Indonesia and Viet Nam, but still lower than in Bangladesh, India or Pakistan. Output of yarn and fabric between 2000 and 2013 increased faster than that of apparel, which partly reflected the export growth of textiles and partly increased the supply to domestic garment-makers.

43 By the early 2010s, the output of "Sock City" in Datang township, Zhuji city, Zhejiang was sufficient to provide two pairs of socks per year for every person on the planet. Gurao (Bra Town, with over 1,000 factories producing 350 million brassieres per year) and Chendian, near Shantou in Guangdong Province, produce one-eighth of all underwear made in China.

Outward FDI in apparel has expanded since 2000 driven by rising costs in China. The main destinations are least developed countries where costs are lower and which have preferential access to major markets, i.e. Bangladesh, Myanmar and in particular Cambodia. Such outward FDI is supported by the Chinese government; it utilizes the management and marketing skills developed by Chinese apparel firms (including understanding what matters to buyers in apparel GVCs, such as quality, reliability, lead time and compliance), and also provides export markets for Chinese textiles and textile machinery producers.

5.3.2 Electronics

In the 1990s, China experienced increasing inward FDI in electronics, clustered in the Guangdong and Jiangsu Provinces, and focused particularly on contract assembly and OEM production. The importance of the electronics industry increased after 2000, e.g. 3C exports rose from US$ 28 billion in 2000 to US$ 405 billion in 2014. The export of 3C goods predominantly (83 per cent in 2007) consist of processing trade. Most of the exporters are domestic private firms but, if weighted by value, exports are dominated by foreign-invested firms. State-owned enterprises accounted for 46 per cent in 2000 but their share had fallen below 10 per cent by 2007, reflecting the transformation of these enterprises into private firms.

Mobile phones account for the largest share of production for the domestic market, and computers for the largest share of exports. Other consumer electronics (mainly TVs) account for approximately 17 per cent of both exports and domestic sales. Based on volume, at least two-thirds of 3C goods (excluding video games) sold in China in 2015 were domestic brands. Globally, Chinese brands accounted for 21 per cent of mobile phone units sold in 2015 (up from 1 per cent in 2007), and for 21 per cent of TVs sold (up from 11 per cent in 2007). This denotes an impressive upgrading to lead-firm status within a short period of time, although the shares may be smaller if data by value were available, and Chinese brands have limited presence in other products. Another indicator of upgrading is the increased contribution of domestic business services providers in the twenty-first century (Table 5.1).

Chinese firms that have established their own brand identity often started as suppliers to or joint ventures with firms from Hong Kong SAR China or Taiwan Province of China from the late 1980s to the early 2000s, providing capital, technology and market access. Other firms gained brand recognition by acquisition, e.g. in 2003, BOE (a state-owned enterprise supported by the Beijing government) acquired Hydis, an established manufacturer of display panels in the Republic of Korea. A third option has been to work closely with well-known brand owners, e.g. in 2004, TCL entered into a joint venture with Alcatel, permitting it to manufacture phones under a licence for a reputable brand, and in 2008, TCL became the first overseas contract manufacturer of TVs for Samsung. In a more recent trend, firms ambitious to upgrade have recruited senior management or engineering personnel from well-known foreign companies.

The semiconductor industry has been a success story in China, but the results are often considered mixed due to the lack of technological upgrading.[44] Although the number of semiconductor firms increased from 172 in 2000 to 492 in 2011, and employment rose from 74,004 to 293,023 in this period, production was largely low value-added processing for export; domestic firms supplied less than one-fifth of the home market and the trade deficit in integrated circuits increased due to domestic demand for advanced chips from the fast-growing 3C producers (Kong et al., 2015).[45] Ernst (2015) reports that in 2013, only 8 per cent of China's domestic semiconductor consumption of US$ 145 billion was supplied by Chinese firms, and that China's semiconductor import bill of US$ 232 billion in 2012 exceeded the value of China's oil imports (US$ 221 billion).

5.4 India's Apparel and Electronics GVCs[46]

A striking feature of India's role in apparel and electronics GVCs is that although individual firms participate in GVCs, aggregate participation rates are low.

5.4.1 Apparel

India's apparel and textiles industries are vertically integrated, and includes a domestic raw cotton material base. The industry is characterized by a large number of firms, including a large informal sector, which tend to be small with low skill levels and poor productivity, and are hampered by a cumbersome regulatory environment. Within this generally domestically-oriented and rather traditional industry, some large firms are involved in GVCs. Gokaldas Exports Ltd (Box 5.2; see also Appendix, Case Study 3), for example, has shown flexibility in adapting to changing conditions and achieving significant scale economies, and has become one of India's leading apparel exporters.

In 1985, following demand shifts in U.S. and European markets where Indian handloom cotton fabrics and colourful flowing designs were experiencing a burst of popularity, there was a sudden surge in apparel exports. At the same time, as foreign buyers began to explore Indian handloom and textile products, the United States and the EU increased their quota allocation of textile and garment imports from India. During the same period, the Government of India modified its financial sector regulations to improve access to foreign exchange for technology upgrading purposes, and announced incentives to promote exports like duty drawbacks, advance licencing and the provision of cash support for exporters.

44 The perception that China needs to transform from catching up by using foreign technology to creating innovations was reflected in the report produced for the Development Research Center of the State Council of China and published in 2013 by the World Bank as *China 2030: Building a modern, harmonious and creative society*). It is also a theme of the study of China's semiconductor industry by Ernst (2015).

45 Of the 492 firms in 2010, only 224 were domestically owned; the owners of 164 were foreign and of 104 overseas Chinese (i.e. from Hong Kong SAR China, Macao SAR China or Taiwan Province of China). Kong et al. (2015) report that the trade deficit in integrated circuits increased from US$ 8.6 billion in 2003 to over US$ 100 billion in 2010.

46 This section draws on Frederick (2018c) background paper.

Producers responded to these incentives. Gokaldas Exports Limited, for example, had begun operations in Mauritius in 1978 and only started manufacturing in India in 1985 (Box 5.2). By initiating production for export in India, Gokaldas responded to improved access to U.S. and EU markets for Indian apparel exports as well as to modifications of Indian policies. The subsequent expansion and success of Gokaldas continued to benefit from government policies. Nevertheless, Gokaldas remained a relatively rare example of an Indian apparel company's GVC participation.

Box 5.2
Gokaldas Exports Ltd - a leading Indian apparel exporter

Gokaldas Exports Limited (GEL) has been serving large global retailers since 1978, when it began its operation as an Indian company incorporated in Mauritius to export apparel. In 1985, the firm was incorporated in India and began exporting to the United States under made-to-order buying arrangements across various categories of garments.

The driving factors behind GEL's initiation of production for export in India in 1985 were changing external conditions and domestic policies. The United States and the EU increased their quota allocation for Indian textile and garment exports. The Indian government modified the financial sector regulations to improve access to foreign exchange for technology upgrading purposes, and introduced export incentives such as duty drawbacks, advance licensing and the cash support.

The firm manufactures apparel under licence from established international brand clients such as Abercrombie & Fitch, Adidas, Benetton, Diesel, DKNY, Gap, H&M, Jack Wolfskin, Land's End, Lee, Marks and Spencer, Macy's, Nike, Northface and Reebok. The major challenge reported by the firm is competition from newly emerging players like Viet Nam, Cambodia, Bangladesh and Sri Lanka, especially as least developed countries receive preferential access to major markets. Other issues include changing standards and quality specifications, different customs and export procedures, packaging and labelling requirements and inspection procedures, especially in the EU and U.S. markets, e.g. the prohibition of colour dyes in Germany caused major losses for the firm in the 1990s.

The labour-intensive industry is slowly transforming into a more capital-intensive one with the induction of computer-aided design and other related technologies. Nevertheless, GEL's 20 manufacturing units spread across the states of Karnataka, Tamil Nadu and Andhra Pradesh employ around 25,000 workers.

Source: Appendix, Case Study 3

The *National Textile Policy 2000*, the Textile Upgradation Funding Scheme of 1999 and the 2006 Amended Technology Fund Scheme were intended to provide greater support to higher-value segments of the textile and apparel supply chain. However, these and more general cluster-related or training schemes appear to have had little impact on the industry's structure or success in promoting clothing exports, which are low relative to global trade in apparel or India's overall exports. In 2015, India's apparel exports amounted to US$ 15.4 billion, i.e. 4 per cent of world apparel exports and less than 5 per cent of India's total exports.

Indian apparel exports no longer benefit from preferential market access. Over two-thirds of apparel exports in 2015 went to the EU (44 per cent) and the United States (25 per cent). Firms like Gokaldas are concerned about their non-preferred status relative to least developed countries such as Bangladesh or Cambodia. India's most significant trade agreements—with ASEAN to be generalized to ASEAN+6 via the Regional Comprehensive Economic Partnership (RCEP)—do not involve any important apparel markets.

Most recently, the Government of India implemented three initiatives to promote apparel exports:

- an interest subvention scheme of 3 per cent on all rupee denominated pre- and post-shipment credits;
- enhanced duty drawback capping;
- 2 per cent export benefit on all exports to notified countries.

In addition, the new textile policy announced by the Government of India aims to promote employment, economies of scale and boost exports. The effectiveness of these policies remains to be seen.

5.4.2 Electronics

India is not a major electronics exporter. In 2015, total electronics exports amounted to US$ 3.5 billion, of which 53 per cent were final products, 25 per cent subassemblies and 22 per cent components. India was not among the world's top ten exporters in any sub-category. The United States and the United Arab Emirates (UAE) are the main destinations, although shares vary from year to year, e.g. in 2011, 17 per cent went to the UAE and 10 per cent to the United States and in 2015, 24 per cent went to the United States and 18 per cent to the United Arab Emirates.

Domestic production largely targets the domestic market. Major lead firms such as Samsung are present, as are EMS companies such as Foxconn, Sanmina SC, Flextronics and Jabil Circuit. Electronic component production is weak, and most electronic components are imported duty-free under the ITA. However, India is strong in design, a global hub for VLSI and board design capabilities; the top 23 global semiconductor producers all have R&D and design centres in India.[47]

India is in a unique position in electronics GVCs because it has a strong presence in integrated circuit design, with most of the top multinationals having an office in India, albeit minimal manufacturing. This division between design and manufacturing is uncommon, but not entirely surprising because the relevant skill sets differ, and design as a digital service activity can be carried out in separate locations by different firms. From an upgrading perspective, India is in an advanced stage of GVC participation by engaging in design, but the design activities are carried out in a branch plant of foreign multinationals with minimal spillover effects to the Indian economy.

47 Very-large-scale integration (VLSI) is the process of creating an integrated circuit by combining billions of transistors into a single chip.

India has a suite of policies to create jobs in electronics and reduce imports, including a range of subsidies for capital expenditures, tax exemptions and infrastructure spending in the National Policy on Electronics of 2012, with a total budget of US$ 5 billion.

Box 5.3
Moser Baer India Ltd – the rise and fall of a GVC participant

Moser Baer India was founded in New Delhi in 1983 as a time recorder unit in technical collaboration with Maruzen Corporation, Japan and Moser Baer, Switzerland. In 1988, Moser Baer India moved into data storage by manufacturing 5.25-inch floppy disks. Responding to technological change, the company was manufacturing 3.5-inch floppy disks by 1993, and in 1999, set up a 150-million-unit capacity plant to produce CDs and DVDs. The OEM strategy involved matching global standards in terms of scale, technology, quality, product flexibility and process integration, and included sales agreements with leading companies such as Verbatim and Polaroid. In the mid-2000s, Moser Baer India was the world's second largest optical media manufacturer with a 17 per cent global market share.

The company faced serious financial problems starting in 2004-5, when storage device technology experienced market erosion due to the introduction of newer technologies. Competitors from Taiwan Province of China, CMC and Ritek, were more agile in shifting to flash-drive technology and by relocating production to mainland China reduced their costs substantially.

Starting in 2007, Moser Baer diversified into photovoltaic cells (PVs) and home entertainment, and later into light-emitting diode (LED) lighting. It set up the world's largest thin film solar fab plant in 2008 at a bad time for the PV business, as the global economy entered recession and Chinese producers pushed down PV prices. The home entertainment subsidiary, founded in 2006, is a domestic business; it operates a digital video processing facility and distributes home videos in a number of Indian languages. Moser Baer's LED lighting business is an assembly unit producing for the domestic market.

Moser Baer India was a successful OEM producer that created a strong position in a dynamic electronic GVC in the 1990s. Facing the joint challenge of technological change and intensified competition, it lost this leading position in the years after 2005 (Mishra, 2012). The responses of moving into PV and LED GVCs appear to represent a downgrading to lower value-added activities. The import to domestic ratio of raw material and packaging material, around 80:20 in 2015-16, is much higher than when the firm's flagship product was storage devices, because the PV and LED lighting facilities are heavily dependent on imported raw materials, mainly from China. The company still has a global presence with DVD and PV exports, but faces strong competition in PV export markets from Chinese companies; the company could be further negatively affected by a slowdown in demand in China, Japan, the EU or the United States and by volatile world PV prices. With a strong brand in the Indian solar PV market, Moser Baer hopes to benefit from demand growth and from government policy initiatives.

Source: Appendix, Case Study 4

Box 5.4
Hical Technologies (India) - successful upgrading in electronics GVCs

Hical established its operations in 1988 making electromagnetic high frequency transformer components for domestic clients in the telecom and automotive industries, and in 1992, entered the international market. In 1997, due to the unreliability of domestic clients, Hical diversified into aerospace and transformed into a 100 per cent export-oriented unit. Since 1997, Hical has been designing and manufacturing electromagnetics and electromechanical products (motors, solenoids and sensors as well as transformers), and supplies system integration to corporations such as BAe, Boeing, GE Aviation and Lockheed Martin. Revenues today are derived from aerospace (around 40 per cent), followed by defence (around 40 per cent), and medicine (20 per cent).

Significant investments have been made in human resources and hard assets. The company diversified into the aerospace business by setting up a "Hical Technology Development Centre" to develop electromagnetic and electromechanical systems for space and aerospace applications. By hiring the best talent from the Indian Space Research Organisation (ISRO) and other aerospace agencies, the company has built a strong design and technology team of engineers.

A strategic agreement with Vacuumschmelze (Germany) concluded in 2011 resulted in collaboration in the manufacture of specialty magnetics using advanced electromagnetic cores. Hical-NSE Electronics, a 2012 joint venture with NSE Group (France), became the vehicle for participation as the Indian Offset Partner in Indo-US, Indo-French, and Indo-Israeli contracts. Collaboration with NSE brought expertise to design, build and sell integrated systems for aerospace, electronics, telecommunications and large-scale industry applications. In 2017, Hical Technologies and General Aeronautics announced a formal relationship under which Hical Technologies will be the product integration and fabrication partner for unmanned helicopters and unmanned aerial vehicles (UAVs or drones) manufactured by General Aeronautics.

Hical Technologies has carved its niche through commitment to reliability and quality. The critical success factor is operational excellence through efficient supply chain management and lean manufacturing practices; major supply comes from the United States, the UK and EU companies. The aerospace, defence and medical industries require compliance with rigorous and complex standards and specifications, and the company maintains a record of zero rejections and 100 per cent on-time delivery.

Source: Appendix, Case Study 5

India has had successful exporters in the electronics industry, but their performance and fate have been idiosyncratic without obvious general lessons. Moser Baier India was founded in 1983, and moved into data storage in 1988. By 2005, it was the world's second-largest optical media manufacturer, having successfully managed the technological transformation from floppy disks to DVDs (Box 5.3; see also Appendix, Case Study 3). The firm became a key player in electronic GVCs. However, Moser Baier India was less agile than competitors from Taiwan Province of China in adjusting to flash drive technology. After 2006, the company responded by diversifying into photovoltaic cell production, home entertainment and LED lighting, and can no longer be considered a major participant in electronic GVCs.

5.5 Viet Nam's Apparel and Electronics GVCs[48]

As discussed in Part One, Viet Nam is a relative latecomer to GVCs compared to China or its Southeast Asian neighbours. Participation in apparel and electronics GVCs has increased rapidly in the twenty-first century. In both industries, the process has largely been driven by foreign investors, and Viet Nam's role in the two industries has involved final processing, with a fairly small share of the exported products' total value added.

5.5.1 Apparel

Viet Nam's apparel industry is segmented between domestic producers with little interest in exporting and foreign-invested enterprises that export. Apparel firms are geographically concentrated; in 2015, 46 per cent of apparel enterprises were in Ho Chi Minh City and 14 per cent were located in Hanoi. Domestic firms focus on vertical integration to produce and sell in Viet Nam, and domestic apparel brands have an established market share. Most domestic textiles are not of export quality, and domestic producers only meet 15 per cent to 16 per cent of domestic demand for textiles.

The existing structure of apparel exporters is dominated by foreign investors who import inputs from their global networks and whose sales are coordinated from headquarter locations abroad. Most investors are based in the Republic of Korea and Taiwan Province of China, and to a lesser extent Hong Kong SAR China and Japan.[49] Vinatex, a former state-owned enterprise that has been partially privatized, is involved in joint ventures with foreign partners and has an ownership stake in nearly all export-oriented apparel producers.[50]

Apparel exports grew rapidly after the termination of the Multifibre Arrangement at the end of 2004. The government initiated a comprehensive development strategy for the industry. Employment in apparel increased from 511,278 employees in 2005 to 1,337,429 in 2015. Since 2005, new production facilities to produce for export have opened, but few new exporting firms have emerged. Viet Nam's advantages include low labour costs and preferential access to major markets.[51] Disadvantages include workforce gaps that hamper new domestic entry or product upgrading. Exports remain concentrated in simple low-value products.

In 2014, Viet Nam imported an estimated 88 per cent of inputs for apparel exports and was the world's second-largest fabric importer. Cotton is primarily sourced from China. Viet Nam's

48 This section draws on Frederick (2018d) and Tong and Seric (2018) background papers.

49 Investors from the Republic of Korea include: (1) Hyun Jin opened factories in 2003, 2006 and 2010, mainly producing specialized gloves for work, gardening, sports or military use for customers in France, Germany and the United States; (2) Sees Global opened its Viet Nam factory in 2008, and now employs 2,000 workers making sports gloves for firms such as Head, North Face and Fila; (3) Suy has two fully owned factories and two subcontracting factories since 2005/6, employing 4,000 workers on OEM contracts for U.S. retailers such as Ann Taylor, Lands' End and Loft; (4) Kyung Seung has three factories in Viet Nam, which expanded by 30 per cent in 2016; as capacity shifted from Indonesia, over 90 per cent of its sales went to four U.S. companies led by Gap with 36 per cent in 2016 and H&M, (5) FTN, an LG subsidiary, opened its Viet Nam factory in 2006 and now employs 1,000 workers, producing for DKNY, Burberry and Calvin Klein.

50 Nadvi et al. (2004) analyse the pre-2004 growth of apparel exports, the decline of domestic textile production, and the dominant role of Vinatex in these developments.

51 Viet Nam has preferential access to the Japanese market under a 2009 trade agreement and GSP treatment in EU markets (which is less advantageous than the status of least developed competitors such as Bangladesh or Cambodia). Viet Nam's most important trade agreements are the ASEAN Economic Community and ASEAN+6 agreements with Australia, China, India, Japan, the Republic of Korea and New Zealand.

yarn industry was virtually non-existent in 2005, but a few Chinese firms established yarn production in Viet Nam to circumvent tariffs, and Viet Nam thus became a net exporter of cotton yarn; in 2015, yarn exports amounted to US$ 2.7 billion and yarn imports to US$ 1.2 billion

The current structure of production for export may be challenged by trade agreements being negotiated with the United States and the EU, which are likely to include rules of origin requiring that textile inputs be produced in participating countries. Since 2015, there has been a pre-emptive influx of investment in Viet Nam's textile industry.

5.5.2 Electronics

Viet Nam's electronics industry emerged as a GVC participant after WTO accession in 2007, and is dominated by a branch plant of multinational corporations. Panasonic and LG have older facilities producing consumer appliances, largely for the domestic market, but nearly all FDI in the industry dates from after 2007. In 2013, foreign–owned enterprises accounted for 97 per cent of Viet Nam's electronics exports. Electronic exports increased from US$ 3 billion in 2007 to US$ 50 billion in 2015.

The largest foreign investor is Samsung, with US$ 11.3 billion invested between 2008 and 2016; one-third of Samsung's global phone output is assembled in Viet Nam, and the Bac Ninh facility is the largest smartphone factory in the world (Box 5.5; see also Appendix, Case Study 6). Nokia moved its smartphone production from China to Viet Nam in response to rising labour costs in China, and Viet Nam was Microsoft's second-largest employment base before FIH (Taiwan Province of China) bought the Nokia and Microsoft facilities. Intel moved its operations from the Philippines to Viet Nam in 2010, and is now the largest U.S. investor in Viet Nam, with assets valued at US$ 1 billion. Canon has three printer factories, including the world's largest laser printer production plant in Que Vo, and largest inkjet printer factory at Tien Son. In 2013, LG Electronics committed to investing US$ 1.5 billion over ten years in an export-oriented consumer electronics factory in Haiphong, making Viet Nam LG's largest production base in ASEAN; LG justified the location decision in terms of wage costs and proximity to China-based suppliers.[52]

Most inputs for Samsung Electronics are imported, and domestically sourced inputs are primarily drawn from foreign-owned firms, while domestically-owned suppliers provide low value-added services such as packaging or printing. Samsung relies on suppliers from the Republic of Korea which followed the firm to Viet Nam to produce inputs for smartphones and tablets; of Samsung's 67 first-tier suppliers in Viet Nam, only four are Vietnamese and all of them are in packaging; of the remainder, 53 are companies from the Republic of Korea, 7 are Japanese, and one each is from Malaysia, Singapore and the UK.[53] The paucity of links

52 *ASEAN Investment Report 2016* (ASEAN Secretariat, Jakarta), page 66

53 Among Samsung's first-tier suppliers from the Republic of Korea, some established facilities in Viet Nam soon after Samsung's decision to expand its smart phone operations there, e.g. Partron Vina since 2009 and Haesung Vina since 2011. In 2014, Partron Vina's output of electronic components reached 450 million units, of which 130 million units were image-sensing modules and 320 million were mobile phone components; the firm had 4,500 employees and revenues of US$ 60 million. Haesung Vina produces camera lenses for mobile phones. Other Korean suppliers investing in Viet Nam include Woojeon (smartphone cases), MCNEX (camera modules), Flexcom (flexible printed circuit board, and Intops (smartphone cases) (*ASEAN Investment Report 2016*). A knock-on effect of the large Republic of Korea investment since 2008 has been the expansion of Republic of Korea retailers such as Lotte and E-mart in Viet Nam.

from multinational facilities to domestic firms limits the benefits from GVC participation, and an important question is whether this is a feature intrinsic to the GVC mode of production or specific to the lack of suitable Vietnamese partners.[54]

Box 5.5
Samsung Electronics Viet Nam (SEV)

Samsung has been in Viet Nam since 1996, originally producing colour TVs. Prior to 2007, Samsung mobile phones were manufactured in six facilities: two in China, two in Brazil, one in India and one in the Republic of Korea. In 2007, considering locations for new facilities to meet global demand and to reduce the concentration in Chinese factories, Samsung decided to move to Viet Nam. SEV commenced operations in 2009, and by 2015, accounted for 50 per cent of all Samsung mobile phone production.

Samsung's speed of start-up and scale of operations in Viet Nam was unique in Southeast Asia. In 2016, the firm accounted for 23 per cent of Viet Nam's merchandise exports, and mobile phones and their parts made up 19 per cent. At the end of 2017, Samsung employed 109,000 workers in SEV and other subsidiaries in Viet Nam, who were overwhelmingly semi-skilled high school graduates (7 per cent with post-secondary vocational qualifications and 4 per cent with university degrees); three-quarters were female. Wages in the communications equipment and electronics components industries more than doubled between 2008 and 2014, which was presumably driven by the large increase in labour demand from Samsung. During this period, employment in manufacturing increased from 3.2 million to 5.8 million, and the growth in jobs was much faster in the communications and electronics industries.

Samsung has found more difficulty in sourcing non-labour inputs locally. The company reports a "localization ratio" of 57 per cent, i.e. all value added retained locally (including profits retained for reinvestment). Local content in the more usual sense of the value of local goods and services as a percentage of total value added is much lower. In 2014, only ten Vietnamese domestic firms were suppliers, and the four first-tier suppliers among these were providing paper packaging products. Samsung reported in 2017 that the number of Vietnamese suppliers had increased to 215, of which 25 were first-tier suppliers while the others were second-tier suppliers. They were providing either services (e.g. meal catering, recreational travel, and cleaning and sanitation) or paper packaging products, which did not enter into the assembly and manufacturing of Samsung's actual final products.

Source: Appendix, Case Study 6

To alleviate the skills shortage, Samsung established the company's largest R&D facility in Southeast Asia in 2012. It has channelled US$ 2.5 million towards grants and scholarships at Hanoi University of Science and Technology and provided US$ 1.4 million in scholarships and laboratory equipment for the Posts and Telecommunications Institute of Technology. Intel invested US$ 7 million for 73 Vietnamese students to complete bachelor's degrees at Portland State University and has partnerships with Arizona State University and the

54 Sturgeon and Zylberberg (2016) report on a July 2014 workshop sponsored by the Vietnamese government and Samsung with the aim of identifying domestic suppliers. None of the 200 local firms that attended could meet Samsung's quality requirements.

Royal Melbourne Institute of Technology campus in Ho Chi Minh City for training engineers and managers.

Samsung's mobile phone production in Viet Nam is an extreme example of a GVC bringing large employment and other benefits to a country in a short span of time. At the same time, it also illustrates the difficulty for the host country to benefit beyond the direct impact on wages and jobs for semi-skilled workers. Samsung has undertaken some efforts to recruit domestic suppliers, but quickly determined that domestic firms did not have appropriate capabilities with respect to scale, cost, delivery and quality. The scale gap between a facility supplying almost one-fifth of Viet Nam's exports and potential domestic suppliers is perhaps the underlying fundamental problem, with Samsung unwilling to deal with 100 suppliers of a component. In this setting, a plausible entry route for domestic suppliers is to work as sub-contractors to first- or second-tier suppliers rather than with direct access to the lead firm.

5.6 Conclusions

The study of GVCs has been hampered by the variety of characteristics, determinants of participation and outcomes. Focusing on China, India and Viet Nam, this and the previous chapter have highlighted differences and similarities among the three countries at the national and industry level – and some behaviours that are idiosyncratic at the level of the individual firm. Taking these sources of variation into account, the firm-level datasets and case studies assembled in the background papers provide insights into GVC participation and performance that both reinforce and deepen the conclusions drawn in Part One from macro analysis. The next two chapters analyse these conclusions.

CHAPTER 6

FIRM-LEVEL EVIDENCE ON DETERMINANTS OF GVC PARTICIPATION

The firm-level evidence on determinants of GVC participation in China, India and Viet Nam must be placed in the context of the historical and macro evidence provided in Part One. China's firm-level dataset from 2002-5 is from a country, whose integration into GVCs has come a long way since the opening of the economy in 1978-9. Initial integration was in labour-intensive export activities with the aid of entrepreneurs, mainly from Hong Kong SAR China, who knew how to manage production and export sales along relatively simple GVCs. The process expanded and became more complex with the reinvigoration of economic reforms after 1992 and China's WTO accession in 2001. The firm-level data from 2002-5 presents a snapshot at a specific point in that development. The case studies of Red Collar and SJET Supply Chain Co. illustrate very clearly that the development continued in the decade after 2005 (see Appendix, Case Studies 1 and 2).

By contrast, India, has been slow to engage in GVCs and without much sign of evolutionary change. The Indian firm survey database covers a longer period than the Chinese dataset up to a more recent date, but the picture does not show rapid change. The individual case studies indicate contrasting experiences. Gokaldas Exports has been successful in apparel GVCs since the late 1980s, but appear to be atypical of Indian apparel firms (see Appendix, Case Study 3). In the electronics sector, Moser Baer was very successful as a GVC participant in the 1990s and early 2000s, but faded dramatically in the late 2000s in the face of international competition, after which the company rejigged its product range with a greater emphasis on the domestic market in the 2010s (see Appendix, Case Study 4). Hical Technologies had the opposite experience as a relative latecomer GVC participant that appears to have established a niche securely based on the firm's competitive strength (see Appendix, Case Study 5).

Viet Nam's GVC integration has been rapid but recent, and is primarily a twenty-first century phenomenon. The firm survey conducted in 2010 captures the early stage of this process. Viet Nam is also distinctive in the major role played by large transnational corporations, in particular Samsung (see Appendix, Case Study 6). The case study of Samsung is more thorough and analytical than the other case studies, reflecting the tremendous role this firm, and indeed a single investment project in the mobile phone electronics subsector, has played in Viet Nam's economy in the 2010s.

The firm level analysis is especially useful in identifying more fine-grained determinants and consequences of GVC integration. This and the next chapter will draw generalizations from the background papers, supplemented with specific examples from the case studies, while trying to avoid over-emphasis on individual firm-specific experiences.

6.1 Trade-related Determinants, Factor Endowments and Costs

As an overarching determinant of GVC participation, trade policies and openness to trade play a distinct role as a necessary condition. China's involvement in GVCs arose after a very clear starting date following the 1978-9 reforms which included an open-door policy. In pre-1978 conditions, substantial GVC participation would have been inconceivable. Even after 1979, the start was slow until economic conditions in Hong Kong SAR China in 1983-4 provided the catalyst for faster integration of Chinese firms into GVCs. Accession to the WTO in 2001 kick-started a new stage of involvement in GVCs and upgrading of GVC roles.

India, as a charter member of the WTO and a GATT contracting party since 1948, did not have a similar trade policy shift. However, firms like Gokaldas were strongly affected by changes in market access, which determined why the firm began export-oriented clothing production in Mauritius and then re-shored to India in 1985. Having 100 per cent exporter status is a significant benefit to Indian would-be GVC participants, as reported in the Hical case study.

Viet Nam's later start in GVC integration has historical roots, and GVC participation became feasible after the normalization of trade relations with the United States in 1995 and WTO accession in 2007. Regional integration following ASEAN membership in 1995, serious steps towards an ASEAN Free Trade Area after 2000, and the creation of the (albeit incomplete) ASEAN Economic Community in 2015 provided added credible commitment on the part of Viet Nam to open trade policies. Given the very high imported input share of value added in Viet Nam's GVC exports, such commitment is crucial to foreign investors who drive the country's integration into GVCs.

Trade theory predicts that trade patterns will be influenced by relative factor endowments, and that hypothesis carries over to prediction of the location of activities within GVCs. China's experience supports the hypothesis, with specialization in labour-intensive processing activities in the 1980s and upgrading to more skill-intensive activities as wages increased in the 2000s. A corollary of this upgrading was the shift of the most labour-intensive activities to lower wage locations such as Cambodia or Lao PDR. Among the case studies, Samsung's decision to locate its new mobile phone assembly operations in Viet Nam rather than China is the clearest example of factor cost determining GVC participation.

Among the surveyed firms in Viet Nam, GVC participants were strongly motivated by labour costs, while non-GVC firms were more concerned about the domestic market, and wage levels were a secondary element. The Viet Nam firm survey indicates that GVC participation has a large positive impact on employment, but in less productive and skill-intensive industries.

The lower productivity of GVC participants is related to a substantial negative gap in skill and capital intensity; even allowing for firm size and sectoral characteristics, the negative skill differential remains. GVC participants in Viet Nam are predominantly foreign firms with high import content, paying substantially lower wages than other firms, and are presumably more attuned to international wage cost differences.

6.2 Infrastructure and Institutions

In all three countries, the opening of the economy with some degree of trade facilitation and domestic deregulation, was a prerequisite for GVC integration and affected all firms. Certain regulation, delays and so forth are mentioned by firms as ongoing obstacles to GVC integration and have been to some extent circumvented by the creation of special zones (historically in China and currently in Viet Nam). Good infrastructure is also important and reflected in the geographical concentration of GVC participants, often located close to ports even if wages are lower in inland locations.

The Viet Nam survey was most specific in asking firms about the main obstacles to exporting. For all firms, bureaucracy and regulation was the number one barrier to exports, and this was especially the case for foreign firms, which face greater difficulties in navigating the complexity of Viet Nam's regulatory environment. Domestic firms also listed lack of effective export support services and access to trade finance as important barriers. There was a striking contrast between the responses of GVC and non-GVC firms. Bureaucracy and regulation, utilities, electricity and telecommunications infrastructure were relatively more important for GVC participants than for non-GVC participants, while lack of export support services was a relatively higher barrier for non-GVC firms. Road and rail infrastructure was an export barrier for 25 per cent of all firms, without much distinction between foreign or domestic firms or between GVC and non-GVC participants. Inadequate agencies in Viet Nam to help firm compliance with international certification standards was a barrier to exports for 15 per cent of firms, again with little distinction by ownership or GVC participation. A general conclusion is that boosting exports is mainly a matter of improving the soft infrastructure of bureaucratic procedures rather than spending on hard infrastructure.

6.3 Skills, Industrial Capabilities and Ownership

While country differences in factor endowments and costs clearly underlie the GVC phenomenon, such differences do not come to light in the firm surveys of China and India because the surveys were not designed to answer this question. One surprising result from the analysis of the firm-level data from China is that the marginal effects of TFP on the decision to engage in GVCs are either economically insignificant, or negative in the case of 100 per cent export processing firms. This may indicate that more efficient firms do not export or, more likely, that they focus on ordinary exports rather than processing exports.

The most striking results in the background papers on India relate GVC participation to variables capturing competitiveness or innovation and to scale. The direction of causality is difficult to disentangle. Aggarwal and Steglich provide arguments for more productive firms being more likely to participate in GVCs. Meyer gives evidence of GVC participation leading to process and product innovation. The overall impression is that in a country where the majority of firms is still at an early stage of GVC participation, the GVC option has helped more dynamic firms, and GVC participation has probably increased their competitive edge.

The evidence in the Indian case study contrasts the finding from China that the productivity of export processing firms tended to be lower and that the impact on productivity of such firms' participation in GVCs was negative compared to that of non-participants. An explanation of the China finding may be that by the turn of the century, the more productive firms had started to upgrade from labour-intensive export processing activities within GVCs to more skill-intensive activities catering to both domestic and foreign customers.

While the micro data did not reinforce the findings from the macro analysis about the importance of industrial competences, this may be present but is ignored by survey respondents as a country-specific rather than a firm-specific effect. For example, when Samsung was deciding about where to locate its mobile phone assembly plant in light of increasing wage costs in China, it selected Viet Nam rather than other low-wage ASEAN countries (Cambodia, Lao PDR and Myanmar), which may have been more attractive in terms of wages but did not have the industrial experience of Hanoi and its hinterland.

Another factor that seems to bear importance in terms of GVC participation is the type of ownership of the firms. In China, for instance, GVC integration or GVC non-participation are correlated with firm ownership type. More than nine-tenths of firms with 100 per cent export processing are foreign-owned or foreign-affiliated. Amongst GVC firms, export processing-intensive firms tend to be involved in low- to medium-tech industries, and firms engaged in 100 per cent export processing had the lowest productivity level in 2002. By contrast, private Chinese firms account for more than 71 per cent of non-GVC participants, and on average, non-GVC firms are smaller and more leveraged than GVC firms. Multivariate analysis reinforces the finding that foreign ownership is a statistically and economically significant determinant of GVC involvement.

6.4 Geographical Determinants of Location and Influence on Trade Patterns

Local conditions are important determinants of the location of GVC participants. In Viet Nam, the highest level of GVC participation is in Vinh Phuc (northwest of Hanoi) and Binh Duong (near HCMC) Provinces, which both rank highly among Vietnamese provinces for accessibility and provincial competitiveness.[55] Samsung located its mega-factory to assemble phones in

55 The *Viet Nam Provincial Competitiveness Index* is compiled each year with support from USAid, and is available at http://eng.pcivietnam.org/uploads/78910-PCI%202016%20report_final.pdf

Bac Ninh, a province next to Hanoi and in the direction of the port of Haiphong. It is also striking how many of China's GVC participants are concentrated in the pre-revolutionary industrial heartland of Jiangsu/Shanghai/Zhejiang and other coastal cities within the vicinity of Hong Kong SAR China, and how many of India's GVC participants (including the three case study firms in Boxes 3-5) have their head offices in Bangalore.

As might be expected, non-GVC firms in China are proportionally more common in provinces without export promotion zones, suggesting the importance of including an indicator of special zones in the analysis. However, incentive packages in Viet Nam provided by the government to investors in industrial and export processing zones are found to have only a limited role as an attraction factor. One problem with isolating individual determinants of GVC integration is that the participation decision is likely to depend on a range of factors whose weight differs by industry or even by product-specific chain. In China's case, the preponderance of special economic zones located in coastal provinces suggests that the correlation between GVC participation and provinces with export promotion zones may be picking up other locational advantages.

The geographical pattern of imported inputs and export destinations varies by industry. In electronics, Viet Nam's GVC trade is overwhelmingly within East and Southeast Asia, with China, Japan and Southeast Asia roughly equally-sized sources of imported inputs, and export destinations dominated by Japan, with Southeast Asian destinations (primarily Malaysia and Thailand) a distant second. By contrast, in textiles, garments and leather goods, imported inputs are overwhelmingly derived from Taiwan Province of China and the outputs are mainly exported to the United States. The wood products and furniture industry has a more diversified set of import sources and export destinations. In all industries, Vietnam's role in the GVCs is primarily labour-intensive assembly undertaken by MNE affiliates, while domestic firms mostly provide low value added services and inputs.

Apart from the impact of special zones (discussed above), governments in all three countries have offered policy support that has intentionally or indirectly increased incentives for GVC integration. There is also evidence, especially from Viet Nam (see above) that cumbersome bureaucratic procedures are inimical to GVC integration. Policy issues and options will be analysed more thoroughly in Part Three, but the firm-level evidence provides some indications of the extent to which policies have influenced decisions on GVC participation.

In marshalling the evidence reported in this chapter for policy recommendations, it is important to be aware of the dangers of extrapolating past experience as the basis for policy (as in the Lucas Critique). GVC participants often tend to cluster. This may reflect external economies of scale or may be a matter of good infrastructure – GVCs inevitably involve the international transport of components. Trying to artificially create a new cluster may be doomed because the policymakers do not understand the forces that might underpin the successful clustering of a specific activity.[56] A stronger implication of the evidence, reinforcing a conclusion from Part One, is that GVC participation is related to pre-existing competencies and that is why

56 Based on Chinese data from 1993 to 2012, Lu et al. (2016) find mixed effects of clustering both on the firms in the cluster and on co-located industries. The impact varies, especially with maturity of the cluster; emerging clusters tend to have a negative impact on co-located industries.

GVCs cluster around successful industrial locations like Bangalore, Jiangsu and Zhejiang, or Hanoi and HCMC. From this perspective, the policy implication is to build up industrial competencies by investing in education, training, technological capabilities and R&D or to improve infrastructure and reduce the costs of international trade.

CHAPTER 7

FIRM-LEVEL EVIDENCE ON OUTCOMES FROM GVC PARTICIPATION

The impact of GVC integration on GDP, employment, wages, productivity and upgrading within GVCs is generally positive, which explains the strength of the phenomenon. The more interesting questions are about the inclusivity and sustainability of growth based on GVC integration. The micro analysis at the firm level is essential for explaining under what conditions and in what dimensions the outcomes from GVC participation are likely to be positive or negative.

7.1 Output, Employment, Wages and Productivity

Integration into GVCs has been a central feature of China's rapid growth in output and in manufactured exports and it is difficult to isolate its impact. Technically, China had full employment before the 1978/9 reforms, but the massive shift in workforce from agriculture to manufacturing represented a shift from work with a lower to higher marginal product. It also had an important gender dimension as the young women who flocked to the factories may not have had great employment conditions in the early years, but were leaving positions at the bottom of the economic scale in rural households and now had at least some discretionary income.

The debate as to whether China would have been better off in the long run without its trade and industrial policy which encouraged the country's firms to engage in exports processing at the lower end of GVCs is yet to be settled, primarily because it is difficult to agree on what the alternative might have been. A crucial point is that China had started to upgrade its GVC participation by the turn of the century. Girma (2018) background paper, using a matched firm level and customs records panel dataset from China, documents economically and statistically significant positive causal effects of GVC participation on a range of firm performance variables, at least in the immediate years following China's WTO accession. GVC participation produced a substantial number of winners, measured by higher wages or by firms' sales and productivity.

Girma (2018) background paper quantifies the effect of different degrees of GVC participation on firm-level performance with respect to employment, wages, sales and total factor productivity

growth. Girma finds robust positive GVC participation effects on employment, wages and sales growth. From simple summary statistics of the outcome variables by GVC level, GVC firms performed significantly better than their non-GVC counterparts in terms of employment, wages and sales growth.

Implications for total factor productivity growth are mixed. Only firms with "ordinary exports" experienced positive average TFP growth. Quantile analysis reveals beneficial TFP effects among firms most strongly involved in export processing, i.e. moderate and high export processing firms, and especially for firms at the lower end of the TFP growth distribution. However, such unconditional relationships should be treated with caution, as they are influenced by many factors unrelated to GVC integration.

More tentatively, the benefits attributable to GVC engagement appear to be largely driven by firms involved in Southeast Asian production networks. This result supports the conclusion in Part One about the significance of regional value chains and the hypothesis that China's rise as a trading giant is due in part to its integration into Asian production networks. GVC engagement in Southeast Asia appears to have led to higher wages, sales and TFP growth compared to the counterfactual state of exporting processed imports to other destinations, although no differential employment effects are found. This may imply that opportunities for upgrading are better in regional rather than global value chains, but the evidence is very tentative.

The evidence from Viet Nam is both stronger and narrower due to the scale of GVC-related foreign investment since 2007. Samsung had a small labour force in Viet Nam before constructing the Bac Ninh mobile phone facility (see Appendix Case Study 6). By the end of 2017, the company employed 109,000 semi-skilled workers in Viet Nam, all of who were high school graduates, 7 per cent with post-secondary vocational qualifications and 4 per cent with university degrees. Three-quarters were female. Wages in Viet Nam's communications equipment and electronics components industries more than doubled between 2008 and 2014, which was presumably driven by the large increase in labour demand from Samsung. During this period, employment in manufacturing increased from 3.2 million to 5.8 million, and the growth in jobs in the communications and electronics industries was much faster.

Participation in GVCs, relative to the size of the economy, is lower in India and unlikely to have a major impact on national labour markets. The concentration of GVC activities around Bangalore presumably has affected the local market, although the Bangalore boom is attributable to more than just GVCs.

7.2 Technology Transfer and Productivity

A major concern of countries whose producers participate in GVCs is whether technology transfer or productivity increases will help the country to escape from the lowest segments of the value chain. Even if that challenge is met successfully, there are concerns about a middle-income trap preventing countries from occupying the highest value added parts of GVCs. The

original Asian Tigers (Hong Kong SAR China, the Republic of Korea, Singapore and Taiwan Province of China) have shown that avoiding such traps is possible, but not inevitable. Among the three countries featured in this report, China is upgrading most visibly, as illustrated by the case studies of Red Collar and SJET (see Appendix, Case Studies 1 and 2), while India has hardly begun to exploit the possibilities of upgrading along GVCs. Viet Nam's recent experience is the most complex in this respect.

Support in terms of technology transfer and joint product design in Viet Nam is greater for firms participating in GVCs than for domestic firms with no GVC participation. In their background paper, Tusha et al. (2018) conclude that being part of a GVC helps local firms receive support, especially from foreign buyers abroad, but the correlation to productivity is not significant. More generally, GVC linkages have a positive effect on the productivity of domestic firms, although many simultaneity issues confuse attempts to relate GVC participation to support and productivity.

Coniglio investigates the backward and forward linkages from GVC participants to domestic firms. Local sourcing is very low in textiles, garments and leather goods, motor vehicles, electronics and metal products—a list that includes the main GVC industries—and lower for firms located in industrial zones and export promotion zones (where over half of foreign firms are located). A multivariate analysis confirms that even when controlling for industry, province and other variables, foreign firms located in Viet Nam that are part of a GVC generate significantly lower backward linkages than other firms in Viet Nam. However, inclusion of a time-since-entry variable suggests that foreign firms develop more domestic linkages the longer they operate in the country.

Tusha et al. (2018) investigates the extent and intensity of linkages in greater depth. They find that foreign firms tend to develop more linkages with other foreign firms in Viet Nam rather than with domestic firms. Their analysis of the relationship between linkages and productivity shows the potential for domestic firms to improve their level of productivity by selling to foreign firms in GVCs, and identifies the necessary conditions for knowledge-intensive linkages to develop. These conditions include the absorptive capacity and technological gap between foreign firms and heterogeneous domestic firms. This reiterates the earlier premise about pre-existing industrial abilities; such competences are important not only for the initial location decision, but also for upgrading within GVCs

The Viet Nam survey provides information for each firm on the number of buyers and suppliers, and the share of inputs and outputs bought from or sold to a certain type of buyer or supplier. The intensity of linkages is measured based on respondents' reporting that they received or provided support for product quality upgrading, production process efficiency upgrading, access to finance, worker training, technology transfer and joint product design. An overall measure of support is constructed by adding scores of one or zero for each of these six categories. On average, local suppliers receive most support from foreign buyers outside Viet Nam and least support from foreign buyers in Viet Nam. Across all buyers, most support is provided towards product quality and efficiency upgrade. Domestic buyers provide more support in terms of access to finance and employee training, while foreign buyers, whether in Viet Nam or abroad offer more support in terms of technology transfer and joint product design.

Heterogeneity is also associated with firm characteristics, e.g. firms with a lower skills level receive more support in the form of training and older firms receive more of varying forms of support and from all types of buyers.

Overall, the evidence from Viet Nam of positive technology transfers and the potential for upgrading within GVCs is disappointing. The anecdote of Samsung holding an event for would-be domestic suppliers and concluding that none of the participants had the necessary characteristics to be a first-tier supplier suggests that technology upgrading such as participation depends on pre-existing industrial competences. As with any anecdotal evidence, however, there may be special features of the Samsung mobile phone GVC that make the leap for domestic firms to become first-tier suppliers too great or Samsung may simply prefer to work with first-tier suppliers from the Republic of Korea.

7.3 Corporate Social Responsibility

This section mainly reports evidence from Viet Nam because the Vietnamese data used in the project were more informative on corporate social responsibility issues than the firm surveys from China or India. [57]

Viet Nam has been very successful in attracting foreign investors in the twenty-first century who locate unskilled labour-intensive tasks in GVCs to the country. Especially since 2007, coinciding with WTO accession, the government has issued plans and passed legislation aimed at stimulating links to domestic firms and attracting higher quality investment, i.e. upgrading within GVCs. More generally, recent policies have been concerned with ensuring that companies observe environmental norms and recognize corporate social responsibility (CSR), although this was not explicitly mentioned in legislation until the 2014 Enterprise Law. CSR is often defined to include commitment to sustainable economic development through compliance with environmental protection standards, gender equity, labour standards and benefits, community development and quality assurance in ways that benefit both the business' and society's overall development.

The 2010 Law on Energy Efficiency requires firms to use energy-efficient technology with less pollution, and the 2014 Environmental Protection Law provides incentives to adopt energy-efficient or less polluting methods, and imposes taxes and other disincentives on environmentally damaging behaviour (e.g. emissions, pesticides, plastic bags). Firms must prepare an energy consumption plan and an environmental protection plan following national standards. However, in analysis based on data from 2010-15, which may be premature to test the hypotheses, there is little evidence of impact on energy intensity or differences between GVC participants and domestic firms.

There is some evidence that foreign firms operating in GVCs have a greater propensity to

57 This subsection is based on Thang (2018) and Coniglio (2018a) background papers.

hire women, but with a wage gap that may be higher than in domestic non-GVC firms.[58] The background paper of Coniglio (2018) on Viet Nam confirms the positive employment effect, but suggests that wage differentials reflect productivity differentials rather than discrimination. Coniglio finds that foreign firms pay lower wages to both female and male unskilled workers than domestic ones. Foreign firms employ a higher share of female workers (7 per cent to 10 per cent more) than domestic firms, and foreign and domestic firms in GVCs have higher female employment shares than non-GVC firms. Thus, GVC participation is associated with greater female employment, often drawing workers from informal activities, but wages are depressed in GVC participating firms by the necessity to be competitive internationally.

Coniglio estimates that gender wage differentials in Viet Nam largely reflect productivity differences, as women are over-represented in low-wage unskilled activities. The gender wage differential is much more pronounced for skilled workers, but here, too, reflects productivity differences rather than discrimination in the workplace.[59] This does not exclude the possibility of discrimination in the education system, if males acquire skills that are more valuable in the workplace.

In sum, foreign firms in Viet Nam offer more employment opportunities to female workers, although the jobs are mainly in low-skill occupations. Foreign firms create few jobs for high-skilled female workers, most likely because Viet Nam's comparative advantage is in labour-intensive low-technology activities. The net effect is to create formal sector jobs for women, but with little impact on gender wage differentials. Reduction of gender wage differentials requires domestic changes in skill acquisition and structural change involving upgrading of tasks within GVCs. The government provides tax incentives under the 2014 Investment Law to firms that employ a large number of female workers.

Many of the firms interviewed for case studies were keen to mention their CSR credentials. They recognize that CSR activities might influence lead firms when selecting GVC partners, although it was often difficult to determine whether their statements translated into actions and whether CSR actions were substantial. In their study on international trade and CSR practices of Vietnamese firms, Newman et al. (2018) found a strong relationship between labour standard compliance and CSR commitments and participation in international markets; conditional on exporting, the degree of involvement in CSR activities was strongly correlated to the trade partner, e.g. Vietnamese exporters to China were less engaged in CSR-related activities than exporters to the United States, which the authors interpreted to reflect differences in stakeholder preferences across export markets.

58 See, for example, Chen et al. (2013) on China.

59 Chen et al. (2013) reach similar conclusions about wages and productivity for China, but their data is limited to analysis by skill differentials.

PART THREE

CONCLUSIONS AND POLICY IMPLICATIONS

CHAPTER 8

CONCLUSIONS AND POLICY IMPLICATIONS

The emergence and rapid expansion of GVCs has transformed the way we think about trade and has created new challenges and opportunities for developing industrial capacity in an inclusive and sustainable way. Economies that successfully developed in East Asia, namely the "Tigers" of the Republic of Korea, Taiwan Province of China as well as Singapore and Hong Kong SAR China, have shown that integration into GVCs can be leveraged to develop domestic industrial capacities. In a markedly changed international trade and investment environment, a new wave of emerging countries are now demonstrating that this path is still viable, even if fraught with challenges.

As the previous sections of the report have shown, China, Viet Nam, India and—to varying extents—other countries in Southeast Asia, have rapidly integrated into GVCs and successively increased their participation. However, struggles abound. Viet Nam, exemplifying the experience of other countries in the region, has integrated into value chains by bringing in foreign investment, but linkages with domestic firms remain sparse. It seems that a strategy of investment and trade liberalization does not suffice to guarantee integration of domestic firms into GVCs, and gains from participation are greatly mediated by the policy environment and the nature of the chains in question or the type of participation.

The conclusions drawn in the previous parts of this report suggest several implications that are relevant when considering policy instruments. Specifically:

- trade policy, low costs of international trade in money and time, and access to logistics and finance services are important components of GVC integration;
- minimum domestic competitiveness is necessary for GVC integration, and policy may help develop the capacity of domestic firms;
- location matters and GVC participants often cluster, but it can be difficult to determine why a particular cluster is in a specific location;

- special economic zones may encourage GVC participation and facilitate clustering, but the evidence that they make an independent contribution to determining GVC integration is weak;

- upgrading within GVCs is not automatic; it is related to domestic competitiveness, and may require targeted support to understand the specific challenges firms face, e.g. in raising skill levels, although general improvements in education, infrastructure and so forth help, too;

- some GVCs have better potential for upgrading than others;

- a comprehensive approach to upgrading should include social and environmental sustainability.

8.1 Policy Implications[60]

The above points suggest a role for policies in facilitating integration and upgrading within GVCs. Indeed, as the UNIDO (2015, 24) report on Global Value Chains and Development points out: "[…] as globalization advances, the significance of GVCs in economic development rises and it is no longer a question of whether but of how developing countries can participate in GVCs and to make the most of opportunities and to overcome challenges that may arise." The 2015 report also cautions about the complexity of the many development goals GVCs may be intended to achieve (Box 8.1), even as some of these goals may be contradictory or impose obstacles to GVC participation.

Box 8.1
Twelve Human, Social, Economic and Environmental Goals of GVC Participation

Value chain development goals can be numerous and diverse and cut across human, social, economic and environmental goals, including:

- Economic development
- Poverty reduction
- Industrial development
- Import substitution
- Export promotion
- Regional development
- Enterprise development, especially SMEs
- Increasing value added capture
- Generating income for specified groups
- Increasing employment
- Creating decent jobs with good working conditions
- Environmental sustainability

This list from UNIDO (2015, 18) illustrates the complexity of objectives when governments look beyond traditional economic goals of development and structural change, the reduction of poverty and regional inequality and improvement of the trade balance. Yet as this report shows, GVC participation and upgrading can contribute to these goals as well as to the goals of inclusive and sustainable economic development with people employed in decent jobs. The policy challenge is that while some goals may be complementary (for instance, a labour-intensive task within a GVC may generate employment and economic development, if workers move from low-productivity agricultural employment, and may promote gender equity if female workers are disproportionately hired), others might be in conflict (for example, refusing to accept the relocation of a firm performing tasks with harmful environmental consequences may promote environmental sustainability at the cost of foregoing increased employment).

60 This section and the next ones build on Mavroedi (2018a and b) background papers.

Policy tools can be put into a stage framework matching known policy instruments to those that are needed to meet minimum conditions, to improve integration and finally to pursue upgrading. Figure 8.1 presents this stylized framework.

Figure 8.1
Policies for Integration and Upgrading: An Integrated Framework

Minimum Conditions for Integration

Education	Infrastructure	Macroeconomic Environment

Instruments for Integration

Trade and Investment	Infrastructure and linkages	Skills and capabilities
- Investment Incentives - Preferential Finance - Trade Policy	- Industrial Zones - Supplier Development - Local Content Requirements - Joint Ventures	- Specialized Skills - Technology Institutes - Vocational schools

Instruments for Upgrading

Trade and Investment	Infrastructure and linkages	Skills and capabilities
- Extending measures for integration to serve upgrading - Encouraging outwards FDI	- Extending measures for integration to serve upgrading - Enhancing Cluster Capacity - Fostering Industry-University-Government linkages	- Extending measures for integration to serve upgrading - Incentives for R&D - Standards and certifications

Source: UNIDO elaboration based on Mavroedi (2018b) background paper.

First, integration is not easy and some minimum conditions for entry exist. Without these conditions, it is unlikely that FDI can locate in the country or that domestic firms can successfully export to buyers. These conditions include education, infrastructure and a conducive macroeconomic framework.

Second, several instruments can support integration. Integration is based on attracting FDI as well as on the creation of domestic firms that can become suppliers, either to subsidiaries located domestically or by exporting. To attract FDI, familiar measures can be used, such as incentives for foreign investors, specialized infrastructure and training the workforce in specialized skills. Linkages can be created with domestic firms by encouraging spinoffs from FDI, by promoting local content or insisting on joint venture ownership as a mode of entry. At the same time, policies can support the development of potential suppliers in desirable industries (or rather, chains). Finally, even though innovation may seem like a distant possibility, the foundations of a national innovation system need to be put in place early on by establishing institutes that can facilitate technology transfer and adaptation, emphasizing skill development and instituting mechanisms that can encourage the interaction of stakeholders, such as associations and forums.

As the capabilities of suppliers increase, instruments can start focusing on the promotion of upgrading. While some instruments are new, especially those that promote further innovative capabilities, the scope of previous instruments is essentially expanded to account for a more capable domestic and foreign supply base. This includes, for example, attention to clusters, shifts from an emphasis on FDI attraction as was the case with zones to emphasize inter-firm collaboration and competition, and building the means to enhance that. In this sense, education, infrastructure and the macroeconomic environment, the three basic conditions, are a work in progress, continuously employed to improve the conditions that encourage technological and industrial capability accumulation. These instruments can help develop specialized assets that will facilitate integration in relational chains or succeed in developing modular suppliers that can undertake a wider range of research, design, manufacturing and post-production functions.

Before analysing these instruments in detail, it is important to stress that the strong evidence of heterogeneity in GVCs and in countries' modes of GVC participation suggests that actual experiences will differ depending on country conditions and sectoral specialization. Hence, while generalizations about appropriate policies can be made, implementation will need to be sensitive to the national setting and nature of specific GVCs.

8.2 Minimum Conditions for GVC Participation

Without meeting certain minimum conditions, it is unlikely that a country's firms will be able to participate in GVCs. Most obviously, these include low costs of international trade in money, time and uncertainty, and low barriers to trade in relevant parts and components. Trade agreements can help assure GVC lead companies of a country's commitment to openness[61]. Good hard and soft infrastructure, ensuring ease of doing business and of trading across borders, are generally important. Evidence of good governance and credible assurance that successful GVCs will not face corruption at or behind the border are minimal requirements, while measures such as Single Windows and Green Channels offer additional support to GVCs.[62]

The macro and micro evidence presented in Parts One and Two highlight that while trade liberalization and facilitation may be necessary, they are not sufficient conditions for GVC integration. A recurring theme has been the importance of industrial competencies, including levels of education and basic infrastructure. Although not highlighted in the studies, a conducive macroeconomic framework with reasonable price and exchange rate stability is crucial.[63] These elements are not particularly new to any policymaker and constitute conditions for development, whether GVC-led or not.

8.3 Policies to Support GVC Participation

GVC integration may be facilitated by instruments to attract export-oriented FDI and to incentivize domestic firms to become suppliers, either to subsidiaries located domestically or by exporting. To attract FDI and domestic firms to GVC activities, bespoke measures such as a selectively liberalized trade regime, investment incentives, specialized infrastructure such as industrial zones, and training the workforce in specialized skills could be adopted, or more targeted supplier development programmes or measures such as local content and ownership requirements could be introduced.

Attracting FDI is probably the fastest way to integrate into desired GVCs. Foreign subsidiaries bring with them capital, technologies and managerial skills that may be superior to those available domestically. Most importantly, they bring knowledge about the production process in GVCs of interest, the way they operate, their structures and governance and their markets. It is also a way to quickly increase the domestic value added produced in an industry (in absolute terms) by inviting FDI in segments of the chain that are currently not undertaken domestically.

61 For instance, signing the WTO's Information Technology Agreement is important for participation in many electronics GVCs.

62 A Single Window allows all border-crossing procedures to be completed in a single step rather than separate immigration, customs, quarantine, vehicle insurance and so forth, each requiring interaction with a different official. Green Channels allow traders to select a nothing-to-declare channel at the border, as passengers are often able to do at international airports.

63 The need for price predictability along supply chains has led participants in Asian electronics GVCs to become sensitive to the RMB/USD exchange rate as a benchmark. Between August 2015 and February 2017, Malaysia, the Republic of Korea and Taiwan Province of China responded to changes in the Chinese currency's value, while Indonesia and the Philippines, which are less involved in electronics GVCs, did not respond (Thorbecke, 2018).

However, the ability to develop linkages with the domestic economy varies depending on the level of efforts to engage with FDI, the mode of FDI entry and the absorptive capacity of the domestic economy. The policy space to foster GVC linkages to the domestic economy has shrunk but not disappeared entirely. Governments can still nudge and influence foreign firms to work closely with domestic firms. In this sense, it is important to broaden the scope of instruments to also include domestic firms that could enter desired chains rather than offering preferential terms to foreign investors only. At the same time, the interests of FDI may not be aligned with local developmental objectives and reliance on FDI can increase exposure to the volatility of external markets. Macroeconomic management focusing on more balanced growth from domestic demand as well as mitigation measures for possible external shocks will be important.

8.3.1 Trade and Investment Incentives

Investment incentives are very frequently employed by countries to make investing in targeted industries more enticing or to encourage more capital- and technology-intensive production. Incentives commonly used include tax holidays from corporate tax, preferential tax rates, deferred tax liability, deductibility for certain expenditures, reduced import tariffs or customs duties, investment allowances, tax credit and VAT exemptions or reductions. They can also include non-tax incentives such as training and research grants, interest rate subsidies, discounted infrastructure and utilities.

A preferential investment policy package for certain activities is a measure that is not new and has been a 'classic' industrial policy tool. These can be compatible with a GVC strategy if the following points are considered:

- Incentives can be used to not only target a given industry, but to encourage specific activities within targeted chains. When integration is the main objective, incentives can be given for industries that offer most opportunities for GVC engagement (for example, electronics, textiles and automobile components).

- Incentives can be conditional on—or at least consider—business plans to enter GVCs. For example, credible plans for orders from foreign buyers, track records of engagement in foreign trade shows, membership in associations that bring domestic and foreign investors together and so on. This may require additional agency support to applicants to put together such applications.

- Incentives can reward pioneers (Rodrik, 2004) so that diversification of engagement with GVCs can be achieved.

- Incentives can be granted to applicants who demonstrate that their business is linking to already existing FDI.

Integration into GVCs requires the establishment of manufacturing facilities and the development of tangible (capital equipment, technology licenses) and intangible (more

educated employees, training, learning-by-doing) assets. Long-term financing is essential in matching those needs, often provided by specialized development or industrial banks. Easing access to capital can improve the capacity of firms to participate and upgrade in value chains. Similarly to adapting incentives to the operations of GVCs, preferential, long-term financing can be given for specific activities within chains that are targeted.

Another aspect of GVC-related financing relates to financing SME suppliers[64]. In some cases, chain leaders are able to create loan guarantee associations to help SMEs commercial credit and in more rare cases they can actually provide inter-firm financing. Ensuring that financial institutions are cognizant of the needs of SMEs participating in GVCs could assist firms in meeting their liquidity needs at a low cost. This requires building capacity within the financial system, designing particular programmes that target SME supplier needs and assisting suppliers with application, possibly through specialized agencies.

Another instrument used for GVC integration is export promotion. While GVCs have mostly been associated with FDI-led trade, exporting to retailers and other distributors abroad is still a main channel of integration, especially in buyer-led chains such as foodstuffs, other agro-based commodities or in simple manufactures. Bearing this in mind, traditional export promotion instruments should not be overlooked, but emphasis should be paid to connecting exporters to intermediaries or buyers in value chains.

8.3.2 Infrastructure and Linkages

Infrastructure is of major significance for development in general, but in the context of GVCs, good infrastructure is crucial. Given that production is import-intensive, delays in transportation and other unforeseen problems can significantly disrupt production of the final product. Logistical and transport infrastructure can help reduce inventory and handling costs as well as reduce delivery times, becoming a draw for the location of FDI and an advantage for domestic suppliers. Policy efforts in this direction should focus on establishing and modernizing infrastructure, improving access for larger vessels and encouraging flexibility by allowing operations by different carriers (see Blyde, 2014b for a detailed review). Alongside hard infrastructure, the enhancement of logistical support services, such as cargo handling, storage, warehousing, supply chain visibility and cross-docking can also be an advantage (ibid.). Among other hard infrastructure items, ICT and power infrastructure also rank high in importance.

Improving infrastructure in the entire country might be a difficult task, but this can be more easily provided in the context of industrial zones. Zones can be constructed near major infrastructure such as ports and airports or be linked to them with good road and railway infrastructure. Additionally, zones can offer specialized shared infrastructure that can be used by the firms located there, thereby reducing the cost of investment for each individual firm. For example, the Suzhou Industrial Park (SIP) in China, which offers some of the best zone infrastructure in the country, has invested in roads, electricity, water supply and drainage, waste water disposal and treatment, gas supply, a broad range of telecommunication services—including broadband and international roaming—cable TV, heating, and land levelling (Zeng, 2016).

64 See Humphrey and Navas-Aleman (2010).

To target integration in specific value chains, zone infrastructure could be particularly attentive to the needs of the manufacturing process in these chains. For example, the lack of waste water treatment facilities in Viet Nam has been cited as one of the reasons holding back investments in textile production, which involves dyeing, a process that is very polluting (Tran, 2012). In semiconductor assembly and fabrication, the stability and ready availability of electricity is of paramount importance. Malaysia had to construct separate power stations to supply the Kulim High Tech Park with stable power in order to attract investment in that industry.

Previous UNIDO reports have distinguished between different types of special economic zones. Industrial parks are the simplest, defined as a tract of land developed and subdivided into plots according to a comprehensive plan with provision for roads, transport and public utilities (UNIDO, 1997). In developed economies industrial parks typically cluster warehouses and distribution centres to meet zoning requirements and address local communities' congestion or pollution concerns. In low-income countries, they can be a development tool, especially for GVC participants who need reliable transport access for inputs and outputs and reliable electricity and communications. A recent twist, embraced by Viet Nam, is to create eco-industrial parks which can improve economic performance and reduce negative environmental impacts (Tudor, Adam and Bates, 2007).

A special economic zone is a designated area in which trade laws and tax regimes differ from the rest of the country. The generic term is flexible in that it can be reserved for export processing activities or tailored in any specific way. Special economic zones usually have one or more of the following as objectives: attracting FDI, creating employment or acting as a laboratory for trying new policies. As with industrial parks, an overarching goal may be to realize Marshallian externalities as producers cluster geographically with better access to workers and other inputs, including specialized services, and prospects of generating new ideas.

In the context of GVCs, special zones may be especially valuable in dispensing with bureaucratic delays that are the bane of GVCs relying on just-in-time delivery between stages of production. Successful zones are characterized by absence of noxious regulations and presence of good infrastructure, including transport to ports. They can also be flexible responses to specific obstacles to GVC integration, e.g. the Mae Sot zone on the Thai-Myanmar border permits Thai and other entrepreneurs to employ Burmese workers in labour-intensive tasks in a situation in which large-scale immigration deeper into Thailand would be politically controversial.

Special economic zones may include policy incentives over and above good infrastructure and freedom from import duties, other taxes and regulations.[65] Another solution is to provide such incentives irrespective of location. In Viet Nam, policy incentives for domestic producers joining GVCs have improved since 2015, most notably with the November 2017 Decree on Development of Supporting Industry (Table 8.1). The Supporting Industry Development Programme was allocated a budget of over US$ 50 million for 2016-20 and was established in early 2017, with the goal of serving domestic producers participating in GVCs. Its activities include connecting firms, providing training in business administration, management and in

65 A strategy for attracting foreign investors through industrial parks or special economic zones should avoid leading towards a race-to-the-bottom at the subnational level, as would be the case if many cities/provinces would compete with each other trying to provide best financial treatment or less restrictive environmental regulations.

human resource development, R&D technology transfer, and building and supplying databases for firms. In 2017, the government announced additional incentives for SMEs, following the SME Development Fund launched in 2014 to help domestic firms overcome financial constraints.

Tabelle 8.1
Subsidies and Incentives for Firms in Supplying Industries

Subsidies

- R&D will be funded by the Supporting Industry Development Programme; government support of up to 50 per cent of expenditure for pilot production projects
- Construction projects of R&D units are entitled to preferential policies on land lease, and may receive support up to 50 per cent of expenses for R&D equipment procurement
- Support of up to 50 per cent of expenditure for developing prototype products
- Support of up to 75 per cent of expenditure of technology transfers for material production projects using over 85 per cent of domestically sourced raw materials
- Partial reimbursement for costs incurred for trademark registration expenses, domestic/ foreign exhibition participation and market access

Fiscal and Other Incentives

- Tax incentives under the provisions of Law 71/2014/QH13 previously not accessible to supporting industry firms (a corporate income tax rate of 10 per cent for up to 15 years, a 4-year tax exemption, and a 9-year 50 per cent tax reduction from the time taxable income is earned)
- Exemption from import tax on goods used to manufacture fixed assets and components that are not available domestically
- Loans at investment credit interest rate from the State investment credit fund
- Short-term local currency loans from credit institutions and branches of foreign banks at interest rates not exceeding the State's interest rate ceiling
- Additional incentives for small and medium enterprises in the form of investment credit and exemption from water surface/ land rents

Source: Tong and Seric (2018) background paper, adapted from Decree No. 111/2015/ND-CP

Beyond good infrastructure, another crucial element for successful integration relates to linkages to the domestic economy. Integration of domestic firms into GVCs can take place by developing vertical relationships with foreign subsidiaries. While some such linkages may develop naturally, policy instruments can also be employed to address difficulties and bottlenecks. This is especially important as local sourcing is usually limited to simple parts, such as plastic casings and metal parts or factory supplies (uniforms, simple machine parts) due to the strict standards of technology-intensive components. Policy instruments can then improve linkages in components that offer more room for technological learning.

It is also worth noting again that while forming linkages is important for integration, the position domestic suppliers take within the chain and the prospects for upgrading also depends on the

type of chain the subsidiary belongs to as well as its market orientation. Linking firms to export-oriented subsidiaries implies firms integrating as suppliers for exported products, which in turn implies a strong emphasis on meeting global standards and scales that could be difficult to achieve. Linking to domestic market-seeking FDI implies developing skills that may be more related to assembling products and/or adapting them for the domestic market, as well as in distribution and sales activities. In the latter case, additional policy support for developing future export capacities may be required. Moreover, the choice of firms can greatly influence the linkages that can develop. The evidence suggests that linkages are greater when the technology gap is smaller, as firms with a higher skill level cannot easily find a suitably capable local supplier.[66]

Samsung's mobile phone factory in Viet Nam is an extreme example of GVC integration, which would have been impossible without both Samsung's technology and its access to large-scale finance (see Appendix, Case Study 6). There are, however, policy challenges for Viet Nam in how to encourage technology transfer to Vietnamese firms and whether the project will lead to skill-upgrading. In some circumstances, technology transfer may be facilitated by forming joint ventures with foreign firms, as in the Hical Technologies case study (see Appendix, Case Study 5). Joint ventures were a key feature in China's transition from a closed economy to a global trader in the 1980s and 1990s. One attraction for foreign investors is that a joint venture partner is more familiar with domestic regulations and labour practices.

Local content policies are an alternative approach to ensuring that foreign investors provide local employment or accept the provision of other domestic inputs. Local content policies can assume a wide range of forms but because the essential purpose is to favour domestic suppliers over imported ones, they risk contravening obligations of World Trade Organization members to treat imported products equally to domestic ones with respect to any laws or regulations. These obligations are far from binding (e.g. they cover goods but are vaguer about services and public procurement), and the use of local content rules appears to have increased since 2008. Two useful surveys of local content policies draw opposite conclusions. Hufbauer et al. (2013) lament the development as having eroded potential gains from trade and give a "conservative estimate" of the cost to the world between 2008 and 2013 of US$ 93 billion. Weiss (2016) looks more favourably at the development which provides increased policy space to developing economies wishing to promote infant industries.

Case studies illustrate the pitfalls and prospects of local content rules and the importance of how they are implemented. For instance, Brazil in connection with its wind farm installation required local sourcing of 60 per cent of components. Weiss (2016) points out that while the local content may have been high, the programme was not very successful in encouraging the expansion of wind energy capacity, partly due to the high cost of local components. In contrast, China's automotive industry is a case in which local content rules applied to domestic producers as well as to joint ventures with foreign carmakers, appeared to be successful. In the 1980s and 1990s, these rules were not WTO-compatible, e.g. the tariff on imported components was adjusted according to the share of components being imported (a 50 per cent tariff if all components were imported dropped to 20 per cent if only four-fifths were imported). Following WTO accession in 2001, the local content policies became subtler, often disguised in public

66 See Amendolaigne et al, 2013 and Kokko, Tansini and Zejan, 1996.

procurement rules. China has successfully created a major automobile industry using local content policies, although how important the policies were is difficult to determine.

8.3.3 Skills, Technology and Industrial Capabilities

Beyond broader measures, such as improving tertiary education and vocational training, integration into targeted GVCs may be facilitated by skilling labour in specific areas that are needed in those chains. Such needs can be identified at the zone or larger cluster level and initiatives can be taken to provide the labour pool with the necessary expertise, either by the State or in private-public partnerships. The existence of an institutionalized provision of relevant training and a skilled labour pool could then draw in more investments in targeted chains.

At this stage, it is also important to start building up the country's national innovation system. A strategy of strengthening the innovation system is highly complementary to one of integrating and upgrading within GVCs. Even though innovation may seem like a distant possibility when a country first enters into GVCs, the foundations of a national innovation system should be put in place early on by establishing institutes that can assist in technology transfer and adaptation; facilitating interaction would be key in this regard.

Specialized research institutions could develop resources that can be used by local firms in targeted chains at a low cost. They can provide resources on technical issues, such as advice on specialized machinery, its use and maintenance, offer training and other capacity building measures in areas of quality control, safety management and other needed areas, or provide measurement and certification services. They can also help by acquiring technology and adapting it to the needs of local firms. In many cases, such institutes already exist in developing countries, but are greatly underfunded and do not sufficiently link to local industry. Creating the space for local industry, foreign investors and research institutes (and other intermediaries) to interact and identify local capacity needs would be helpful in targeting limited resources towards areas where demand exists.

Interaction between different agents in the system helps create and share new knowledge, hence, the need to view things from a systematic perspective. Facilitating interaction between the system's core agents (domestic and foreign firms, research institutions, financial intermediaries and others) can improve the dynamism of the domestic innovation system. Holding forums and other events related to integrating and upgrading in targeted GVCs as well as creating relevant business associations can represent ways of facilitating such interactions.

The general conclusion is that the instruments for GVC integration in Figure 8.1 can be useful but need to be applied with care. The industry analysis and case studies described in this report provide examples of successful joint ventures and of foreign investors responding to incentives. International commitments, such as WTO membership, may limit the use of some policy instruments, but as the local content discussion illustrated, they do not seriously crimp the desirable policy space.

8.4 Policies to Support Upgrading Within GVCs

Upgrading within GVCs entails similar issues. Many of the measures listed in the previous section on integration can be used to facilitate upgrading by making the criteria for preferential instruments more ambitious and focusing more on the development of capabilities rather than linkages only. Upgrading essentially requires an expanded scope of previous instruments to account for a more capable domestic and foreign supply base. Education involves higher levels of schooling and more specialized training. Infrastructure improvement goes beyond road, rail and port upgrading to include sophisticated tracking of cargo and high-speed reliable internet connectivity. Trade facilitation can shift from eliminating corruption at border crossing points to having common forms and Single Windows and to e-clearance based on efficient risk analysis. GVCs draw on cross-country cost differences, but also and fundamentally on efficient connectivity that minimizes inventory needs. Governments play a major role in ensuring that these conditions exist on their territory and that the nation's standards are set at the highest possible levels.

Given that upgrading requires the accumulation of technological and industrial capabilities, in what follows we will focus on three areas of prime relevance in this regard: 1) enhancing cluster capacity, 2) developing an effective system of innovation and 3) strengthening quality infrastructure and conformity assessment services.

8.4.1 Enhancing Cluster Capacity

Industrial zones, broadly defined, were considered to be a key strategy for attracting investments and integrating into GVCs. When it comes to upgrading, the emphasis shifts to supporting clusters, whether they emerged from zones aiming to attract FDI or not. The principles are similar in both cases, in that support for clusters often aims to provide specialized infrastructure and services that can be used by clustered firms, reducing their individual investments. However, by considering clusters we focus on the forces of agglomeration and its benefits for knowledge spillovers, the development of specialized skills and the possibilities that open up for flexible specialization.

One of the most important justifications for supporting clusters is their potential for technological spillovers, arising from geographical proximity (Porter, 1989). Proximity encourages entrepreneurs and staff to meet and exchange knowledge, a process that is enhanced by labour turnover. Moreover, the larger market created by a clustered industry creates incentives for division of labour among firms, leading to the emergence of more specialized equipment and service suppliers at the margins of the cluster. Labour also develops specialized skills, and individual firm-level investments in training can be reduced. Promoting clustering in industries that benefit from such spillovers can improve collective efficiency and make an industry globally competitive.

Clusters have also been linked to the operations of GVCs. Enterprises that participate in clusters, including SMEs, have the ability to join GVCs through the external linkages developed by the cluster. This means that a cluster can specialize in a specific part of the chain and not

necessarily in the entire production process. The collective insertion into GVCs implies that the ability of firms to upgrade is affected by both the collective efficiency of the cluster in which they are located, and by the governance pattern of the chain the cluster is part of (Giuliani, Pietrobelli and Rabellotti, 2005).

Given the diverse types of clustering, the way they emerged, the industry and chain they are connected to, interventions cannot be one-size-fits-all. Support can take many forms, including many of the instruments considered separately in this report. Indicatively, we list the following:

- *Infrastructure*: Clusters have often centered on industrial zones that have relevant infrastructure. Even in the case of spontaneous cluster emergence, retroactively building facilities can promote sustainable cluster development. Beyond the standard infrastructure that is found in industrial zones, cluster infrastructure should pay more attention to building shared facilities, not only in terms of providing collective services (e.g. waste water management or testing services), but also to facilitate interaction, which is one of the key benefits of clustering. Spaces that are especially suited to SMEs and start-ups are also essential.

- *Providing Tools for Innovation*: Even though shared facilities for innovation could fall under infrastructure, it is worth stressing the need for services that can facilitate process and product upgrading. This can include the establishment of design and research centres that can cater to local cluster needs, in addition to performing technical information dissemination. Specialized measurement, testing and certification centres can be especially useful as well. The advantage of establishing these facilities within the cluster is that the identification of upgrading needs among stakeholders becomes easier, as there is some level of industrial specialization within the cluster.

- *Building Channels of Communication*: Again, given that interaction is crucial in building a competitive cluster, establishing institutional channels of communication and networking between firms can be of great use. This can include encouragement of associations, especially if they are not purely horizontal, but brings together actors along the value chain, the organization of special networking events and fora that bring stakeholders together to discuss issues of importance and shared training or research projects.

- *Facilitating Access to Factor Inputs*: The availability of specialized personnel and access to capital are two important limitations to growth, especially for small firms. Cooperation with local universities or vocational institutes to provide skilled personnel and collective firm training can fill some of these gaps. Access to capital can be improved by establishing specialized financial institutions to operate within the cluster and offer tailored services.

- *Market Support*: Helping clusters reach customers or subsidizing the efforts of firms to access value chains can be an important tool. Supplier development schemes can be adapted to the cluster level and emphasize upgrading, rather than simply integration.

- Anchor firms: Even though not all clusters need to have a large firm anchor, in developing country clusters, a large domestic firm or large MNCs have often served as catalysts for cluster emergence and vertical integration. The ability of very large firms to innovate and invest in the localization of input production can have significant ripple effects, as in the case of the Hsinchu Science Park (HSP) in Taiwan Province of China, which relied on a large state-led initiative to kick-start growth, and the Bangalore IT cluster in India that was MNC-led.

8.4.2 Improving the Innovation System

In developing countries where innovation systems are not complete or mature, knowledge flows within GVCs can be of primary significance for the development of firm-level capabilities. However, interactions within the innovation system can help the firm build additional capabilities, especially to achieve upgrading in areas that are not necessarily within the scope of the buyer-supplier interaction.

Paying attention to technological capabilities has also become more important as industrial sectors have not only become more globalized, but have also increased their scientific content, especially in fields such as chemical and electrical engineering, electronics and telecommunications and biotechnology. It is now even more important to provide advanced training in science that can increase absorptive capacity. At the same time, firms need to have independent capabilities for developing technologies, as barriers to upgrading are not uncommon and intellectual property regimes are becoming increasingly strict.[67]

Adopting a GVC perspective when thinking about the innovation system can provide a focal point for strategic investment and coordination. First, it is important to integrate foreign buyers into the local innovation system, whether located in the country or not. This means engaging them in relevant fora and discussions and forging alliances for joint R&D projects and capacity development in domestic suppliers. Second, priority areas for direct funding of research, whether in firms or in research institutes, should be identified by taking the upgrading trajectory of firms into account. Third, populating the innovation system with research and service providers (e.g. testing and certification agencies) that are important to the targeted value chains will enable upgrading in those areas (see below).

8.4.3 Strengthening Quality Infrastructure and Conformity Assessment Services

The structure of GVCs is such that lead firms and their major markets are located in developed countries, such as the United States, the EU and Japan. Consequently, products and their subcomponents often need to meet safety, environmental, technical and ethical criteria embodied in foreign or international standards. Some standards are compulsory for entering markets, while others are voluntary, with the latter usually aimed at social and environmental sustainability. In general, a variety of actors is involved in the development and governance of standards, from the government to the private sector and NGOs.

67 See Mazzoleni and Nelson, 2007, and Pietrobelli, 2008

Standards facilitate trade but can also act as a barrier to trade, effectively shutting out less sophisticated and smaller exporters that cannot meet them, either due to a lack of information and funds or because of the need for collective action that is not forthcoming (the latter is especially important in agro-foods). On the other hand, standards can also allow for greater division of labour and guarantee the interoperability of systems, enabling economies of scale in production. They can also allow for more precise measurements that facilitate comparisons between products, enabling the operations of value chains.

The ability for suppliers to meet required standards is an important draw for buyers within GVCs (ADB, 2014). However, the costs can be substantial and include upgrading relevant infrastructure, developing systems and practices, training staff and establishing audit and certification capabilities (ibid.).

Supporting suppliers in meeting standards in their respective industries is an important policy dimension, especially as suppliers move into more sophisticated production. Support can include investments in laboratories and other facilities that can offer certifications, accreditations and other relevant assessments (ADB, 2014).

The efforts of the government in Malaysia to offer measurement and testing services to local firms also falls under this umbrella. The country's R&D centre in ICT technologies, MIMOS, houses labs that provide a wide range of advanced reliability, failure analyses and wafer/integrated circuit testing services at subsidized rates to reduce individual costs for electronics suppliers. Similarly, the Penang Skills Development Centre (PSDC), a public-private initiative, hosts one of the largest electromagnetic compatibility labs in Southeast Asia, among other shared testing services. With access to this kind of testing services, suppliers can ensure they meet quality and safety standards at a much lower cost than would be the case if they sent samples to overseas labs or invested in their own equipment.

8.5 Conclusions and way forward

Although GVCs are often assessed in terms of their contribution to income and employment, the Sustainable Development Goals should remind us that long term economic, environmental and social impact needs to be borne in mind when evaluating GVC participation (Box 8.1). GVC integration provides an important starting point for industrialisation. Emerging economies should use GVCs purposefully for the development of manufacturing and export capabilities, in order to achieve broad-based and sustainable industrialisation. Beyond the economic dimensions, many GVCs have contributed to inclusive growth by bringing females into the formal workforce, but that outcome is not inevitable, and there is more debate over female (non)participation in GVCs at the managerial level. The environmental impact of GVC participation is generally disregarded, although as the Meng and Tang (2018) background paper shows, the negative effects can be indirect and substantial. Expecting greater corporate social responsibility from GVC participants is a positive step, but it is not a substitute for the government providing good social policies or an excuse for turning a blind eye to GVC

participants that pay lip-service to CSR but cut corners on, for example, occupational health and safety.

* * *

Looking forward, it is important to be aware of the importance and acceleration of change associated with GVCs. This is evident in the rapid and dramatic changes in Viet Nam's labour market and export composition over the last decade due to GVC participation. At the firm level, the benefits and costs of timely adjustment to change are illustrated by Moser Baer India (see Appendix, Case Study 4). The company was dynamic in responding to the technological shift to floppy disks and then from floppy disks to DVDs, but it missed the shift from DVDs to USB flash drives after which the company faced serious difficulties and had to redefine itself. Such product-specific trends are difficult to predict, even for a firm that had become a leader in its market segment.

The policy implication of promoting flexibility is easier said than done. Education may be a partial answer, promoting general purpose skills rather than specific training and vocational education.[68] Excessive regulation is the enemy of flexibility; a concern voiced in Malaysia, where GVC participation has been declining, and in Singapore, concerned about its diminished role in electronics GVCs.

Financial development is a counterpart to flexibility insofar as would-be entrepreneurs with good ideas may be constrained by inadequate access to credit. A well-regulated financial sector will find a balance between over-regulation leading to adverse selection in favour of low-risk projects and under-regulation beyond deposit insurance that creates moral hazard and too much risk-taking. An effective financial sector will have good loan officers who can sufficiently well assess risk and return to avoid excessive non-performing loans. However, good regulators and loan officers require training and experience, which takes time.

The limits of servicification within GVCs and of the separation of service and manufacturing functions are unknown. Apple and Samsung have pursued opposite strategies, with Apple subcontracting all manufacturing and Samsung maintaining control over manufacturing functions. Around 2010, Samsung shifted its assembly operations from China to Viet Nam and Apple's first-tier partner, Foxconn, opened large new facilities in western China. Presumably one of these strategies is superior in terms of reducing production costs, although the relative success of Apple and Samsung may depend on design and functionality as well as on internalization and production costs.

Some broader future developments are predictable. Baldwin (2017) highlights the transition from the first unbundling in the nineteenth century, when falling transport costs led to increased locational separation of production from consumption (i.e. trade in finished products), to the second unbundling in the late twentieth century when falling trade costs led to separation of

68 This is an old argument; Schultz (1975) argued that general purpose skills are especially valuable in disequilibrium situations. Following the dissolution of the Soviet Union and transition from central planning, household survey evidence indicates that senior specialists with vocational qualifications and experience in specific tasks were among the biggest losers, while college graduates with more general degrees involving broad analytical skills were the group that performed best, especially female college graduates (Anderson and Pomfret, 2003).

tasks within production (i.e. GVCs). An incipient third unbundling is associated with changes in information and communications technology by which virtual face-to-face communication becomes a closer substitute for actual face-to-face communication. This change is likely to broaden the geographical scan of GVC lead-firms so that GVCs increasingly become global rather than regional. A more general way to portray this development is that a firm's scanning of potential suppliers and customers, which historically was local, has moved over the last century to the national and then regional and in future global arena.

These processes vary by product. When the search for the absolutely best suppliers is driven by high quality standards rather than cost, as in the Boeing 787 GVC or for Hical Technologies, then the value chain is already truly global. Such patterns are both a challenge and an opportunity for countries seeking GVC integration; the national competencies and industrial and technological capabilities emphasized in this report will become increasingly important, while absence of competencies will forestall GVC participation and upgrading. Automation is a predictable threat facing GVC participants who perform routine repetitive tasks, and in particular, automation threatens low- and semi-skilled employment in developing economies (Hallward-Driemeier and Nayyar, 2017). Foxconn, for example, has been a major adopter of robots in its Chinese factories. Among key competencies, the ability to be complementary to automation is likely to gain in significance.

One impact of globalization and GVC formation has been increased agglomeration as activities tend to cluster in urban areas. The third unbundling makes it less clear where agglomeration will take place, perhaps becoming almost indeterminate as an initial location becomes associated with dynamic scale economies. The third unbundling could lessen the advantages of regional value chains in East Asia, perhaps accelerating the development of GVCs that are global, or it could strengthen the role of megalopolises that may, or may not, be in Asia.

APPENDIX: CASE STUDIES

CASE STUDY 1:

SJET Supply Chain Co. (China)

SJET Supply Chain Co. is a supply chain platform provider that matches supply and demand through its intelligent supply chain system. SJET integrates information, logistics and capital flow into its B2B multinational platform to provide comprehensive trade services for export-oriented companies. About 5,000 suppliers, over 100 export-oriented companies and dozens of banks are part of this platform. SJET's customers are primarily from industries such as information technology, consumer electronics, communication products, fast-moving consumer goods, medical devices, new materials and new energy. SJET targets enterprises with assets between US$ 400,000 and US$ 400 million. In addition to credit for supply chain financing, SJET provides services such as importing materials, logistics, distribution, review of credit, customs declarations, export of final products and other activities along the entire value chain.

The founder of SJET Technology accumulated initial assets through sales of technical products as an individual businessman starting in the 1980s. In 1992, foreign investment from Hong Kong SAR China increased significantly in the Shenzhen area, and he saw an opportunity to play a facilitating role for electronic products going from Hong Kong SAR China to Shenzhen and then to inland areas. In 1995, SJET Technology was established as a trading company for computer accessories. Cooperation with Gigabyte Technology (Taiwan Province of China) in 1997 provided an entry into becoming an agent for electronic computer components including motherboards, virtually concatenated group (VCG) cards and floppy drives.

China's WTO accession further opened the domestic market, generating fierce competition. The agency market for computer components was quickly saturated, so the company developed its own products, entering the field of security integration systems in 2003. SJET Technology obtained technical support from cooperation with Siemens and other international companies and was also responsible for importing and exporting those companies' consumer electronics. The government encouraged companies to engage in technical R&D through experience gained from cooperation with international high-tech companies, and SJET Technology invested in international manufacturers such as Jizhan Electronic Technology Co. Although SJET Technology made progress on R&D, the agency business still constituted the main source of profit.

In 2007, SJET was separated from SJET Technology. The new company gradually enhanced its logistics services in customs clearance, product purchasing and so forth, but only slowly in the first two years. The present CEO joined the company as a minority shareholder in 2009, and his solution to slow growth was to change from providing business process outsourcing for a single enterprise to facilitating the entire chain. SJET prioritized supply chain integration in electronic products at a time when domestic SMEs were developing their own export-oriented electronic products.

In 2009, SJET commenced its transformation to integrate the entire value chain and built an ecosystem of stakeholders around the world. In this ecosystem, supply chain administrators

(i.e. SMEs in related industries) and supply chain coordinators (SJET) work at the centre. Supply chain administrators are responsible for managing orders and value creation of products. Supply chain coordinators focus on integrating material, capital and information flows via control of three platforms: virtual production management, supply chain logistics and the marketing operation in Hong Kong SAR China. Project design, production and so forth are shared within this ecosystem. SJET's ecosystem enables SMEs to enter GVCs and increase profit from the global market.

With the aid of the internet and information technology, SJET moved one step further in 2012 with the development of an SAP system and a B2B platform, facilitating information collaboration along the entire value chain. This process was accelerated through cooperation with Capgemini, IBM and leading international software vendors, while the talent cultivated and hired by the company also contributed to sustained growth. The ability to maintain data on buyer and supplier needs and capabilities from the entire value chain enables quick and accurate matching of supply and demand.

To match the new business model, the company flattened its organizational structure in 2013 into three main operation parts: front-end, mid-end and back-end. The back-end consisting of the system of information, financial, training, clearing and risk-control is rigid. The front-end is the flexible business centre, consisting of five business groups that interact with each other, although each has a distinct business orientation: business and sales, industrial chain, ecosystem, innovation and intelligent terminal. The mid-end combines the other two parts through interactions with both customers and the technical team. All orders are managed through a database which promotes standardization and integration of the business process. Supply chain management services cover a range of processes from material purchasing to exporting, which enables customers to focus on their competitive advantages.

As an example, SJET plays a facilitating role for smaller mobile phone companies, who are able to identify overseas customers and develop appropriate products but are often not able to fulfil all overseas orders due to lack of capital, bargaining power against suppliers, production capacity or other problems. SJET provides a platform of services to companies after they have reached agreement with overseas buyers. For example, company A is a mobile phone design company in Shenzhen that has successfully developed its own brands overseas after five years of cooperation with SJET. After SJET's operation platform in Hong Kong SAR China (Chuanglian) receives the deposit paid by company A's customer, the mainland virtual manufacturing platform of SJET (Wuzhoutong) is responsible for global procurement of materials according to company A's specifications. Suppliers of key components, determined by company A, must be approved by SJET following a risk assessment. If A cannot identify available suppliers, SJET recommends appropriate ones. All the materials are delivered to SJET's warehouses to be sorted and then sent to factories on SJET's platform, which are automatically matched according to A's requirements. At this stage, payments for materials are advanced by SJET. During production, quality control and inspection of finished products are under the charge of A. The shipment is delivered to Chuanglian and then to the overseas buyers by logistics companies appointed by SJET. After A has negotiated payment with the bank, SJET takes charge of the settlement of currency exchange, tax rebates and so forth. Settlement between SJET and

A is the final step. Because SJET monitors activities related to import and export, and other activities are taken over by companies in SJET's platform, A can focus on R&D and key business decisions, accumulating capital and experience to pave the way to developing its own brand. This facilitates A's product upgrading, as well as strengthens its competitiveness in the global market.

CASE STUDY 2:

Red Collar (China)

Starting as a small township enterprise, Red Collar accumulated manufacturing expertise and capital to become a mass producer when apparel exports increased considerably. The turning point came in 2003, when information technology began flourishing in China. Taobao (a Chinese website for online shopping that is operated by the Alibaba Group) was launched in 2003, and many apparel companies utilized the buyer-to-customer platform as a new sales channel. Red Collar explored the digitalization of the manufacturing process to become a mass customizer through a manufacturer-to-customer platform in which the manufacturer directly interacts with end customers, e.g. if a customer in an overseas department store wants to buy a customized suit, he/she can use a portable system provided by a salesperson to complete the design process and the customer's data is transmitted to Red Collar's manufacturing plant. There is no heavy investment or reliance on physical sales outlets in overseas market. Further, it encourages customers to design by themselves, which reduced the demands of professional designers who are expensive in the traditional apparel manufacturing process.

The Red Collar Group was established in 1995 in Qingdao, Shandong Province. The group's predecessor was one of the many township enterprises that responded to the opening of the economy after 1979 to produce for the domestic wholesale market. Its operation was limited to small-scale production of a narrow range of products based on manual work. After establishment of the Red Collar Group, in addition to operating its private brand domestically, Red Collar produced apparel for foreign brands under an OEM model. From an early stage, Red Collar invested heavily in world-class processing equipment. Aiming to differentiate itself from competitors, Red Collar imported fabrics and accessories from Italy to ensure high quality and, despite the expense, the company invited fashion designers from Italy to promptly follow global fashion trends.

During the 2000s, Red Collar collaborated with famous partners from the United States, Italy, Germany and other EU countries. Revenues from OEM far exceeded sales to the domestic market. Red Collar's mission was to increase production capacity as well as improve efficiency to reduce variable costs. However, problems arising from product homogeneity, soaring export volume and slumping prices led to fierce competition and the need for new channels.

In 2003, the impact of internet technology encouraged the founder to start transformation from mass production to mass customization. Customization was initially limited to a small scale

for the New York market, while OEM remained Red Collar's principal business. Newly employed programmers worked with internal skilled workers for several years to develop the global customized platform. In accordance with its business transformation, Red Collar gradually achieved a flat organization structure which reduced administration expenses by at least 20 per cent. Added to 30 per cent reduction in its production costs, the net profit margin of apparel customization increased from 2.8 per cent in 2011 to 25 per cent in 2015.

Between 2005 and 2015, the Group invested heavily to transform from traditional manufacturing by developing a global internet platform for apparel customization. In 2011, apparel customization only accounted for 10 per cent of total sales revenue. In 2015, revenue from apparel customization accounted for 96 per cent of the total sales of RMB 1.1 billion (approximately US$ 180 million), with a net profit margin of 25 per cent. The Group's finished products, especially tailored suits, can be delivered within seven working days. Most of Red Collar's overseas sales are to major retail chains or tailors, with 70 per cent of customized orders in 2015 coming from the United States, Canada, Italy and other EU countries. Once the company successfully operated in the overseas market, Red Collar set out to stimulate the growth of domestic customized apparel sales, and has committed to improving operations in the domestic market with its brands, including Red Collar, R.Prince, Cameo and RCollar.

Production data accumulated over time enabled the company to build its database and modularize the production process. Customers can design their own suits as well as pick fabrics and accessories after submitting their measurement data collected through Red Collar's unique method. The system automatically finishes the arrangement of manufacturing, including pattern making, data transfer to employees and other processes that used to rely on manual work. In 2015, the company founded a manufacturing research centre, a data research centre, an organizational innovation research centre and another eight research centres. The company fully achieved customized production in 2015 and in that year, both its sales and profit more than doubled.

Supported by the export tax rebate policy and its business philosophy of high quality, Red Collar survived the Asian financial crisis. After China's accession to the WTO, Red Collar explored more overseas customers and started its practice of transformation to apparel customization in 2003. This was not a coincidence, but a careful consideration. The series of policies in these years purposely led companies to change from low-end to advanced manufacturing.

CASE STUDY 3:

Gokaldas Exports Ltd. (India)

Gokaldas Exports Limited (GEL) is one of the leading apparel exporters of India and has been serving large global retailers since its inception in the year 1978. It began its operations as an Indian company incorporated in Mauritius to export apparel. In 1985, the firm was incorporated into a private limited company in India with Blackstone F P Capital Partners (Mauritius) as a major holding company. It added a second manufacturing facility and began exporting to the United States under made-to-order buying arrangements. With state-of-the-art design capabilities and manufacturing facilities, it provides multiproduct goods and a diversified product portfolio across various categories of garments for men, women as well as children.

Today, GEL is an ISO 9001:2001 certified company and operates from 20 manufacturing units spread across the states of Karnataka, Tamil Nadu and Andhra Pradesh. It has an installed capacity to produce more than 2.5 million garments per month and employs around 25,000 workers. The company manufactures apparel under a licence from established international brand clients such as Abercrombie & Fitch, Adidas, All Saints, American Eagle, Arvind Brands, Banana Republic, Benetton, Camel Active, Chicos, Columbia, Diesel, Decathlon, DKNY, Esprit, Gap, Grasim, Guess, H&M, Hollister Hurley, Jack Wolfskin, Land's End, Lee, Marks and Spencer, Mexx, Macy's, Nike, Northface, Old Navy, Puma, Reebok and Reid and Taylor.

A major challenge facing the company is to improve profitability in the midst of growing competition from newly emerging players like Viet Nam, Cambodia, Bangladesh, and Sri Lanka, especially as those with least-developed country status receive preferential access to major markets. Another problem the company faces is the different packaging and labelling requirements, customs and inspection procedures, especially in the EU and U.S. markets, as well as changing standards and quality specifications, e.g. in the 1990s, the prohibition of colour dyes in Germany caused major losses for the firm. Changing tastes and preferences have shifted the focus towards new designs, which has resulted in continuous technology upgrading, such as improving technology-intensive CAD/CAM systems, 3D printing and 3D technology for mass customization; the labour-intensive apparel industry is slowly becoming a capital-intensive industry with the introduction of computer-aided design and related technologies.

As part of their corporate social responsibility objective, GEL works actively on issues related to gender equality, poverty eradication, sustainability, education and health. GEL complies with the guidelines on corporate governance stipulated under Clause 49 of India's 2015 Regulations on Listing Obligations and Disclosure Requirements. The firm has generated considerable employment, and the firm's female to male employment ratio is higher than that of its competitors. The firm is conscious of environmental issues; GEL complies with a variety of international norms and undergoes frequent environmental and energy audits. It also consciously promotes a healthy work environment adapted to employees' health and safety needs. Achievements in sustainability include reverse osmosis plant in denim laundry to enable 85 per cent recycling of wash water, solar lighting for external factory periphery implemented on a pilot basis for six factories and to be extended to all units, and the majority of manufacturing units have obtained the Global Organic Textile Standards Certification.

CASE STUDY 4:

Moser Baer India Ltd. (India)

Moser Baer India was founded in New Delhi in 1983 in technical collaboration with Maruzen Corporation, Japan and Moser Baer Sumiswald, Switzerland. Storage devices emerged as a major consumable item for the IT industry, and in the mid-2000s, Moser Baer India was the second largest optical media manufacturer with around 17 per cent of the global market. Technology was the primary reason for the firm's rapid growth in the 1980s and 1990s, but technological obsolescence threatened its existence when the firm's storage devices technology experienced market erosion due to the introduction of newer technologies. Starting in 2007, Moser Baer diversified into photovoltaic cells and home entertainment, and later into light-emitting diode (LED) lighting. It continued to focus on its key strengths: geographical presence across the world, combined with a strong focus on quality and a strong distributor network. Government policies promoting IT and exports and preferential purchases by government organizations for products made in India may have helped, but technology was the key for its competitiveness.

In 1988, Moser Baer India moved into the data storage industry by manufacturing 5.25-inch floppy disks, and by 1993, the company was manufacturing 3.5-inch floppy disks. Responding quickly to major technological changes, the company set up a 150 million unit capacity plant to manufacture Recordable Compact Disks (CD-Rs) and Recordable Digital Versatile Disks (DVD-Rs) in 1999. The strategy for optical media was identical to that successfully implemented in the disk business – creating a facility that matches global standards in terms of size, technology, quality, product flexibility and process integration. In 2003, the company was the first to market next-generation storage formats like Blu-Ray discs and HD-DVD in India. In 2007, the company acquired OM&T BV, a Philips' optical technology and R&D subsidiary. Today, it is the only large Indian manufacturer of magnetic and optical media data storage products, exporting approximately 85 per cent of its production

Since inception, Moser Baer has endeavoured to pursue a sustainable business model based on low costs, high margins, high profits, reinvestment and capacity growth. Along the way, deep relationships have been forged with leading OEMs, with the result that there are hardly any global technology brands in the optical media segment today with which Moser Baer is not associated. To retain its business, Moser Baer focused on upgrading high-speed flash memory technology. It produces storage devices under agreements with Verbatim and Polaroid, and remains one of the leading players in the global storage media industry both in terms of low cost mass manufacturing and in offering a wide range of high quality products.[69] However, in a shrinking market, the company faced serious financial problems starting in 2004-5. The competitors from Taiwan Province of China, CMC and Ritek, were more agile in shifting to flash-drive technology and by relocating production to mainland China, thus reducing their costs substantially.

In 2006, Moser Baer India announced diversification into the photovoltaic and home entertainment businesses. To some extent, this involved transferring the company's core

69 The company conforms to the JET, JIS and JPEC specifications. Successful re-certification under the Integrated Management System of ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007, Disney ILS Audit and SA 8000:2008 Standards for Environment, Health & Safety Management and Social Accountability, respectively, audited by various certifying agencies like DNV & CT PAT.

competences; Moser Baer's business was the micro-coating of surfaces, i.e. coating a silicon wafer on a large glass panel. Related technologies were obtained through investments in solar technology start-ups such as Solaria and SolFocus. On the supply side, Moser Baer's strategy was to obtain poly-silicon, the raw material used to coat the solar panels, through long-term supply deals with companies like REC Group, LDK Solar and Deutsche Solar. In 2007-8, Moser Baer set up the world's largest Thin Film Solar Fab plant. The photovoltaic business was established at a bad time in 2008, as the global economy entered recession, and as Chinese producers pushed down the price of photovoltaic cells by 85 per cent between 2009 and 2017 (Carvalho et al., 2017). Moser Baer experienced a difficult four years.[70]

Moser Baer Entertainment Limited was founded in 2006, and operates as a subsidiary of Moser Baer India, based in Mumbai, India. In 2008, Moser Baer signed an exclusive home video licensing deal with UTV Motion Pictures and launched a digital video processing facility in Chennai. Moser Baer Entertainment Ltd. distributes home videos in VCD and DVD formats in Hindi, English, Tamil, Telugu, Malayalam, Kannada, Marathi, Gujarati, Bengali, Bhojpuri and Punjabi languages. The company also offers non-film titles, such as devotional, classical, health, tourism and educational series. Moser Baer Entertainment Limited offers its products through carrying and forwarding agents, distributors, owned and franchised outlets and online sales.

Moser Baer is also moving towards establishing itself in the Indian LED lighting market. Moser Baer Technologies and Universal Display Corporation announced a technology and licensing agreement for energy-efficient white OLED lighting.

Moser Baer is presently an assembly unit, which is heavily dependent on the import of raw material, mainly from China. The import to indigenous ratio of raw material and packing material was around 80:20 in 2015-16; the ratio was considerably less when the firm's flagship product was storage devices, and has been boosted as a result of diversification into the solar and LED lighting industries.

The company has a presence in over 100 economies, serviced through 15 marketing offices spread across the globe, with representatives in India, the United States, Europe, Japan, Russia, Ukraine, Egypt, Argentina, Chile, Malaysia and strong tie-ups with many global technology players in the optical media storage business. In the PV space, Moser Baer has a presence in the entire value chain, with products being sold to more than 82 economies. With a reputation for high quality and a strong brand in the Indian solar PV market, Moser Baer hopes to benefit from India's potential demand growth in both the off-grid and utility scale markets in the years to come. In the domestic market, it also looks forward to emerging opportunities following the announcement of government policy initiatives and to timely receipt of the SIPS subsidy from the Government of India.

Moser Baer India Limited recognizes its corporate social responsibilities. It is an equal opportunity employer and complies with the Code of Ethics and Conduct, which provides equal treatment in all aspects of the working environment. To realize the goal of "Education for All", the company has already provided adult literacy classes for 82 women in two villages

70 Mishra (2012).

and pushed 692 children into formal education through enrolment drives in the villages. The company has launched advanced computer programming and personality grooming sessions for rural youth, and during 2015-16, this initiative resulted in 1,228 beneficiaries. "Nayee Roshni", a youth development initiative of Moser Baer Trust, provides training to rural youth on various aspects of team-building exercises, mass mobilization activities such as street theatre and sessions on issues such as substance abuse and child sexual abuse. In addition, it has also covered more than 6,000 families through livelihood interventions. The company is committed to leadership in environment, health and safety by creating a culture of work safety in order to achieve its target of zero accidents. Recycling of materials, energy efficiency and renewable energy are pillars of sustainable policy; during 2015-16, the company's efforts saved 5,662 trees through in-house recycling/reuse of 36,299 wooden pallets for product packing. The company recycled 2,368 tons of polycarbonate and 162 tons of solvent, used clean fuel and grid power to reduce carbon-dioxide emission, reduced kitchen waste by installing biogas plant and produced biogas equivalent to a half-cylinder of LPG per day from kitchen waste.

CASE STUDY 5:

Hical Technologies (India)

Hical Technologies is a 100 per cent export-oriented unit, with revenues from aerospace (around 40 per cent), followed by defence (around 40 per cent) and medicine (20 per cent). Technology and innovation have been the main driving forces for the company, and the company is committed to attaining technology leadership in electromagnetic and electromechanical devices through research and development and strategic equity and non-equity partnerships. Since 1997, it has grown rapidly as a high-end electromagnetic component manufacturing company supplying leading corporations in Europe, the United States and Asia. Today, Hical is a single source supplier for 150 different types of parts produced in-house to the world's leading aerospace companies.

The company began its operations in 1988 as Hical Magnetics, a closely held private limited company with a manufacturing facility in Bangalore producing electromagnetic high frequency transformer components for domestic clients in the telecom and automotive industries. In 1992, based on its strength in electromagnetic design and development expertise, the company decided to enter the international market. The unreliability of domestic clients, i.e. public sector companies, pushed the company to diversify into aerospace and transform into a 100 per cent export-oriented unit (EOU) in 1997.

The company diversified into the aerospace business by setting up a state-of-the-art "Hical Technology Development Centre" for developing electromagnetic and electromechanical systems for space and aerospace applications. By hiring the best talent from the Indian Space Research Organisation and other aerospace agencies, it achieved capabilities in providing end-to-end solutions starting from ideation, proof of concept, detail design, prototyping, test rig development, performance testing and qualification for aerospace applications. It has

attained world class capabilities in designing and developing sensors, electromechanical products and subsystems and hydraulic products and subsystems.

Hical's first major technology-related strategic agreement was signed in 2011 with Vacuumschmelze, Germany. This agreement established cooperation in the manufacture of specialty magnetics using the advanced electromagnetic cores of Vacuumschmelze. Hical became the third manufacturer of these products for Vacuumschmelze, after their partners in China and Malaysia.

The first major international joint venture was signed with France's NSE Group in 2012. The new firm, Hical-NSE Electronics Private Limited, became a strategic arm of Hical Technologies to cater to the Indian Offset requirement. This collaboration brought expertise to design, build and sell integrated systems for aerospace, electronics, telecommunications and large-scale industry applications. As an outcome of this collaboration, the company became the Indian Offset Partners for Indo-US, Indo-French, and Indo-Israeli contracts. In February 2017, Hical Technologies signed an MOU establishing a formal relationship with General Aeronautics in which Hical Technologies will be the product integration and fabrication partner for unmanned helicopters and unmanned aerial vehicles (UAVs, or drones) manufactured by General Aeronautics.

The firm has three manufacturing facilities in Bangalore, all equipped with state-of-the-art manufacturing processes. It designs and manufactures high reliability electromagnetics and electromechanical products (motors, solenoids and sensors and transformers), and supplies system integration (box builds and cabinet integrations) to BAE Systems, Boeing, GE Aviation, Lockheed Martin and others. The products and services can be classified broadly into (a) built to print, (b) design and development, and (c) built to specifications. Hical Technologies has regional offices in the United States, the UK, France, Italy and Singapore; in other places, it is represented through its agents.

Hical has stringent norms for its suppliers and distributors. It sources globally and manages supplier quality through timely and regular feedback on performance through on-site audits. The firm has a codified conflict metal policy, an elaborate supplier's manual which advocates high reliability and commitment for quality. In addition to global sourcing, the company has more than 100 local sub-contractors for special processes, sheet metal, casting, forging, moulding and laser welding. All three manufacturing units are custom-bonded as exporting units. The government has allowed self-certification and self-bonding that eliminates potential delays in the supply chain, and the entire supply chain is controlled by the SAP HANA ERP system. Hical also acts as an Indian arm of NSE-France to provide technical services to Hindustan Aeronautics Ltd.

For Hical, the main future challenges lie in technology and economics. In an international high-end technology niche market limited to few players, continuous technology upgrading through equity and non-equity-based strategic alliances is necessary to survive and grow. The clientele of aerospace systems require compliance to some of the most rigorous and complex standards and specifications, and to comply with such benchmarks not only tests the manufacturing

processes but also the associated work culture. One of the reasons behind Hical's past success was cost efficient technological solutions, but rising wages in India are eroding the firm's cost competitiveness. It is difficult to attract talent in the first place, but it is even more difficult to retain talented human resources; special attention is given to training and upgrading of skills and to providing excellent working conditions to ensure that the employees have a rewarding experience. High-end technology customers have strong supplier loyalty and therefore, there are high entry barriers for new entrants, but to maintain loyalty, the incumbent firms need continuous and consistent improvement in operational excellence coupled with quality consciousness, which is another form of challenge, especially if it is linked to customer satisfaction.

Government Incentives

The company has been a recipient of the following government incentives: (a) no import licence was required to import industrial inputs, and imports were exempt from customs duty, (b) supplies from the domestic tariff area to EOUs are deemed exports, which exempted the company from payment of excise duty, (c) on fulfilment of certain conditions, Hical availed a five-year tax holiday, (d) the land for the company's three manufacturing facilities in Bangalore was given at concessional rates under the EOU programme, (e) the company was permitted to sub-contract part of its production processes to units in the domestic tariff area on a case-by-case basis, and (f) the company availed fiscal incentives to promote R&D, technology upgrading and design innovations.

Corporate Social Responsibility

Corporate social responsibility activities undertaken by the company include education, health and skill training. Being a high-end technology company, Hical nurtures talent without gender discrimination or wage disparity. The female employment ratio is low because the company has not taken any special measures to increase the number of women in employment. The company recently increased its commitment to promote gender equality and empower women. It also adopted appropriate measures for reducing inequalities faced by socially and economically backward groups. Conscious of environmental issues, Hical has complied with international norms and frequently undergoes environmental audits. It is an ISO 14001 company and has adopted energy conservation on a mission mode.

CASE STUDY 6:

Samsung Electronics Viet Nam (SEV)

Samsung has been in Viet Nam since 1996, originally producing colour TVs. Its presence has been boosted since 2007 by a number of large investments in mobile phones and related activities, of which the largest is the US$ 7.5 billion complex in Bac Ninh Province. Since that facility began operations in 2009, Samsung and mobile phones have played a major role in Viet Nam's exports and lead evaluation of the country's participation in electronics GVCs. SEV established the second largest mobile phone factory in Thai Nguyen in 2013 with a US$ 2 billion investment.

Prior to 2007, Samsung manufactured mobile phones in six facilities: two in China, two in Brazil, one in India and one in the Republic of Korea. In 2007, the company considered locations for new facilities to meet global demand and to reduce the concentration in Chinese factories. SEV commenced operations in 2009, and by 2015, Viet Nam accounted for 50 per cent of all Samsung mobile phone production. The process was disrupted in 2016 by a manufacturing defect related to faulty batteries in Galaxy Note 7 smartphones, assembled in Viet Nam, which led to a multi-billion dollar recall and discontinuation of the top-end model. In 2017, 30 per cent of Samsung mobile phones were being assembled in Viet Nam. Samsung accounted for 23 per cent of Viet Nam's merchandise exports in 2016, and mobile phones and their parts made up 19 per cent.

SEV received generous tax incentives. The Bac Ninh operations only began to pay taxes in 2013. In 2016, Samsung's tax bill of US$ 300 million represented about 15 per cent of SEV's net income (reported in Samsung's financial statement as US$ 1.9 billion on sales of US$ 18.1 billion), which is less than Viet Nam's corporate tax rate of 20 per cent. In 2016, Samsung established a US$ 300 million R&D centre in Hanoi, employing 1,500 people and positioning SEV to expand into higher value-added activities; it was also an instrument for obtaining added incentives accruing to "high-technology enterprises" under Viet Nam's Law on Investment.

Samsung employed 109,000 workers in SEV and other subsidiaries in Viet Nam at the end of 2017. They were overwhelmingly semi-skilled; 89 per cent high school graduates, 7 per cent with post-secondary vocational qualifications, and 4 per cent with university degrees. Three-quarters were female. Although Samsung's wage bill is confidential, wages in the communications equipment and electronics components industries more than doubled between 2008 and 2014, which was presumably driven by the large increase in labour demand from Samsung. During this period, employment in manufacturing increased from 3.2 million to 5.8 million, and in the communications and electronics industries, the growth in jobs was much faster. Samsung performed inspections and audits of all suppliers to ensure compliance with its guidelines on labour rights, workplace health and safety and employment benefits.

Samsung reports a "localization ratio" of 57 per cent in Viet Nam, i.e. all value added retained locally (including profits retained for reinvestment). Local content in the more usual sense of the value of local goods and services as a percentage of total value added is 40 per cent

(according to Samsung) and closer to 30 per cent (according to Vietnamese officials). In 2014, only ten Vietnamese domestic firms were suppliers, and the four first-tier suppliers among them provided paper packaging products. The 63 other first-tier suppliers in Viet Nam were from the Republic of Korea (53), Japan (7), Malaysia (1), Singapore (1) and the UK (1). Samsung reported in 2017 that the number of Vietnamese suppliers had increased to 215, of which 25 were first-tier suppliers while the others were second-tier suppliers. They were providing either services (e.g. meal catering, recreational travel, and cleaning and sanitation) or paper packaging products, which did not enter into the assembly and manufacturing of Samsung's actual final products.

Since 2014, in collaboration with the Vietnamese government, Samsung has held an annual workshop known as the Samsung Sourcing Fair. The first workshop was attended by over 200 domestic suppliers responding to Samsung's plan to source 91 parts locally, but upon assessment, Samsung found that none of the participants could meet its requirements. Since 2015, Samsung has also offered a three-month technical consultation programme, in which experts from the Republic of Korea are deployed to Vietnamese firms to help improve manufacturing processes. At the end of 2017, Samsung had 26 firms enrolled in the programme and estimated large productivity gains and a reduction in defects from the participating firms. However, the numbers are small, and Samsung has emphasized that firms like itself cannot be expected to spend large sums to meet inadequacies in the domestic supply base. An alternative solution is for domestic firms to identify roles as second-tier suppliers, and for the first-tier suppliers to help them improve their capabilities.[71]

71 One example is the arrangement between Woojin, a manufacturer of plastic injection moulding machinery from the Republic of Korea that has invested in Viet Nam, and Ninh Nguyen, a Vietnamese firm operating in the Saigon Hi-tech Park. Woojin has supplied the local firm with 68 energy-efficient plastic injection moulding machines and helped with installation and maintenance of equipment and training of staff, so that Ninh Nguyen could enter the Samsung GVC (*ASEAN Investment Report* 2016, 170).

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INDUSTRIAL DEVELOPMENT ORGANIZATION

Vienna International Centre · P.O. Box 300
1400 Vienna · Austria
Tel.: (+43-1) 26026-0
E-mail: unido@unido.org
www.unido.org