



Research Network

Sustainable Global Supply Chains



Sustainable Global Supply Chains

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Foreword by the **network hosts**



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Global supply chains affect the economy, the environment and social welfare in many ways. Worldwide, economies are experiencing global supply shortages today, affecting key industries such as automotive and consumer electronics as well as vaccine and medical supplies industries. These preoccupy policymakers, who are debating independent national production capacities and restrictions on international trade, but also large companies, which consider reshoring production and abandoning just-in-time procurement. At the same time, the greening of the global economy requires a restructuring of global production to massively decrease its environmental footprint. This creates new supply chain challenges – how to move towards circular economies and how to reorient energy-intensive industries towards renewables and green hydrogen, for example. And let's not forget: Consumers are increasingly demanding higher social and environmental standards. Transparency requirements and binding due diligence obligations will in particular affect countries that export raw materials and labour-intensive goods produced under problematic environmental and social conditions.

All of this calls for policies that shape global supply chains in accordance with globally agreed social and environmental objectives. Policies along these lines will have to balance the legitimate interests of different countries and they may easily fail to achieve their objectives unless they are firmly grounded in a thorough

understanding of the respective structures in supply chains, including the power relations between the actors. Further, the economic, social and environmental effects of alternative policy options need to be well understood. Science can make an important contribution here, especially if it maintains a constant dialogue with politics and society.

This is why the international “[Research Network Sustainable Global Supply Chains](#)” was initiated by the Federal Ministry for Economic Cooperation and Development (BMZ). It currently comprises about 100 internationally leading scientists from all over the world and is jointly coordinated by our four institutes. Its tasks are: To conduct and stimulate research that contributes to making supply chains more sustainable; and to collect and synthesize the best international research on this topic and make it accessible to policy makers and other societal actors. In addition to its own research, the network organises academic conferences and discussions with policymakers, organises a blog and produces podcasts. With this report – the first in a new annual series – we present new research highlights, provide a forum to debate controversial supply chain topics and identify policy-relevant research gaps for the network's future work. The report is, at the same time, an invitation to participate in the discussions on how investment, production and trade will be reorganized in a global economy that has to respond to geopolitical challenges.

Foreword by the **Federal Ministry for Economic Cooperation and Development**

With exports of around 1.4 trillion euros and imports of more than 1.2 trillion euros, Germany is more closely involved in global trade than almost any other country in the world. This close integration within the global economy also means that we bear a special responsibility for social and ecological conditions along global supply chains. At the same time, we have great leverage to advance the protection of human rights worldwide, promote decent work and higher value creation in developing countries, and set the course for the social and ecological transformation of the world's economies.

To meet this responsibility, a wide range of measures are implemented as part of German development policy. For example, we support our partner countries in strengthening their administrative and oversight structures, such as those concerned with enforcing labor protection laws or environmental standards. We also support them in improving the environment for doing business, developing vocational training systems and providing financial services for small and medium-sized enterprises.

At the same time, we are taking action at home in Germany and in Europe. The German Corporate Due Diligence in Supply Chains Act of 2021 represents a milestone. With this law, Germany has for the first time laid down in binding terms what companies must do to protect internationally recognized human rights along their supply chains. The next step

is a corresponding regulation at the European level. A strong EU supply chain law is an important building block for the protection of human rights and environmental standards worldwide. This way, living conditions can be improved for millions of people in affected countries. But these measures alone are not enough. We need a combination of legal regulations, voluntary standards, multi-stakeholder partnerships and development policy support measures – the so-called “smart mix” of voluntary and binding measures. This is what the BMZ is working for.

In order to find the right mix of measures, we as policymakers depend on the scientific community. We need quantitative and qualitative data, empirical studies and scientific assessments in order to be able to make evidence-based decisions. That is why the BMZ launched the Research Network Sustainable Global Supply Chains, which brings together renowned research scientists from around the world. We are very pleased that the Network is looking into the pressing questions surrounding the sustainable design of global supply chains, providing us with scientific advice and giving new impetus to the international debate. The work of the Network is an important foundation for our efforts to promote sustainable supply chains and decent work worldwide.

I therefore warmly congratulate the Network on the publication of its Sustainable Global Supply Chains Report 2022, in which many of the Network's interesting analyses are compiled and presented. I wish all readers an informative and stimulating read!



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**Sustainable global
supply chains:** New
policy challenges, new
research perspectives

Sustainable global supply chains: New policy challenges, new research perspectives

Introduction

Global Supply Chains (GSCs)¹ have become a key feature of globalisation. Production processes are increasingly broken down into specific tasks and organised across national borders. They are organised and governed by “lead firms” (Gereffi, 1994) that set many of the standards according to which other firms in the chain operate. About half of all global trade is nowadays organised in GSCs (World Bank, 2020a).

The organisational structure of GSCs has an enormous influence on whether the global community reaches the Sustainable Development Goals. GSCs have enabled developing countries to access international markets and thereby increase people’s incomes, but the types of new employment created do not always meet international standards of decent work. Likewise, global firms often introduce new technologies and better environmental practices to local firms, but their integration in GSCs also triggers additional resource extraction and boosts transport-related greenhouse gas emissions. Put simply: While GSCs provide new opportunities to firms and countries, GSC integration does not automatically translate into sustainable development in its economic, social and environmental dimensions.

Societal stakeholders are increasingly recognising the importance of influencing the ways in which GSCs are organised. Turning GSCs into a force for sustainable development is higher on the agenda of policymakers, firms and non-governmental organisations than ever before. We are witnessing a boom of policy debates about supply chains, covering a wide range of issues, such as:

- how to ensure compliance with human rights, decent work and living wages when sourcing from low-wage or poorly governed countries;
- how to make economies more circular and reduce carbon-footprints along the supply chain and
- how to make economies more resilient and ensure the supply of strategic goods, such as energy, vaccines and semiconductors, without sacrificing too many of the advantages of the international division of labour.

Whereas the overall objective of making global supply chains more sustainable is widely shared, the pathways towards achieving this are hotly debated. To start with, there are different interpretations of the societal effects changes in supply chains may have. While some herald Bangladesh’s integration into the global textile supply chain as one of the most impressive



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¹ Throughout this report, we use global supply chains and global value chains synonymously, fully aware that both terms are used with varying connotations in different disciplines

economic success cases (World Bank, 2020a), others present it as a case of exploitative labour relations (Saxena, 2019). Assessments often diverge because there is no counterfactual. We cannot know exactly in which conditions Bangladeshi textile workers would be employed, had the national garment industry not been developed. In most cases, integration into global supply chains has both positive and negative effects – net effects are hard to establish. We do not have enough data, especially when long-term effects of emerging trends are concerned. Similarly, we do not yet know how new digital features, such as robotics, artificial intelligence and the internet of things affect the demand for labour in GSCs, or what the balance between lost and new jobs will amount to as new business models unfold. Views on these issues diverge considerably (e.g. on robotics, Acemoglu & Restrepo, 2017 vs. Dauth et al., 2021). Moreover, weighing economic, social and environmental effects against each other implies value judgements. Outcomes depend on societal preferences.

Research has an important role in addressing the manifold knowledge gaps. While recognising that societal decisions on issues of supply chain governance will always be partly based on value judgements, research can offer the basis for evidence-based decisions. Correlations and causal links identified between supply chain integration and economic, social and environmental developments help to

understand overall developments in the field. Insights on interdependencies and trade-offs between different objectives inform policymakers, and societies at large, about appropriate policy options. Moreover, research can explore the (intended and unintended) effects of these policies and thereby find ways to make them more effective.

This chapter identifies major trends that are expected to have big effects on the future of global supply chains, such as digitalisation, decarbonisation and rising geopolitical tensions. It discusses key challenges arising from these trends and their implications for making global supply chains more sustainable. Based on this analysis, policy-relevant research gaps are highlighted.

The remainder of this chapter consists of four sections. Sections 1-3 are organised along the three dimensions of sustainable development: the economic, the social and the environmental. For each of these dimensions, we review relevant literature to identify societal challenges, research gaps and policy options for making global supply chains more sustainable. While we distinguish the three dimensions to better guide the reader, we try to avoid “thinking in silos” by addressing the complex interdependencies between the economic, the social and the environmental. The final section summarises the main findings, highlights areas for future policy-relevant research and pleas for more multi-disciplinary research.

“... we review relevant literature to identify societal challenges, research gaps and policy options for making global supply chains more sustainable.”

1. Global supply chains and sustainable economic development

In the last decades, participation in GSCs has contributed to economic development in many countries (World Bank, 2020a). Many benefits of GSC participation are well established in the literature. Productivity gains arise through specialization, knowledge spillovers, training of suppliers, compliance with higher standards and learning by exporting, among others (Verhoogen, 2021). Firms that export to international markets are more likely to acquire new technology (Almeida & Fernandes, 2008) and to invest in innovation due to increased competition and exposure to foreign markets (Atkin et al. 2017). Firms that import can access better and cheaper foreign inputs and learn from the foreign technology and knowledge embodied in these imports (Kugler & Verhoogen, 2009; Goldberg et al. 2010; Paunov, 2011). Bas and Paunov (2021) show that trade liberalization improves input quality and raises firms' skill demand. High-quality inputs and high skill intensity jointly boost firms' output quality. Firms sourcing domestic inputs from importing industries also benefit.

Taken together, GSC participation is seen as an important driver of economic upgrading, which captures an important precondition of economic development. Economic upgrading refers to the process by which economic actors move from low-value to high-value activities (Gereffi, 2019). Research distinguishes between different modes of upgrading: product upgrading, process upgrading, functional upgrading and intersectoral upgrading. These may be linked and

change over time (Gereffi, 2019). GSC firms are significantly more likely to introduce new products and new processes than firms not linked to GSCs (Seker, 2012, Veugelers, et al., 2013; Turco & Maggioni, 2015). Banga (2017) examines the case of Indian manufacturing and finds that the product sophistication of GSC firms is on average higher than that of non-GSC firms. Furthermore, existing evidence suggests that investments made by multinational enterprises into local suppliers can lead to knowledge transfer (Arnold & Javorcik, 2009) and that such investments further increase the probability of the affiliate itself introducing new products (Brambilla, 2009; Guadalupe et al., 2012).

Even though there is a general consensus that participation in GSCs can promote economic development in the Global South, empirical evidence indicates that participation in GSCs alone is not sufficient (Barrientos et al., 2011, Fagerberg et al., 2018). Developing countries often run the risk of becoming trapped in low value adding activities of the supply chain with only small profits or employment opportunities (Pahl & Timmer, 2020). Research on the determinants of upgrading in specific settings is therefore critically important.

Moreover, the identified opportunities and challenges related to economic upgrading of firms and economic development by way of participation in GSCs may now need substantial revisiting. Several major global trends may push GSCs on a different orbit altogether. The following three global trends have already started to affect GSCs' shape, and are likely to continue doing so in the future:

First, the **shift in economic power to emerging markets and trend towards regionalization** are changing GSCs. After the 2007 financial crisis, growth of GSCs slowed down and production became more regionalized. China's accession to the World Trade Organization (WTO) in 2001

firms sourcing in the South towards more pluricentric constellations, with more domestic and regional supply chains and intensified South-South trade (Barrientos et al., 2015). It could well be that there is potential for developing countries to benefit from these trends. Evidence so far is mixed.

“Supply chain research needs to consider the shift ... towards more pluricentric constellations, with more domestic and regional supply chains and intensified South-South trade.”

initiated a shift of the global centre of economic power towards Asia. China's development has pulled other economies in the region into Chinese supply chains (AMRO, 2020). The regional distribution of suppliers to the largest global companies increasingly concentrates in Asia. What is more, suppliers of Chinese companies are more and more based in other Asian countries (Falk et al., 2021). The importance of regional production networks has been growing over the last years. Even when manufacturing activities are moved out of China due to rising labour costs, they often continue to be strongly linked to supply chains within China (Stapelton, 2019). Asia is no longer simply producing goods for consumption in industrialized countries; rather, rising incomes have increased local demand and made the region a destination for many consumer products and services (AMRO, 2020).

Supply chain research needs to consider the shift away from traditional patterns of Northern lead

Due to lower entry barriers, domestic and regional supply chains sometimes provide enormous opportunities for small local firms (Liverpool-Tasie & Reardon, 2021). However, they are also often associated with worse working conditions (Pasquali, 2021). Development implications of emerging domestic and regional chains will obviously be context-specific, calling for empirical case study work.

Second, the current constellation of global production has been challenged by new **geopolitical dynamics**. In 2018, the US started increasing tariffs and other trade barriers on China. This so-called US-China trade war has amplified the drifting apart of two major economic blocks and has fostered a decoupling also in related areas such as technological leadership. Although participation in GSCs is seen as a way of diversifying risks, the resilience of GSCs has been contested in recent years. The COVID-19 pandemic has led to a discussion on the costs and benefits of GSCs and the security of supply in critical inputs such as

medical equipment. Additionally, the recently started Russian-Ukrainian war has made dependencies evident and challenges the idea of global interdependencies and cooperation as political baseline agreement. Will Europe's efforts to become more independent of Russian energy create new opportunities for other oil and gas abundant countries, or push renewable technologies? What is more, food security has become an urgent issue as Russia and Ukraine are major wheat producers and many countries, particularly in Africa, depend on wheat imports from them (Heidland & Mahlkow, 2022). Is there a need for more diversified supply chains and what role should policy play? Several governments have recently introduced measures that aim at securing the supply of critical components and at increasing resilience to shocks in general. These measures include, for instance, efforts by the US and the EU to bring the production of semi-conductors closer to their home markets (see e.g. The White House 2021; European Commission 2022), to control the production of vaccines and medical equipment (Bown, 2021), or efforts by China to gain digital sovereignty (AMRO, 2020). These trends have wide ramifications for firms' competitiveness and consumer prices and thereby affect third parties in many ways, including e.g. Latin America or Africa.

Third, **automation of production and digital transformation** are game-changers for the organization of global production. Information and communications technology (ICT) developments allowed advanced economies to relocate production stages to developing countries, which in turn generated local employment

and productivity growth (Stapelton, 2019). However, the evidence on the relationship between automation and GSCs is mixed (see the debate Marin vs. Freund, p. 42 ff.). On the one hand, automation could reduce the offshoring of labour-intensive manufacturing work. On the other hand, it could also lead to additional employment and trade through increased productivity (Stapelton, 2019).

Global trade tends to be dominated by a few big and productive companies. Automation may reinforce this concentration. Companies that automate are larger, more productive and more likely to be involved in GSCs. Large multinationals tend to have complex supply chains and invest in advanced technologies. Artuc et al. (2019) find that increased robot use in Northern countries increases imports from developing countries, suggesting that counterbalancing effects of automation are at work that also benefit trading partners with lower levels of automation. Other research, in contrast, suggests that the displacement effect of automation is stronger than the counterbalancing channels (Stapelton, 2019). Automation raises several concerns particularly for developing countries. First, firms from developed countries could reshore production, thus not source from low-income countries. Second, some typically labour-intensive manufacturing activities remain concentrated in emerging economies such as China, where they have been automated rather than relocated. What does this imply for GSC opportunities in low-income countries?

Besides automation, digital transformation is likely to affect the order of global production (Hallward-

Driemeier & Nayar, 2018; Lütkenhorst, 2018). On the one hand, digitalization can facilitate product upgrading of firms. Increasing digital capability at the firm level can boost product sophistication, enabling them to climb the value chain ladder (Banga, 2019). On the other hand, it is less clear what role digitalization will play with regard to other types of upgrading strategies, like process and functional upgrading, and whether digital technologies are impacting upgrading strategies across lead firms and supplier firms differently (Banga, 2019). Furthermore, the digital economy is based on platforms providing applications for all types of businesses, opening doors to new players and bringing supply- and demand-side players together to transact. Platforms themselves are integral to value creation, e.g. through data collection (Lundquist & Kang, 2021). They can provide network effects (access to consumers and sourcing options), lower trade barriers and increase productivity by reducing information asymmetries (Lundquist & Kang, 2021). However, smaller firms can be constrained by a lack of training in new digital tools, human capital, internet connectivity and digital infrastructure. Digital platform consolidation can adversely affect smaller players with limited market power. Market consolidation determined by the relative switching costs between digital platforms has implications for productivity gains (Lundquist & Kang, 2021). E-commerce sales have been growing globally since the COVID-19 pandemic. However, the top 10 countries in terms of e-commerce sales account for 4/5 of global e-commerce, and they are concentrated in Asia, Europe and North America (Lundquist & Kang, 2021).

Overall, the effects of digital trends on GSCs are not well understood. Digital transformation enables new business models, new products and more flexible value chains. It is important for economies, particularly emerging market economies, to find ways to be competitive in this environment. For many developing and emerging economies, progression along manufacturing value chains remains a viable development strategy. However, digitalization could offer new opportunities to enter global production networks. A crucial question is under which conditions new opportunities could arise. Digital platforms can be especially beneficial for small and medium-sized firms as they allow to access services that might otherwise be prohibitively expensive and allow overcoming skill gaps. At the same time, platforms often require economies of scale and imply winner-takes-all dynamics, thereby excluding especially smaller firms. Important questions arise: How can firms in low-income countries benefit from digital transformation? What kind of policies are needed to facilitate taking advantage and, for instance, to protect small firms from market power of large platforms?

2. Global supply chains and social sustainability

The social dimension of firms' participation and upgrading in GSCs has been attracting more attention in recent years. Early research on global supply chains primarily focused on identifying and examining the drivers and characteristics of economic upgrading, i.e. increased value added in supplier firms' production. Contrary to early assumptions that economic

upgrading would automatically translate into social benefits for workers, GSC research increasingly finds that economic upgrading “may lead to social upgrading, but that it is neither a necessary nor a sufficient condition” for social upgrading (Rossi 2019; Barrientos et al., 2011; Gereffi & Luo, 2014). Economic upgrading deals with productivity gains regardless of how they are distributed between capital and labour. In contrast, social upgrading emphasises employment effects as well as “the rights and entitlements of workers as social actors by enhancing the quality of their employment” (Barrientos et al, 2011; Rossi, 2013). It draws on the ILO’s definition of decent work (ILO, 1999).

the manifestation of more balanced power relations between workers and management in the context of sound industrial relations” (Rossi 2013: 224).

Social upgrading in terms of employment, skills and gender inequality reduction differs both within and across countries. Research has shown that participation in GSCs can have positive effects on employment - for instance, firms participating in GSCs tend to employ more women than non-GSC firms (World Bank, 2020a). However, evidence also suggests that “the gains from [GSC] participation are not distributed equally across and within countries. Inequalities arise in the distribution of firm markups

“GSC research increasingly finds that economic upgrading ,may lead to social upgrading, but that it is neither a necessary nor a sufficient condition’ for social upgrading.”

Research on social upgrading distinguishes between measurable standards and enabling rights (Barrientos et al., 2011; Elliott & Freeman, 2003; Rossi, 2019). Measurable standards include the level of employment, wages, worker’s physical well-being, and employment security (Rossi, 2019; Salido & Bellhouse, 2016). Enabling rights, on the other hand, refer to the ILO’s core labor standards of freedom of association, the right to collective bargaining, non-discrimination, voice and empowerment (Rossi, 2019). These enabling rights are “the full expression of the rights and entitlements of workers as social actors, and are

across countries; in the distribution of capital and labor, between skilled and unskilled workers as well as between male and female workers; and geographically within countries” (World Bank, 2020a: 66).

Based on evidence from various case studies, the relation between economic and social upgrading can be roughly categorized along four trajectories (see box below):

- **Economic upgrading without social upgrading.** In this scenario, firms participating in GSCs benefit from economic upgrading, whereas workers experience no or only limited social upgrading.

Box: Four trajectories of economic and social upgrading

<p>Economic upgrading without social upgrading</p> <ul style="list-style-type: none"> • Economic upgrading of firms • No or only marginal social upgrading for workers 	<p>Economic upgrading with social upgrading</p> <ul style="list-style-type: none"> • Economic upgrading of firms • Workers experience social benefits (e.g. through worker’s trainings, higher wages, more flexible working models)
<p>Economic upgrading with social downgrading</p> <ul style="list-style-type: none"> • Economic upgrading of firms • Disadvantages for some (often irregular, unskilled) workers 	<p>Social upgrading without economic upgrading</p> <ul style="list-style-type: none"> • No upgrading of firms • Social benefits for workers (often due to advocacy and/or pressure from organizations, consumers, or regulations)

Source: Own, also drawing on Milberg and Winkler (2011).

Asymmetric power relations within GSCs are likely responsible (Milberg & Winkler, 2011; Rossi, 2019), i.e. the growth and productivity gains are predominantly captured by lead firms rather than by supplier firms, especially when relations with suppliers are “captive” (Gereffi, Humphrey & Sturgeon, 2005). As the World Development Report (World Bank, 2020a: 68) describes, “[l]arge corporations that outsource parts and tasks to developing countries have seen an increase in markups, suggesting that cost reductions are not being passed on to consumers. At the same time, markups for the producers of these inputs in developing countries are declining.” Additionally, when increased productivity does result in higher margins for supplier firms, the benefits may not be redistributed to workers “due to deeply rooted power imbalances, including the lack of representation, unionization and collective bargaining” (Rossi, 2019: 279).

- **Economic upgrading with social upgrading** describes a situation in which economic upgrading of

GSC firms is equally matched by social upgrading for workers and/or affected communities. A recent example of this can be observed in the Information Technology services industry: firms have not only gained economically as a result of the COVID-19 pandemic, but workers employed in the sector were also able to benefit from more flexible working models, for instance by switching more easily to work-from-home-jobs (Shankar, 2020). This is a privilege usually only common in white-collar jobs (Dünhaupt et al., 2021:20). The call centre industry in the Philippines presents another earlier example. It experienced the creation of jobs through knowledge transfer paired with training and skill development for workers (Fernandez-Stark, Bamber, & Gereffi, 2011).

- **Economic upgrading with social downgrading.** In this scenario, social upgrading may occur for some workers, while others may even be affected negatively. The latter is known as social downgrading, which describes the deterioration of conditions, rights and entitlements

for workers. In the Moroccan fashion industry, for example, the workforce is split between regular (i.e. contractual) and irregular, often unskilled workers (Rossi, 2013, 2019). Regular workers were able to obtain social benefits (such as skill upgrading), but irregular workers tended to experience social downgrading in the form of more casual or non-existing contracts, poor wages, excessively long working hours or discrimination. In African horticulture generally (Barrientos et al., 2016) and in Eswatini with regard to social benefits among direct and indirect suppliers (Pasquali & Godfrey, 2022), similar dynamics exist.

- **Social upgrading without economic upgrading.** Although less frequent, this scenario describes the occurrence of social upgrading independently of economic upgrading, for instance due to the establishment and advocacy of producer organizations, cooperatives and the subsequent provision of more secure contracts and better pay, or increased compliance with labour laws due to consumer pressure (Rossi, 2019).

Beyond these general trajectories, the causal relationship between economic and social upgrading is not yet fully understood. The correlation between both forms of upgrading is contingent on a number of variables

and impacting factors. Future research should therefore focus on identifying the various drivers of social upgrading/downgrading. Marslev et al. (2021), for instance, offer new insights on the connection between social upgrading and power dynamics among employees; Xu and Ye (2021) take a closer look at the effect that automation and digitalization might have on labour degradation and working conditions in China. Additionally, the correlations and causal links between these variables require more research to determine why some workers, firms and communities benefit from economic upgrading, while others do not.

The impact of economic upgrading on the most vulnerable groups in global supply chains demands particular attention. These groups include women, migrants and irregular workers. As Rossi (2013) points out, GSC's prevailing characteristic of exploiting low labour costs may increase the vulnerability and insecurity of these groups. Gender dynamics in GSCs is a sub-field of GSC research that particularly demands more attention. Although the level of female employment in GSCs has generally risen over the years, women still predominantly work in lower value-added labour-intensive tiers of the value chain and in occupations that require lower skills and pay less (Staritz & Reis, 2013; World Bank,

“The impact of economic upgrading on the most vulnerable groups in global supply chains demands particular attention. These groups include women, migrants and irregular workers.”

2020a). Research examining gender inequality in GSCs must critically assess in how far these patterns are influenced by societal gender norms and perceptions of men and women in different cultures and contexts (Barrientos, 2001; Mayoux & Mackie, 2007).

Additionally, a broader social upgrading lens is required, both conceptually and in terms of recognizing existing potentials and impacts beyond processes within companies. Resulting assessment of social upgrading could include the positive or negative impact of GSCs on local and regional development processes (Müller, Saulich, & Schulze, 2022). This broadened view of social upgrading takes the opportunities that GSC participation may bring to surrounding communities into account, i.e. through the creation of indirect jobs, the building of infrastructure, higher property values, etc. Yet it also critically assesses the negative impacts of GSCs on affected communities, such as increasing social inequality, environmental and health risks, or social conflicts within and across communities.

Due to increasing awareness of unfair working conditions, unequally distributed gains, and violations of human rights and environmental standards along GSCs, companies are increasingly expected to monitor risks

and ensure sustainability along their supply chains (Eccles & Klimenko, 2019; UNFSS, 2018). These expectations are put forward by customers, investors and governments. In response, many companies, especially large-scale ones, have introduced voluntary sustainability standards and codes of conduct shaping their relationship with suppliers. In the 1990s, anti-sweatshop campaigns put pressure on multinational enterprises to improve working conditions along their supply chains, which resulted in large real wage increases in targeted enterprises (World Bank, 2020a: 89). In 2011, the United Nations Human Rights Council adopted the United Nations Guiding Principles of Business and Human Rights (UNGPs). The principles serve as a global authoritative standard for transnational corporations and business enterprises and a transformational roadmap towards a “future where the billions of people whose lives are impacted by corporate activities are treated with respect for their dignity and fundamental welfare – a world where human beings and corporations alike can thrive and prosper” (John Ruggie, former UN Special Representative for Business and Human Rights and author of the UNGPs).

While non-binding agreements and voluntary standards have certainly had some impact, for instance by creating more transparency along

“The limited impact that voluntary sustainability standards have had so far has sparked a wave of national and supranational initiatives for mandatory due diligence and corporate social responsibility regulation.”

GSCs, their implementation and compliance depends solely on the voluntary commitment and willpower of companies. Non-compliance with voluntary sustainability standards (VSS) appears to be a recurring issue (Locke, 2013; Stroehle, 2017; Hiete et al., 2019). The limited impact that voluntary sustainability standards have had so far has sparked a wave of national and supranational initiatives for mandatory due diligence and corporate social responsibility regulation. In 2015, the UK adopted the Modern Slavery Act aimed at curbing the illegal exploitation of people for personal or commercial gain. Two years later, France became the first European Union member state to pass a comprehensive national due diligence law mandating companies of a certain size to monitor, prevent, and remedy human rights breaches in their supply chains. Germany followed in 2021 with its own Supply Chain Due Diligence Act; the most comprehensive proposal for an EU-wide mandatory due diligence law was presented by the European Commission in February 2022. Meanwhile, the US and the EU are also leveraging trade policy instruments to ban products known to originate from child or forced labor (at the end of 2021, the US banned the import of products from China's Xinjiang province).

The academic and political debate around corporate responsibility and due diligence in global supply chains mainly revolves around three key aspects:

1. the instrument (i.e. legislative frameworks vs. voluntary standards),
2. the scope (all companies irrespective of size vs. exemptions for SMEs), and
3. potential unintended consequences (see debate Markus Krajewski vs. Gabriel Felbermayr p. 36 ff.).

Future research on social upgrading and regulation of GSCs will need to examine the effects of due diligence laws and their potential to substantively impact social and economic conditions for workers along global supply chains. In assessing the capability of mandatory due diligence regulations to reduce poverty by guaranteeing legal minimum wages for workers in production countries, research must pay attention to the on-going debate on what exactly constitutes a fair and sufficient wage (so called living wage) and how these wage levels can be scientifically measured and compared among countries (Stamm et al., 2019). Particular attention must also be paid to potential unintended consequences of due diligence laws, especially for producers and smallholders in the Global South (Beghin et al. 2012; Zezza et al., 2018). Deteriorating conditions for smallholder farmers in developing countries (see Ponte, p. 116 ff.) and the decrease of farmworkers' incomes with the introduction of standards (Oya, Schaefer, & Skalidou, 2018) give reason to substantial concern. Additionally, companies in fear of being declared non-compliant with new regulations may choose to withdraw from certain high-risk regions (Parker, 2018). In lieu of creating secure employment and better labour conditions for workers, this cut-and-run approach could inadvertently lead to a reduction of employment opportunities and an increased shift from formal to informal employment.

3. Global supply chains and the natural environment

To explore policy options for improving the links between GSC and environmental sustainability, two aspects need to be distinguished.

First, how GSCs impact environmental sustainability, and how such effects can be mitigated. Second, how policies aimed at increasing environmental sustainability affect the configuration of GSCs, and how they can be designed to enable sustainable development, not only in its ecological dimension, but also in terms of economic and social upgrading. Traditional GSC research has neglected both dimensions of environmental sustainability (Bolwig et al, 2010; Marchi et al, 2019). Most research still focuses on inter- and intrafirm dynamics to better understand how countries and firms can increase productivity and profitability (Rossi 2019:372).

Regarding the **impacts of GSC on the natural environment**, both positive and negative effects have been identified. Production in GSCs implies that raw materials and intermediate products criss-cross the globe before final goods are assembled and delivered to their customers. Compared to traditional trade, where goods entirely produced in one country are exchanged with goods manufactured in another country, the spatial unbundling of production in GSCs implies “higher carbon dioxide (CO₂) emissions from transportation ... (as well as) excess waste (especially in electronics and plastics) from the packaging of goods” (World Bank, 2020a: 4). Moreover, to the extent that the increased specialization of firms increases productivity and economic prosperity, demand for new products and services increases, often associated with unsustainable lifestyles. This again results in greater resource consumption and pollution. At the same time, increased prosperity also increases the willingness to pay for environmental quality and invest

in clean technology (Shapiro, 2021). A literature review by Delera (2021:1) summarises that “participation in GVCs makes firms more energy and emission efficient than their domestic peers.” This is not surprising, as firms in supply chains are on average more productive, which means they also use less material inputs per unit of output (Shapiro & Walker, 2018). Also, they are larger (on average), use more advanced technology and apply certification more consistently. Yet, exceptions also exist, for example in agriculture and mining, where export production tends to have larger environmental effects (Delera, 2021).

This hints at the need to look beyond aggregate trends. Environmental effects are obviously specific to economic sectors and technologies. Jungmichel, Schampel & Weiss (2017) provide a synopsis of environmental impacts along global supply chains for the main industries in Germany. Such exercises help to identify hotspots that call for in-depth empirical research – as for example Mayyas (2019) does for lithium batteries and Ninimäki et al (2020) do for textiles.

The **effects of environmental policies** on the configuration of GSC are far less well understood. Those pieces of GSC literature that do address this link are mostly focused on environmental standards. Standards “determine the terms of market-entry but also affect the extent to which different producers are able to position themselves in global value chains in a manner which provides for socially and environmentally sustainable income growth” (Kaplinsky & Morris, 2018:322). They involve compliance costs, which may exclude poor producers who are unable to bear these costs. Yet,

“The lack of research on the question how decarbonisation and the shift to more circular economies will affect GSC is striking.”

they may also create socio-economic benefits and induce better production techniques, especially if price mark-ups are passed on along the supply chain. As laid out above, research shows evidence for both negative and positive effects, depending on supply chain characteristics and the design of the respective standards (Ponte, 2019; Meemken, 2020). Consequently, additional research on the design and effects of standards is required.

The lack of research on the question how decarbonisation and the shift to more circular economies will affect GSC is striking. Even though these “techno-economic paradigm shifts” (Perez, 2016) have deep implications for essentially every kind of supply chain and are hotly debated in environmental science and policy circles, they are a major blind spot in the academic supply chain literature.²

The exception here is carbon leakage – that is, the increase of greenhouse gas emissions in countries with relatively lax climate policies as a result of stricter policies elsewhere. Carbon leakage may happen as countries with lax standards increase their market share in polluting industries and/or because industries may be relocated to less regulated jurisdictions. Research confirms the existence of carbon leakage to different degrees, depending on sector characteristics; yet, the effect size is not very big

(Copeland, Shapiro, & Taylor, 2021). Hence, we do not observe a major reconfiguration of GSC. Importantly, however, “most of the data [...] comes from a period when emission permit prices were low” (Copeland, Shapiro, & Taylor, 2021: 26). Yet, carbon pricing initiatives are mushrooming, covering an increasing share of global GHG emissions (2021: 21.5%) and prices are going up (World Bank, 2021). At the same time, implementation of carbon pricing schemes is highly uneven across countries, thereby creating much larger incentives for carbon leakage. This calls for new research in settings with considerable carbon price differentials and in which energy-intensive industries (such as steel and chemicals) are involved.

Carbon leakage presents a negative spillover effect of stricter environmental standards, but there are also positive spillover effects. These standards stimulate the development of clean technologies, which later often diffuse to other countries (Altenburg & Rodrik, 2017; Ambec, 2017). More research is needed to understand both the negative and positive spillovers between countries and their implications for GSCs.

Decarbonisation first of all affects energy systems, which then has knock-on effects on downstream industries. Firstly, the importance of fossil fuel inputs decreases, devaluing

² For example, neither the seminal Handbook on Global Value Chains (which covers 35 Chapters; Ponte, Gereffi & Raj-Reichert 2019) nor the World Bank/WTO Global Value Chain Development Report 2019 address these issues

oil fields and coal mines as these resource become “unburnable” given stricter climate policies. Importantly, from a GSC perspective, the risks of such asset stranding (Ansari & Holz, 2020) extend towards downstream industries, including refineries, power plants, pipeline infrastructure and energy-intensive industries. Then, all major industries are developing decarbonisation strategies to shift their energy supplies towards renewable energy, often with far-reaching implications for the entire supply chain. A case in point is the automotive industry’s shift to electric

and geothermal resources, many of which are in developing countries (Altenburg et al. p. 98 ff.). Overall, the shift from fossil to renewable energy sources thus changes the locational advantages in many industries. Yet the GSC implications remain vastly under-researched.

Carbon pricing also affects GSCs by increasing transport costs. Transport accounts for one third of all emissions embodied in traded goods (Cristea, 2013). *Ceteris paribus*, production systems that rely on moving inputs back and forth across the globe thus

“... special emphasis should be placed on the impacts of three game changers for sustainable development, especially in developing and emerging economies.”

vehicles, where key inputs change and new geographies of supply emerge. As polluting industries are phased out, demand for renewable energy and green hydrogen surges. Differences in the costs and availability of renewable energies will create new competitive advantages, again with manifold effects on GSC. Low marginal costs of renewable energies can be expected to attract investments in green hydrogen and other industrial feedstocks, which, in turn, make the respective locations attractive for energy-intensive industries that are under pressure to reduce their environmental footprints. This “renewables pull” effect (SCI4climate. NRW, 2021) offers new prospects for industrial development in locations with strong solar irradiation, wind

become relatively more costly than domestic production – an incentive for backshoring or nearshoring of offshore production. Yet, many other factors need to be considered here, such as different carbon-intensity of production across regions and the mode of transport (Copeland, Shapiro, & Taylor, 2021). It is thus not easy to predict how exactly a tax on transport emissions affects GSC. This requires more research.

Last, but not least, the envisaged transformation from linear “take-make-dispose” supply chains to circular economies, in which resource use is minimised and materials are reused and recycled, will affect GSCs in many ways. While compared to the decarbonisation agenda, circularity

targets are not (yet?) equally binding, the European Commission is pushing ambitious legal reforms with Initiatives such as the EU Circular Economy Action Plan (European Commission, 2020). For example, regulations requiring the use of recycled materials, such as scrap metal, reduce the demand for iron ore and other mining products (Nechifor et al., 2020). In the garment industry, efforts to shift “from an industry producing large volumes of essentially disposable items, to one producing valuable items that remain in use for a long period before being repurposed or recycled” (UNEP, 2020: 7) would obviously reduce demand. It would also change the current structure of a global value chain that has historically provided opportunities for employment creation and industrial upgrading for many countries. If circular economy principles were strictly implemented, international trade would be reduced and GSC become shorter. Developing countries would lose export markets for natural resources and have to “shift focus from low production costs to unique contributions in value cocreation” (Hofstetter et al., 2021). Academic research so far has contributed little to understanding the effects of such transformations.

4. Conclusions and major policy-relevant research gaps

GSCs have manifold effects on economic, social and environmental sustainability. Changes in the configuration of GSCs – regardless of whether they are driven by technological change, geopolitics or government regulation – have wide, and often hardly predictable, ramifications. They impact on who participates in GSC, who reaps the benefits and how

the natural environment is affected. Thus, **identifying changes in GSC and studying their economic, social and environmental effects** is one of the big challenges for GSC research. In our subjective view, special emphasis should be placed on the impacts of three game changers for sustainable development, especially in developing and emerging economies:

1. The revolution in digital and automation technologies: It often raises entry barriers; it enables huge, yet often unequally distributed productivity gains; it is likely to alter established patterns of GSC fragmentation and offshoring; it can make supply chains more transparent; and it requires new skills and infrastructures.
2. The impact of decarbonisation and circular economy scenarios: These will substantially change competitive advantages in GSCs, weakening the position of developing and emerging economies in some industries (due asset stranding in fossil-fuel dependent industries and reduced demand for certain other natural resources), and strengthening it in others (related to renewable energy, green hydrogen, new minerals such as lithium, bio-economic alternatives to fuel and labour-intensive organic farming, for example).
3. Changing geopolitics: The current US-China tensions may affect GSCs in many ways, leading to protectionism and less international division of labour. Likewise, the war in Ukraine and the economic embargos against Russia are changing supply chains for gas, oil and grain, among others.

Another big research challenge is to better understand the **effect of**

specific policies aimed at making GSC sustainable.

Governments increasingly adopt measures aimed at shaping GSC in accordance with societal goals. Choosing the best possible mix of policies, however, is far from trivial.

‘Horizontal’ policies are largely undisputed, i.e. those that do not differentiate between technologies, sectors and nationality of investors. These include measures to make the regulatory environment business-friendly, to invest in infrastructure and education and to ensure basic standards. Some authors and institutions deem this sufficient for exploiting the benefits of GSC (Stolzenburg, Taglioni & Winkler, 2019; World Bank, 2020a), whereas others call for additional “vertical” policies, such as: Human Rights Due Diligence Laws that hold lead firms specifically accountable; “carrots and sticks” to induce foreign investors to increase local content or share technologies; and industrial policies to encourage domestic production in industries considered to be strategic. This is where it becomes controversial (see the “Debates” section, p. 28 ff.). Such interventions typically produce a range of direct and indirect, intended as well as unintended effects. In most cases, different policy instruments could potentially be applied to achieve the same objectives. This calls for a research focus on rigorous and comparative policy evaluation, using for example baseline surveys and

experimental designs. Such research needs to place more emphasis on indirect effects, which, due to being difficult to measure, often go unnoticed. This includes effects on suppliers in the second and third tier, especially when they operate informally, as well as effects on firms and workers that are not directly related to the GSC, but may be affected through substitution and price effects as well as on the sector’s overall competitiveness.

We want to end with a plea for multidisciplinary and methodological plurality. In recent years, GSC research has greatly benefited from new multi-regional input-output data (such as WIOD and EORA) that allow to capture, at an aggregate level, how the division of labour in GSCs evolves, where value is created and what the effects on employment are. Also, many environmental effects can be measured, for example, the amount of GHG emissions used to produce a specific final product, accounting for the emissions embedded in the production of raw and intermediate materials. Great progress has also been made in terms of firm-level analysis. For example, the OECD’s Analytical Activities of MNE (AMNE) database allows to better understand the role of multinational enterprises in GSCs, for example how important their domestic linkages are and how much multinationals contribute to local employment. Comprehensive cross-country datasets have led to

“GSC research can gain much if scholars from different disciplines exchange on and combine their conceptual frameworks and methodological skills.”

an enormous uptake of quantitative analyses of GSCs in the discipline of economics, as they allow to make generalizable statements for entire industries, and the results are replicable and can thus be tested and further refined by other researchers.

Yet, econometric studies also have their limitations. First, firms are very heterogeneous. They adopt very different, context-specific strategies, and these fine-grained firm level characteristics necessarily go unperceived in statistical analyses. Here, the disciplines of business and innovation studies that provide in-depth analyses of the specificities of firms and technologies, exploring processes of cumulative causation, can provide important insights. Second,

analysis of past firm behaviour tells little about future developments, especially when external conditions change fundamentally – and several of the changes highlighted above are truly disruptive and therefore not comparable to previous shocks. Here, integrated approaches combining, for instance, integrated assessment models with technology forecasting techniques and political stakeholder analysis, may be the best way forward. Third, econometric studies can only provide limited insight into the effects of specific GSC policies, such as due diligence laws or new standards, as the causalities involved are highly context-specific. GSC research can gain much if scholars from different disciplines exchange on and combine their conceptual frameworks and methodological skills.

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Debates

The Debates address policy-relevant controversies in global supply chain research. We invite leading researchers with different views on the respective topic to share their ideas and challenge each other. The debates help to identify policy options for making global supply chains more sustainable.

Should governments push for higher domestic value added in export sectors?

Developing countries often try to increase the domestic value added of their exports. Those exporting natural resources try to create forward linkages, processing minerals or agricultural products locally. Countries that successfully export labour-intensive manufactures, assembling garments for example, often try to integrate backwards – producing yarn and cloth or even cotton locally. The basic idea is to retain value in their countries and diversify their economies.

David Dollar argues that governments should avoid creating “artificial” incentives to use of local inputs, as this lead to exports of inferior quality and decreased competitiveness. Governments are not good at interfering in how much value added of a product must be produced locally. Countries should rather specialise on those steps of the production process in which they have comparative advantages. **Arkebe Oqubay & Christopher Cramer** challenge this proposition. They see the need for industrial policies that coordinate and stimulate targeted investments to increase domestic value, secure better positions within global value chains and steer structural change.

David Dollar is a senior fellow in the John L. Thornton China Center at the Brookings Institution. Before he joined Brookings, David was the U.S. Treasury's economic and financial emissary to China. He has also worked 20 years for the World Bank, serving among others as country director for China and Mongolia and in the World Bank's research department. He has written highly influential publications on economic reform, globalization, and economic growth and poverty and is co-editor of the Global Value Chain Development Report 2019.



Arkebe Oqubay is a Senior Minister and has been at the centre of policymaking for three decades. He spearheaded Ethiopia's industrial policy, which included, among other things, a deliberate strategy to attract productive FDI into Ethiopia's light manufacturing industries and promote domestic linkages. Arkebe serves as board chair and vice-chair in many leading public enterprises, including Ethiopian Airlines. He is a Professor of Practice at the University of Johannesburg and at SOAS, University of London and also was the African candidate for the post of UNIDO's Director General.



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David Dollar: In assessing Global Value Chains, developing countries should target total value added, not the value-added share.

The emergence and expansion of Global Value Chains (GVCs) has been a boon to developing countries. Traditionally, international trade consisted of a product produced in one country, consumed in another. Trade enabled countries to export the items that they had in abundance and to import ones that they lacked. GVCs opened up new trading opportunities by breaking up the production process into a series of discrete steps and intermediate products. GVC trade crosses at least two borders during the production process, and often many more. GVC trade now accounts for about two-thirds of world trade. Widely traded products such as autos and electronics often have hundreds if not thousands of components, which can now be produced in different countries.

The emergence of GVCs has had a major effect on development opportunities by making it easier for developing countries to participate in manufacturing GVCs. Under traditional trade, developing countries tended to export primary products that they had in abundance – oil, minerals, agricultural products. It was difficult to break into manufactures because this involved producing a complete good, with design, technology, different types of inputs, and branding and marketing. With GVCs, on the other hand, it is possible for a developing country to specialize in certain activities along the production chain, without having to produce a complete product. The decade of the 2000s, in particular, was a time in which GVCs expanded; the number of discrete steps in almost all production chains increased; and developing countries became a key locus of manufacturing production. In 1985 developing country manufactured exports were less than 1% of world GDP; by 2008 that share had increased

more than five-fold. This period was one of particularly rapid GDP and employment growth for developing countries, with a concomitant fall in absolute poverty.

While developing countries have benefited from GVCs, they worry that they will be stuck permanently with an unfavourable role in the division of labour. Studies have documented that for iconic products like the iPhone, only a tiny fraction of value added is contributed by developing countries, whereas more advanced economies provide and profit from the high-value inputs. A question that naturally arises then is whether developing countries should set, as a target of policy, to increase the domestic value-added share in their exports. Paradoxically, such a target does not make sense and may be counter-productive.

First, let's stipulate that it is natural for developing countries to want to produce more value added overall (economic growth). Most value added comes from labour so this is also a target to create more jobs, especially formal sector jobs that have better pay and benefits. Jobs in the export sectors will typically fall into this category. To expand the total number of jobs in exports will require improvements in key foundations such as schooling and infrastructure. The government plays a key role in fostering the expansion of these inputs. This argument is not about a laissez-faire approach versus an interventionist government; it is about what government interventions are effective at increasing total value added and enhancing human welfare.

Second, let's note that as successful economies develop, the value added share in specific exports will typically go up in some sectors and down in others. GVCs are organized by multinational firms, and they will be looking for ways to cut costs by shifting more production to suppliers in the developing world. However, there are also country-sector cases in which the domestic

value added share of exports goes down. Korea's exports of electronic products, which have been phenomenally successful, has been accompanied by a steady decline in domestic value added versus imported value added. Korean firms use the best imported components and services, and that enables them to be globally competitive. If the government had tried to restrict imports of components and services for electronics production, the industry would have been less successful with less overall export and value added production.

In theory, an all-knowing government might be able to distinguish sectors in which some protection of domestic suppliers would encourage successful development of clusters, versus sectors in which the protection makes the whole industry globally uncompetitive. But in practice governments do not have a good track record with these kinds of import-substituting policies. A relevant contrast is between Bangladesh and Pakistan. The latter encouraged backward linkages from garments to cloth and yarn and cotton. Bangladesh opened up more and gave its garments producers access to the best global inputs. The result is that Bangladesh is a much more successful exporter and its approach has led to more total value added exported and more manufacturing jobs. Aside from information asymmetries that make government intervention problematic, there is also a political economy issue: corruption will tend to distort government choices. Industries lobby for temporary, "infant-industry" protection, but once in place the protection becomes permanent. A few favored

firms benefit, but not the larger economy. In my 20 years in the World Bank, I found that this was the best argument for trade liberalization: industrial policy inventions were generally made on political, not economic grounds.

Most developing countries have learned these lessons and allow duty-free imports of parts and components. Without this, it is hard to get MNCs to consider your production location. But an interesting trend in global trade is that more and more value added in manufactures trade comes from services sectors. This reflects several trends: there is a growing Intellectual Property – especially software – contribution to value chains; also, the management of complex chains relies on services like telecom, transport, and finance. While developing countries are relatively open to trade in goods, especially parts and components, they tend to be relatively closed to trade and investment in services. This is the new frontier in liberalization for developing countries.

In summary, developing countries would do well to open their economies widely, including to intermediate parts and services. There is an enormous agenda of things that the government must do to underpin success, including education, infrastructure, regulatory framework, financial stability, to name some key ones. The issue is not government versus market but rather the division of labor between the two. The government interfering in how much value added of a product must be produced locally is not likely to be a priority use of scarce government resources.

Arkebe Oqubay & Christopher Cramer reply to David Dollar: Why governments need to push for local value added?

David Dollar rightly emphasises the astonishing expansion of Global Value Chains (GVCs) and the trade in intermediaries that has been a key feature of this. And he rightly emphasises that integrating into GVCs has helped developing countries (well, some of them) overcome barriers to securing a greater share of global manufacturing exports. But he is too complacent about how difficult it is in fact to thrive and 'upgrade' within a world dominated by GVCs.

He also rightly states that thanks to the rise of GVCs developing countries have come to claim a share of global manufactured exports five times higher than in 1985 and that this period was also associated with fast growth, rising employment, and poverty reduction. What he fails to point out is that this growth in manufactured exports was far from evenly distributed; rather it was highly concentrated – as was the growth and the poverty reduction – in countries characterised by a variety of policies that despite their differences were united in defying free market theories: they were not the paragons of 'openness' and small states that Dollar goes on to recommend.

And his argument that targeting a rise in the domestic value-added share of their exports may 'paradoxically' be counterproductive for developing countries oversimplifies the challenge. The realities are more complicated. Yes, manufacturing export jobs are very important and often have better pay and conditions than alternatives; but at the same time the rapid rate of growth of manufacturing export jobs has often involved systematic, artificial institutional repression (at best) of wages, especially women's wages and where there have been improvements these owe a lot

to collective union pressure and conflict. Yes, states can be corrupt and fail; but they don't fail equally and markets also fail societies frequently and dismally. Yes, encouraging transnational companies (TNCs) and FDI can bring many benefits; but those countries that have done best through integrating into GVCs have managed FDI rather than simply opening the floodgates.

And yes, states do need to invest in education and infrastructure – ever more so, in fact. But they need to do significantly more than this light touch 'facilitative state' of the sort encouraged by the recently (finally) disgraced Doing Business Index. Dollar suggests that South Korea, where as electronic exports have risen in a phenomenal success story so domestic value added share has fallen, is somehow a vindication of the government standing back: "If the government had tried to restrict imports of components and services for electronics production, the industry would have been less successful with less overall export and value added production". He argues that developing economies should open up widely, not only to imported inputs but also to global services, given how much of the final value of today's goods derives from branding, telecoms, finance, logistics.

We interpret South Korea's experience differently. It is a very good example of what Keun Lee calls the 'in-out-in again' sequence. It may well be that what Dollar envisions – opening up tout court to TNCs – is at least to some extent effective early on but that it is extremely limiting over the longer run. Developing countries that attract TNCs and through them get a foot on the ladder of upgrading are not then automatically propelled on an escalator: they need to clamber and pick their way upwards. For that they need some degree of independence. As Lee and others observed, foreign value added (FVA) rose in South Korea, fell during a period of retreat from GVCs (for example, in the auto industry), then rose again when Hyundai and others re-entered

GVCs but with capabilities in place to compete at a more sophisticated level. While this non-linear development unfolds, domestic productive capabilities and the 'ecosystem' of production linking firms, infrastructure, and knowledge all develop domestically, bringing more jobs, and many better jobs, as well as higher shares of the profit from global trade.

GVCs have varied enormously – they cannot all be grouped together glibly. Some have clearly opened up learning opportunities, decent employment prospects, and developmental dynamics. Some have led to countries and sectors getting stuck with few spillovers or learning dynamics. This variation is what matters and looking more closely at it can be illuminating. What has made the difference between South Korea and Mexico, between Taiwan or China and Romania? Private sector dynamism is a huge part of it but again and again we have to acknowledge the role of states: targeted credit and export subsidies, conditional openness to FDI, and indeed at times import protection, and the targeted use of SEZs.

There are many variants. Morocco combines incentives to the private sector with a dramatic state-backed social housing programme and uses state-owned holding companies as spearheads of industrial policy. As one Standard & Poors analyst put it: 'A well-run state-owned company is better than a badly run private-sector company'. One of the success stories has been Morocco's auto industry, where a large number of foreign companies now operate and where the government ('extremely demanding but extremely supportive' as Renault's Morocco managing director told the Financial Times) has also forced them to draw on local suppliers.

If institutional streamlining has helped in Morocco just as much as tax breaks, clear institutional support was one of the key features of Ethiopia's dramatic rise in foreign investment through the

2010s. Ethiopia in its own way also engaged in the kind of 'managed opening' that in different ways characterised Taiwan, South Korea, and others. One of the most striking corporate successes in Africa in recent years has been the expansion of Ethiopian Airlines, evolving as Africa's largest air carrier. A state-owned enterprise, Ethiopian Airlines has been at the heart of a government-backed set of coordinated investments (by the state, TNCs, international financial institutions, and Ethiopian investors) for example in high value agricultural export production and in freight handling capacity. Its expansion has been part of a network of linkage effects drawing in high value exports, tourism, and even initiatives to manage the global pandemic. It has also been extraordinarily well led for many years but one of its moves in recent years was – precisely appreciating the need for service sector opening that Dollar notes – to forge a partnership with DHL to expand logistics capabilities and competitiveness.

Foreign investment in Ethiopia had grown slowly in the years to 2013 but then after 2014 inflows jumped four-fold, reaching \$4.3 billion in 2017. That happened because of government policies that included targeting leading brand investors (e.g. in garments) and massive investment in developing an industrial ecosystem through specialized industrial parks aiming to develop forward and backward linkages or verticality, supported by productive infrastructure (air freight capacity, rail and dry port facilities) and mechanisms for dialogue with investors to develop productive partnerships which have facilitated skills development, knowhow transfer, and inter-firm linkages. Although it is early days, linkages have developed already: to fabric mills, accessory production, and packaging in the textiles and garment sector, to production in Ethiopia of malt for the rapidly growing brewery sector, and to aerospace manufacturing, aviation training and maintenance, and airport management around initial expansion

of Ethiopian Airlines. Without building new industrial parks with a clear commitment to sustainability, leading investors would not have arrived. And without the investment, there would not have been the pressure on the government to gradually improve policymaking in a process of trial-and-error (to 'fail better', as Samuel Beckett would have it) by addressing constraints that were then revealed.

We think that David Dollar's suggestion that industrial policy requires an 'all-knowing' state does not reflect today's understanding of industrial policy. Industrial policy is about coordinating and stimulating investments, securing a place within global value chains and helping to steer structural change rather than simply accepting what 'the market' doles out; it is about balancing public interests with those of private firms, and it is about encouraging the myriad intimate connections of learning and productive links among actors in an economy. During the Covid-19 crisis, which threatened the existence of firms and jobs, industrial policy in Ethiopia meant building on established capabilities and relationships to protect against disaster and even to grab new opportunities for repurposing production and increasing exports.

Of course, the South Korean experience also reminds us (if we have been paying attention to *Parasite* and *Squid Games*) what strains societies

face if they do embrace the ideology of growth above all and with full liberalization, as the country shifted in a more 'neoliberal' direction from the early 1990s onwards. Let us be clear: states fail and markets fail, repeatedly. The trick is to fail better, and states can both help markets fail better and fail better themselves: they also have to help create and join markets in the first place.

Beyond the narrow imagination of much economics, we can learn from experiences in the USA and UK and others especially during and in the wake of wars, from earlier experiences of catching up with the UK, and from the long history of economic thought in China. These experiences all deepen the ideas of markets as social institutions rather than outside society and governance, and as institutions that states have often governed and participated in to promote strategic goals of welfare, survival, and development. An essential feature of industrial policy has been experimenting, trial and error, and learning. That will continue to be the case for effective integration into GVCs. Abundant evidence shows that optimal outcomes are not automatic and that targeted policies are what enables successful structural change through integration into GVCs.

Reply to Arkebe Oqubay & Christopher Cramer:

The specific question that we are debating is not whether governments should have industrial policy – all governments do. The question is whether it makes sense to set specific goals for the share of domestic value added in exports. In reality, the share of domestic value in exports varies enormously across sectors and products, so having a single numerical target is impossible. The question then is whether it is effective for the government to set product-by-product targets. Are these binding regulations or aspirations? No successful exporter has taken this approach. There are lots of policies that can encourage backward linkages, such as infrastructure and human capital investments. If governments do these things, backward linkages will naturally occur – but to a different extent in each industry because production chains are so different. If governments require the use of domestic inputs but have not made these investments in infrastructure and people, then the policy condemns one's firms to low productivity and poor competitiveness.

Most developing countries have learned these lessons and have open trade for parts and components. But many countries still protect their service sectors, and services are becoming an increasingly important input into manufacturing production. This is because products are increasingly “smart,” with software and design being a big input. Also, services such as finance, transport, and telecom are essential for managing modern value chains. There is research evidence that using imported services increases the quality of manufactured exports of developing countries. Hence opening up service sectors is the new frontier of trade liberalization.

Reply to David Dollar:

The question of specific quantitative targets is a bit of a diversion. We have no difficulty agreeing that specific quantitative targets for the share of domestic value-added in exports are not the most effective policy focus. But David Dollar argues that the best way for developing countries to secure benefits within GVCs is by liberalising almost everything, and that the wave of liberalisation should now wash over services trade.

However, to make the most of integrating into GVCs and to drive up domestic value-added overall requires strategic public-private coordination and a strategy that goes beyond infrastructure, generic human capital investment, and trade openness tout court. The record of economic history makes that very plain.

This goes just as much for services as it always has for manufacturing. Service sector liberalisation, including in GVCs, has not been key to remarkable structural change in Japan or China, nor to Brazilian or Chilean high-value agricultural exporting. Developing countries need to be open to imported services, for sure, in some areas (we gave Ethiopian Airlines' joint venture with DHL for logistics as a good example). Nevertheless, they also need to nurture domestic service value-added capabilities, which do not just flow ‘naturally’. Building capabilities for knowledge-intensive service activities is about far more than investing in training colleges and schools. These capabilities need firm-level tacit knowledge, acquired through learning-by-doing. That needs time, market space, and patient finance. The key to financing and creating space for learning by doing lies in public-private dialogue; it also relies not just on incentives but, above all, on linking incentives to performance. If the learning is too slow and capabilities do not build, TNCs may up sticks and move on.

Do due diligence laws improve the rights of workers in production countries?

In 2011, the United Nations passed the Guiding Principles on Businesses and Human Rights, thereby establishing the first global framework for preventing and addressing risks to human rights in global supply chains and laying down standards for corporate social responsibility in business activities. Yet, despite its widespread endorsement by both states and companies, issues of human rights violations and environmental destruction along global supply chains persist. This has spurred a wave of initiatives for mandatory due diligence laws, both on the national as well as the supranational level. In 2017, France became the first European country to adopt a national due diligence law; the Netherlands and Germany followed in 2019 and 2021 respectively. Meanwhile, in March 2022, the European Commission published its first draft of an EU-wide law on corporate sustainability due diligence. Yet, there is disagreement on the effectiveness of mandatory rules as well as potential unintended consequences.

Markus Krajewski lays down arguments for a comprehensive legislative framework, drawing on the example of the recently passed German supply chain due diligence law and its potential to improve human rights along global supply chains. **Gabriel Felbermayr**, on the other hand, criticizes that a mandatory law disproportionately affects companies and may inadvertently lead to unintended consequences. He instead argues for a negative list of companies known to violate human rights that could be barred from EU supply chains.



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Markus Krajewski: Due diligence laws can be expected to improve the conditions of workers and suppliers in production countries

After a long political campaign and internal struggles within the Federal Government, Germany adopted a Law on Supply Chain Due Diligence (Lieferkettensorgfaltspflichtengesetz) on 10 June, 2021. It will enter into force for companies with more than 3000 employees on 1 January, 2023 and a year later for companies with more than 1000 employees. Like the French Loi de Vigilance of 2017 and the Dutch Child Labour Due Diligence Law of 2019, this new German law aims at obliging corporations to engage in human rights due diligence in their supply chains and business transactions. These due diligence laws are based on the voluntary United Nations Guiding Principles (UNGP) on Business and Human Rights adopted by the UN Human Rights Council in 2011. The German law was envisaged in the National Action Plan (NAP) on Business and Human Rights in case that voluntary approaches would not be sufficient. In 2020, an independent study revealed that less than 20% of all German companies followed the soft law guidance of the UNGP and the NAP. In consequence, the German government proposed a national law for mandatory due diligence in global supply chains.

The new German Law requires companies to establish a human rights risk management system, conduct regular risk analyses, adopt preventive and remedial measures in the company's own business and with regard to direct suppliers, as well as install a complaint mechanism. If a company gains substantiated knowledge of human rights breaches further down the supply chain, it is required to also take the above mentioned measures regarding indirect suppliers. The scope of the due diligence obligation is determined by the principle of appropriateness: Companies are only required

to engage in activities that are appropriate in relation to the nature and extent of the business activity, the leverage of the company, the severity, reversibility and probability of the violation, and the nature of the company's causal contribution to the violation. The law also requires companies to prepare an annual report on the fulfilment of their due diligence obligations in the previous financial year.

Does the German Law, do due diligence laws in general, have a positive impact on human rights in the supply chain? After all, this is their objective. The proposal of the German due diligence law states: "This law aims at strengthening the rights of persons affected by corporate activities in supply chains [...]". Thus, any due diligence law will have to be measured against improvements of the rights of workers and affected stakeholders in the supply chain.

Of course, it is too early to expect any empirically sound evidence – the law will only enter into force in 2023 and it will take a while until its effects can be assessed. Even with laws that have already been in force for a few years, such as the French Loi de Vigilance, it is too early to prove a clear causal relationship between the law and an improvement of workers' rights and affected stakeholders, because the real effects will only be felt in a few years.

Is it likely that due diligence laws will improve the rights of workers in supply chains? This again will depend on the effective implementation of such laws. Due diligence laws will have a positive impact if they induce companies to move from short-term contracts to longer commitments which lead to safer work places and more sustainable production methods. Of course, the behaviour of German, French or other EU companies are not the only, sometimes not even the most important determinant of human rights in the supply chains. Weak governance structures in the production countries, lacking

capacity to implement labour and social standards, activities of domestic companies and of foreign competitors from countries that do not have mandatory due diligence laws may off-set any changes in the supply chains of companies obliged to engage in human rights due diligence. However, if a German company ensures that its local supplier pays a living wage as required by Section 2 paragraph 2 No. 8 of the German Supply Chain Due Diligence Law, it is clear that this will have a positive effect on the rights of the workers of the local supplier.

How likely is it that due diligence laws will contribute to a deterioration of the rights of workers and affected stakeholders? Many observers and business lobbyists argue that such laws will lead to the withdrawal of companies from suppliers in countries with weak human rights standards, which would have negative effects on the human rights situation. So far, neither the French Law nor similar laws seem to have had a significant effect on the supply chains. More importantly, many large companies including leading brands of the German automotive industry or the textile sector have been pursuing due diligence strategies in their supply chains on a voluntary basis. This has

not led to any significant changes in the choice of countries where they operate or where they source from. It is thus unlikely that a mandatory requirement to engage in due diligence for all companies will have the opposite effect.

Furthermore, due diligence laws increase access to remedies and justice for affected rights-holders. While victims of human rights abuses are often unable to hold lead firms of a supply chain or parent companies of a transnational corporation accountable in their domestic courts, due diligence laws may provide grounds for victims to receive compensation and justice in home state courts. In this context, it is unfortunate that the German Supply Chain Due Diligence law explicitly excluded any claims for liability based on a violation of the law. However, this does not mean that victims of corporate human rights abuses cannot utilise due diligence laws and base their claims on the tort of negligence in domestic courts. The details will depend on the applicable law. In any case, claiming that a lead company of a supply chain contributed to human rights violations by not engaging in due diligence may be a powerful claim even if it is not made in a court of law.

Gabriel Felbermayr reply to Markus Krajewski: A negative list approach instead of a mandatory supply chain due diligence law

In too many countries, the human rights situation and the treatment of the environment are cause for concern. Too many governments do not apply or enforce their international commitments, from the Universal Declaration of Human Rights to the International Labor Organization's core standards. Germany has introduced a mandatory supply chain due diligence law (MDDL) that will oblige companies above a certain size-threshold to monitor whether their foreign suppliers abide by a list of norms and to take remedial action if needed. Firms that fail to engage in sufficient monitoring are subject to fines. The law mostly focuses on human rights violation in direct suppliers and rules out liability claims. Planned EU-legislation would be structurally similar but could be more far-reaching.

If the regulation works, abusive suppliers would be eliminated from EU supply chains. However, the legislation ignores economic costs that go much beyond the mere monitoring expenses incurred by EU buyers. An alternative approach that consists in negative listing "bad" suppliers by a central EU agency would be at least as effective in weeding out unlawful suppliers but would have smaller negative side-effects on the development process.

The economic problem is as follows: EU buyers cannot perfectly observe behaviour of suppliers in far-away countries. By investing in monitoring activities, they can reduce but not eliminate this uncertainty. Therefore, it is possible that, despite their best efforts, one of their developing country suppliers violates a human right or an environmental standard. The German MDDL foresees substantial fines, reaching 2% of turnover, if the overseeing authority finds that the

importer has not provided "best effort" – a rather ill-defined legal concept. So, with the MDDL, buying from foreign suppliers exposes buyers to new risks that they cannot fully eliminate. Rational firms will want to minimize that risk by concentrating their monitoring activities on fewer but larger suppliers and by withdrawing from countries where monitoring is particularly difficult or where the baseline probability of bad behaviour (e.g., because of weak local institutions) is large. Importantly, what matters for firm behaviour is not so much the size of monitoring costs but the costs of potentially being declared, rightly or not, non-complying. Consequently, suppliers that are not at all infringing any rights may be eliminated from EU supply chains. The MDDL risks hurting law-abiding suppliers, too, as they cannot costlessly signal that they are law-abiding.

This is a pity. Numerous empirical studies show that participation in global value chains (GVCs) lifts local communities in developing countries out of abject poverty. Lower poverty, in turn, leads to improvements in social, environmental, and political conditions. Of course, correlation does not imply causation, so hard empirical evidence is difficult to obtain. Furthermore, there are always exceptions to statistical relationships. But the evidence very clearly points towards large societal benefits from GVC participation, particularly in the manufacturing sector.

Two empirical facts are very well established. First, firms that legally participate in GVCs almost always belong to the formal sector, where law enforcement is strongest, taxes are collected, and standards are most likely to be upheld. If they were informal firms, they could not engage in international trade, at least not directly – the link that the German MDDL mostly focuses on. Studies show that the most frequent and most egregious violations of human rights are found in the informal sector, in small-scale farming, in family households, where government regulations, imperfect as they may be, are often

not applied. Second, only a subset of formal firms participates in global value chains. But those who do are positively selected. They are larger and more productive; they pay higher wages, offer better working conditions, and respect the environment more. So, if firms' participation in GVCs declines, fewer workers enjoy the so-called exporter premia and more of them are pushed into informality. Where EU firms move out, buyers from other regions, for example China, may move in – exerting less pressure on suppliers and weakening the geostrategic position of the EU.

Buyers reacting by adjusting their supply chains is not just a theoretical possibility. Kolev and Neligan (2022) provide an empirical evaluation of the French MDDL, which has been in force since 2017. They find that French imports from “risky” countries have indeed fallen and that the new legislation acts like a non-tariff barrier to trade. In the cost evaluation attached to the German law, no impact analysis for poor countries' participation in GVCs is conducted.

To avoid such undesired restructuring of GVCs from happening, a more centralized approach that does not impose costs and risks on EU firms would be the better alternative. Instead of requiring every EU buyer to scrutinize each and every supplier, a central EU agency should instead assume the monitoring task and maintain a negative list of firms that are barred from EU supply chains. This would avoid costly duplicate monitoring and minimize legal uncertainty. In addition, importers respecting the list would be sure not to be fined. They would not have incentives to adjust their supply chains – except, of course, by kicking out listed firms. Thus, only firms

exhibiting bad behavior would be unplugged from EU value chains. There are various examples of negative lists, the most famous one being the US' “entity list”. Currently, it lists thousands of firms on around 500 pages of text. Clearly, for a supply chain negative list to be effective, a transparent mechanism leading to the listing of a firm and a possible delisting would be needed. In principle, the same stakeholders that are given voice in the German MDDL could bring cases to the attention of an EU decision-making agency.

Policy practitioners may prefer an MDDL over a negative list, because the former outsources the decision to terminate foreign supplier relationship to private firms. That decision would be a purely private decision. If, instead, a public government agency makes such a choice, foreign governments may impose sanctions on EU firms to retaliate against what may be perceived as an unwarranted protectionist measure. This concern is justified. However, proceedings under an MDDL may as well attract political attention if systemically relevant or publicly owned suppliers are involved. Moreover, some politicization may in fact be useful: in contrast to individual firms, a central EU agency can take the wider repercussions of their decisions, such as on the EU's geostrategic position, into account. And the threat of being put on a negative list that bars exports to the entire EU, with strong signaling effects beyond Europe may be a very potent incentive for suppliers in developing countries to abide by the rules. In short, there are good reasons to believe that a negative list approach would be more powerful and at the same time less detrimental to development than the MDDLs that are currently so popular in parliaments.

References

Kolev, G. & Neligan, A. (2021), Trade Effects of Supply Chain Regulations: Empirical Evidence from the Loi de Vigilance, Working paper, presented at

the Research Conference on Sustainability of Global Value Chains, 7.12.2021

Reply to Gabriel Felbermayr:

Gabriel Felbermayr and I agree on two fundamental grounds: Environmental degradation and human rights violations in global value chains need to be reduced as much as possible and participation in global value chains is economically beneficial for many developing countries in their fight against poverty. However, we disagree on the right instrument. A negative list approach as suggested by Professor Felbermayr is bound to fail for three reasons: First, as Gabriel Felbermayr points out himself, the most severe human rights violations and environmental damages are not linked to well-known and established firms, but to small companies, workshops and sometimes even family businesses. Including them in an EU list is simply impossible unless thousands of Brussels bureaucrats spend years in assessing and researching local companies all over the globe. Second, a negative list approach would punish those (European) companies that have already embarked voluntarily on the path suggested by the UNGPs – implementing human rights due diligence by assessing the risks in supply chains and trying to prevent human rights violations through working with local partners, trade unions and suppliers. Why would companies like Volkswagen or adidas continue to invest in training and supporting their local suppliers if there is a risk that the local supplier will end up on the list? And thirdly, a negative list would be a clear non-tariff barrier and thus a violation of Article XI GATT. The negative list suggested by Gabriel Felbermayr is also not comparable to the famous US “entity list”, which includes individuals and companies involved in disseminating weapons of mass destruction and other activities sanctioned contrary to U.S. policy interests. This is a much more narrowly defined field than companies violating human rights or damaging the environment.

Reply to Markus Krajewski:

Towards a Compromise: Markus Krajewski points out problems with a negative list approach. I would agree that such a design is not a panacea. I also share his dislike of bureaucratic monsters. But his criticism goes too far. Supervising myriads of small-scale foreign suppliers more tightly always requires a huge bureaucratic effort regardless of which entities carry out the task. My argument simply is that it is more efficient to concentrate such effort centrally rather than duplicate it in tens of thousands European importing firms. I also do not think that reducing the aggregate cost burden punishes those firms who have already made efforts. Regardless of costs incurred in the past, all companies are happy if red tape is reduced. As to conformity with WTO-law, I leave the judgement to the law professor, just adding the humble note that there appear to be divergent views amongst legal scholars.

But maybe there is ground for compromise. Why not complement the mandatory due diligence law with a combination of two lists? A positive list of countries whose suppliers are exempt from the application of the law and need not be monitored. And a negative list containing companies that need not be monitored either as their participation in European value chains is outlawed. Then, the application of the law could be limited to foreign suppliers from non-listed countries that do not figure on the negative list. Lawmakers should also encourage a private sector certification initiative to minimize duplication of costs and redundancies. Such a design could lower risks and costs for European importers, minimize the likelihood of unintended relocation effects and still achieve the objectives on which Markus Krajewski and I have no disagreement.

Will the COVID-19 pandemic reinforce preexisting trends that in turn lead to reshoring or other forms of GVC restructuring – and what does it imply for policymakers?

The COVID-19 pandemic has highlighted the vulnerability of global supply chains. In a survey among high-level executives in 1,181 companies in the US and four European economies, Euler Hermes (2020) found that “almost all (94%) companies surveyed reported a COVID-19 induced disruption to their supply chains.” As a response to such disruptions, companies consider advancing automation to become less dependent on workers; some are rethinking their sourcing strategies, favouring close-by suppliers and diversifying sources. Some researchers therefore expect global production organization to change, whereas others argue that high initial fixed cost of global sourcing and production prevent firms from rigorously adjusting existing sourcing practices. What is the evidence, and what does it imply for policymakers?

Dalia Marin argues that the uncertainty shock induced by the COVID-19 pandemic increased cost of GVCs. At the same time, cost of automation decreased and the pandemic is expected to further accelerate this trend. As a result, reshoring and restructuring of global supply chains is likely to occur. In contrast, **Caroline Freund** argues that the COVID-19 pandemic will not reshape GVCs substantially. Firms are expected to increase resilience through dual sourcing strategies more often, however, reshoring is too costly. Furthermore, she reasons that automation will not be reinforced by the pandemic and will not lead to restructuring, rather it could be trade enhancing.



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Caroline Freund is Dean of the UC San Diego School of Global Policy and Strategy (GPS) and an expert in international trade and economic development. Prior to joining GPS, she served as global director of Trade, Investment and Competitiveness at the World Bank, where she was co-director of the flagship World Development Report 2020 on Global Value Chains. Freund also served as a senior fellow at the Peterson Institute for International Economics. Her work has appeared in leading academic journals.

Dalia Marin: Uncertainty Changes all – How Supply Chains change with COVID

The COVID pandemic is an unprecedented uncertainty shock. We use the rise of uncertainty in the financial crisis to evaluate how global supply chains (GVCs) will evolve with the pandemic. I then ask whether the government needs to step in to help firms to navigate in the crisis.

With the fall of communism in 1989 and the entry of China into the WTO in 2001 major markets with low labor costs entered the world economy. Firms in high income countries started to produce in GVCs, relocating part of production to these regions to save on labor costs. Moreover, a revolution in the transport sector – containerization – lowered transport costs making offshoring very profitable. As a result, GVCs exploded in the hyper-globalization period 1990-2008. According to estimates GVCs accounted for 60% of world trade. But since the financial crisis 2008 GVCs have stopped to grow.

Why have GVCs stopped to grow? The financial crisis changed the relative costs of GVCs and robots. The increase in uncertainty in the financial crisis made GVCs more costly with the increased risk of a non-delivery of an input good. Uncertainty rose after the financial crisis until the Euro debt crisis by over 200% as indicated by the World Uncertainty Index (WUI). WUI developed by Ahir et al (2018) counts the frequency of the word uncertain or variants in EIU country reports.

At the same time the cost of financing a robot relative to hourly wages declined sharply (by over 100%) favoring the adoption of robots. As a result, firms in high income countries reshored production back to their home market and invested in robots instead. We find that after the financial crisis GVCs and robots became substitutes. The more robot intensive a sector is the less it engages in GVCs

(Kemal and Marin 2020). COVID accelerates this trend and is likely to lead to deglobalization. We expect that COVID will reduce GVC participation by 35% and increase robot adoption by 76%. The calculation assumes that in the COVID pandemic the WUI increases by 300% (the first SARS1 in 2002 epidemic increased the WUI index by 70%) and lowers the ratio between interest rates to hourly wages by 30%. The estimated growth of robot adoption of 76% is on the high end since it does not take into account that uncertainty also reduces investment and robot adoption.

Rising transport costs are likely to accelerate the shift away from GVCs. During the pandemic the cost of containers used to ship goods from Asia to Europe and the United States has risen nearly tenfold (Drewry 2022), and transport workers, facing increasingly harsh working conditions, have been leaving their jobs. It remains to be seen whether the turmoil in the transport sector with supply-chain bottlenecks is transitory or persists for longer.

This vulnerability helps to explain why the European Union has earmarked part of its EUR 750 billion Next Generation EU recovery fund to establish a semiconductor and battery cell sector in Europe to make Europe less dependent on Asian suppliers. US policymakers have similar concern. The Biden administration presented an assessment of America's supply chain vulnerabilities, with the aim of identifying interventions to strengthen domestic production networks.

Some might argue that rich country governments' effort to strengthen domestic and regional production networks reflects new form of economic nationalism driven by fear of China. But the crucial question is whether companies really need state help to protect themselves against supply chain turbulence.

There are three ways advanced economy firms can make their input supplies more resilient

and only one of them requires government involvement. One option is to take control and reshore production from developing countries. A second way to insure against supply chain shocks is to build inventories and to switch from “just in time” production to a “just in case” model. Third, companies can dual-source or triple-source inputs, relying on suppliers from different continents in order to hedge the risk of natural disasters and other regional disruptions.

But the third strategy, diversification of input sources, has its limits. For example, a highly specialized supplier that invests in research and development in order to provide a specific input is not easily replaceable, and sourcing others can be costly. Heavy regional concentration of suppliers also make diversification difficult. Most producers of chips, battery cells, rare earth materials such as cobalt and lithium, and pharmaceutical ingredients are based in Asia. Geographic clustering of input suppliers can

generate upheavals in the rest of the world, as the current global semiconductor shortage illustrate. In a 2012 paper, MIT’s Daron Acemoglu and his coauthors showed that disruptions to an asymmetric supply chain network – in which one or a few suppliers deliver inputs to many producers – can spread throughout the world economy and potentially lead to a global recession. That supply chain disruptions can have economy-wide effects have been recently shown in empirical studies of the 2011 Great East Japan Earthquake (Carvalho et al 2021) and of three decades of major natural disasters in the US (Barrot and Sauvagnat 2016).

In such cases, governments can play a useful role by helping to provide firms with more potential alternative suppliers. Governments in the US and EU can ensure that a sufficient number of suppliers are available in both Europe and North America to hedge against the risk of disruption.

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Caroline Freund reply to Dalia Marin: COVID won't reshape supply chains significantly

In the 1990s and early 2000s, the costs of international trade fell and global value chains multiplied. Trade costs fell because of new mega trade agreements, WTO formation and expansion, EU deepening and expansion, as well as unilateral tariff reduction in developing countries. The drop in trade costs made it profitable to offshore stages of production and factories began increasingly operating across borders. New communications technologies, such as the internet and e-marketplaces, also supported the formation of global value chains because complex, fragmented production could be seamlessly coordinated and finding new suppliers was easier. This period became known for expanding global value chains (GVCs), and by the mid-2000s more than half of the value of trade was crossing more than one border (World Bank 2020).

After the financial crisis, it was economic fundamentals that held back supply chains, not uncertainty, as Marin argues. Global income growth was tepid which depressed trade and removed some of the incentives to expand supply chains. Moreover, there were no major liberalization initiatives or changes in technology to spur another round of GVC expansion. Global value chains stagnated; they remained largely intact, with many parts and components crossing borders, but they stopped expanding.

Then COVID happened. Goods trade initially plummeted and then quickly recovered, with exceptionally strong performance in 2021.

As Dalia Marin writes, COVID has been an uncertainty shock, but given the strong trade performance during the crisis, I disagree that it will lead to a major shift in GVCs. COVID triggered both supply and demand uncertainty. Supply has

become less predictable because of periodic, geographically concentrated labor shortages or port closures. But by far the biggest effect has been on demand. In the initial months of COVID, demand for most goods plummeted, as workers lost income and retreated to their homes. Later, government stimulus programs kicked in and consumers accrued savings from weak spending on services, such as travel, restaurants, and gym memberships, and demand for goods exploded.

The result has been a surge in international trade in goods, as consumers gobbled up electronics, home office furniture, stationary bikes, etc. The surge in consumer demand was unexpected and many firms had mistakenly cancelled orders of inputs, and were now seeking to expand and build inventories, so demand surged even more. But, even in absence of supply stoppages, in the short run, capacity is effectively fixed for many goods and the sudden sharp rise in demand was simply unmeetable. For all the discussion of ships stuck in the ports of Los Angeles and Long Beach, container traffic was up 16 percent in 2021 as compared with the previous record haul in 2018.

It is not surprising that supply has been unable to keep up with demand, even as we embark on the third year of the pandemic. Economic theory is clear that the optimal investment response to a temporary and highly variable demand shock is to wait for more information. Indeed, firm surveys show that the vast majority of firms are largely sitting on the sidelines, waiting to make major investment decisions--though on balance they have shifted from a negative investment outlook at the onset of the crisis to a positive one now (Abhishek, Kusek, Albertson 2021). Given that firms do not know if goods demand will remain strong, it does not make sense to invest in greater capacity that could become excess capacity in future.

Like Marin suggests, firms can moderate supply problems with dual sourcing. I agree that this

is likely to happen more often and will help resilience, but dual sourcing is unlikely to cause a major shift in supply chains. Expanding diversification beyond dual sourcing, however, is too costly because of the need to develop relationships, meet customization standards requirements, and benefit from scale economies.

What about reshoring or nearshoring? The benefits from sourcing in low cost countries is simply too great to lead to much reshoring or nearshoring. Moreover, reshoring is a terrible way to reduce risk since it reduces the scope to maintain production when shocks are local. The old adage “don’t put all your eggs in one basket” and all that.

One way to examine how firms behave in response to increased risk is to look at what happened following the earthquake in Japan in 2011. In a recent paper, we examine the change in sourcing over the long run owing to the supply shock (Freund et al. 2021). We find that importers did seek alternate suppliers, but they tended to find other large, low cost suppliers that could produce at scale. They did not diversify, reshore or nearshore. In other words, that shock (which unlike COVID, destroyed capital) simply accelerated shifts that were already underway (Freund et al. 2021).

Contrary to Marin, I am not convinced that automation/adoption of robots and supply chains are substitutes. As shown in the World Bank (2020), the most automated industry-

automobiles is also the most intense user of cross-border supply chains. In fact, automation and GVC production tend to go hand in hand. The reason is that automating one part of production lowers costs and allows firms to produce and sell more output. This scale effect results in more demand for imported inputs that are not automatable. In related work, we examine the adoption of 3D printing technology for hearing aid production (Freund, Mulabdic, Ruta 2019). Similarly, we find that the shift to the new technology expanded trade, as the process remained complex and subject to returns to scale. Unlike conventional wisdom, which predicted a shift away from imports, trade actually surged following the adoption of 3D printing!

I think any future reorganization of supply chains is more closely related to geopolitics than to COVID-induced resilience planning or the adoption of new technologies. US-China trade tensions could lead to a world where supply chains are carved out by political alliances. Reorganization along these axes can happen because of export controls, import protection, sanctions, and discriminatory investment practices—all of which are currently in place for some goods. If government policy continues to encourage such “allied” supply chains, trade will not decline but will be reshaped. The medium-term economic gains from trade and innovation will be lower, in exchange for the well-intentioned, complex goal of expanding long-run economic and political security.

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Reply to Caroline Freund:

I would like to focus my response to Caroline Freund on one point: Are supply chains and robots substitutes or complements.

Whether supply chains and robots are substitutes or complements is an empirical question. If the adoption of robots lowers costs, firms become more competitive and produce more. They will thus import more intermediate inputs from developing countries as is pointed out by Caroline Freund. However, we find that firms in high income countries, which are already sufficiently endowed with robots reshore production from the developing countries (Kilic & Marin 2020). For these firms the share of labor costs in total costs is already low. They can then relocate production back to high wage countries and employ robots instead of expensive workers. This is a profitable option in particular when the delivery of the input from the developing country becomes uncertain due to a pandemic, a natural disaster or due to geopolitical risks. This is the reason why we find that supply chains and robots became substitutes after the financial crisis (when uncertainty increased substantially) while they were complements (although hardly statistically significant) before the financial crisis. Our analyses covers all high income countries (except Japan) and most developing countries including China. Automobiles are no exception. When we run robustness checks in which we exclude individual industries from the analysis, our reshoring results do not change when we exclude or include the car sector.

Reply to Dalia Marin:

The period before the financial crisis and the period after it were very different. Before the crisis, trade costs fell sharply, global value chains expanded, and income growth was robust in most of the world. The period after the crisis was characterized by stagnation on all fronts. In contrast, robot adoption has been increasing steadily throughout both periods. The correlation between robot adoption and GVC formation, which Dalia Marin argues changes over time, is not necessarily the result of a causal relationship. An alternative explanation is that the cost of robots fell throughout the period, raising their use; while trade costs first fell and later stagnated, leading to a slowdown in GVC formation.

I have not seen any compelling evidence of extensive reshoring in advanced countries, nor of reshoring related to automation. Although there is a lot of hype around reshoring, the evidence tends to be anecdotal. Kearney's reshoring index has been positive for the US in only two of the last 12 years – implying that offshoring remained dominant. A study of Spanish firms finds that automating tends to precede more intense importing from, or opening affiliates in, lower income countries, suggesting robots and GVCs are complements.

By definition, robots directly replace some workers. The three pertinent questions are: (i) Do robots in advanced countries primarily replace domestic workers or replace workers in developing countries? (ii) What types of new jobs are created to complement the automation? And (iii) Where are these new jobs created? One thing Dalia and I can probably both agree on is that more research is needed to answer these questions.



New research insights

New research insights presents recent academic contributions from network members and other academics looking at supply chain impacts and/or at public policies for making these chains more sustainable. The research insights have been published in our blog.

New research insights

New research insights on sustainable global supply chains

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GVCs and COVID-19: Lessons thus far from trade during a global pandemic



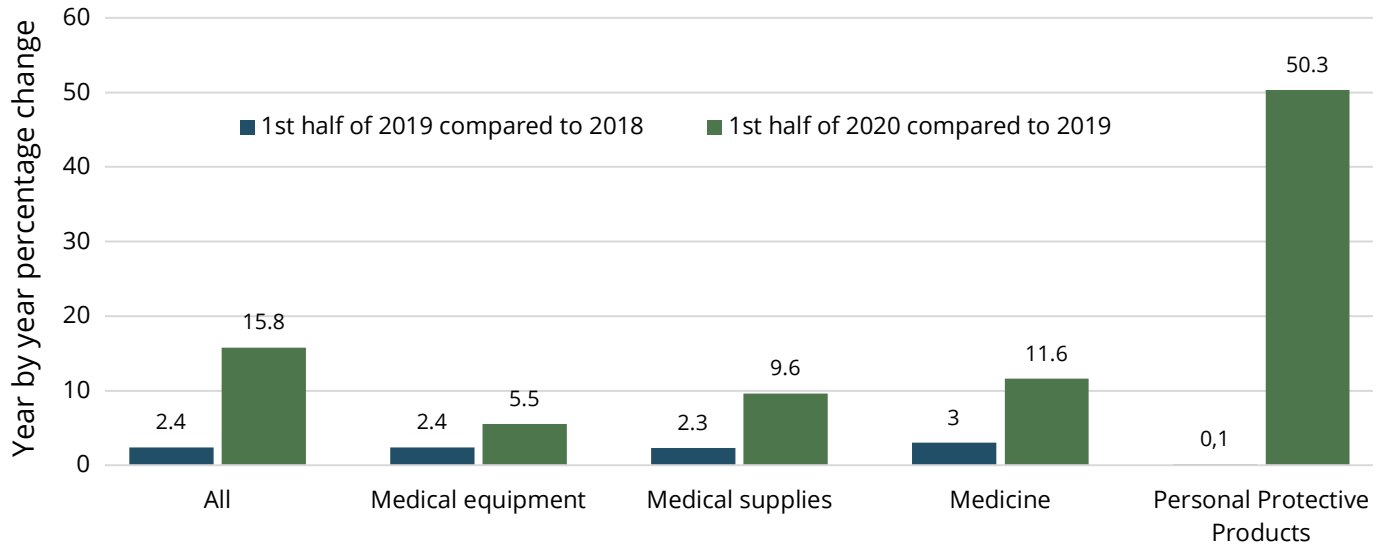
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One year into the global COVID-19 pandemic, global trade and global value chains have held up admirably well considering the overall economic impacts in most countries.

The COVID-19 pandemic led to shortages of medical equipment and pharmaceutical products in many countries as demand spikes exceeded existing supply and production capacity. Most countries are dependent on imports for critical goods, such as personal protective equipment and various medicines, from a relatively small number of countries. WTO data shows that Germany, the US, and Switzerland supply 35% of medical products to the world, and that China, Germany, and the US export 40% of personal protective products. In light of unmet peak demand, we saw bidding wars and export restrictions that raised the price of many pandemic-related critical goods. But through mid-year 2020, exports of many critical goods had soared compared to the previous year (see figure 1.).

While total world trade declined by 14% in the first half of 2020 compared to the same time period in 2019, imports and exports of medical goods increased by 16%, reaching US\$ 1,139 billion in value. Trade played a critical role in meeting skyrocketing demand for products considered critical in the COVID-19 pandemic, with global trade in these products growing by 29%. Total imports of face protection products in the first half of 2020 increased by 90% compared to the same period last year. Trade in textile face masks has grown about six-fold. China was the top supplier of face masks, accounting for 56% of world exports. To ramp up mask manufacturing, China leaned heavily on imports of intermediate input materials: its imports of non-woven fabric tripled in April 2020 compared with the same month of 2019, with Japan and the United States as the leading suppliers. China was also the sixth-largest importer of face masks in the first half of 2020.

Figure 1: Trade in medical goods has increased significantly in COVID-19: Percentage change of trade in medical goods in the first half of 2019 and the first half of 2020 compared to the same period of previous year



Source: WTO (2020).

The initial health-related lockdown in Wuhan and other parts of China and the border lockdowns imposed by most countries resulted in transport delays and interruptions of production in complex value chains because of missing intermediates. These disruptions increased public awareness about the risks associated with globally fragmented production processes. As a result, many policy makers and analysts argued for reshoring supply chains and the production of critical goods to improve supply chain resilience and limit reliance on imports. These calls were often reinforced by populist calls for a return of offshored manufacturing activity and jobs.

What are the lessons of the pandemic for global value chains? Will there be significant reshoring, more nearshoring, redistribution of global supply chains, or maintaining of the status quo? Following the growing

trade tensions with the abrupt US policy changes under the Trump administration resulting in higher tariffs being applied to China but also other countries, we observed significant rises in trade policy uncertainty (Baker et al., 2019), but with little evidence of reshoring. Since the main value of the WTO, as Koopman et al. (2020) argue, is to increase certainty and transparency, the multilateral trading system can play a key role in times of uncertainty. The authors suggest that membership of the WTO locks in beneficial reform and has a public good nature that also fosters trade with non-members. IMF research has suggested that trade growth is largely driven by factors other than trade-related policies (IMF 2016) and WTO research on trade costs clearly demonstrates (see figure 2) that trade policies and regulatory differences across countries explain only part of trade cost variations across

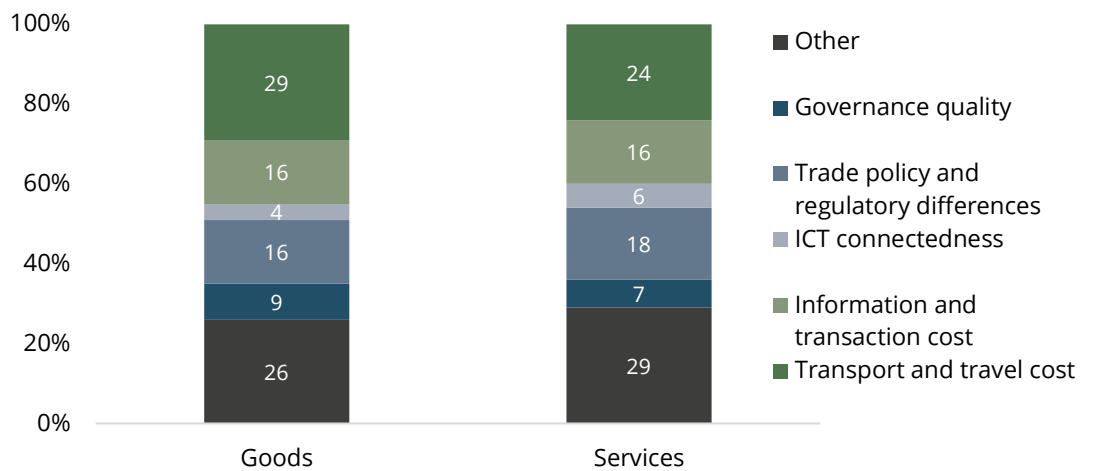
countries and sectors, with transport and travel costs and information and transaction costs accounting for equal or greater shares (Rubinova and Sebti, 2021). While tariffs clearly play a role in how and where companies align value chains, it is also clear that many other factors contribute to that decision making.

The challenge for firms, and governments, is to balance a risk-versus-efficiency trade-off. Firms' optimization processes can no longer focus purely on efficiency (factor cost minimization) gains and must now put more weight on risks (rising policy and economic uncertainty). As Baldwin (2016) and others have pointed out, improvements in communication technology, lower uncertainty due to large numbers of international economic agreements, and falling domestic and international trade costs, partly due to the international agreements and partly due to technological improvements, essentially allowed firms to focus on

efficiency gains through outsourcing domestically and offshore. This fragmentation of production, often building on domestic fragmentation of supply chains, spread globally as international trade costs fell relative to domestic trade costs (Beverelli et al. 2019).

While supply chain risks have always remained, exemplified by events like the Fukushima disaster or US Gulf Coast hurricanes, they were viewed as more naturally occurring random events rather than systemic policy risks. Assessments of supply chain disruptions initially focused more on these kinds of events (see for example Simchi-Levi et al. 2014). Yet, with the advent of the US-China trade conflict in 2017, and the broader US efforts to disrupt existing international commitments on trade, and finally with a major global health pandemic in the form of COVID-19, firms are likely to reconsider their traditional focus on pursuing pure efficiency in supply chains and consider how best

Figure 2: Determinants of trade costs, percentage of bilateral variation



Source: Rubinova and Sebti, 2021. Sector-specific results are aggregated to the two categories using a weighted average where the weights are determined by the variance of trade costs in each sector.

to manage risks in those supply chains. Governments, held accountable by their citizenry, also need to consider how best to manage these risks in the form of comprehensive health policies coherent with economic policies, and combined with efficient use of taxpayer and private sector resources to manage future crises.

Recent research by Lund et al. (2020) examines how firms are responding to these rising risks by estimating how much in annual profits might be lost due to supply chain disruptions. This kind of effort puts a value on what a maximum risk mitigation strategy might be worth to a firm, given that firms are not likely to spend more on that strategy than the foregone profits. Accenture (2020), along with other firms such as Deloitte (2020), have started to deploy supply chain risk assessment tools for firms to be able to identify potential weak links in their supply chains. Governments are also conducting such exercises, as seen in recent work by Global Affairs Canada (Boileau, 2020) and a request from the United States House Ways and Means Committee to the United States International Trade Commission (USITC) to conduct an assessment of US supply chains for critical goods (USITC 2020), which was followed by yet another request for an even deeper study.

Thus far, global trade data following the US-China trade conflict suggests that the more typical response of firms has been to diversify their global supply chains to other countries rather than to re-shore production. Similarly, the response to the COVID-19 pandemic shows that trade and many GVCs have been relatively resilient, after initial disruptions and declines,

with merchandise trade recovering to its December 2019 level in November of 2020. Given the very large decline in global GDP in 2020, the trade decline is much smaller relative to the GDP decline than in past downturns, and particularly compared the Great Financial Crisis of 2008-9. At the end of 2020, trade declined about twice as much as GDP, while trade declined 6 times the decline in GDP during the great financial crisis. Despite the wide-scale disruptions to the movement of goods and people, and significant labor market disruptions for production, trade and global value chains remain relatively robust, at least in the mid-term.

It appears that firms, thus far, see opportunities to manage the rising risks from either policy uncertainty or a global health crisis by reorienting and diversifying their supply chains rather than reshoring. In some cases, governments are supporting domestic firms in realigning their foreign supply chains (Japan) and others are advertising that their economies provide a new alternative location for shifting supply chains (India, Mexico) from over-reliance on China.

One might argue that diversification from over-reliance on China had already started and was likely to occur over the longer term as China's economy rebalanced from its historical reliance on investment and manufacturing as a source of growth to consumption and services (World Bank, 2013). Rising wages, increasing domestic regulations, and a planned transition to higher value-added activities had already seen significant outward FDI from China into other, lower wage, countries (Rosen and Hanemann, 2009). A recent

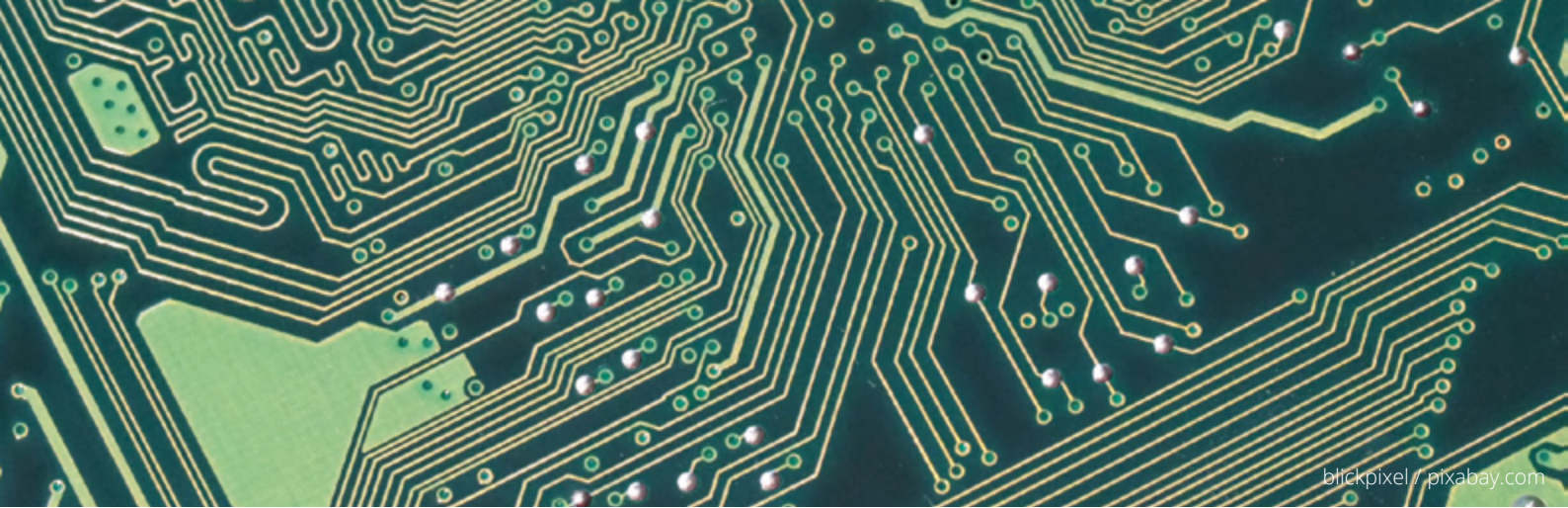
examination of China's potential transition to its 2030 goals suggests that if the transition is successful, and China's savings rate declines and consumption increases, China's role in the global economy would change substantially, moving from a large source of net exports, to a substantial importer, and potentially reducing its historical position in global and bilateral imbalances (Bekkers et al., 2021). Should such a change actually play out, it would be reinforcing the kinds of realignments of global supply chains we have observed over the past few years.

What lessons might we draw from the research on GVCs and determinants of trade flows in the context of the COVID-19 pandemic? Global value chains have developed due to the rapid

evolution of technology, international agreements on trade and investment, and the ability to move production to low cost countries. Trade policies and their related trade costs do play a role in the firm calculations but typically other factors drive trade growth and GVC developments. Increasingly, firms have included the potential of rising costs related to supply chain disruption risks to their calculus, and not just pure cost efficiency. COVID-19 has added a global health-related risk element to these calculations, but the risk-versus-efficiency trade-off has yet to suggest a move to re-on-shoring of production, but rather appears to be leading to more re-alignment of global supply chains, reinforcing global trends already being observed for other reasons prior to Covid-19.

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Integration in global IT value chains does not necessarily improve innovation capacity



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Global Value Chains (GVC) have characterized the evolution of the global economy during the last three decades. Integration in GVC offers remarkable potential for international tasks specialization and for accessing key knowledge and technology. Yet, it is less clear whether and under which circumstances countries and firms are able to acquire innovation capacities.

Whether this is possible or not depends on the techno-economic characteristics of the sector considered and on countries' contextual factors. In this blog post, based on Lema et al. (2021), we use empirical evidence on 45 countries around the world to investigate the building up of innovation capacities in the Information Technology industry (IT), distinguishing between the 'Computer, electronics and optical products' (hardware) and the 'IT and other information services' (software) sectors.

GVC participation & innovation in IT sectors

Both the hardware and the software sectors are highly innovative and deeply influenced by GVC trade. About 40% of R&D investments by the top R&D investing companies worldwide are performed in the IT industry (Grassano et al., 2020). Furthermore, the spread of digital technologies, together with the reduction in transport and communication costs, has favoured the reorganization of international production and business models and the rise of GVCs (UNCTAD, 2020).

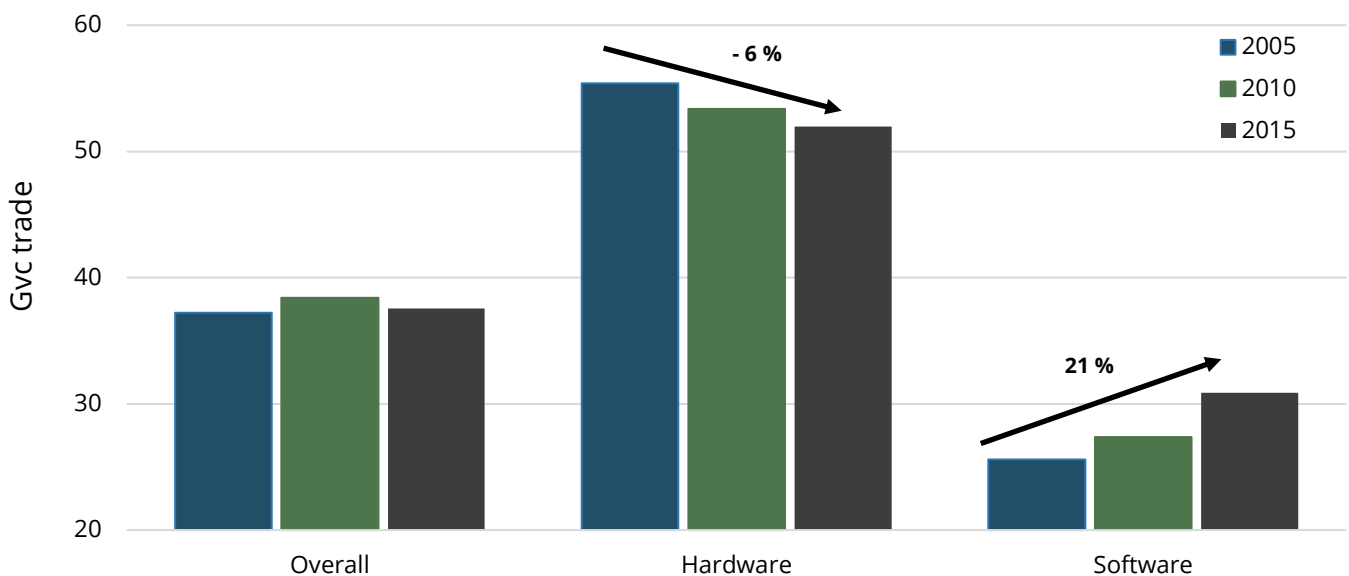
In 2005, GVC trade in the hardware sector was particularly high, while that in software was rather low. Since then, the two sectors have been moving in opposite directions: GVC participation has decreased in hardware (-6% between 2005 and 2015) and strongly increased in software (+20%; Figure 1).

Similarly, differences in innovation capacity across the two sectors have been especially marked. In terms of patents filed at the United States Patent and Trademark Office (USPTO) in 2015, those related to technologies pertaining to the hardware sector were much more prominent than those related to the software sector (44% vs 2.4%). However, between 2005 and 2015, patents related to the software sector almost doubled (+90%), experiencing a much higher growth rate than the hardware sector (+26%), albeit from a much lower base.

What explains these differences between hardware and software sectors?

The hardware and software sectors are very different in terms of the prevailing characteristics of innovation and GVC

Figure 1: GVC trade: total and in IT industries



Source: Authors' elaboration from TIVA OECD data.

Note: Share of trade in intermediaries over total trade.

Figure 2: Hardware and Software characteristics

	Hardware	Software
Innovation		
Type of innovation	Product	Process/Service
Innovation mode	STI	DUI
External sources of innovation	Universities, suppliers	Users
Global Value Chain		
Governance	Modular	Relational
Length	Long	Short
Fragmentation	High	Low

Source: Authors’ adaptation from Castellacci (2008) and UNCTAD (2020).

Note: STI: Scientific and Technological-based Innovation;
 DUI: Learning by Doing, Using and Interacting.

integration (Figure 2). The hardware sector is largely characterized by product innovation based on codified scientific and technical knowledge, which can be globally accessed to solve local problems. The codification of knowledge enables firms to innovate regardless of their GVC position. The possibility to codify specifications and the modularity of products allow for an independent development and production of specific components. Codification and standardization thus reduce asset specificity and the need of the buyer to directly control and interact with its suppliers.

The software sector, in contrast, is characterized by the acquisition of tacit knowledge based on learning and experience and requiring a strong interdependence with users. As a result, GVCs are characterized

by complex (relational) interactions among players that can create mutual dependences and dense exchanges of knowledge prevail.

GVC & innovation trajectories in the IT

Based on an industry-country level dataset combining information from the Trade in Value Added (TiVA) database produced by the OECD and USPTO which provides information on patents, Lema et al. (2021) reach the following main findings:

1. Countries with initially well-developed innovation capacity experience a greater increase in patenting activity, hinting to a strong cumulativeness of the innovation process in the IT industry. This also implies that countries lacking such initial capabilities find it more

difficult to catch up with international leaders. In other words, IT industries benefit from increasing knowledge returns to innovation.

2. In the hardware sector, an increased innovation capacity is associated with a decreased GVC participation. This can be explained by the ability to codify and separate production from innovation in this sector. Deepening of innovative capacities thus depends less on integration into GVCs and de-globalization (reshoring) has few implications for continued innovative capacity. Conversely, suppliers may move deeper into GVCs without gaining significant access to critical tacit knowledge.

3. In the software sector, in contrast, the strengthening of innovation capacity is significantly correlated with increased participation in GVCs. This can be explained by the continued dependence on user-producer interaction for innovation in the software and IT-enabled services sector.

4. Some countries (i.e. Finland, Israel, South Korea and USA) are able to leverage synergies between hardware and software and appear among the most dynamic in both sectors. Therefore, dynamism in hardware may be fostered by a dynamic software sector, and vice versa.

Conclusion

IT industries are characterized by strong cumulativeness in the innovation process that may lead to an increasing concentration in innovation capacity in a handful of countries. Indeed, our evidence shows that leading countries

in the IT industry have strengthened their innovation capacity with respect to others, calling for some reflection on the possible effects on the worldwide catching-up process.

However, hardware and software sectors are characterized by differences in the way GVCs and the innovation process are structured. In general, only in the software sector GVC participation and strengthening of the innovation capacity seem to go hand in hand. The increasing relevance of GVC trade in software calls for a better understanding of the GVC-innovation linkages in knowledge intensive business services.

Some countries have been able to reinforce their innovation capacity both in the hardware and software sectors, suggesting that they may be in a better position to leverage the complementarities deriving from the recombination of hardware and software triggered by platforms and industry 4.0 technologies. National systems of innovation do not seem to have the same capacity to foster and exploit these synergies. A finer-grained analysis to understand the synergies (or lack of them) among different subsystems is needed. New unexpected windows of opportunity may be opening from the development and integration of physical and virtual systems.

Our findings suggest that strong innovators have been more successful in integrating hardware and software capacities, possibly because they enjoy key ownership stakes in platforms, giving access and capability to leverage knowledge and orchestrate innovation networks (Sturgeon 2021).

The GVC-innovation link is not straightforward, as it is sometimes assumed. There is a vast literature showing a strong positive correlation between GVC participation and innovation (e.g. Tajoli and Felice 2018), but as we show in our study, there are important exceptions. The plurality of patterns observed, reflecting a complex and dynamic relationship between GVC participation and innovation, calls for further research to understand the role of specific factors that may lead to successes or failures in global knowledge intensive industries.

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Automation versus relocation in clothing global value chains: Will investments shift from China to Africa at a big scale?

Since the beginning of this century, China has emerged as the workbench for the world's clothing industry, increasing its share in global exports from 18% at the turn of the century to about 40% in 2015 (Lu 2016). This had important implications for poor countries, as participation in global clothing value chains historically had been an accelerator of industrialization and poverty reduction (Whitfield, Marslev & Staritz 2021). In the last 50 years, especially a number of Asian countries had first accumulated manufacturing capabilities in the textile and clothing industries and then diversified towards more sophisticated industries. China's unprecedented domination of the world market, however, closed this option for many countries. Other clothing exporting countries found it increasingly difficult to compete with China's unique combination of a huge low-cost labour force plus enormous economies of scale and scope of the world's largest industry clusters. This is now changing. In the last 15 years, industry wages

in China have risen steeply, thereby eroding China's competitiveness in labour-intensive manufacturing (Fig 1).

Does this enormous shift provide new opportunities for sub-Saharan African countries? Can they attract these industries and fill the space vacated by China?

To assess these questions, we need to understand the rationale of clothing manufacturers in China. There are two options: to relocate production abroad – or to automate at home. The Chinese government supports both. In 2012, it adopted The Twelfth Textile Industry Development Plan, which officially called for a “going-out strategy” for this sector and encouraged the leading firms to build up overseas operations. At the same time, factory automation is one of the most prominent objectives of its “Made in China 2025” strategic plan.

And both trends are indeed strong. In terms of relocation, since labour cost competitiveness started to erode,

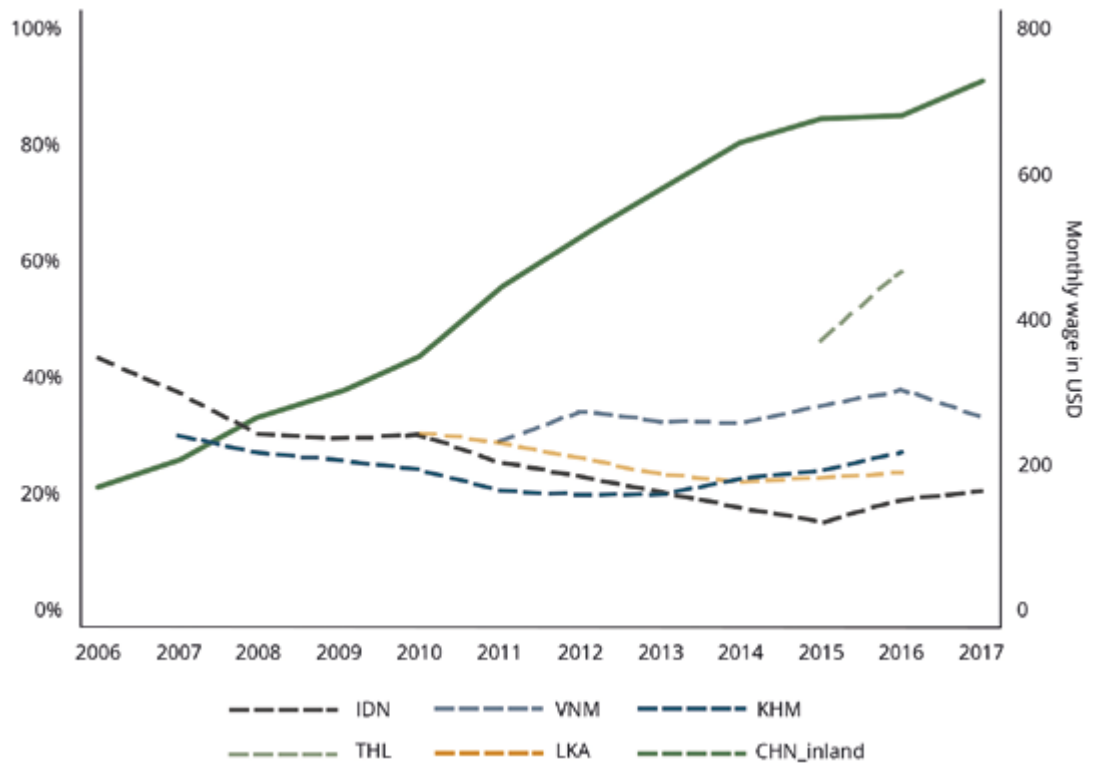


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Figure 1: Manufacturing wages in China vs. other South-East Asian countries



Source: ILO, cited in Chen & Li (2019)

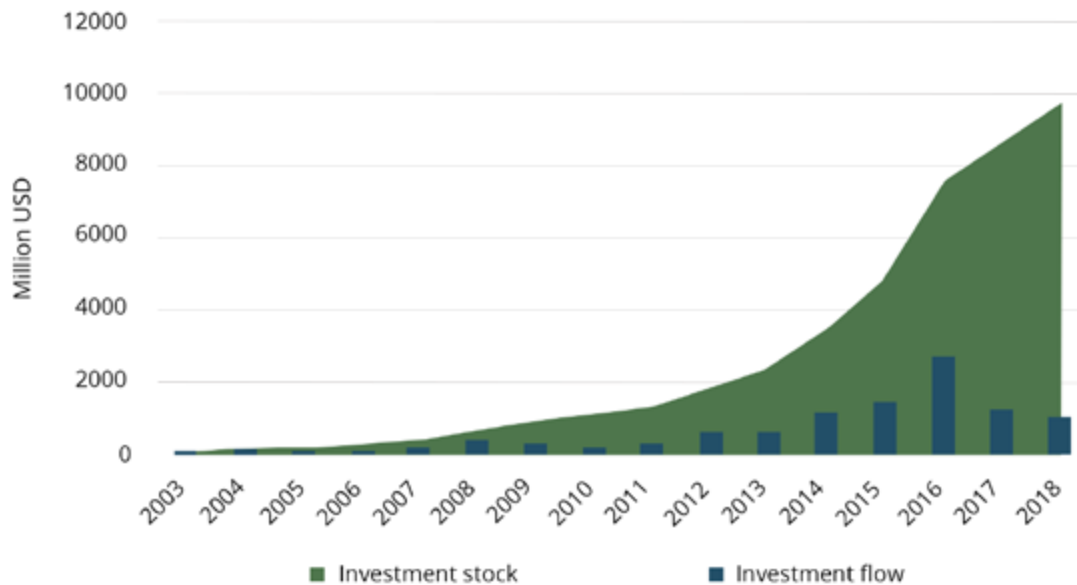
Chinese textile and clothing firms' foreign investments have soared (Fig 2).

This is reflected in China's market share in global clothing exports, which fell to 30.8% in 2019 (Statista 2020). Chen and Li (2019) estimate that about 25-35 percent of clothing manufacturing in terms of value of exports has shifted from China to Southeast and South Asian countries, mainly Cambodia, Vietnam, Myanmar and Bangladesh. Only a tiny fraction of these investments went into sub-Saharan Africa, with a certain peak in 2015-2017, but tapering off in the following years. The largest recipients were Egypt and Ethiopia. Wages in most African countries are relatively high compared to Asian competitor countries, and where they are low, as in Ethiopia, low productivity

raises unit labour costs; and even more importantly, many Asian countries offer more attractive investment conditions in terms of political stability, skilled labour, proximity to related industries as well as reliable transport and energy infrastructure (Altenburg et al. 2020).

With regard to factory automation, Chinese firms also undertake big efforts to mitigate rising labour costs. Many types of clothing production are already largely automated, including knitwear and simple products such as T-Shirts and underwear. The sewing operations for complex products such as shirts and suits, however, are difficult to robotise, as the limpness of the fabric requires constant manual pulling and slipping to bring the material into the right position for

Figure 2: Foreign Direct Investments of Chinese clothing and textiles industries (2003-2018)



Source: MOFCOM (2019), cited in Altenburg et. al. (2020).

the sewing machine. Firms around the world are experimenting with a number of automation techniques (Nayak & Padhye 2018). Most of them are applying multiple sensors to allow for robotic vision sewing, and some use chemicals to stiffen the fabric (Altenburg et al 2020, 11ff.). While it is technically feasible to make sewing robots (“sewbots”) produce even complex clothing products, manual production is still far more cost-effective and faster. In 2017, only 443 sewbots were sold globally – 300 times less than to the automotive industries (International Federation of Robotics, cited in Altenburg et al. 2020). Yet many auxiliary activities have been widely automated, such as all upstream activities (design, production of yarn and textiles), the spreading, cutting and ironing of fabrics as well as packaging and sales. Interestingly, China accounted for 64% of the incipient global sewbot market (ibid.).

Chinese firms are willing to incur the costs of factory automation, as the advantages of agglomeration in home-grown industrial clusters act as a strong deterrent to relocation. In 2017, the Center for New Structural Economics in Beijing and the Overseas Development Institute in London conducted a survey among export-oriented light manufacturing firms in China (Xu et al., 2017). Among the apparel firms surveyed, only 6% said that their first response was to transfer to a new location, whether inside or outside of China, and only 10% said that it was within their top three strategies. Only very few firms considered moving to sub-Saharan Africa, which for many companies remains uncharted territory compared to neighbouring Asian low-wage locations. Of the 640 surveyed firms, only three had established production bases in Africa, all in Ethiopia, and all in footwear.

What, then, are the prospects for Africa? While there are no signs of a major relocation of firms from China to this region, given the size of the clothing industry in China capturing even a small percentage of relocating firms or redirected contracts could make a big difference for some African countries. Only a few countries in the region are potentially competitive with Asian competitors in terms of labour costs – above all Ethiopia. In addition, the Ethiopian government adopted a foreign direct investment strategy that prioritized building strong relations with large global clothing retailers and brand marketers that in turn encouraged some of their core suppliers in Asian countries to set up factories in Ethiopia. This government strategy worked because the Western retailers and brand marketers that responded, such as H&M and PVH, already had a business strategy of shifting part of their sourcing from Asia to Africa and were looking for a new sourcing location on the sub-continent. Ethiopia, with its receptive government, became that new location. In particular, PVH worked with the Ethiopian government to design an eco-friendly industrial park in Hawassa where fabric production, accessory producers and assembly firms could co-locate to capture the benefits from agglomeration and economies of scale. The industrial park also included zero-liquid discharge facilities to treat water waste, especially from fabric production. The Ethiopian government then created several other industrial parks across the country. While other global clothing buyers have not become as invested as PVH in Ethiopia as a new sourcing location, they do seek to benefit by sourcing from the foreign firms that have set up in the industrial parks. The

Ethiopian government also invested in infrastructure to link the parks to ports and airports, and worked closely with these global buyers and transnational suppliers from the investment through the exporting stages to address challenges and bottlenecks (Whitfield, Staritz & Morris 2020).

Among the foreign clothing and textile firms attracted to Ethiopia by the government’s industrial policies, Chinese firms constitute the largest group (see Table). In particular, Chinese firms dominate foreign direct investments in yarn spinning and fabric production for export or indirect export (selling to exporting clothing firms), which has been a key part of the government’s policy to increase value addition in Ethiopia. These Chinese firms include major providers of woven, wool and linen fabric producers for retailers and branded merchandisers such as PVH and H&M.

Challenging conditions need to be met in Ethiopia and other African countries in order to succeed. Political stability and other factors eroding investors’ confidence arguably are the biggest

Table: Number of export firms in Ethiopia’s textile and clothing sector, 2019

Nationality of investor	TOTAL
China	20
Ethiopia	16
India	7
South Korea	6
Sri Lanka	4
Bangladesh	3
Others	19
TOTAL	75

Source: Altenburg et. al. (2020).

hindrance. Moreover, interested countries need efficient transport infrastructure and customs, a pool of workers that can be trained quickly in order to increase productivity, and stable energy supplies for the development of textile production.

Interviews with leading researchers and entrepreneurs in the field of clothing automation suggest that manual assembly is expected to remain cost-competitive for (only) about 15-20 years (Altenburg et al 2020) before automation will make it redundant. This offers African countries a temporary opportunity to build the respective infrastructure and attract investments from international

clothing firms, yet it also suggest that such investments can only be maintained if African countries use this window of opportunity to move up in the global textile and clothing value chain. This, in turn, will require more specific industrial policies to develop high-quality skills and infrastructure to woo investors into higher-value functions and segments of the clothing industry. It also requires reducing lead times to compete in short-cycle fashion markets, and to strengthen the role of local firms, inter-firm linkages and domestic supply (Whitfield, Staritz & Morris 2020). Ethiopia is taking steps in this direction, which may pay off if political stability is restored.

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The protectionist threat to global value chains: Evidence from the Brexit shock in the UK textile and apparel industry



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The 2016 Brexit referendum and Donald Trump's election are often associated with the beginning of a new era of economic nationalism and protectionism, which have given rise to the cross-country emergence of discriminatory trade measures harming foreign commercial interests (Evenett, 2019; Gereffi, 2018). Between 2018 and 2019, governments worldwide introduced more than 2,000 contractionary trade policies to strengthen domestic industries at the expense of foreign competitors (Evenett and Frits, 2019). These new measures are creating a serious challenge to globalisation and international trade, which have experienced a slowdown since the 2008 economic and financial crisis (Mirodout and Nordström, 2020). This increased protectionism has been predicted to have profound side effects for international business activities and the configuration of global value chains (GVCs) (De Backer and Flaig, 2017; Van Tulder et al., 2020, WTO, 2020). Particularly, it may have consequences for the competitiveness of domestic firms involved in complex international

production networks by reducing the benefits from sourcing abroad. Moreover, the impact of protectionist measures is likely to have a 'cascading' effect in the GVC context and to be amplified through intermediate goods that are exported downstream in the value chain (Cappariello et al., 2020).

One of the most globalised and leading export industries with a long history of protectionism is the textile and apparel (T&A) industry (Frederick and Gereffi, 2009). This is a classic example of 'buyer-driven' value chain, where firms such as retailers, designers and brand manufacturers, responsible for the most valuable activities in the value chain (e.g., research, design, branding, sales), play a key role in the organization of global production by linking dispersed networks of overseas manufacturing suppliers with final consumer markets (Gereffi and Memedovic, 2003). While the Multi Fiber Agreement quota system and its successor, the Agreement on Textiles and Clothing, were phased out in 2005, some forms of trade distortion have



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continued to affect the T&A GVC, whose exports in 2019 declined and were weighed down by political tensions and protectionist measures (WTO, 2020).

One key question is thus how protectionist trends and increased restrictions to trade affect international business activities and the configuration of GVCs. To gain insight into this topic, we investigated the implications of the Brexit trade shock – from the 2016 referendum until the formal UK's withdrawal from the EU in January 2020 – for firms along the UK T&A value chain (Casadei and Iammarino, 2021). We relied upon data from an original survey carried out between June 2019 and January 2020 with 688 firms amongst 1) manufacturing suppliers and 2) retailers, designers and brand manufacturers as GVC actors involved into higher value-adding activities. This period was characterised by high uncertainty about future trade policy between the UK and the EU, with persistent fears of a no-deal option and the awareness of future increased trade costs under any possible scenario. While a last-minute deal with the EU was eventually signed in December 2020, non-tariff barriers such as market access restrictions, customs procedures, and administrative burden imply higher trade frictions for firms that operate internationally (Financial Times, 2021a).

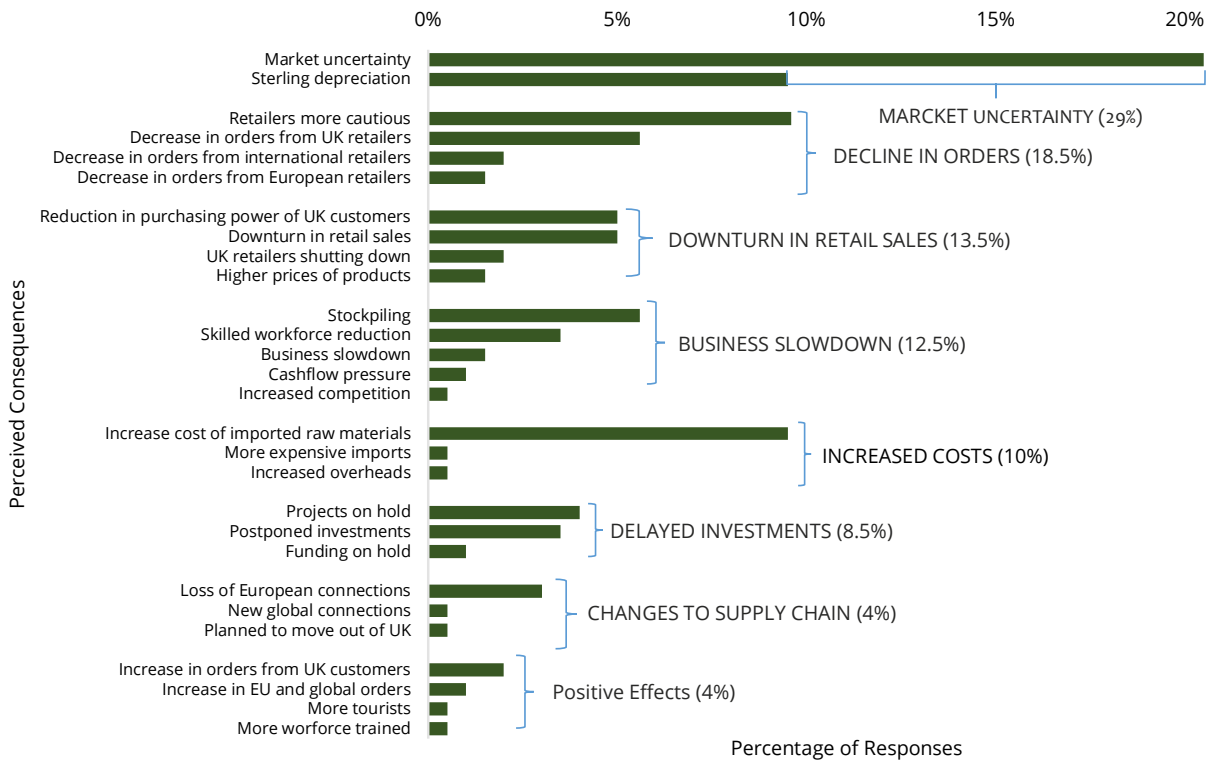
The impact of Brexit on firms along the T&A value chain

The Brexit shock affected over 60 per cent of firms in the two groups under investigation. Overall, market uncertainty, sterling's depreciation and a fluctuating exchange rate were major factors behind a large variety of consequences. Respondents

complained about increased costs, particularly of imports, which resulted in higher prices, lower demand and reduced profitability of products. Firms pointed out a downturn in retail sales, following a substantial reduction in the purchasing power of UK costumers and an increase in the price of products, with several brands and high-street shops shutting down. A substantial number of respondents claimed to have experienced a slowdown in their businesses, with a reduction in profitability, investment plans and workforce. In addition to these implications shared amongst the two groups of firms, we identified a different array of consequences for suppliers and firms involved in higher value-adding activities.

Amongst Brexit-affected manufacturing suppliers (Figure 1), respondents mentioned a significant decrease in the number of orders from more cautious domestic and foreign retailers, particularly because of continuous rising costs as well as of unpredictable future tariffs and delivery times. Firms declared to have experienced increased foreign competition as well as stocked up on raw materials, which is a rather unsustainable precaution to counterbalance the impact of the shock. Indeed, anticipatory stockpiling involves additional inventory holding and depreciation costs that may reduce trade flows (Alessandria et al., 2019). Several manufacturers indicated to have lost old connections or established (or planned to establish) new ones along their supply networks, for example losing large retailers that moved production offshore, as well as switching from UK to other European or international suppliers or moving plants and warehouses to a EU country. Only 4% of manufacturers witnessed

Figure 1: The impact of Brexit on manufacturing suppliers



Source: Casadei & Iammarino (2021).

a positive effect, experiencing for example an increase in orders from UK retailers seeking to source more products domestically to avoid potential difficulties with foreign suppliers.

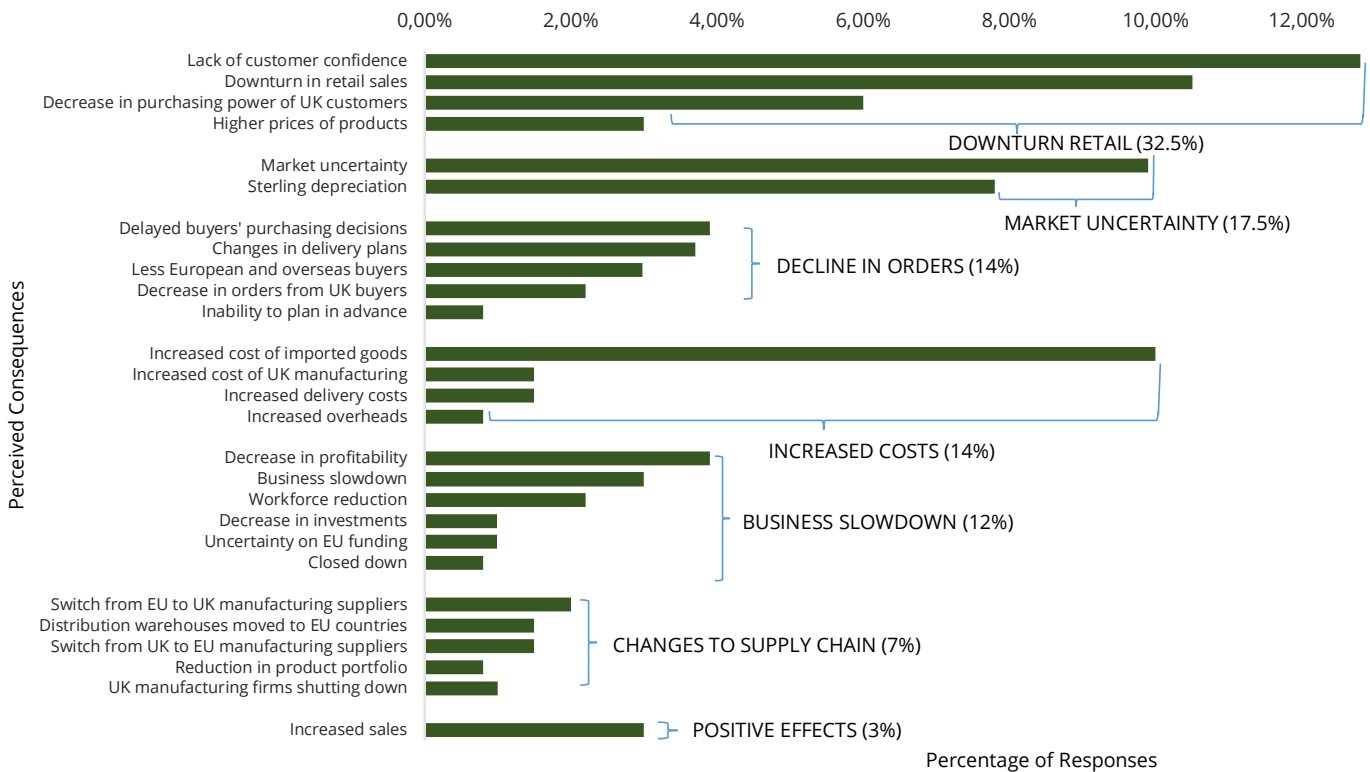
With respect to Brexit-affected retailers, designers and brand manufacturers (Figure 2), some respondents complained about a decrease in orders from UK, European and international buyers, and reduced ability to plan in advance and meet the demand of new potential foreign customers. Several firms claimed to have already applied (or planned to apply) changes to their supply and distribution networks, for example by moving production from the UK to the EU (and vice versa). This group of firms, particularly micro businesses usually constrained by less financial resources, appeared the most worried about the threats to their trading relationships

within Europe and internationally. Concerns were reinforced by a negative perception of domestic manufacturing, which was defined as expensive and characterised by a lack of firms endowed with adequate technical skills, specialist expertise, and machineries. Only 3% of firms stated to have been positively affected by Brexit with an increase in sales particularly to the EU and US.

Did the degree and type of GVC integration matter?

The small share of manufacturing suppliers claiming to have been positively affected or non-affected by Brexit were weakly integrated into the GVC, with few if any links with foreign firms. For example, most firms that moved towards a more domestic supply chain through reshoring stated not to have faced any consequence.

Figure 2: The impact of Brexit on retailers, designers and brand manufacturers



Source: Casadei & Iammarino (2021).

Indeed, trade shock and related uncertainty may lead firms involved in production stages dispersed across countries to secure timely delivery of products domestically rather than abroad (Harrigan and Venables, 2006). This may become an issue when the required competences are not available in the home country. Additionally, manufacturers supplying more international buyers were the most exposed to Brexit uncertainty, likely due to the increased cost of imported inputs that rendered domestic production more expensive and less competitive to foreign customers. The level of integration in GVCs seemed to be less significant for retailers, designers and brand manufacturers, although those businesses that recently implemented reshoring strategies were less affected by Brexit. The type of production phases offshored also influenced the

impact of the shock, as manufacturing firms involved in backward linkages (i.e., intermediate inputs imported from foreign value chain partners) appeared more sensitive to it. Indeed, firms sourcing intermediate inputs and components that go into further processing may have a higher negative perception of shocks associated with a potential disruption of the entire production process in case of late/failed arrival of components (Harrigan and Venables, 2006).

What can we learn?

The 2016 Brexit referendum initiated a period of high uncertainty over future trade policy between the UK and the EU, characterized by persistent threats of increased restrictions to trade. We have shown how firms belonging to a traditionally highly globalised industry – textile and apparel – were negatively

affected by the UK's 'protectionist' decision to leave the EU. A variety of consequences, mostly linked to market uncertainty, were detrimental to the profitability and survival of firms operating both upstream and downstream this value chain, which showed clear signs of disruption and ongoing restructuring. Even before the signing of the new UK-EU deal, several manufacturing suppliers, retailers, designers and brand manufacturers had already applied changes to their GVC networks, with the aim of sheltering themselves from future trade frictions. Particularly as concerns manufacturing suppliers, unsurprisingly, firms more integrated into the GVC and offshoring inputs and components that go into further processing appeared more sensitive to the trade shock.

On 1st January 2021, the UK left the EU single market and customs union. As largely predicted in scholarly research (e.g., Dhingra and Sampson, 2019), many UK businesses, including those in T&A, are now struggling to effectively trade under the new UK-EU trade agreement mostly because of the Brexit red tape (Financial Times, 2021b). While it is clear that firms along the T&A value chain will have to deal with further changes to their trade exchanges and production networks, it remains to be seen to what extent such transformations will materialize and how they will affect the broader industry in the long-term. The Brexit case, however, emphasises how threats of future trade restrictive policies already affect the configuration of GVCs in addition to hindering international business activities even before contractionary measures are implemented.

As concerns policy implications, it is now vital for the government to help the sector thrive and continue trading with the EU by recognising its importance within the government's conversations and by financially supporting the multitude of micro firms that have seen their supply networks disrupted by the red tape. Policy support is particularly crucial for restructuring the manufacturing sector, which in the long-term might face both an increase in domestic demand and a drastic reduction in linkages with foreign firms. A recent research stream has emphasized the role of the state as a 'facilitator' in the integration and upgrading of firms within GVCs, for example by promoting tax incentives, R&D subsidies, skill formation and training programs, and investment support (Horner, 2017). The development of new skills and capabilities, the adoption of more innovative machineries and equipment, the upgrading of product quality and production standards, and a deeper integration in some production phases of the value chain would boost the confidence of both domestic and foreign fashion designers and retailers. Also, the definition of a sector-specific trade strategy, including for example help for firms in exhibiting at trade shows in key overseas markets or investments for making domestic fairs and events more appealing to an international audience, would promote both exports and inward investments which are now urgently needed by the industry to remain competitive in the T&A GVC.

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Mandating sustainable governance of the supply chain – complementing old carrots with new sticks?



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In the wake of the COVID-19 crisis, supply chain challenges have received renewed attention and have become a major concern from both resilience (Golan et al., 2020) and sustainability (Sarkis, 2021) perspectives. For example – based on its Green Deal – the European Union (EU) is considering the circular economy as a tool for Post-COVID recovery, which in turn requires closed-loop supply chains to be effective. In the United States (US), the Biden Administration has issued an executive order on America's supply chains, which is meant to instruct a 100-day evaluation of supply chains and resilience in sensitive industries. Additionally, and importantly, organizations are facing emergent regulations with 'teeth' and penalties for poor due diligence in their supply chains; a shift away from self-regulatory approaches and norms. What does this mean for sustainable chain governance?

Firms in supply chains increasingly face pressure from consumers and civil society organized in non-governmental

organizations (NGOs) to become more socially and environmentally sustainable. For firms, this implies market and reputational risks that may damage their long-term profitability. The response to these pressures was typically of the neo-liberal (Larner, 2000) mode through industry self-regulation and voluntary and market-based standards (Czarnecki and Fiedler, 2016).

Voluntary governance mechanisms for sustainable supply chains, including certifications and standards, are mushrooming around the world. They have developed to cover a wide range of issues, and they are often overlapping and sometimes at odds with each other (Reinecke et al., 2012). Typically, they entail only minimal penalties for negative environmental and social practices. Moreover, they can generate inconsistent – or poor – results (Filip, 2020), for example by creating new challenges for small producers in the agriculture sector, making smallholders potentially less competitive. As a result, problems in

social and environmental sustainability of supply chains remain. Firms tend to search for the least expensive sources and locations and trade-off economic exigencies with environmental or social performance. It is this context where more 'teeth' are needed.

In fact, recent and not-so-recent legislation and regulation has started to introduce new institutional approaches for governing supply chains based on binding regulations. For instance, the EU has passed regulations and laws on product stewardship and hazardous material content for certain materials and products. For example, the Waste Electrical and Electronic Equipment (WEEE) regulation (2012) has caused greater proper collection of electronic waste from the supply chain at the end-of-life of products. The Global E-Waste statistics show that overall European electronic collection and recycling rates are at 42.5% (Forti et al., 2020). In contrast, in the US, in the absence of federal WEEE regulations, only 9.4% is collect and recycled.

With Section 1502 of the Dodd-Frank Act (2012), the US has tried its hands on managing the supply chain with information-based regulations requiring companies to report – without penalty as long as they report – on conflict minerals (Kim and Davis, 2016; Schwartz, 2016). While this has led to improved reporting, the lack of transparency and accuracy remains – with some rollbacks in the legislation occurring in the US (Woody, 2019). At the same time, this kind of approach has diffused to the EU and other regions. These regulations can support sustainability in supply chains through information-based mechanisms, but actual changes in sourcing is still up to the reporting organization.

More recently, we can also witness a trend towards due diligence laws in supply chains. For instance, the new German Lieferkettengesetz Sorgfaltspflichtengesetz was passed on March 3, 2021 by the Federal Cabinet and is expected to come into effect in 2023. The regulation empowers national agencies to assess whether an organization is meeting its obligations. Punitive fines or denial of public contracts can be administered to those found guilty of bad supply chain practices. NGOs and trade unions would also be allowed to initiate legal action in civil courts on behalf of victims.

Still, some believe the new legal initiative does not go far enough (Human Rights Watch, 2021). A major criticism is the neglect of environmental standards in this law (Wehrmann, 2021). That is, the current law considers only human rights violations, but not necessarily other potential violations although human rights violations may encompass environmental and corruption activities. At the same time, this German due diligence law is one of the most coercive regulations in existence. It may trigger similar actions elsewhere, as several other European countries as well as the European Commission are now discussing similar approaches.

Yet, regulations that aim to make supply chains more sustainable face issues of coverage and feasibility. Many barriers and boundaries (Sarkis, 2012; see Figure) are associated with managing sustainable supply chains. The figure shows flows that are constrained and managed by various boundaries. There are nine boundaries listed and each can be very strict and well defined or porous and ill-defined depending on the context. For

example, organizational boundaries can be very clearly delineated, while cultural boundaries may cover multiple regions even crossing or have multiple cultural boundaries within political and geographical locations.

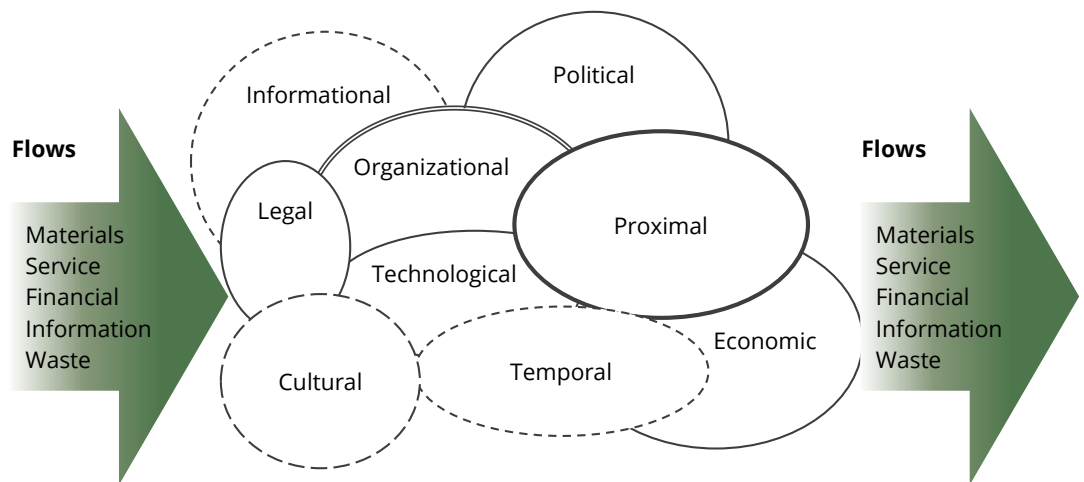
Each boundary dimension will play a role in the diffusion of standards and regulations such as balancing cultural norms, temporal concerns and varying legal and political frameworks. There might be, for example, some disagreements on what is and what not a violation is. There might also be concerns about knowing, seeing and timing. Since it is not possible to address all these in one short series of observations, we point out a couple directions to start the discussion.

Arguably, the neo-liberal approach, especially in terms of traditional cost-benefit and market policies (Filip 2020), is limited when it comes to fully addressing the multitude of issues facing multi-tier supply chain standards management. We have been investigating sustainability standards

diffusion along supply chains for a number of years (Grimm et al., 2014; 2016; 2018) and found coordination and information sharing amongst the supply chain partners and other stakeholders such as customers and regulators to be critical. To achieve this, effective supply chain mapping and visibility (or transparency) are necessary but are typically severely constrained (Mubarak et al., 2021).

One possible solution for regulators, certifiers, and supply chain partners is refinement and further development of inter-organizational technology, especially multi-tier and network systems-technologies such as distribute ledger or blockchain technology. By no means is this the ultimate solution, but it can aid with visibility and mapping to help monitor and improve supply chain performance. Clearer measures, metrics, and consistency in definitions for sustainability and business dimensions – as supply chain partners may not have the same conceptions – will be required.

Figure: Barriers, boundaries, and supply chain flows associated with green and sustainable supply chains



Source: Sarkis (2012)

Overall, we can expect that the newly introduced coercive measures and government involvement will be a game changer in the supply chain domain. It is likely that when responsibility for ethical and sustainable practices goes beyond the organizational walls and when institutional fields shift, new tools and perspectives are needed. New sticks are replacing or complementing old carrots in multi-tier supply chain sustainability governance. I am not

recommending that we should fully dispose of voluntary standards and industry self-regulation. But the great reliance on these neo-liberal mechanisms for making sure the supply chain is acting in a sustainable and ethical way has had its limitations. Balancing and mixing these actions with regulatory mechanisms that are coercive is needed and is occurring. Companies and their supply chains need to prepare.

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India's manufacturing and services value-chains are shifting South – A curse or a blessing?

Much has been written on India as an outlier in Global Value Chains (GVC). Despite being one of the largest and fastest-growing markets located in direct proximity to 'Factory Asia' (Baldwin, 2008), India is documented to have low participation in global networks, especially amongst South Asian economies. This is due to the stagnant growth of its manufacturing sector, low ability to attract FDI in manufacturing, domestic-oriented markets, and R&D levels (Ray & Miglani, 2020). Further, its existing GVC linkages are in low value-added manufacturing tasks, underscoring the need for Indian GVC participating firms to climb up the manufacturing export chain ladder. While India is a global exporter of ICT services, Indian ICT firms engage in low value-added activities, carrying out mundane labor-intensive tasks like coding and body-shopping (Pattnayak & Chadha, 2019).

In this blog, I find a gradual shift of India's VC trade in both manufacturing and services from the Global North towards the Global South, mirroring the rise of 'polycentric trade' (Horner & Nadvi, 2018). China, in particular,

has overtaken the US to emerge as India's biggest trade partner in the first half of the financial year 2020-21, with India's long-standing dependency on pharmaceuticals, heavy machinery, and telecommunications (Business Today, 2021). A shift in India's geography of GVC trade may present new opportunities as well as challenges for firms to undertake economic upgrading. South-South (SS) value chains may offer higher opportunities for product upgrading but the jury is still out on whether SS value chains offer overall better economic upgrading opportunities than North-South (NS) value chains.

India's manufacturing value chains are shifting south

India's value-added trade flows across partner shares reveal an interesting trend: Indian manufacturing GVCs are shifting South (Figure 1), particularly from Europe towards Asia. The share of manufacturing foreign value-added (FVA) in India's domestic final demand originating from the Global North declined from 60% in 2005 to 50% in 2010 to 43% in 2015, while that



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originating from Southern partners increased from 27% in 2005 to 38.6% in 2010 to a further 45% in 2015. A closer look at the data reveals that the largest decline has been in the case of Europe as the share of manufacturing FVA originating from this region declined by 10 percentage points between 2005-2015, while that from East and South-East Asia increased by 14.5 percentage points.

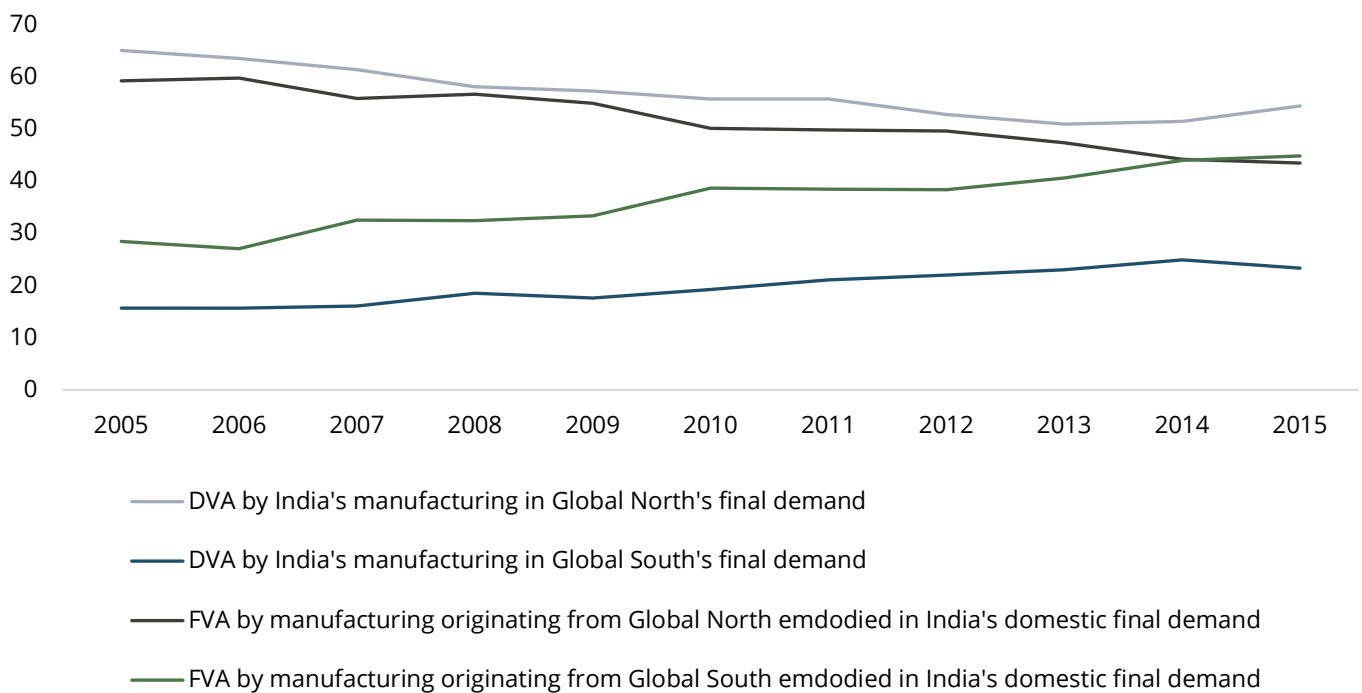
A similar trend can be observed in the case of domestic value-added (DVA) by India's manufacturing in foreign final demand. Its share in the case of Northern partners has declined by almost 10 percentage points in the period 2005-2015, while that in the case of Southern partners has increased from 15% to 23%. This shift is primarily from Europe to China. Indian manufacturing's DVA share in

Europe's final demand declined by 5.15 percentage points between 2005-2015, while that in China increased by 3.3%.

India's services value chains are shifting South

In terms of shifting geographies, a similar trend can be observed in India's service value chains. Figure 2 shows that the DVA by India's total services in Global North's final demand declined from 68.5% to 63% in 2005-2015, while FVA by services originating from Global North in India's domestic final demand declined from roughly 70% to 58.5%. In contrast, the DVA by India's services to Global South's final demand increased by 16.8 to 20% between 2005-2015, while FVA by services originating from the Global South increased from 16% to 27% (Figure 3).

Figure 1: India's manufacturing GVC trade, by partner shares (%)



Source: Author, constructed from OECD-TiVA database. Global South comprises of 22 developing countries in TiVA.

Figure 2: India's SVCs with Global North

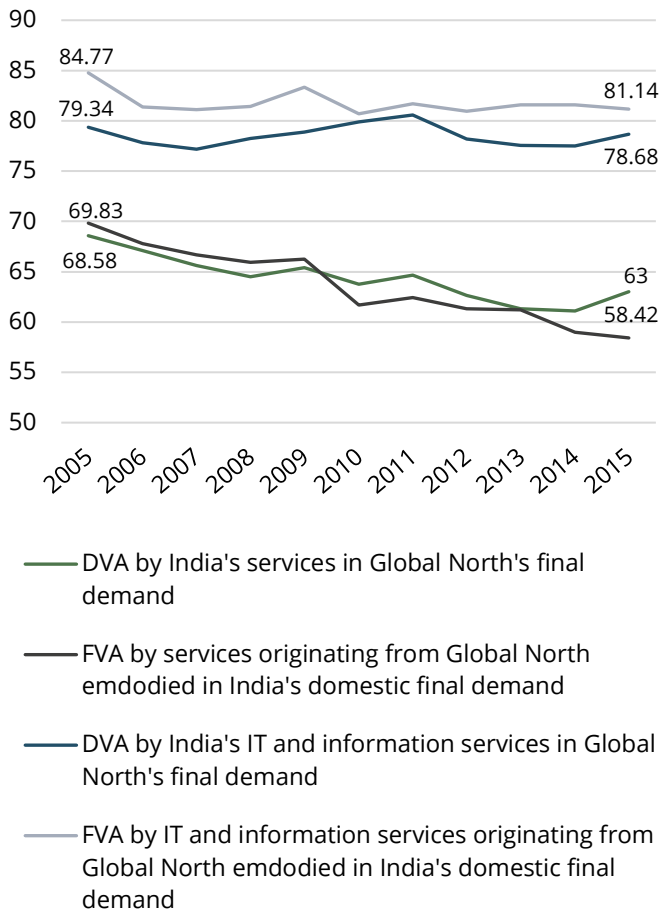
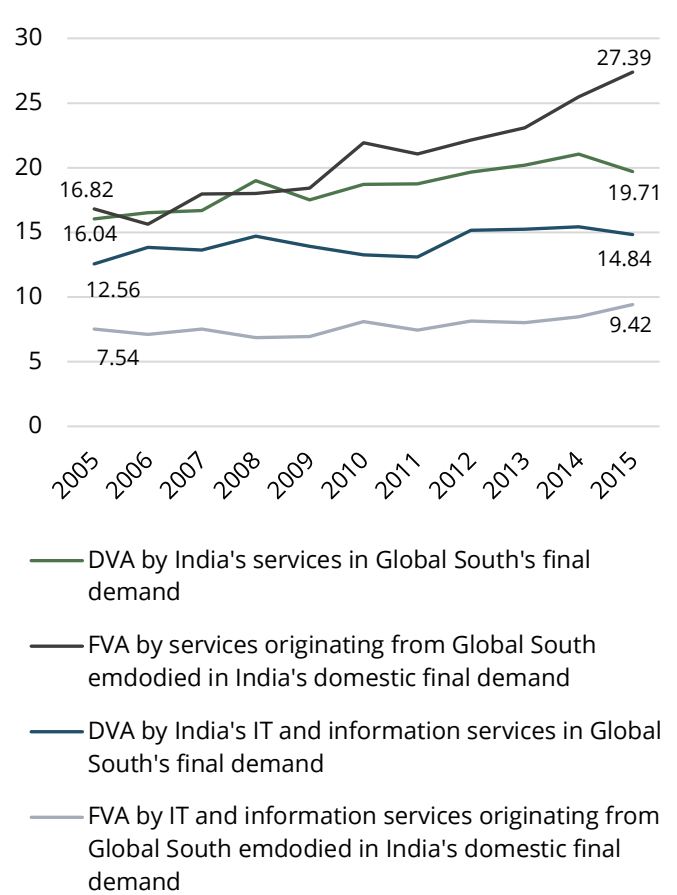
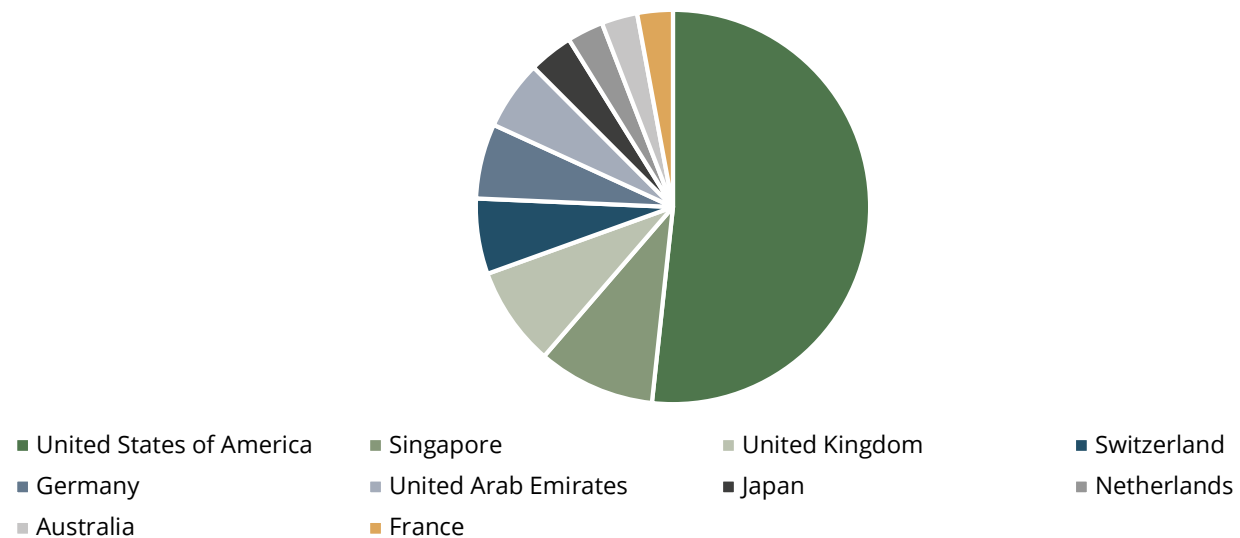


Figure 3: India's SVCs with Global South



Source: Author, constructed from TiVA.

Figure 4: India's ICT services exports, by country share (%), 2017-2019 average



Source: Author, constructed from BaTIS dataset.

ICT services account for almost 40% of India's total services exports, and around three-quarter of IT services are delivered digitally i.e. via the internet (Shingal, 2020). Just 10 countries make up 64% of India's total ICT exports, with data from 2017-2019 revealing a dominance by countries in the Global North, particularly a 33% share of the U.S., followed by Singapore (6.2), UK (5.2) and Switzerland (4.0) (Figure 4). However, India's linkages in ICT services value chains also demonstrate a shift towards the Global South (Figures 2 and 3). It is further noted from the data that DVA by Indian ICT services in Germany and UK's final demand declined by 3.45 and 2.65 percentage points respectively between 2005-2015. Of the 22 Southern countries examined, India's DVA in final demand increased for 15 of the 22, with the highest percentage point increase in China- from 3.11% to 4.58%.

Shifting geographies of India's GVC trade; drivers, opportunities, and risks

This southern shift in India's GVC trade could be due to several factors, including pull factors such as the growing importance of large domestic markets in the Global South and the emergence of 'lead' firms in the South- for instance, Huawei in China and Mahindra and Mahindra in India. However, rising digitalization and automation of manufacturing production in the Global North, in the context of a persistent global digital divide, could be a factor pushing away Indian firms from GVCs led by Northern lead firms. Although India continues to lag other economies in the digitalization of manufacturing, digitalization in Indian manufacturing

can significantly boost export intensity (Banga & Banga 2020) and product sophistication (Banga, 2021). At 3 robots per 10,000 workers, India's robot density is significantly below the world average of 74 (IFR, 2020). The Covid-19 pandemic is likely to further accelerate global manufacturing automation to mitigate supply-chain risks in the future (Seric & Winkler, 2020), potentially leading to re-shoring of manufacturing by Global North from less digitally integrated Indian firms.

This shift in India's GVCs towards the South could create new opportunities for productive Indian firms to form their own GVCs and for India to act as a 'growth pole' in the region. South-South value chains are likely easier to enter, less tightly controlled (Tessmann, 2018), and may offer higher upgrading opportunities than North-South value chains (Navas-Aleman, 2011). But evidence on this is limited and mixed. For instance, East African firms captured 10% more value in SS value chains than in NS value chains (ITC, 2019) but for Kenyan leather firms, product quality and value-added tasks were found to be lower in SS chains (Pasquali, 2021). More nuanced research is therefore needed to examine upgrading opportunities for Indian firms in SS value chains compared to NS VCs, particularly for the case of services value chains, given that India is a huge hub for business process outsourcing. Further, unpacking heterogeneity in upgrading opportunities across lead firm geographies within SS value chains can reveal key insights. Exploring the role of digitalization in changing geographies of GVC trade forms another interesting area of future work.

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Four keys to resilient supply chains



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If you work in the field of trade policy, you have likely spent much of the last year responding to the following questions: Where are the masks? Why is there not enough personal protective equipment? Why is vaccine distribution so slow? In short, have we become too reliant on global supply chains? In this context, trust in trade risks becoming a casualty of COVID. This is unfortunate, as trade probably plays an important role in making economies more resilient.

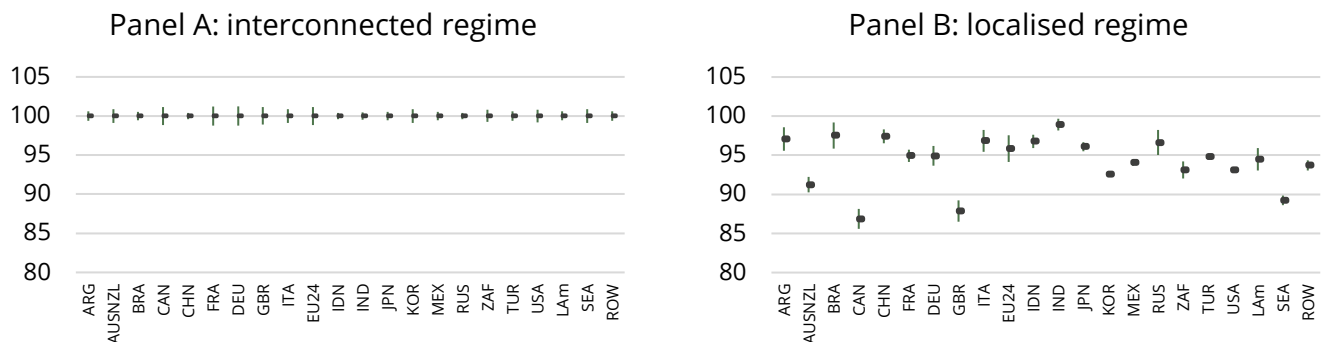
In this context and in constant consultation with our stakeholders, we have been mainstreaming COVID-related analysis in the OECD Trade and Agriculture Directorate's programme of work. Our objective has been to deepen the common evidence base, identify a toolkit of policy options, and improve communication about the importance of open markets during the pandemic.

To deepen the common evidence base we relied on a combination of economic modelling, in-depth examination of specific supply chains and qualitative information based on consultations with the private sector.

In reaction to increased calls for "reshoring", one of the first things we did was employ the OECD's economic modelling capacity to compare whether an interconnected economy fares less well in a situation of external shocks than a more localised regime featuring less geographic diversification and fewer production stages as a result of reshoring. In the localised regime also, incentives to source inputs from abroad are reduced through a global rise in import tariffs combined with national subsidies for domestic production. In addition, firms are more constrained in switching between different sources of inputs, making international supply chains more "rigid".

We find that localised regimes are characterized by less trade but also by lower output, compounding the economic slowdown already caused by external shocks like the COVID-19 pandemic (OECD, 2021a). Not only that, but the localised regime proves to be more vulnerable to shocks, as the lack of adjustment channels leads to increased instability and proves detrimental in terms of trade, prices and household income (Figure 1).

Figure 1: In a localised regime, shocks result in lower levels and lower stability of real GDP for most countries



Source: OECD METRO database and simulations

Note: All changes in variables are relative to the level of the interconnected regime base scenario which is set to equal 100. Blue dots show the base in the given regime relative to the interconnected base, and whiskers show average deviations for negative and positive trade cost shocks.

Economic models like the OECD's METRO model per definition rely on a simplified representation of the global economy and therefore cannot provide all the answers to the questions policy makers have in a crisis like the Covid-19 pandemic. We therefore complemented our modelling work with deep dives into specific supply chains, especially for essential products like face masks, PPE and vaccines (OECD 2020a, 2020b).

We wanted to better understand what was behind the bottlenecks and immediate shortages that were such a source of political and public concern. Our conclusions are quite clear: shortages were not caused by the collapse of supply chains, but by an unprecedented surge in the scale of demand (OECD, 2020c). Furthermore, when we look at the geographically diversified production of a range of COVID-19 products, it is evident that no country or region can unilaterally meet its own needs. In fact, global supply chains have been part of the solution to global shortages. So policy-

makers should be careful not to misdiagnose the supply chain disruptions as a widespread over-reliance on foreign supply.

We also felt it was crucial to test our analytical conclusions against the real world experience and expertise of individual firms and business associations. To collect this qualitative information, we were fortunate to be able to work with Business at OECD to conduct consultations with supply chain managers in sectors such as pharmaceuticals and medical goods, ICT goods and services, transport and logistics, and agri-food.

We heard that, overall, supply chain risk management strategies held up reasonably well. Most firms are considering fine-tuning, rather than overhauling, their approaches to international supply. This includes identifying alternate means of transport, and staying in front of customs requirements and procedures through pre-qualification and registration, where possible.

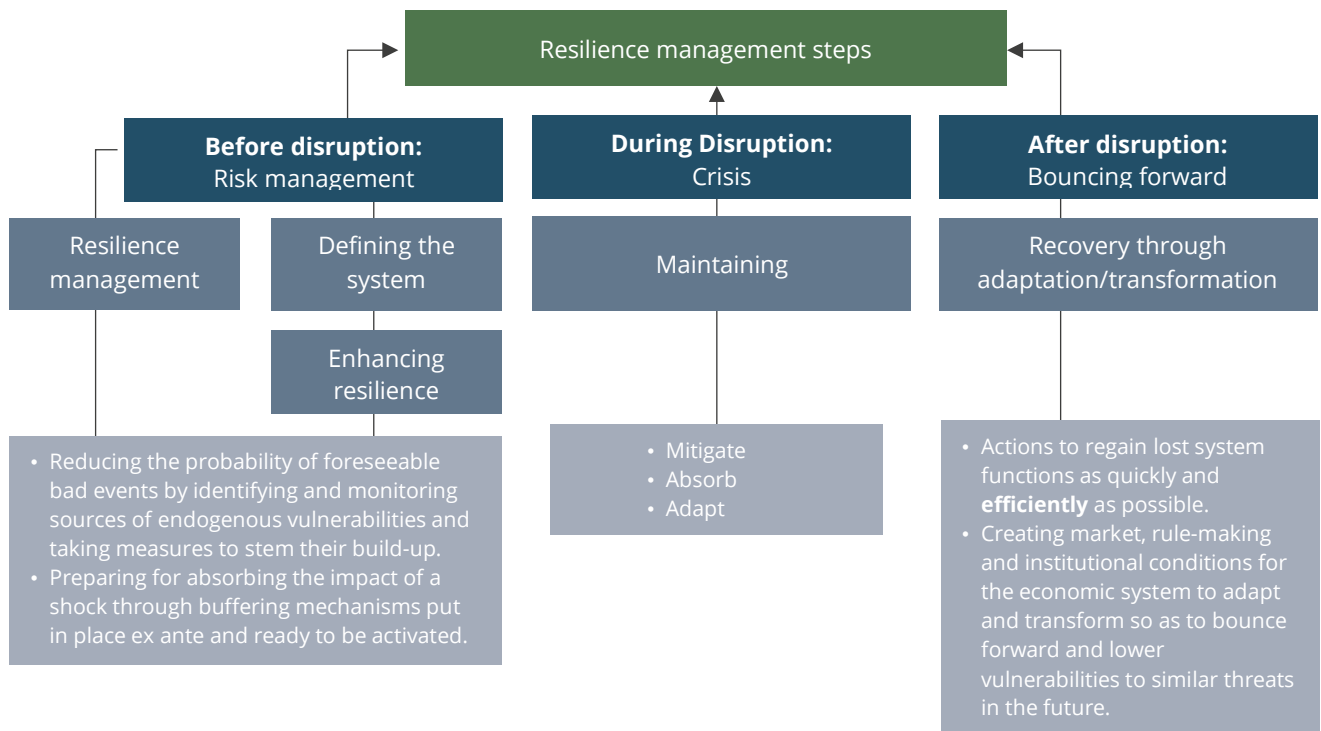
There is a strong sense that global supply is required to respond to demand spikes, while diversified production networks boost security of supply. Digitalisation was highlighted as an enabler of resilience, as were trade facilitation measures such as acceptance of electronic documents (at and behind the border), regulatory flexibility (even if on a temporary basis), and the alleviation of restrictions on trade in services. Finally, some factors of concern were repeatedly mentioned, including the chaos caused by unpredictable recourse to export restrictions and the costs and unpredictability generated by heterogeneous health measures and requirements.

Economic modelling, the in-depth examination of specific supply chains, and the qualitative experience of

supply chain managers underline the importance of open markets in times of crisis and the crucial role value chains have played in adjusting to an unprecedented demand shock in a specific set of health-related goods. Much of this work is synthesized in our contribution to the OECD-G7 report on Fostering economic resilience, which sets out a toolkit of policy options available to governments to promote resilient supply chains (OECD, 2021b).

Our work also highlights the key role of coordination and coherence among governments and consultation and cooperation between the public and private sector. If we have learned anything during the COVID-19 crisis, it is that international supply chains will continue to be subjected to unexpected disruptions. The public will continue to demand that

Figure 2: The role of governments on building resilience



Source: oe.cd/supply-chains

governments take steps to ensure security of supply, and trade policy-makers will need policy solutions that address these expectations without resorting to beggar-thy-neighbour measures (Figure 2).

Going forward, we are centralising this growing evidence base in an online tool that identifies four keys to resilient supply chains. Our objective is to promote accessibility, communication, transparency, and policy impact.

The first key is to anticipate risks. Understanding the nature of shocks and accurate diagnosis of the problems is essential to identifying the most appropriate policy responses. This is true not simply in the present context of COVID, but also to provide important insights for the handling of future supply chain disruptions.

The second key is domestic tools to minimize exposure to risk. At the national level, reducing risk and promoting growth need not be a zero sum dilemma. Investing in infrastructure, enabling digital trade, sound procurement management and regulatory flexibility can promote the resilience of supply chains while also contributing to productivity and competitiveness.

The third key is public-private tools to build trust. Public-private cooperation can boost confidence that global supply chains will be able to provide needed goods and services at the right time and in the right quantities. These approaches include firm-level risk management strategies,

public-private action plans, the stress testing of supply chains, and strategic governance at the national level.

The fourth key is international tools to keep markets open. While governments can take a number of actions at the national level, ensuring resilient global supply chains requires collective efforts at the international level. This can involve the full range of international economic co-operation tools, from multilateral, plurilateral and bilateral agreements, to softer forms of policy coordination and peer review.

Each of these four keys is comprised of issues, policy actions and relevant tools and publications to promote policies resilient supply chains without undermining robust, sustainable and inclusive economic recovery. It is our intention that this evidence base will be kept up to date with new contributions from the OECD, experts and national administrations. Moreover, it is our hope that a common base of evidence will promote coordination, coherence, consultations and cooperation as governments and business strive to address unprecedented disruptions to international trade.

The OECD's founding principles and values hold that open and rules-based international trade is an essential condition for economic growth from which all can benefit. We invite you to explore these four keys to resilient supply chains, and to contribute to further deepening the evidence base that can ensure a robust, sustainable and inclusive recovery.

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No end of globalization: Digital technologies as a source of fragmentation of manufacturing

As the performance of digital devices increases by the minute and new digital base technologies like artificial intelligence (AI) or the internet of things (IoT) proliferate, economic relationships change. This not only accounts for processes within enterprises: the automation of tasks, tools for the integration of work processes, and collaboration through cloud infrastructures will also affect the geographies of production, i.e. the places at which work is performed.

In public discourse, one-sided expectations are widespread. The narrative of "Industry 4.0" is mostly associated with the prospect of economic de-globalization. The reasoning behind this is: digitalization makes the relocation ("reshoring") of manufacturing capacities feasible because labor costs become increasingly irrelevant. What is more, the use of AI and the IoT is increasing the flexibility of companies, and they are expected to manufacture customized products without significant losses in efficiency. This would encourage investments in geographical proximity to target markets because a quick response to customer requirements

(rather than mere cost or quality considerations) would become the decisive competitive advantage. Even the labor-intensive apparel industry is in the process of relocating back, according to McKinsey & Company in its study "Is apparel coming home?" (Andersson et al., 2018).

Such assumptions are not entirely wrong, but flawed for two reasons: First, they depart from wrong assumptions about the scope of technology adoption and its consequences. Second, they omit the effects of digital network technologies that support a growing fragmentation of production – not reshoring. The main objective of this contribution is to counter this one-sided narrative by showing that digitalization does not solely entail opportunities for reshoring, but also facilitates further offshoring. Such a balanced view on the future of global production has important policy implications: neither should we expect an exodus of manufacturing from developing countries with potentially disastrous consequences for employment and development, nor are we witnessing the end of cost-driven offshoring and competition.



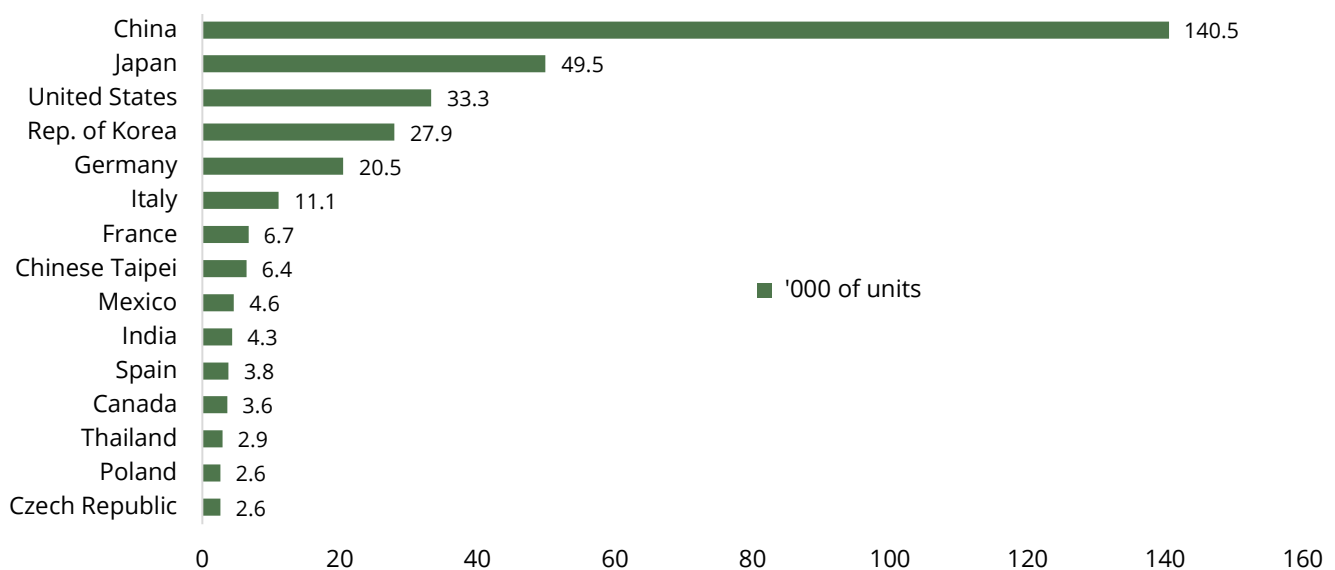
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Catch-up automation drives offshoring

A closer look at the effect of technological change shows that automation does not enhance the competitiveness of high-wage locations, but rather the one of emerging economies. It is a fact that the wage cost differential between the leading industrialized countries and the production locations in emerging economies, namely China, has been declining in recent years, Labour costs in China in 2005 were one-tenth of those in the US; today they are about one-third (Andersson et al., 2018). This is not related to technological change but, mainly a result of labor shortages, a rising tide of labor disputes, and general economic development. The attractiveness of offshoring manufacturing based on cost considerations thus has become much less attractive.

That said, the effects of automation are exactly the opposite as proponents of the reshoring argument assume: In Germany, the US, and Japan, for instance, automation is predominantly incremental. This means that there are hardly any leaps in automation (against the background of already highly automatized production) (Krzywdzinski, 2021). Science-fiction-like tales about “manless factories”, as always, ignite public imagination, but such approaches are scarce. There are many frictions concerning the actual return on investment (advanced automation is expensive), the need to adapt and readjust processes (which is burdensome), and the need for workers’ intuition and experience that becomes particularly relevant in the context of highly developed production models. ‘Industry 4.0’, if taken seriously beyond the fairy tale, is not about the substitution of work,

Figure: Annual installations of industrial robots, 15 largest markets, 2019



Source: World Robotics (2020)

but about data-based optimization of processes that help to raise productivity and to enhance the flexibility and responsiveness of enterprises.

In many emerging economies, however, automation is gaining speed. China, in particular, is by far the main recipient of industrial robots, accounting for roughly two-thirds of world consumption (see figure). The bulk of such investments is not advanced automation of the 'Industry 4.0' type at the technological frontier (which is much harder to implement). Rather, catch-up automation is the low-hanging fruit: devices that are up and running in advanced industrial countries for many years but have played a minor role in emerging economies because they were not yet affordable (Butollo & Lüthje 2017). The reason such automation equipment is being implemented now on a grand scale lies in the changing cost structure: automation equipment can now be bought relatively cheap, whereas the cost of labor has risen. The variables concerning the economic feasibility of automation have reversed!

The result is relative productivity gains on the part of the emerging economies – because the use of technology there meets operating costs that remain comparatively low. This particularly concerns locations with an intermediate cost structure close to the US, Europe, and Japan. In Eastern Europe, German lead firms are pushing suppliers to invest in automation equipment of a similar level of sophistication as in Germany (Schwarz-Kocher, Krzywdzinski, & Korflür 2018). Under these circumstances, from a German perspective, the pressure to relocate

is not decreasing but increasing. As a result of automation, companies in emerging markets can manufacture more productively while production costs remain comparatively low.

The IoT and AI make distributed manufacturing even easier

Recent technological breakthroughs do not mainly concern mechanical robotics anyway. It is mainly about connecting the internet with offline processes and using the data that can be detected by sensors to optimize them. Such methods can be used to improve the efficacy of distributed work processes in fragmented manufacturing networks, but also in distributed knowledge work. Not the only field of application, but probably one of the most relevant is the combination of e-commerce and logistics that has revolutionized retailing in recent years. The IoT and AI play a significant role in this. This can be observed, for example, in the way Amazon operates: the company can deliver products to consumers within the blink of an eye because it can anticipate the future behavior of customers based on the analysis of present-day buying behavior. Accordingly, the goods are distributed in advance to local department stores, from where they can be delivered quickly (Ulanoff 2014).

While there are major differences between online retailers serving private customers and the management methods used by large companies to coordinate their supply networks, elements of the approaches described above are also taking hold in the supply chain. Contract manufacturers

in the electronics industry, which act as world market factories for the major brand-name companies in the IT sector, have, for example, been organizing their manufacturing since the early 2000s in such a way that hubs for configuring products are set up near the target markets, while the actual manufacturing of the hardware takes place in Asia (Hildrum, Ernst, & Fagerberg 2011). The secret of these companies' success lies not only in the combination of high-tech and low wages but also in their sophisticated logistics networks, which minimize warehousing costs based on data monitoring and predictive analysis.

Both the combination of e-commerce/logistics nexus and the practices of digitized supply chain management are examples of how the objective of rapid responsiveness to differentiated customer demand does not necessarily require production networks to be located close to customers but is compatible with a global structure of production. And the story is not over: Alibaba founder Jack Ma claims that soon any product on earth can be delivered to any place on earth within 72 hours by his company (Hu, 2020). This might reflect the hubris that is typical for the shooting stars of the new tech companies, but it also should be taken seriously. It shows that a quick response to customers does not necessitate locating production facilities close to consumers: advanced logistics does the trick.

A multi-directional geographic reshuffling

As argued above, the reshoring narrative is flawed. At the same time, even if this is the case, there are reasons that make greater geographic integration of manufacturing and consumer markets seem likely. The interruption of supply chains during the early stages of the COVID19 pandemics demonstrates the risks of an overly complex, globalized, and time-sensitive production network. Currently, management strategists strive for enhanced resilience of operations, although it remains questionable whether this will lead to a significant retreat from global sourcing (Butollo, 2020). More relevant are geopolitical tensions: the current shortage of computer chips shows the perils of excessive dependence on imports (Tyson & Zysman 2021). And in the face of more severe trade restrictions, it might simply become a necessity for manufacturers to maintain a physical presence close to end-markets. In a multipolar world economy that is less polarized between rich countries as consumers and developing countries as manufacturing hubs (which never was that evident), the heydays of offshoring and globalization might be over. But the future most likely will see a complex reshuffling of the geographies of production in which tendencies of a geographic integration of manufacturing and consumption coincide with the opposite tendency of global fragmentation. New digital technologies play an important part in making the latter possible.

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What determines countries' global value chain participation? Three lessons from the past that matter for the future of global value chains



Ana Margarida Fernandes
World Bank

Countries participate differently in global value chains

In the early 1990s, Argentina tried to develop a homegrown auto industry, hiding behind an average tariff of more than 13 percent. Over the past two decades, Argentina's auto exports have stagnated at a dismal 0.2 percent of global auto exports.

employing 35 percent of its global staff. A decade ago, Vietnam barely exported electronics products.

What sets Argentina, Poland, and Vietnam apart is their very different participation in global value chains (GVCs). In fact, the meteoric rises of Poland and Vietnam and the faltering of Argentina are not unique. China's World Trade Organization (WTO) accession in 2001 ushered a new wave of GVCs which gave rise to "Factory Asia", while large parts of the Africa, South Asia, and Latin America regions are being left behind with little backward integration into GVCs (Figure 1). Backward GVC participation measures the import content of exports relative to total exports.²



Hiau Looi Kee
World Bank

Around the same period, General Motors (GM) set up GM Poland to import Opel cars for the large Polish domestic market. In 1994, production activities of GM Poland started, and today Poland is one of the world's major auto exporting countries.

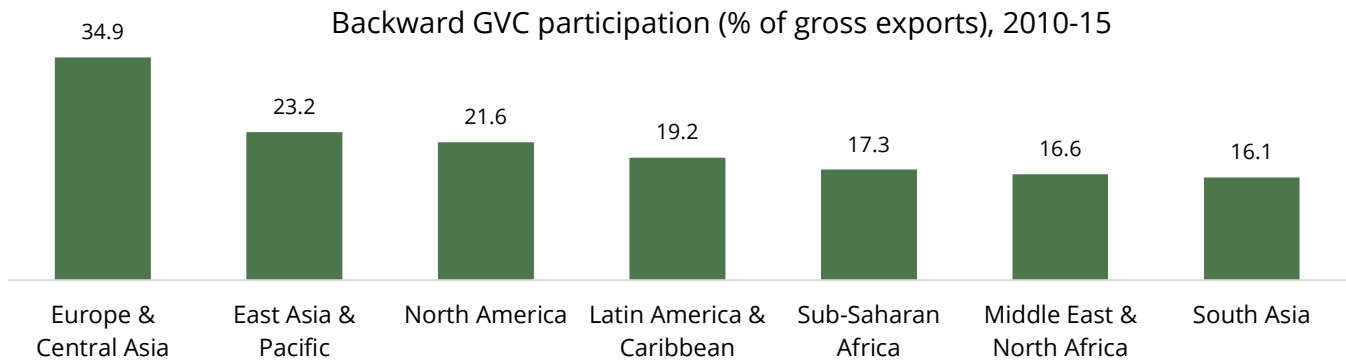
At the heart of GVC participation are the international fragmentation of production across countries and durable firm-to-firm relationships that promote access to capital and inputs along production chains.³ The efficiency gains and technology



Deborah Winkler
World Bank

Similar to the auto industry in Poland, Vietnam's electronics industry expanded sharply in less than a decade, fuelled by foreign direct investment (FDI). Today, Vietnam is the world's second largest smartphone exporter, producing 40 percent of Samsung's global mobile phone products and

Figure 1: Backward GVC participation varies across regions



Source: Fernandes, Kee and Winkler (forthcoming) based on data from Eora.

Note: Backward global value chain (GVC) participation measures the import content of exports relative to total exports. Averages shown cover the period 2010-2015.

diffusion within GVCs explain the boost to incomes and the reductions in poverty in the participating countries, as the examples of Bangladesh, China, and Vietnam illustrate.⁴ Empirical evidence across and within countries confirms that GVC participation fosters productivity, value-added, and growth.⁵

Given the positive developmental impacts of GVC participation, it is important to understand the factors that drive GVC participation.

What factors determine backward GVC participation across countries?

Our forthcoming article⁶ in the World Bank Economic Review studies the determinants of backward GVC participation based on a panel dataset covering more than 100 countries over the past three decades. The time period reflects the growing international fragmentation of production. The diversity of countries in all geographical regions and at

different stages of development makes the dataset uniquely suitable to estimate the relative importance of different determinants.

To address the challenges in establishing causality in a cross-country setting, we use both instrumental variables and difference-in-difference estimation approaches.⁷ We also undertake event studies to isolate the effects of trade and FDI liberalization episodes on GVC participation.

Our study finds that several factors increase backward GVC participation across countries, especially capital and skills factor endowments, smaller geographical distance to the GVC hubs (i.e., the distance to China, Germany and the United States), higher institutional quality, lower tariffs, and larger FDI inflows.⁸

Certain factors are shown to matter more strongly for GVC trade (i.e., trade flows by firms that use imported inputs for their exports) relative to traditional

trade (i.e., trade flows by firms that only export but do not use imported inputs).

Three lessons from the past that matter for the future of global value chains

In the current wake of supply chain disruptions due to the COVID-19 pandemic, increasing protectionism, and rising nationalism across the globe, we highlight three key lessons from our analysis that will continue to matter for the future of GVCs:

1. Keeping trade costs low is key

Countries at a greater distance from GVC hubs face a higher level of trade frictions and therefore trade costs. Our analysis finds that a shorter distance to the GVC hubs – China, Germany, and the United States – is positively correlated with backward GVC participation.

Geography and thus trade costs are shown to affect GVC trade more strongly than traditional trade. There are several explanations. First, due to the larger number of trade links in a GVC, performance is determined by the strength of the weakest link in the supply chain.⁹ Second, trade costs affect not only prices of export goods, as is the case for traditional trade, but also those of imported inputs in a GVC.

In the context of the ongoing supply chain disruptions during the COVID-19 pandemic, characterized by increasing shipping prices and longer lead times, these considerations are critical. Higher trade costs will be factored into prices with negative consequences for final consumers. Going forward, it is key to strengthen the resilience of GVCs by improving trade facilitation and

connectivity to keep trade costs low, which will be particularly beneficial to GVC participation in remote countries.

2. Trade and FDI liberalization matter

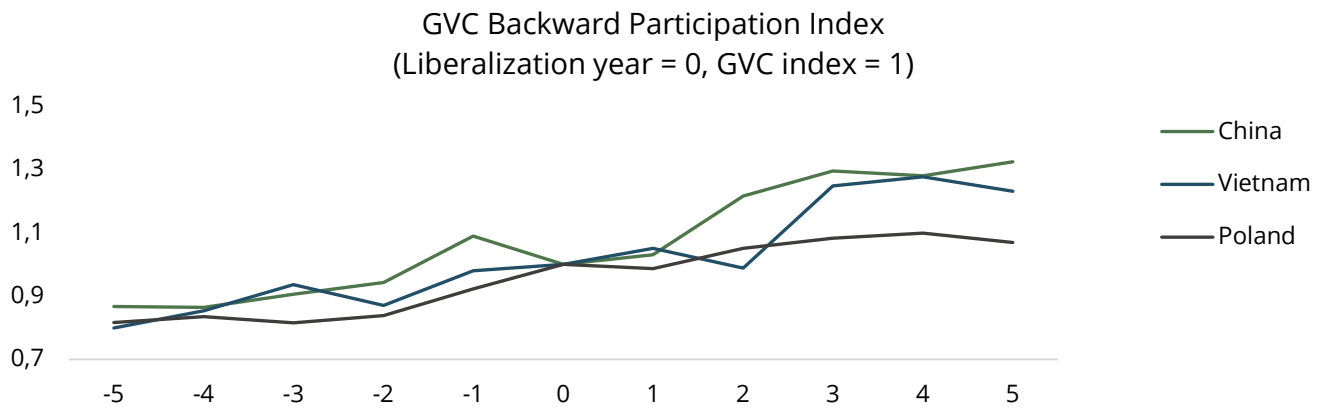
Our event studies find a clear upward trend in GVC participation following trade and FDI liberalization events due to WTO or European Union (EU) accession for a selection of countries.¹⁰ The evolution of the GVC index (which equals 1 in the liberalization year) from five years before to five years after such events suggests an upward trend after the event (Figure 2), while a pre-trend before the event is rejected econometrically.

Policy barriers on imports and exports, such as tariffs or quotas as well as non-tariff measures, increase trade costs, with consequences for countries' participation and positioning in GVCs. Our study shows that lower tariffs are significantly linked to higher backward GVC participation across countries and also across country-sectors. Our findings also highlight that tariffs affect backward GVC participation more negatively than traditional trade.

Countries can attract FDI to overcome relative scarcity of capital, technology, and knowledge, and thus integrate into GVCs. Our research confirms the positive effect of FDI inflows on backward GVC participation and the effect is stronger than on traditional exports. This suggests that most of what we capture is the role of export-oriented type of FDI in manufacturing.

These findings highlight that increasing tariffs and constraining FDI inflows have negative effects for countries' GVC participation and, ultimately, for firms, workers and consumers depending

Figure 2: Backward GVC participation increased before and after a trade and FDI liberalization event



Source: Fernandes, Kee and Winkler (forthcoming) based on data from Eora.

Note: The event year 0 is the year of the trade and FDI liberalization. The backward global value chain (GVC) participation index is equal to 1 in event year 0. The actual calendar years for the event are 2001 for China, 2004 for Poland, and 2007 for Vietnam.

on GVCs. Countries need to resist the urge to increased protectionism in order to strengthen the recovery and resilience of GVCs following the COVID-19 pandemic.

3. Reducing institutional quality is harmful

What distinguishes GVC trade from traditional trade are the intense firm-to-firm interactions characterized by contracting and specialized products and investment.¹¹ Weak contract enforcement is thus a significant deterrent not only for traditional trade, but even more so for GVC trade.

Our research confirms that better institutional quality is linked to higher backward GVC participation. Countries with stronger institutional quality have a comparative advantage in GVC participation of contract-intensive sectors.

The presence of relationship-specific investments (e.g., the customization of products) and the exchange of large flows of intangibles (such as technology, intellectual property, and credit) reinforces the potential role of institutional quality as a significant determinant of relational GVC participation.

In the current context of rising nationalism worldwide, as illustrated by the ongoing law battle between Poland and the EU¹², countries need to be aware that reducing institutional quality is harmful to their GVC participation. Countries could instead enhance their institutional quality by entering deep preferential trade agreements which cover legal and regulatory frameworks, harmonize customs procedures, and set rules on intellectual property rights.

Notes

- ¹ Baldwin (2016).
- ² Our paper relies on the backward GVC participation measure of Borin and Mancini (2019), which captures the import content of exports of a country, originally referred to as the vertical specialization index in Hummels, Ishii, and Yi (2001).
- ³ Antràs (2016, 2020).
- ⁴ World Bank (2019).
- ⁵ Constantinescu, Mattoo, and Ruta (2019); World Bank (2019); Stolzenburg, Taglioni, and Winkler (2019); Pahl and Timmer (2020). At the firm level, considering firms that import intermediate inputs and export as participating in GVCs, the evidence clearly shows that they benefit in terms of higher productivity, capital intensity, and employment relative to firms that engage only in exports (Muûls and Pisu 2009; Wagner 2012; Kasahara and Lapham 2013; World Bank 2019; Banh, Wingender, and Gueye 2020).
- ⁶ Fernandes, Kee and Winkler (forthcoming).
- ⁷ We use instrumental variables estimation to address the potential endogeneity of trade liberalization and FDI in the cross-country regressions. Our paper also uses a difference-in-difference framework following Rajan and Zingales (1998) for cross-country cross-sector regressions to sidestep endogeneity concerns for other determinants, such as endowments or institutions.
- ⁸ The choice of determinants of GVC participation draws heavily on Antràs (2020) and World Bank (2019).
- ⁹ Antràs (2020).
- ¹⁰ For readability, we only show three countries in Figure 2, while our analysis covers seven countries.
- ¹¹ Antràs (2016, 2020).
- ¹² <https://www.france24.com/en/europe/20211027-eu-court-fines-poland-1-2-million-per-day-as-rule-of-law-row-escalates>

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Green hydrogen: Opportunities for industrial development through forward linkages from renewables¹



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Green hydrogen will be a key element in any decarbonisation strategy. All major economies are investing heavily in green hydrogen, and often also in international energy partnerships to secure long-term imports. This creates new opportunities for industrial development. Countries which are well-endowed with renewable power sources can induce investments in electrolyser plants and related methanol and ammonia industries, which then offer low cost inputs for energy-intensive industries (steel, aluminum, base chemicals, fertilisers) and manifold downstream industries that use green steel or chemical feedstocks. To actually build such renewables-based value chains requires proactive industrial policies.

The fuel of the future

Almost all countries have committed to decarbonizing their economies in the coming decades. Likewise, many large corporations announced plans to cut their carbon footprints to net-zero. This requires a massive upscaling of

renewable power – not only to replace fossil fuel-based power plants, but also for the purpose of electrifying a wide range of end-uses, including road and rail transport, heating and cooling. Moreover, a considerable share of the renewable energy will have to be dedicated to the production of green hydrogen to substitute fossil fuels in “hard-to-abate” activities that cannot be easily electrified. This applies mainly to the production of steel, base chemicals and cement as well as for aviation, shipping and long-haul trucking.

Demand for green hydrogen is therefore expected to expand rapidly. According to IRENA’s (2021) 1.5°C Scenario, demand for hydrogen will amount to 74 EJ, 21% of the world’s total final energy consumption, by 2050, of which two-thirds will be for green hydrogen. Many governments and large corporations have recognized the strategic importance of green hydrogen and started to invest heavily.

Green hydrogen is still expensive, about twice as much as grey hydrogen. At its current cost, it cannot compete with hydrogen produced with fossil fuels, but this is expected to change for three reasons: First, carbon pricing increases the cost of alternative fossil fuels, and public and private standards

are making the use of low carbon alternatives compulsory; second, global average prices of renewable power are rapidly decreasing – by 80% since 2010; third, technological innovation and economies of scale are expected to substantially reduce the cost of electrolyzers and improve the efficiency of renewable energy conversion. According to Strategy@ (2020), green hydrogen will already in 2030 be cheaper than blue and competitive with grey hydrogen. In 2050, it will be clearly the lowest cost option. IRENA (2020a) calculates the same trend for green hydrogen generated using solar or wind resources compared to blue hydrogen (Fig. 1). Several large corporations have set the target of producing green hydrogen at \$1-2/kg already in 2025.² It should be noted, however, that such calculations are fraught with uncertainties, as they make assumptions about global policy driving carbon prices up and electrolyser technology becoming considerably cheaper.

Green hydrogen as an opportunity for industrial development

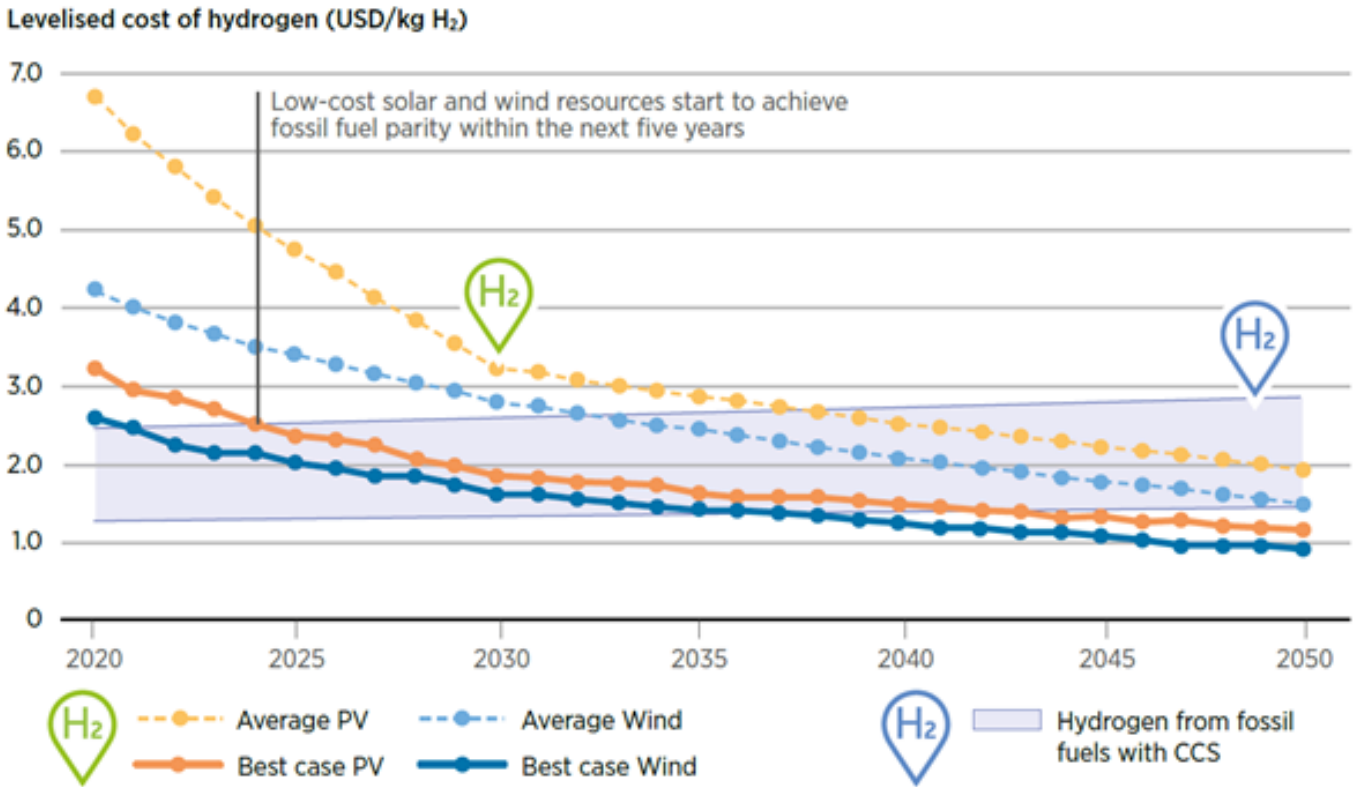
Countries with abundant solar, wind and geothermal power endowments are likely to benefit the most from the

The main ‘colours’ of hydrogen

Hydrogen is obtained from electrolysis of water. The required energy can be produced from a variety of sources. Grey hydrogen is derived from natural gas and produced from fossil fuels and associated with high CO₂ emissions. Blue hydrogen is based on the same process, but here up to 90% of emissions are trapped using carbon capture technologies. Green hydrogen is derived from renewable energy sources and therefore the only carbon free version of the gas, but blue hydrogen is also expected to play a role, until sufficient clean electricity becomes available for the worldwide decarbonisation of industries.

Figure 1: Hydrogen price trends

Green hydrogen production costs: Approaching competitiveness with blue hydrogen
Hydrogen production costs from solar and wind vs. fossil fuels with carbon capture and storage, 2020-2050



Note: Electrolyser costs: 770 USD/kW (2020), 540 USD/kW (2030), 435 USD/kW (2040) and 370 USD/kW (2050). CO₂ prices: USD 50 per tonne (2030), USD 100 per tonne (2040) and USD 200 per tonne (2050).

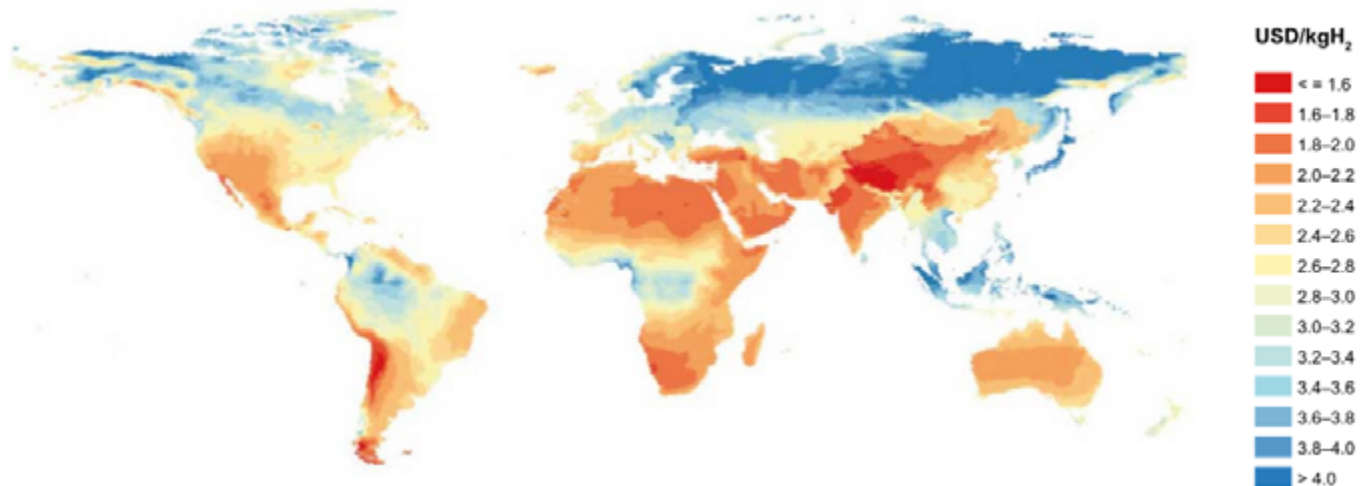
Source: IRENA (2020a).

new industrialization paths derived by the shift to green hydrogen. This is good news for many low- and middle-income countries as IEA (2019) estimates that the most attractive sites for producing green hydrogen on the basis of solar and wind energy are located in Africa, the Middle East, Southern Asia and the Western parts of South America.

There are **four main channels** through which green hydrogen can, directly or indirectly, **spur industrial development** along a range of “renewable energy => hydrogen => steel or chemicals => downstream industries” value chains.

1. Replacing fossil fuels in the power sector requires enormous **investments in renewable power**. Demand for green hydrogen stemming from the hard-to-abate economic activities further increases the demand for renewable energy. Thus, solar and wind farms, geothermal and hydropower projects as well as the use of biomass will attract enormous investments in favourable locations. Countries with the right factor endowments that also manage to improve the techno-institutional capabilities required to run power projects efficiently will greatly benefit from

Figure 2: Hydrogen costs from hybrid solar PV and onshore wind systems in the long term



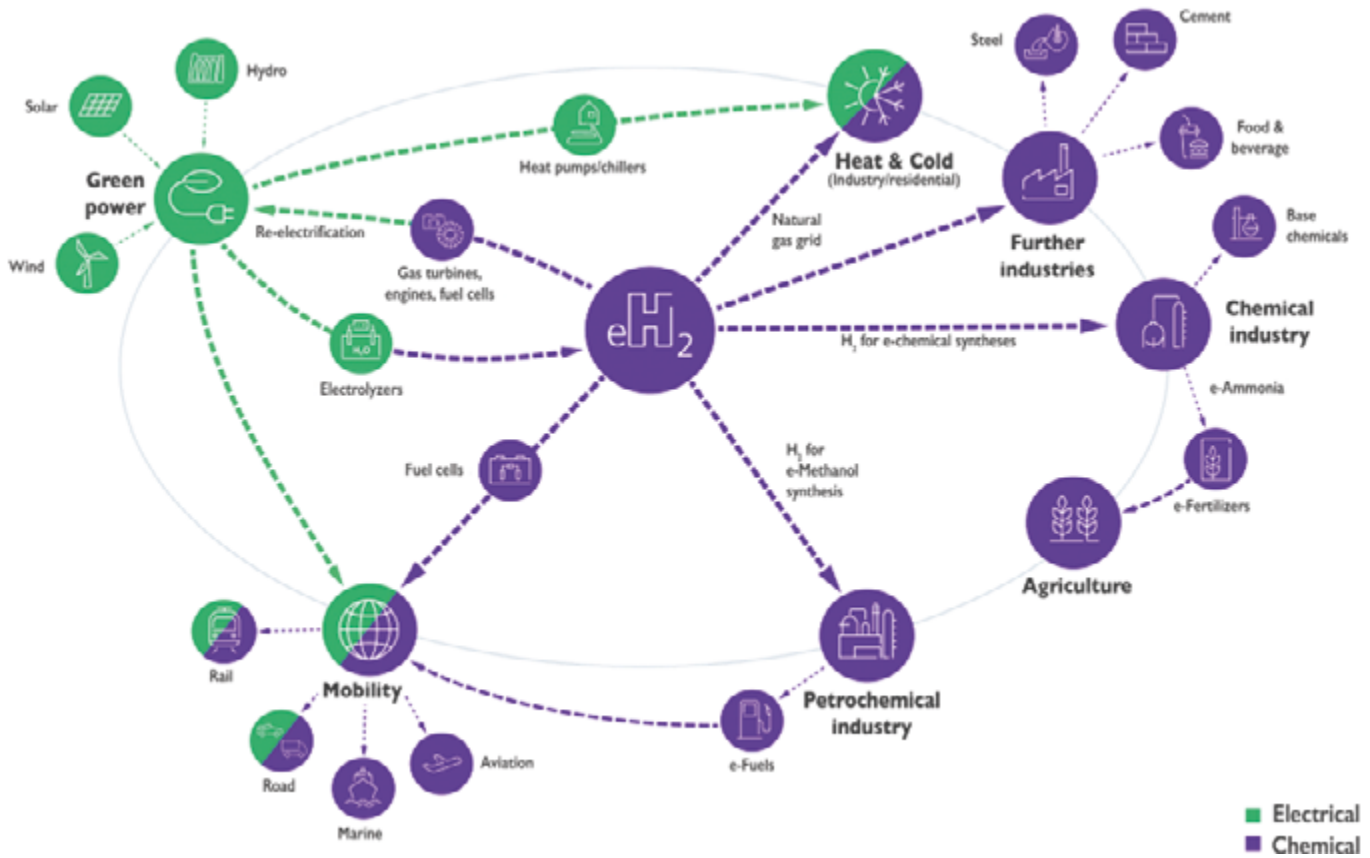
Source: IEA (2019)

the expected demand boom. Some may also become competitive in the manufacture of parts and components, in related technologies such as smart grids and energy storage as well as in financial and project management services.

2. The conversion of renewable power into green hydrogen requires **investments in electrolysers**. While green hydrogen can be easily stored and used directly in some industrial processes, it needs to be converted into higher energy density products (such as methanol or ammonia) for other processes and easier storage and transportation. Figure 3 shows the manifold industrial linkages of renewable power and green hydrogen.
3. Countries which achieve abundant production of renewable power, green hydrogen and its derivatives at low cost, will inevitably become attractive for a range of **energy-intensive industries including the steel, chemical and cement industries**, which in turn provide the inputs for many downstream

- industries, from automotive to pharmaceutical and fertilizer industries. As pressure to decarbonize increases, availability of renewables and green hydrogen becomes an important pull-factor for the relocation of industries. This “renewables pull” (SCI4climate.NRW 2021) can already be observed in the automotive industry, where aluminum parts and carbon fibers are in some cases sourced from low-cost locations for renewable power.
4. Advanced innovation systems and industry 4.0 technologies can help countries overcome the costs and inefficiencies associated with green hydrogen production while exploiting the growing market for **hydrogen-based technology exports**. This includes markets for fuel cell technology, hydrogen-based steelmaking technologies, tankships and synthetic fuels using a range of digital solutions such as big data analytics, digital twins, sensing, artificial intelligence and block chain-based traceability systems.

Figure 3: Industrial linkages of renewable power and green hydrogen



Source: Own, adapted from Siemens Energy

Industrial development through forward linkages from renewables: strategy matters

The trend is clear: Green hydrogen will be a key element of the future global economy. Governments, industry and other stakeholders need to find out how they can adapt their industrial development strategies to the new framework conditions. This not an easy task, and it requires multi-stakeholder strategies (ESMAP 2020).

Societal stakeholders need to identify which of the various value chains outlines above can be exploited in line with their factor endowments,

geographical advantages and technological capabilities. Each value chain requires different investments in renewables, electrolysers, grids, ports and pipelines. Taking the right decisions is complicated primarily driven by uncertainty of prices and technologies. Demand for green hydrogen depends on a range of political decisions in major economies: on the level of carbon prices, support of renewable energy deployment, acceptance of alternatives such as carbon capture and storage and nuclear energy, willingness to adopt protectionist measures as well as geopolitical considerations about energy security. All these factors may accelerate or decelerate the demand.

Also, green hydrogen deployment depends on complementary large-scale investments in new technologies, for example tankships, thereby creating uncertainty about transport options and costs. If countries wish to exploit renewable energy and green hydrogen to attract energy-intensive industries, they need to consider a wide variety of factors affecting the choice of location for these industries, from inter-industry linkages and availability of qualified work force to investment climate issues. Importantly, safeguards are needed to ensure that green hydrogen industry development does not exacerbate existing water scarcity or land use conflicts and that industry demands and exports do not undermine electricity supply for private consumption. Thus, a range of new regulations need to be adopted, and countries need to join international initiatives to develop common safety and environmental standards.

An increasing number of countries are developing green hydrogen roadmaps and strategies. Most industrialised countries will be net importers of green hydrogen. Their strategies aim to decarbonize their industries, secure the import of green hydrogen, shield their industries from unfair competition from countries with less ambitious decarbonisation policies, and exploit early mover advantages. Some countries – Australia, for example – are home to energy-intensive industries and with plentiful renewable power sources.

Those countries are particularly well-positioned to reap early mover advantages in green hydrogen.

For many developing countries, green hydrogen is a promising export option. Those countries usually have smaller domestic industries demanding green hydrogen, but many are endowed with abundant renewable energy resources and large areas of barren land. An increasing number of potential exporters are also developing green hydrogen strategies, including Chile, Uruguay, South Africa, Brazil, Saudi Arabia, Ukraine, Turkey, Vietnam and Morocco (IRENA 2020b). The strategic choice here is whether to envisage green hydrogen as a new export commodity (corresponding to our channels 1 and 2) or a stepping stone towards the development of complex industrial value chains (channels 3 and 4). In the first scenario, countries well-endowed with solar, wind and other renewable power resources encourage investments energy parks, electrolysers and related feedstocks as well as the required export infrastructure, including pipelines and ports. Such investments, if managed well, may boost export revenues; yet, they tend to be capital-intensive, with very limited effects in terms of employment creation and technological learning. In the second scenario, governments see low-cost renewable power and green hydrogen as the basis for creating industrial clusters and value chains with higher value added.

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Notes

¹ A modified version of this blog has been published on UNIDO's Industrial Analytics Platform: <https://iap.unido.org/articles>

² <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/experts-explain-why-green-hydrogen-costs-have-fallen-and-will-keep-falling-63037203>



Vinícius Mendonça / Ibama

Brazil exports illegal gold: How to tackle the problem

Brazil exported over 19 tons of illegal gold in 2020, exposing the markets of Canada, Switzerland, the United Kingdom, and others to the impacts illegal activities bring especially to the Amazon rainforest and indigenous peoples. Adequate controls of gold origin are non-existent in the country enabling fraud schemes that allow illegal gold to be sold on the formal market. Because of this, it is urgent to implement a traceability system in Brazil to track gold origin and its legal, environmental, and social compliance. Importing countries play a vital role in this process and are urged to demand action from Brazilian authorities to enhance controls and to implement traceability practices for their imports.

Illegal gold mining in Brazil is an old problem. With gold prices skyrocketing in recent months because of investors' reactions to the Covid-19 pandemic, the issue has only become worse (Tollefson, 2021). A new gold rush has started in the Amazon rainforest, but not without leaving behind a trace of destruction and invasions of Indigenous Lands and Conservation Units.

The result: Brazil exported 111 tons of gold in 2020, and out of that total, 17% (or 19.123 tons) were illegal, since the gold production was not registered or lacked authorization (Instituto Escolhas, 2021a). Importing countries such as Canada, Switzerland, the United Kingdom, among others, were exposed to the risk of illegality.

Calculations based on official data show that Brazil produced only 92 tons of gold in 2020, although exports reached 111 tons. This means 18.638 tons were unaccounted for in production records. Moreover, among the registered production, 485 kg were mined without permits in Mato Grosso and Pará states. Thus, a total of 19.123 tons of gold exported lacked known origin or authorizations (Instituto Escolhas, 2021a).

The illegal gold was exported mainly by the states of Minas Gerais, São Paulo, Amazonas, the Federal District, and Goiás. This assumption is based on the fact that those states did not produce a single gram of gold or exported much more than their production,



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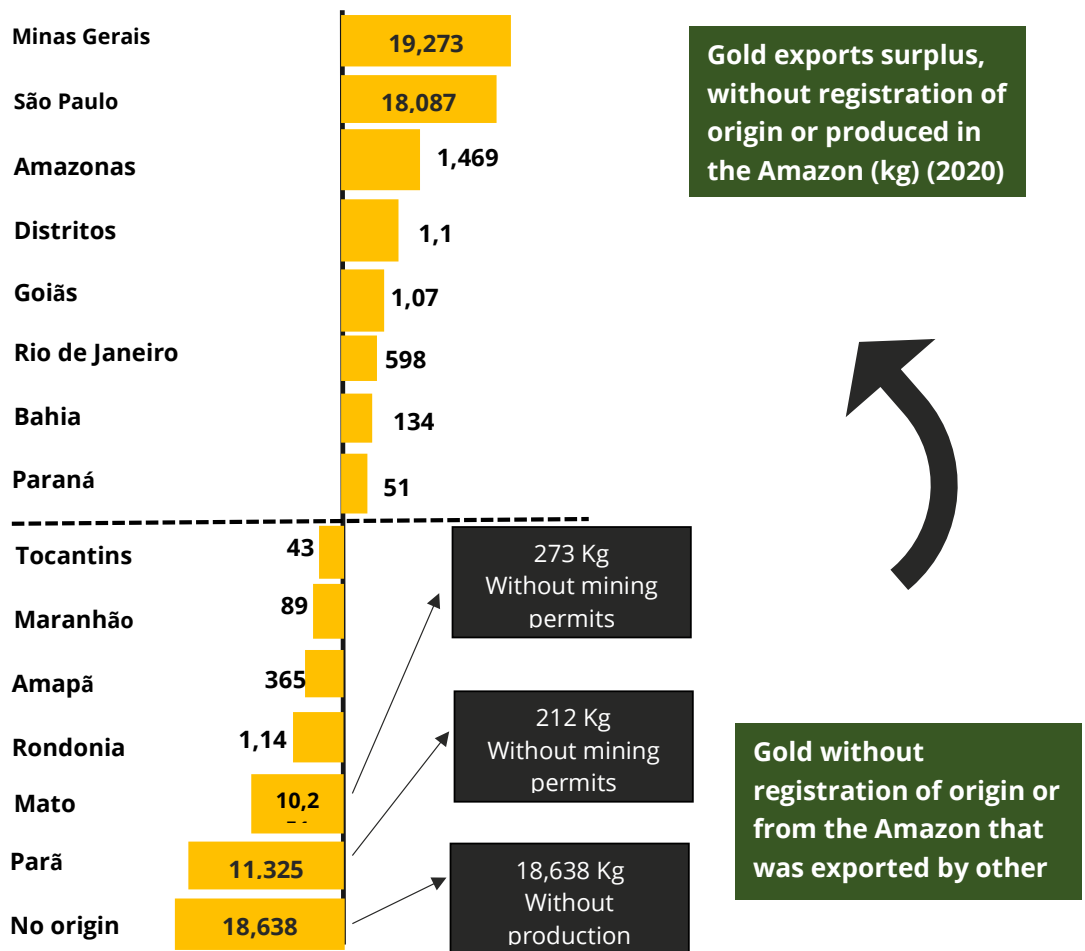
suggesting they were exporting illegal gold or gold mined in states in the Amazon region.

This conclusion was based on a thorough examination by the Instituto Escolhas' research team of production and exports of gold in each Brazilian state based on official databases and modelling. And a clear pattern was found: states in the Amazon region produced much more gold than they exported, while states in other regions, mainly in the Southeast, exported much more gold than they produced.

That is, the surplus exports of the latter included illegal gold, as well as a share of the gold that was produced in the Amazon.

São Paulo state, the second-largest exporter of gold in Brazil, did not produce any gold in 2020. Therefore, 100% of its exports were contaminated by illegal gold. Minas Gerais state, the largest producer and exporter of gold in Brazil, was also not free from contamination, since 37% of its exports were not produced in the state itself (Instituto Escolhas, 2021a).

Figure: In 2020, some states exported surpluses contaminated with illegal gold or gold from the Amazon



Source: Instituto Escolhas, 2021a.

These results mean that the importing countries, which bought gold from Pará and Mato Grosso and other Brazilian states with export surpluses, are contaminated by illegal gold and gold produced in the Amazon.

The top destinations for Brazilian gold are Canada, Switzerland, and the United Kingdom. Also, gold is the main product traded between Brazil and these countries, representing 44% of the bilateral trade with Canada, 74% with Switzerland and 25% with the United Kingdom (Comex Stat, 2021). In 2020, Canada bought from Brazil US\$ 1.9 billion (41 tons) of gold and most of it from Minas Gerais state (54%), followed by São Paulo (15%). Switzerland bought US\$ 1 billion (20 tons) mainly from Bahia (28%), Minas Gerais (22%), Mato Grosso (18%), São Paulo (10%), and Pará (9%) states. The United Kingdom bought US\$ 645 million (11 tons) mainly from Minas Gerais (80%) and Goiás (20%), but also in small quantities from São Paulo and Amazonas states (Comex Stat, 2021).

All these big importing countries are exposed to the risk of illegality as they sourced gold either from Pará or Mato Grosso states or from states with export surpluses, such as Minas Gerais, São Paulo, Bahia, and Amazonas.

Illegal gold mining problems have only intensified

In the Amazon, environmental and social challenges around illegal gold mining are well-known. They include deforestation, mercury contamination, and violence. Deforestation levels associated with mining activities alone have increased in the Amazon 5 times

over the last 5 years. They rose from 18 km² in 2015 to 100 km² in 2020, with 82% happening in the state of Pará (INPE, 2021).

Also, although mining activities are not allowed in Indigenous Lands and in various types of Conservation Units, gold mining research requests inside these territories have grown recently, following the private sector's claims to allow exploitation in these areas.

Currently, there are 6.2 million hectares of land covered by gold mining research requests within Indigenous Lands and Conservation Units in the Amazon (Instituto Escolhas, 2021b). That is an area twice the size of Belgium.

This situation intensified with Bill 191/2020, presented by the federal government to Congress to allow mining inside Indigenous Lands, despite the indigenous peoples' resistance and the fact that gold mining would not bring socioeconomic development to these communities, although the government saying it would (Instituto Escolhas, 2021c).

Lack of control is an incentive for fraud schemes

The truth is that illegal gold coming from Indigenous Lands and Conservation Units in the Amazon already circulates in the formal market. This happens because adequate controls are nonexistent in Brazil. Fraud that allows illegal gold to be sold in the formal market – a scheme known as 'gold laundering' – have already been uncovered by investigations and reported through judicial actions (MPF, 2021).

These schemes happen when garimpeiros (wildcat miners) sell illegally mined gold to financial institutions known as Securities Distributors (or DTVMs, in Portuguese). By law, these institutions are the only ones allowed to buy gold from garimpos (wildcat mines) (Law nº 12844/2013). In addition, the law states garimpeiros need to fill out a form – sometimes only on paper – specifying where the gold comes from. However, this is a self-declaratory process, garimpeiros are not required to present documents proving the origin of the gold. By law, this process is based on the good faith of the sellers.

Usually, illegal miners simply state that their gold came from a legal mine. No one verifies if the gold came from that mining site or from an Indigenous Land, for instance. The purchase is finalized, no questions are asked, and the illegal gold becomes legal, entering the official market and leaving almost no trace behind of its illegal origin.

How to tackle the problem?

Due to insufficient controls and considering that Brazil exports illegal gold in large quantities, it is urgent to adopt a traceability system for gold in the country. What is needed is a system to track the origin of gold and its environmental and social compliance, as well as a ban on the commercialization and export of illegal gold.

There are initiatives that could be prioritized, such as Bill 836/2021, which is currently under discussion by the Brazilian Senate. The Bill provides the basis for more effective control of gold commercialization by establishing that sales would be conditioned on proof of origin and environmental licensing of

mining sites, as well as documents for the transportation of gold. In addition, it establishes that commercialization should be based on electronic invoices and that all documentation should be linked to electronic databases.

For a traceability system to be implemented in Brazil, since the government fails to be proactive, importing countries play a vital role as large-scale consumers of Brazilian gold. Considering gold is Switzerland's, Canada's, and the United Kingdom's top import from Brazil it is crucial for them to act, along with other countries, as illegality is high. It would be important for these countries to demand that Brazilian authorities implement such a system and to condition their imports to traceability practices.

Currently, Brazil is not included in the list of Conflict-Affected and High-Risk Areas (CAHRAs) accompanying the EU Conflict Minerals Regulation that establishes due diligence obligations for gold, tin, tantalum and tungsten imports. The immediate inclusion would help signaling the risks of Brazilian suppliers and the need for supply chain monitoring.

It would also be necessary to strengthen the standards for minerals responsible supply chains set by the Organisation for Economic Co-operation and Development (OECD) (OECD, 2016). OECD's guidance indicates companies should either adopt traceability systems or identify upstream actors in their supply chain. The latter, however, would not be sufficient to prevent illegal exports from Brazil, as gold transactions may occur through intermediaries. A weak local law enables fraud schemes to hide the illegal origin of gold during its commercialization

between garimpeiros (wildcat miners) and financial institutions (securities distributors). Also, there is no way to know if big mining companies trade gold from other mining sites other than their registered ones.

Another opportunity to strengthen controls is the Environment Bill under discussion in the United Kingdom parliament. The bill establishes companies must implement a due diligence system for “forest risk commodities”. However, minerals are not included among them when they should be, considering mining

impacts on forests and biodiversity. Further, due diligence systems should expressly include traceability methods. The bill would also be more effective if it classified high socioenvironmental risk countries, such as Brazil.

Tracking gold origins and its legal and environmental compliance from the mining site to the exports is the only way importing countries can disassociate themselves from illegal gold, while supporting local efforts from civil society to end the violence and destruction that inflicts the Amazon rainforest and its people.

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geralt / pixabay.com

Rethinking social upgrading in global value chains around worker power



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The concept of ‘social upgrading’ has been instrumental in bringing the situation of workers in export sectors across the global South to the fore in research on global value chains (GVCs) and global production networks (GPNs). Responding to accusations of ‘labour-blindness’ (Taylor 2007), scholars in the field defined social upgrading as the “process of improvement in the rights and entitlements of workers as social actors” (Barrientos et al. 2011, 324). It includes measurable standards – tangible aspects such as wage levels, contractual terms and working hours – and enabling rights, which refer to freedom of association, non-discrimination, voice and empowerment. While this was a welcome move, and has spawned many case studies, the concept has been criticized for insufficiently theorizing how and why social upgrading occurs (Selwyn 2013). To contribute to rectifying this, we propose a reconceptualization of social upgrading around worker power. We apply this approach to the case of the garment sector in Cambodia to understand how strike action, understood as an outcome

of shifting state-labour relations and reflective of intersections of worker identities, was a causal factor for social upgrading. Our findings contribute to a more comprehensive understanding of the processes of social upgrading.

A reconceptualization of social upgrading around worker power

In so doing, we build on a stream of GVC/GPN research that treats workers as agents with the capacity to shape their own situation and the dynamics of globalization, more broadly (e.g. Coe and Jordhus-Lier 2011; Selwyn 2013; Newsome et al. 2015). A common starting point for unpacking such agency is the distinction between associational power, which stems from the ability to mobilize collectively, and structural power, arising from positionality in the economic system and the capacity it provides for disrupting accumulation (Wright 2000). The latter can be broken down into marketplace bargaining power, a result of tight labour markets, and workplace bargaining power, which accrues to workers who occupy strategic spots

or chokepoints in production (Silver 2003). These distinctions and their linkages can usefully be integrated with insights from economic geography, situating agency at the intersection of a 'vertical' and a 'horizontal' dimension of GPNs (Neilson and Pritchard 2009). While the vertical dimension represents transnational structures and relationships such as inter-firm governance, competition among suppliers or transnational

civil society campaigns, the horizontal dimension describes the ways in which workers are embedded in particular locations and institutional contexts. Foregrounding workers' struggles, and the various ways in which structural and associational power articulate along these horizontal and vertical dimensions as shown in the table, can offer an understanding of the causal processes of social up- and downgrading.

Table: Conceptualizing worker power in GVCs

	Associational	Structural
Vertical dimension	<ul style="list-style-type: none"> • Transnational organizing and activism • Cross-border alliances with trade unions or NGOs and multistakeholder initiatives • 'Upscaling' of conflicts to trigger 'boomerang' via lead firms, states or other actors 	<ul style="list-style-type: none"> • Workplace bargaining power: Strategic positionality in GVCs; capacity to disrupt accumulation in/ via GVCs • Marketplace bargaining power: Competitive dynamics of regional and global labour markets
Horizontal dimension	<ul style="list-style-type: none"> • Workers' capacity to mobilize, through formal or informal channels • Alliances with NGOs, communities and other social movements ('social movement unionism') 	<ul style="list-style-type: none"> • Workplace bargaining power: Strategic positionality in firms and industries; capacity to disrupt accumulation in/via local and national economies • Marketplace bargaining power: Unemployment and underemployment in local labour markets; possession of scarce skills (skill intensity); alternative employment and survival
State-labour relations Strategic selectivity inscribed in state institutions + social basis of state power	<ul style="list-style-type: none"> • Industrial relations framework • State orientation, mediation and intervention in capital-labour relations 	<ul style="list-style-type: none"> • State policies on e.g. labour markets, migration, social protection, education, agriculture and land • Workers' capacity to provoke intervention of, and wrest concessions from, the state
Worker identities Intersections of social hierarchies + interlinkages between spheres of production and reproduction	<ul style="list-style-type: none"> • 'Classes of labour', workforce segmentation and obstacles to solidarity • Labour control based on social hierarchies (e.g. gender or migrant status) • Multidimensionality of worker identities as basis for mobilization 	<ul style="list-style-type: none"> • Segmentation and fragmentation of workforces along hierarchical lines • Reproductive work burden • Co-constitution of labour regimes by productive and reproductive spheres

Source: Marslev et al. (2022).

Yet, we call for a deeper theorization of the places in which GVCs ‘touch down’ at the local scale, emphasizing two aspects that play out largely at the horizontal dimension: state-labour relations and the intersectionality of worker identities. First, ‘the state’ regulates worker power in fundamental ways but was for long consigned to the margins of GVC/GPN research (Werner 2021). We propose a strategic-relational approach to viewing the state as a complex social relation and a key arena of social conflict (Jessop 1990). The nature of state-labour relations is critical for understanding how and why states regulate, mediate and intervene in capital-labour conflicts, and what opportunities and constraints workers in GVCs face in seeking concessions from suppliers, lead firms or the state itself. State strategies towards trade unions and NGOs, for instance, set the parameters for workers’ associational power; and policies on migration, social protection, education and other areas regulate labour supply, with bearings on workers’ structural power.

Second, workers’ identities are complex and multi-dimensional, as class is interwoven with other social categories such as gender, race, age, nationality, ethnicity and community, interlinking the spheres of production and reproduction, which feminist scholars have pointed out for a long time (e.g. Mezzadri 2020; Bair 2010). Such an intersectionality perspective is useful to understand not only the differentiated outcomes for different types of workers in GVCs but also how worker power is confronted by a wider array of social relations beyond production. For instance, supplier firms adjust to pressures from lead firms by creating fine-grained stratifications

among their workforces linked to differences (e.g. gender, ethnicity or migrant status), which is the basis for differential schemes of remuneration and working conditions. Yet, these positionalities can also inform shared identities and collective consciousness among workers as a basis for labour activism in GVCs (Carswell and De Neve 2013).

The case of the garment industry in Cambodia

Our reconceptualization of social upgrading can be illustrated by the case of the garment industry in Cambodia. After a long phase of social downgrading – with falling real wages, a boom in temporary contracts and a wave of mass faintings – workers saw their nominal minimum wage (measurable standards) double between 2012 and 2015; and by 2019, their real minimum income was twice as high as in 2012 (Marslev 2019). In terms of enabling rights, however, the situation deteriorated. While Cambodia had a progressive labour law and a unique social clause in its past trade agreement with the US, which led to the comprehensive Better Factories Cambodia programme, it made it into the ITUC’s top 10 of the “world’s worst countries for workers” in 2016 (ITUC 2016).

The steep wage hikes were triggered by an unprecedented strike wave in the garment sector as shown in the figure that culminated in a sector-wide strike in December 2013. This exercise of associational power had important ‘horizontal’ and ‘vertical’ dimensions. Horizontally, strikes were characterized by an unusual unity in an otherwise fragmented union movement and supported by a broad coalition of

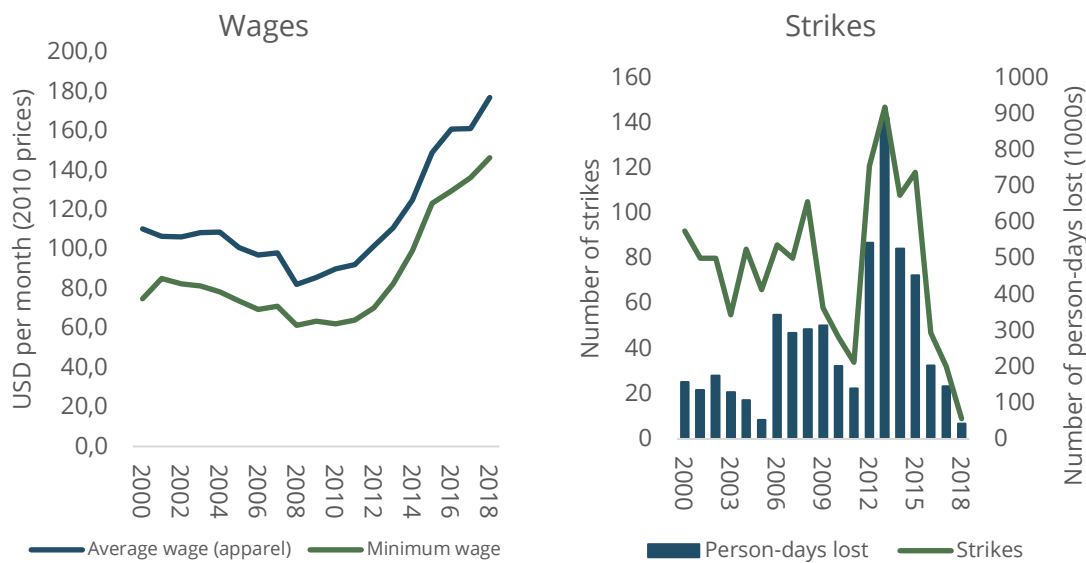
occupations, social movements and the political opposition (Arnold 2017). Vertically, images of workers killed during a police crackdown of the strike forced global brands and retailers to intervene, a ‘boomerang’ process that heightened pressure on employers and the government (Merk 2009). These events did not just lead to immediate wage gains but also institutionalized subsequent concession through a new, annualized wage-fixing mechanism. In parallel, however, employers and the government took measures to curb workers’ associational power, including a controversial trade union law in 2016, legal harassment and anti-union tactics that led to a decline in strike activity (Marslev 2019).

The measurable gains in the 2012-2014 strikes were also secured against the backdrop of shifts in workers’ structural bargaining power. Due to a number of processes, including a reduction of a post-Khmer Rouges baby boom,

deteriorating garment wages vis-à-vis alternative employment and an inflow of investors escaping rising wages in China, factories experienced the first labour shortages, leading to a rise in workers’ marketplace bargaining power. Unions – in collaboration with transnational activist networks – targeted factories, where workers enjoyed higher workplace bargaining power, and sought concessions from suppliers with reputation-sensitive buyers. This helped drive a wedge into the united employers’ front against worker concessions (Marslev 2019).

Our framework, however, also brings attention to the ways in which the outcomes for garment workers were shaped by state-labour relations, and thus deeply entwined in domestic politics. The strike wave fed into the greatest challenge to Prime Minister Hun Sen and his Cambodian People’s Party (CPP)’s strong powerbase in rural areas from which many garment

Figure: Strike activity and wages in Cambodia’s garment sector



Source: Minimum wages: Ministry of Labour and Vocational Training. Wages: Ministry of Commerce. Wages are deflated by CPI (2010=100) from data-bank.worldbank.org. Strikes and person-days lost: GMAC; updated for 2016-2018 from BFC (2018); 2018 as of 31 August.

workers originate. After two decades, the garment workforce had become a decisive bloc – representing almost a tenth of voters – and promises by the political opposition of higher minimum wages during the 2013 election led to a near-defeat of the ruling party. Although the CPP stayed in power, the threat became acute in December 2013, when opposition protests and garment strikes converged into a mass movement. In this light, the material concessions since 2013, and Hun Sen’s charm offensive in the 2018 election, which was won after dissolving the opposition, emerged as bids to secure the ‘garment vote’; and the crackdown as an attempt to break the alliance between independent unions and opposition forces (Marslev 2019).

The power of Cambodian garment workers, moreover, is conditioned by intersections of class, gender, family and rural-urban relations. For many families, sending female members to work in urban areas is part of “trans-local” livelihood strategies. Women are not just expected to shoulder the bulk of household work, but to take economic responsibility by remitting back much of their incomes; a dual burden that generates a deep fear of unemployment and dissuades many from engaging in activism (Salmivaara 2020). In the 2012-14 strikes, however, these social structures also became instrumental in exercising associational power: workers’ action was encouraged by rural families who – in the context of pressures on family farming, including falling rice prices, rising costs of fertilizer and heavy floods – had material stakes in higher garment minimum wages, and mobilization spread through extended family networks. Garment workers “protest[ed] not only for themselves

but as the representatives of a wider household structure” (Lawreniuk and Parsons 2018, 33).

Conclusion

Analysing social upgrading as the outcome of the exercise of – and shifting sources of – worker power, as illustrated by the case of Cambodia, not only provides a more realistic assessment of how and why social upgrading occurs; it also brings attention to the complex power dynamics that underpin – and sometimes contravene – institutional attempts to ameliorate poor working conditions, offering valuable nuances to governance-based approaches to social upgrading. While the case presented above involved a major strike wave and visible capital-labour conflict, we argue that our reconceptualization can also be applied to contexts where worker struggles manifest themselves in more covert ways or where capital-labour conflict is channelled into more negotiated and institutionalized forms. The case, further, shows that social up- and downgrading can go hand in hand, as workers achieved minimum wage increases and new wage-setting frameworks, but at the cost of rising work intensity and a backlash on enabling rights. This is related to the counterstrategies of firms and the state that need to be conceptualized along worker power in GVCs. Our conceptual approach contributes more broadly to GVC research on understanding power more comprehensively through interactions between firms, workers and states at the vertical and horizontal dimensions.

This blog post builds on Marslev et al. (2022), where more extensive discussions of the theoretical framework and empirical case can be found.

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Who gains and who pays the costs of environmental sustainability in global value chains?



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The mainstreaming of sustainability management in business is providing new avenues of value creation, capture and (re)distribution, and new opportunities to transfer the costs of environmental compliance along Global Value Chains (GVCs). Suppliers, workers, and farmers – often based in the Global South – create new value through environmental improvements, which are showcased by lead firms to consumers, governments, and the general public. What remains hidden are the additional costs to create this value, incurred by suppliers. Based on a recent paper and book (Ponte 2019; 2020), this blog unveils the hidden costs of environmental upgrading in global value chains, especially for weaker actors, and highlights how economic and environmental upgrading processes facilitate green capital accumulation by lead firms in GVCs while the actual impact on environmental outcomes remains limited.

The hidden costs of upgrading in global value chains

Upgrading is a concept that has been used in GVC analysis to highlight paths for actors to 'move up the value chain' for economic gain. This body of work is often based on a typology defining four kinds of economic upgrading (Humphrey & Schmitz, 2002): product upgrading, process upgrading, functional upgrading, and inter-chain upgrading. Recent scholarship recognizes the need to move beyond economic upgrading to social and environmental upgrading, and the relations between them. In this context, environmental upgrading has been seen as a process by which actors modify or alter production systems and practices that result in positive (or reduce negative) environmental outcomes' (Krishnan 2017: 117). Environmental upgrading can be driven either internally through strategic firm choices – e.g. to improve efficiency or reduce energy consumption – or externally from changing regulation or civil society and consumer pressure.

Examining environmental upgrading also entails distinguishing between the costs and benefits accruing to lead firms and those accruing to their suppliers – included in this are ‘hidden costs,’ which encompass ‘unintended consequences, perverse effects, and unacknowledged impact on workers, communities, and environment’ (LeBaron and Lister, 2021). If focus on the micro-level here, namely, direct costs to organizations occurring as a result of Corporate Social Responsibility, labor and/or environmental initiatives and strategies by individual companies, drawing from the case studies of wine in South Africa and coffee in East Africa.

The hidden costs of upgrading in the South African wine value chain

Since the formal end of apartheid in 1994, substantial environmental upgrading processes have taken place in the South African wine industry. Improvements include major growth of exports of certified organic and biodynamic certified wines, and the development of several initiatives by government, industry, and NGOs tackling environmental issues, such as Sustainable Wine South Africa – wines that follow specific guidelines on sustainability obtain an integrity and sustainability seal that is affixed to the bottle. Yet, this value has been captured by South African exporters and UK retailers while the extra costs of sustainability have been to a large extent transferred upstream to primary wine producers and grape growers.

Some producers have functionally upgraded to become wine marketers and distributors. Capability transfers have likewise taken place by leveraging

the scenic beauty of Western Cape wine farms to expand wine tourism – all the while advertising environmentally compliant production with certified organic and biodynamic wines. The economic outcomes, however, paint a grim picture. A 2005 Deloitte study shows that 36% of wineries with sub-R25 million revenue were making a loss; in 2016 (post-upgrades) only 13% of the 3,300 producers operating at sustainable income levels, 44% at break-even, and 40% at a loss (Veseth, 2017). Yet, for example, biodiversity provisions included in some of the existing sustainability initiatives are limited in scope – many farms have already cut down indigenous vegetation, such as fynbos, to establish vineyards planted with *Vitis vinifera*, an alien species.

The case study of the wine value chain in South Africa suggests that: (1) sustainability has been used opportunistically by lead firms for marketing, reputational enhancement, and risk management purposes; (2) South African value chain actors, regulators, and supporting institutions have invested heavily in portraying the industry and individual companies as caring for the environment and painted this portrait along with scenic and natural beauty of the Winelands in this country; (3) actors not directly involved in the wine value chain, such as government, conservation groups, and sustainability certification initiatives, have unwittingly facilitated a sustainability-driven supplier squeeze by lead firms; and (4) the hidden costs of environmental upgrading have been carried by primary grape and wine producers, with clearly deleterious impacts on their profitability.

The hidden costs of upgrading in East African coffee value chains

Coffee is a particularly interesting case study because almost all of its production takes place in the Global South, while a large proportion of consumption takes place in the Global North. The coffee value chain in some ways is becoming more similar to that of wine, with a multiplication of unique offerings and environmental content and the increasing importance of economies of scope as well as scale. Sustainability features have now become a central part of the demands placed by coffee roasters, which are then transmitted by international traders to domestic coffee operators and eventually to farmers in producing countries (see Grabs 2019; Millard 2017). This has led to the emergence of a sophisticated assemblage that provides environmental and social sustainability certification or verification options to coffee farmers and traders to deliver these demands. Coffee producers around the world used to supply a relatively homogenous product at volume, with their rewards propped up by the quota system of the International Coffee Agreement. This was a system run by the International Coffee Organization between the 1960s and the late 1980s – through the allocation of quotas and management of stocks in view of avoiding excessive price swings – to the benefit of producing countries. They now deliver coffee of many different physical, social and environmental quality specifications (Neilson et al., 2018), at different volumes (including micro-shipments), and sometimes through

direct-trade relations (Vicol et al., 2018). In other words, there has been a clear improvement in upgrading, with important environmental components.

In relation to economic outcomes, however, much of recent research shows that indications of geographic origin (Neilson et al. 2018) and sustainability certification focused on environmental issues have not translated into improvements in farmers' income and livelihoods (Akoyi & Maertens 2018, Chiputwa et al. 2015). Regarding environmental outcomes, research on private, individual supply chain sustainability systems suggests that coffee farmers included in these schemes achieve better environmental performance than control groups but are mainly limited to management systems, resource efficiency improvements, and recycling activities (Giuliani et al. 2017).

In sum, sustainability certification and verification systems are being used by mainstream roasters and international traders as marketing and reputation management tools (Soler et al. 2017), with only modest environmental outcomes at the farm level. Despite the good intentions of coffee sustainability initiatives and certifications and the support of bilateral donors in helping small producers to meet new and stringent environmental standards, the costs embedded in these processes are placed on the shoulders of farmers – who are also receiving small or no environmental premia. This means that the value produced by farmers through environmental upgrading is captured mostly by roasters.

Implications for orchestrating sustainability in global value chains

Researching environmental upgrading can help understand whether and how the (re)distribution of hidden costs can lead to increased North-South inequality under the guise of sustainability. Since business is leveraging sustainability mainly for its purposes, governments and international organizations need to consider appropriate forms of re-regulation and find ways of better orchestrating a variety of sustainability governance initiatives if they wish to achieve fair and just environmental protection. Existing research shows that governments should combine a variety of orchestration instruments in different GVCs – depending on their governance structures and the power dynamics that underpin them (Ponte, 2019). In general, successful orchestration is more likely to happen when a combination of directive and facilitative instruments is used, when sustainability issues have high visibility, and when there is interest alignment between private and public actors at key nodes of the GVC. What does it mean in practice?

Let's take the example of coffee. Given that the ICO regulatory role is unlikely to be restored, it is public authorities at the national level in producing and consuming countries that could play a sustainability orchestration role. In relation to combinatory efforts, both consuming and producing countries can further ramp up many of the facilitative efforts they are already

carrying out to support producers, cooperatives, and exporters that are seeking voluntary certifications. Producing countries could also include sustainability considerations in national branding efforts. In terms of directive efforts, producing countries could set a minimum sustainability standard for export, charge a sustainability export tax at times of high international prices, and/or include sustainability standards in indications of geographic origin. Consuming countries could more forcefully enact demands for sustainable coffee certification for public procurement (e.g. in schools and hospitals) and/or require sustainability standards to clear imports – as the WTO has been relatively open in lenient in accepting the protection of the environment and health as legitimate policy objectives.

Improving environmental issue visibility in the coffee GVC is a more complex challenge. Coffee stories, labels, and certifications are already dotting the packaging landscape that speaks directly to consumers. However, orchestrators could promote efforts to pay a minimum price at the farmer level for coffee that meets certain environmental criteria. Initiatives in producing countries that seek to frame sustainability as part of geographic origin and/or national branding can act in this direction as well. Finally, in relation to interest alignment, orchestrators could charge a mandatory sustainability export tax to be returned to farmers. This would provide more direct sustainability incentives at the farm level, as well as better align public and private interests in producing countries – given that

many producers perceive sustainability as an imposition placed by buyers and abetted by their governments.

Social movements and civil society organizations should also find new ways of advocating change that is cognizant of value chain dynamics and of the unexpected outcomes and inequalities that may arise from

otherwise valuable initiatives to promote sustainability. Integral to this are strategies that include knowledge of the limitations of what business can achieve through self-regulation, and of the pressure points within value chains where orchestrators are most likely to stimulate positive change and tame inequalities.

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How to find synergies between effectiveness and equity when designing supply chain sustainability policies

Companies with global supply chains are under growing pressure to ensure that their activities and sourcing patterns abroad do not contribute to environmental degradation and human rights abuses. In response, many businesses create supply chain sustainability policies. Such company-internal schemes, such as supplier codes of conduct or internal guidelines, specify companies' commitments and expected supplier practices. These policies are then passed down through multiple tiers of the supply chain until they reach the relevant actors on the factory floor or at the farm level. A prominent example of such policies are zero-deforestation commitments, in which companies pledge to stop purchasing commodities that were grown on former forest land (Garrett et al. 2019). Such zero-deforestation supply chain commitments may contribute significantly to ecosystem conservation.



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However, supply chain sustainability policies may also generate unintended outcomes (INOBU 2016; Klooster 2005; Pereira et al. 2016). This blog draws on a recently published article (Grabs et al. 2021) to argue that companies can make decisions during supply chain policy design, implementation, and enforcement that allow for synergies between effectiveness (in ecosystem conservation) and equity (in allowing all types of producers to access sustainable supply chains) and avoid trade-offs between the two goals.

Unintended consequences of supply chain sustainability policies? The risk of exclusion

One important example of unintended consequences of supply chain sustainability policies concerns producer exclusion. For instance, such policies may exclude smallholders and other producers with low capacities to adapt to changing supply chain requirements from the value chain. Such unintended exclusion can be prevented by ensuring access equity.

Access equity represents the equal opportunity of different groups of producers, particularly those with high and low adaptive capacities, to participate in sustainable supply chains (Pignataro 2012). Access equity safeguards the freedom of choice of producers to decide which markets they want to participate in. If the sustainable market offers improved prices or sales conditions, they will also be able to benefit from such perks.

But who is likely to be excluded? We suggest to use the concept of adaptive capacity to think about which producers may be inadvertently at a

risk of exclusion. Adaptive capacity is any capability or asset that allows producers to rapidly adapt to changing market conditions and expectations. We find that such capabilities can be thought of in six broad categories: education and access to information; technological capacity; financial resources; legal standing; organizational scale and quality; and attitudes, values and norms. In each of these categories, producers with low adaptive capacities may encounter barriers that prevent them from adjusting their practices quickly enough to be kept in the value chain. However, corporate actors may help producers to overcome such barriers, for instance by creating awareness training, simplifying criteria, providing financial support and premium payments, or helping producers to attain necessary legal documents (see Figure 1).

How to generate synergies between effectiveness and equity

In our work, we examine how companies may design supply chain sustainability policies in a way that avoids unintended producer exclusion, while still addressing the sustainability challenges at the center of the policy. As exclusion can pose reputational costs to companies, this can motivate companies to try to tackle this challenge. We find that there are a number of decisions at various points in the policy implementation process that allow for such synergies. Figure 2 shows the different stages of the process and seven synergistic steps that companies – in conjunction with other policy makers – can take to ensure producer inclusion without limiting their policies' effectiveness.

Figure 1: Barriers to sustainable market access and policy design criteria to avoid unfair market exclusion

Barrier type	Examples	Counteracted by...
Education and access to information	Knowledge about initiatives, openness toward innovation	Outreach, awareness raising
Technological capacity	Good agricultural practices, book keeping, access to correct inputs	Simplify criteria, offer technical assistance, integrate trainings and capacity building
Financial resources	Assets, capital available for sustainable investments	Financial support, premium payments
Legal standing	Land rights and tenure, adherence to land use designation	Simplify criteria, assistance in attaining correct legal documents, lobbying for regulatory alignment
Organizational scale and quality	Farm size, group membership	Simplify criteria, support group formation
Attitudes, values and norms	Pro-environmental attitudes, non-monetary values and behavioral norms toward conservation	Participatory program design; norm-based rather than financial policy framings; community-level implementation

Source: Grabs et al. 2021.

Some companies in key deforestation-risk commodities are already pursuing steps to this effect. For instance, palm oil companies such as Wilmar and Musim Mas have dedicated substantial resources toward widespread rule dissemination and the removal of barriers to compliance (**steps 4 and 5**). Wilmar's training program on compliance with the Indonesian Palm Oil Standard reached 8,670 independent smallholders out of 18,100 farmers that directly supply their mills (Wilmar 2020). Lessons learned on scaling outreach efforts – such as train-the-trainer programs – are now also increasingly used to sensitize smallholder farmers on no-deforestation criteria and rules directly. Further, select farmers are aided in getting land titles and other types of legal alignment (**step 5**), albeit still on a pilot project level.

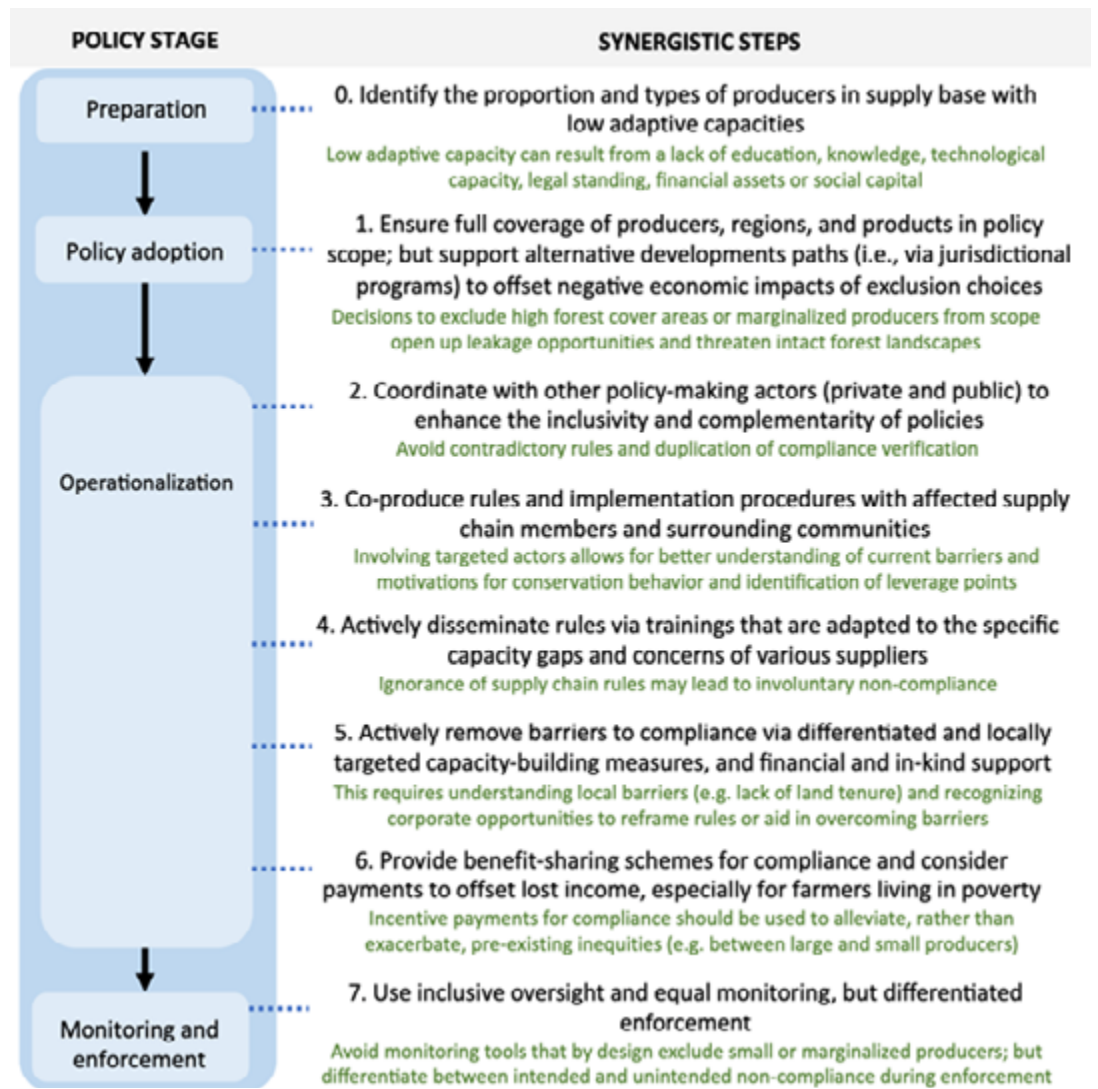
Cocoa companies, in contrast, support smallholder transformations by piloting community co-production (**step 3**) and payments for compliance (**step 6**). The Cocoa and Forests Initiative was launched in 2017 as a highly ambitious, sector-wide, public-private partnership that aimed to tackle the problem of commodity-driven deforestation in a holistic fashion (Carodenuto 2019). In a step-wise, multi-stakeholder approach, actors moved from statements of intent to joint action frameworks and implementation plans, which ensured a strong coordination between public and private actors (**step 2**). Although cocoa farmers were not strongly involved in policy development, some companies organized consultations in cocoa communities on the implementation of the framework (**step 3**). Furthermore, positive

incentive-setting for conservation (step 6) was also integrated, as companies promoted payments for ecosystem services to protect and restore forested areas. However, such schemes are still at a small scale.

The way forward

In conclusion, businesses need to be part of global solutions to meet the complex and multidimensional sustainability challenges of our time. However, ad-hoc or naive approaches may cause unintended consequences and have adverse livelihood impacts on the most vulnerable global value chain members. Companies can

Figure 2: Seven steps toward synergies between effective and equitable supply chain sustainability policies



Source: ETHZ-EPL (2021)

avoid such drawbacks, and thereby avoid reputational cost, by closely considering the likely effects of sustainable supply chain policies on diverse actors in a businesses' value chain, and adjusting their rules and support structures in response. In this way, they can generate synergies between the effectiveness and equity of their supply chain sustainability policies. At the same time, companies cannot do it alone – there is an urgent need for greater cooperation and alignment by public policymakers in

producing and consuming regions to provide the regulatory space and resources for the steps outlined above (e.g. a clear land tenure system) and to contribute to a more equal playing field (e.g. by providing financial incentives for more inclusive supply chains and disincentivizing smallholder exclusion). In the long run, moving toward more diversified, sustainable economies may be the best bet for tropical countries that aim to pursue sustainable livelihoods and development while preserving vital ecosystems.

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Special:
Sub-Saharan Africa's
prospect of economic
development through
global supply chains

Sub-Saharan Africa's prospect of economic development through global supply chains

Introduction

How countries in Africa can successfully grow jobs and boost income remains a priority on the region's development agenda. As in many other developing countries, integration into global supply chains (GSCs)¹ is featuring prominently as a pathway towards achieving this development objective and has received wide endorsement from scholars, development agencies, and international organizations.²

GSCs offers a new development path to developing countries because of the unique global integration opportunities and the associated benefit it offers to the region: it has enabled developing countries to engage in international markets without having to develop an entire export industry and to acquire knowledge and technology either through technology transfer from global lead firms or by learning from and interacting with other value chain actors in an integrated production process (e.g. Kowalski et al., 2015; Baldwin, 2016; Owusu, 2021; Ndubuisi & Owusu, 2021). Hence, developing countries that are well-integrated into GSC can embed more technology and know-how in all their agriculture, manufacturing, and services production. The outputs from these

countries' sectors are also exposed to a wider market. These cumulatively lead to productivity gains, higher returns per unit output and the opportunity to leap-frog their development process.

However, amid the development benefits GSCs offer, it is important to acknowledge that GSCs are not what they used to be a couple of years ago due to some emerging megatrends. Four of these megatrends are particularly relevant to Africa and are in the spotlight of this chapter:

- China's rising global economic power and transition to knowledge-intensive sectors;
- Global digital transformations;
- Africa's regional integration;
- Global trajectories towards environmental sustainability.

These megatrends entail profound implications for the development dividends African countries can gain through GSCs as they present them with great opportunities as well as risks. For instance, China's rising economic power has, among others, led to a major restructuring of most resourced-based GSCs away from the North American and European markets to China. While this provides African countries export opportunities



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¹ While much of the literature cited in this chapter uses the term Global Value Chain, this report consistently refers to Global Supply Chains, which we use synonymously.

² At the same time, some scholars like Rodrik (2018, p. 14), are less optimistic about the economy-wide development role of GSCs as they argue that "the affected sectors and activities remain a very small part of the domestic economy. New capabilities and productive employment remain limited to a tiny sliver of globally integrated firms."

“It is important to acknowledge that GSCs are not what they used to be a couple of years ago due to some emerging megatrends. Four of these megatrends are particularly relevant to Africa and are in the spotlight of this chapter.”

in resource-based GSC for the booming Chinese market, China's less emphasis on standards and certification gives African countries less opportunities to develop capabilities and upgrade in the resource-based supply chains where China is the final market. Also, while global digital transformations amid huge gaps in the digital divide in Africa pose a development challenge, digital technologies such as blockchain technologies may benefit African countries by making GSCs more transparent. Africa's regional integration offers the countries on the continent larger markets and opportunities for deepening the division of labour which may enhance their competitiveness in global supply chains. Finally, whereas early industrializers relied largely on environmentally unfriendly technologies to industrialize, that door is currently closing for African countries given the increasing entrenchment of stringent environmental sustainability standards in global production processes. In particular, these stringent standards are creating entry barriers for many African firms into different supply chains. At the same time, some big game-changers like the bioeconomy and green hydrogen are emanating from this global trajectory and may create new opportunities for African countries.

Against this background, this chapter probes the risks and opportunities these megatrends hold for Africa's development through GSCs with the goal of identifying relevant research gaps. As a caveat, we acknowledge that economic development as a concept has evolved considerably and is likely to encompass all dimensions of upgrading discussed in chapter 1 of this report. In this chapter, however, we limit our focus on economic development in terms of employment and income gains. That said, the rest of this chapter is organized as follows: Section 1 examines how the region is currently integrated into GSCs. The second section explores how GSCs affect Africa's development prospects through GSCs. The third section concludes and highlights promising avenues for future research.

1. Africa's participation in GSCs

An understanding of the risks and opportunities the megatrends present to Africa's prospect of economic development through GSCs requires first an understanding of how the region is currently integrated into GSCs. For this purpose, we use standard GSC measures as described in the box below.

Box: Measuring GSC participation

Backward GSC participation: refers to the ratio of the “foreign value-added content of exports” to the economy's total gross exports. It captures how much intermediate products an economy imports to produce the goods and services it exports.

Forward GSC participation: corresponds to the ratio of the “domestic value-added sent to third economies” to the economy's total gross exports. It captures the domestic value-added contained in inputs sent to third economies for further processing and export through value chains.

GSC participation index: provides an estimation of how much an economy is connected to global value chains for its foreign trade measured as the sum of backward and forward GSC participation.

Source: Adapted from WTO: https://www.wto.org/english/res_e/statis_e/miwi_e/explanatory_notes_e.pdf

Africa is well integrated into GSCs, with its degree of participation being comparable to that of other developing regions (Figure 1). Africa's GSC participation index is only 2 percent lower than the World's and the East Asian average, and about 7 percent higher than the South Asian and Latin American average. Between 1990 and 2015, the region's average GSC participation increased by 8 percentage points, from 34 percent to 42 percent, while it increased by about 7 percentage points in both East and South Asia and 4 percentage points in Latin America. While African countries are well-integrated into GSCs, there is considerable heterogeneity across countries. For instance, in 2015, Guinea and DR Congo had the highest GSC participation level in the region with each country's aggregate GSC

participation index placed at about 64 percent. This was followed by Lesotho and Tanzania with their respective country-level index placed at about 57 percent each. In contrast, Uganda had a GSC participation index of only about 27 percent (see Figure 2). Africa's GSC participation levels reflect the resource abundance of most countries in the region. For instance, Guinea is a leading exporter of bauxite and holds the mineral's largest reserve in the world. DR Congo is rich in diamonds, copper, gold and oil, which it exports in large quantities. Lesotho is a major exporter of textiles and diamonds, while Tanzania is known globally for its tobacco and coffee exports.

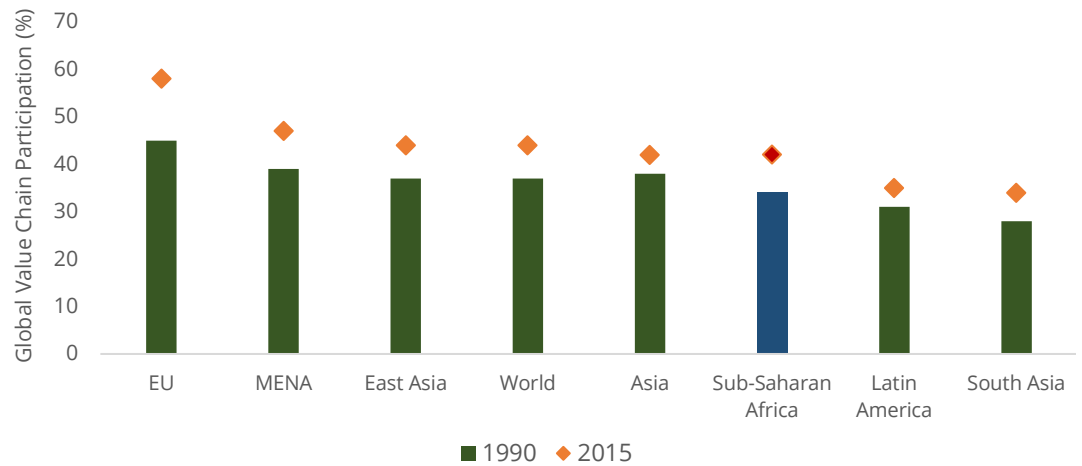
Countries in Africa participate more in upstream phases of the global production system (see Figure 2),

“Africa is well integrated into GSCs, with its degree of participation being comparable to that of other developing regions ... Countries in Africa participate more in upstream phases of the global production system.”

above all by providing primary and basic inputs, such as crude oil, natural gas and minerals (see Figure 3). Exceptions include Seychelles, Cape Verde, Namibia, Botswana, Sao Tome and Principe, Mauritius, Eswatini,

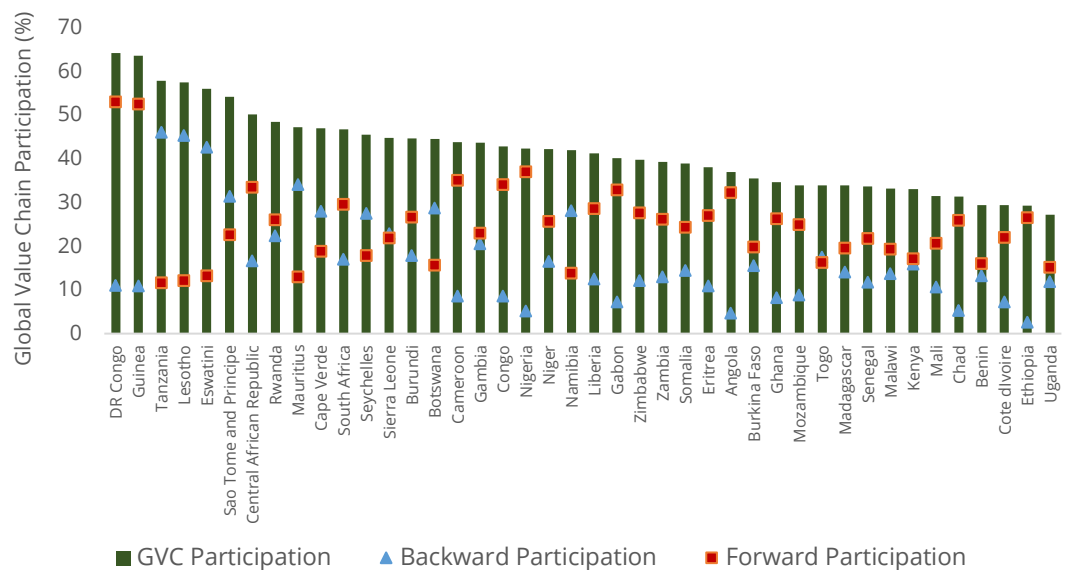
Lesotho, and Tanzania, for which the participation is characterized more by backward than forward participation. For instance, using 2015 numbers, Lesotho's strong backward

Figure 1: GSC participation of world regions, 1990 and 2015



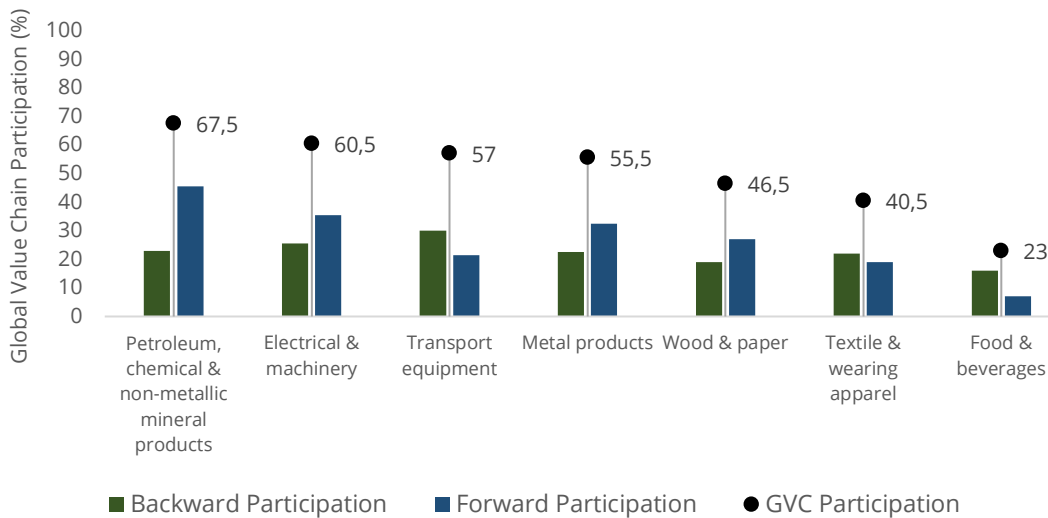
Source: Author’s calculation based on UNCTAD-Eora GVC Database

Figure 2: Africa’s GSC integration patterns: 2015



Source: Author’s calculation based on UNCTAD-Eora GSC Database

Figure 3: Africa's GSC integration in 2015, by industry and forward vs. backward participation



Source: Author's calculation based on UNCTAD-Eora GVC Database

participation is through specialization in fishing, transport equipment, textiles and wearing apparel while it is transport equipment, electrical and machinery and petroleum, chemical and non-metallic mineral products in Namibia. In the case of Mauritius, it is through specialization in mining and quarrying, textiles and wearing apparel and metal products.

At the sectoral level, Africa's GSC participation is strongest in petroleum, chemical, and non-metallic products. In most sectors, except for food and beverages, textile and wearing apparel as well as transport equipment, African countries are, on average, specialized in upstream activities (Figure 3). This underlines that Africa's GSC participation is largely explained by its natural resource

endowment. Further, the region's limited capability in processing some of these natural resources explains the trend towards specialization through forward participation. This suggests that countries within the region that are less resource endowed are less integrated into GSCs and their GSC participation is dominated by backward participation. Recent research suggests that backward participation is a more important driver of productivity growth and product quality upgrading than forward participation (Ndubuisi & Owusu, 2021; Owusu, 2021). The observed pattern thus calls for strategies to move up in the respective supply chains and for upgrading into knowledge-intensive industries for better value capture and industrialization opportunities.

2. Global megatrends and Africa's integration into GSCs

This section discusses the implications of the four megatrends we identified in the introduction — China's rising global economic power and transition to knowledge-intensive sectors, global digital transformation, Africa's regional integration, and global trajectory to stringent environmental sustainability – for Africa's prospect of economic development through GSCs.

2.1 China's rising global economic power and transition to knowledge-intensive sectors

Since China's economic reforms that were initiated in the late 1970s, the country has achieved an average annual real GDP growth rate of about 9.7 percent, making China the largest engine of global growth for many years (Lin et al., 2016). Although the annual growth rate has declined since 2015 to about 6 percent per annum in 2019, optimists still believe China has many positive supply factors that could support a potential growth rate of 8 percent through 2028.³ Unarguably, China's lofty growth episode over the past decades has turned it into a major global economic player, making it the world's factory and number one exporter, graduated into an upper-middle-income country and transitioning towards a knowledge-intensive economy. What implication does this hold for Africa's prospect of economic development through GSCs? First, China's rising global economic power and transition to knowledge-intensive sectors provide

African countries export opportunities in resource-based GSC for the booming Chinese (and greater East Asian) market. Second, it also provides the region with export opportunities in light manufacturing, as China loses competitiveness in those industries due to rising unit labour costs.

China's economic and production shifts create opportunities for Africa in resource-based GSCs, although so far with relatively little value capture. China's global demand for energy, minerals and metal commodities as well as soft commodities like cotton has increased significantly over the past two decades. While China is a major producer of some of these commodities, its production capacity now lags behind its demand for these commodities to fuel its rapidly growing industrialization and urbanization needs (Farooki & Kaplinsky, 2013). This has caused a major restructuring of most resourced-based GSCs away from the North American and European markets to China, and it has implications for Africa's prospect of development through GSCs. First, it creates a new market for those African countries that are well-endowed in these resources. Second, it allows for a relatively easy entry of new firms into such resource-based GSCs due to China's lower emphasis on standards and certification (Kaplinsky et al., 2011). At the same time, standards have proved to be an important source of capability-upgrading in many low-income economies in the past (Kaplinsky et al., 2011).

China's production shift also creates a window of opportunity for Africa in light manufacturing GSCs. China's successful structural transformation

³ For a more extensive discussion, see Lin et al. (2016).

“China’s production shift ... creates a window of opportunity for Africa in light manufacturing GSCs.”

was facilitated by the abundant and cheap labour force that helped to attract a substantial share of the light manufacturing industries from high-income countries when the latter lost comparative advantage in those industries due to rising wages (Lin, 2012).⁴ Recently, however, its labour costs have been on the rise (Lin & Xu, 2019). This has resulted in China's loss of competitiveness in light manufacturing, and some jobs are expected to relocate to other countries with abundant and relatively cheap labour forces. Lin (2012) estimates that about 85 million factory jobs fall into the category of light manufacturing industries in China.⁵ Labour costs in most African countries, although high, are lower relative to that of present-day China (Lin & Xu, 2019). Africa's demographic dividends with a young population entering the labour force offer Africa a latent comparative in the light manufacturing industries. Therefore, if African countries capture a significant share of these jobs, light manufacturing industrial offshoring to African countries could be a major source of unleashing the region's long-awaited economic development.

At the same time, while available evidence suggests that rising labour cost in China has ushered in a wave of outbound light manufacturing

foreign direct investment (FDI) from the country (Xu & Hubbard, 2018; Lin & Xu, 2019), it is unclear to what extent African countries can benefit from this trend. Although data limitations have impaired an exact estimate of the amount of such FDI into Africa, there are signs of Chinese outbound FDI in light manufacturing industries in Africa (Sun et al., 2017). However, the scale of such investment is not large enough to generate structural change. Rather than African countries, China's neighbours in South Asia and Southeast Asia with comparable low-wage have been beneficiaries of this outbound FDI instead (Wang et al., 2020; Altenburg et al., 2020). This trend can be explained by market proximity as well as unfriendly business environments and uncompetitive wages in most African countries. Moreover, increasing automation of some production processes in China has reduced labour absorption capacity in light manufacturing sectors (see also next section).

2.2 Global digital transformation

The global economy is witnessing an unprecedented digital transformation that is underpinned by the digitalization and automation of goods and services production as well as digitalized

⁴ China's type of structural transformation process, the “flying geese” model in which a more advanced country (the “lead goose”) transfers capital, technology, and management skills to a less developed country (a “follower goose”) and thereby facilitating economic transformation (Akamatsu, 1962).

⁵ While this is only a direct job, there could be more jobs that are supported through backward and forward linkages.

markets and platform economies. We now live in a digital economy in which almost every facet of life is either reliant on or significantly enhanced by the use of digital technologies. The proliferation of fourth industrial revolution technologies, such as artificial intelligence, blockchain, Internet of Things (IoT), big data and cloud computing, advanced robotics, factory automation and additive manufacturing (3D printing) has significant impacts on GSCs. In particular, they are blurring the boundaries between physical and digital production systems and disrupting the entire industrial landscape in the global economy (Brynjolfsson & McAfee, 2014). It is, therefore, not surprising that the relationship between these technologies and GSCs has been an important area of economic inquiry in recent times (e.g. Laplume et al., 2016; Rehnberg & Ponte, 2017; Brun et al., 2019). The digital transformation creates both challenges and opportunities for Africa's development through GSCs.

the comparative advantage of low-wage countries as automation means that machines can substitute labour at lower cost, leading to the reshoring of production. In line with most African countries' current specialization patterns in GSCs, such a trend erodes their competitive advantage and stifles their potential entry into GSCs. Indeed, there is growing anecdotal evidence of reshoring: Airtex Design Group is shifting part of its textile production from China back to the US and C&A is relocating some garment manufacturing to Germany. Two recent studies, albeit not focused on Africa, also show evidence of automation-led reshoring (Faber, 2020; Krenz et al., 2021). At the same time, the automation-led reshoring argument seems far from being conclusive as several scholars indicate that the effects of automation on GSCs might be less strong than suggested by the proponents of the argument (see the debate Marin vs. Freund, p. 42 ff.); also Oldenski, 2015; De Backer et al., 2016; Hallward-Driemeier & Nayyar, 2017).

“The digital transformation creates both challenges and opportunities for Africa's development through GSCs.”

Digital technologies may shorten GSCs through reshoring or disintermediation and thereby limit Africa's development prospects through GSCs. The widespread robotization and automation of production and business operations in established global centers of manufacturing challenges the existing patterns of comparative advantage. They eradicate

The shortening of GSCs may be exacerbated by the diffusion of additive manufacturing (AM), especially 3-D printing, although the uptake will likely vary by industry and operation type for quite some time to come (Laplume et al., 2016; Rehnberg & Ponte, 2017). In particular, whereas the quest for scale economies typically generate GSCs as production processes are split into

tasks that are sequentially performed by geographically dispersed firms, the increasingly wide-scale adoption of AM may reverse this trend as it allows fewer production stages (Laplume et al., 2016; Buonafede et al., 2018). Combined with big data analytics, AM may also lead to the production of higher levels of customized products rather than mass production. Ultimately, these trends may reshape the GSCs of several goods towards shorter, more regional, or even local, independent, and custom-tailored supply chains (Buonafede et al., 2018). As greater digitalization through the IoT makes production more efficient, it may shorten future supply chains by rebundling certain production activities into “smart” factories where IoT are used both to automate production as well as communicate and share information to optimize the whole supply chain (Hallward-Driemeier & Nayyar, 2017). Finally, AM tends to make supply chains shorter by enabling goods and services producers to produce and deliver their products directly to end-users, bypassing supply, distribution and sales networks (UNCTAD, 2017). Overall, these developments pose a potential challenge for Africa's GSC-led development by eroding labour-intensive tasks as well as other intermediary roles African firms could take over in GSCs.

At the same time, digital technologies could promote Africa's further integration into GSCs and support higher value capture. Digital technologies such as big data and cloud computing have been pivotal in the expansion of GSCs: they have significantly reduced supply chain coordination costs and made it easier to track and monitor components

as they move through the supply chain (Hallward-Driemeier & Nayyar, 2017). With big data analytics, for instance, manufacturing firms can monitor every detail of the production and supply chain process by identifying potential bottlenecks and underperforming components and processes while strengthening dependencies between components. These benefits can further strengthen GSCs and promote their expansion, creating more opportunities for firms in Africa to participate. Further, the widespread use of scale-neutral digital technologies, such as smartphones, video and virtual-reality conferencing and computer translation, offers firms from the region opportunities to integrate into GSCs by reducing the costs of matching buyers and sellers (Hallward-Driemeier & Nayyar, 2017) and through improvement in their productivity. The diffusion of AM and robots to Africa may also offer local firms potential export opportunities in manufacturing activities, enabling them to innovate and/or produce at a lower cost, enter supply chains and capture higher value (Andreoni et al., 2021). This would be the case, for example, if firms invested in these technologies to improve productivity, in turn becoming more competitive and able to succeed in export markets or strengthen their GSCs integration.

Banga and te Velde (2018), for instance, highlight the case of Funkidz, a local furniture manufacturing SME in Kenya, that invested heavily in computer-aided design and manufacturing technologies, which resulted in lowering the cost of production, enabling the firm to diversify into new furniture lines. They also highlighted the case of another firm in Kenya, Megh Cushion Industries, that

invested heavily in multi-purpose Computer Numerical Control (CNC) auto-cut technology, 3D scanning, and fiber lasers for cutting, which have reduced the cutting time substantially, enabling it to move from supplying automotive parts like foam pads and car door panels to supplying complete transport seating, van conversions, and after-market accessories.⁶ Digital technologies like blockchain can create additional opportunities for higher value capture for the region, by increasing securitization of property rights as well as transparency along the supply chains.

2.3 Africa's regional integration

Amid structural rigidities that plague most African countries, the region's continuous uncompetitive position in GSCs with little value capture and limited opportunities for upgrading has led to many decades of global integration with only modest economic development. Therefore, the promotion of regional supply chains (RSCs) has featured prominently as a new pathway to economic development. RSCs can help to leverage the potential of complementary activities within a region, such as differentiated labour costs and productive capabilities, regional tastes and cultural preferences, natural resources or geopolitical features such

as maritime access (Black et al., 2021; Pasquali et al., 2021). Moreover, while GSCs and RSCs connect lead firms and suppliers, the lead firms in RSCs tend to have less power compared to those of GSCs as they do not always control the marketing and retailing nodes (Keane, 2015). Insofar as RSCs are less concentrated, firms entering such supply chains face fewer barriers and have better opportunities for higher value capture and upgrading (Keane, 2015; Paremoer, 2018).⁷ Overall, regional integration offers Africa a rare opportunity to develop through RSC integration. Within the broader narrative of Africa's regional integration, two key aspects shape Africa's development prospects through GSC: the implementation of the African Continental Free Trade Area (AfCFTA) and Africa's urban growth along with its rising middle class.

The implementation of the AfCFTA offers opportunities to build stronger RSCs to complement gains from GSCs while boosting the region's economic resilience but it remains to be seen if the AfCFTA can deliver these promises. The AfCFTA, founded in 2018, with trade commencing in 2021, can play a key role in delivering the gains of RSCs as it is expected to drive a greater degree of specialization, more production, processing, and higher-value exports from the region and to facilitate development through GSCs.

⁶ Country-level analysis by Ndubuisi & Avenyo (2018) and Andrenelli & González (2021) also show that digital technologies such as robots and 3-D printing increases export activities, while Banga (2022) found that digital capability among Indian firms leads to product upgrading. Buonafede et al. (2018) found that diffusion of AM decreases a country's participation in GSCs, implying that it might induce a decreasing reliance on intermediates processed abroad, hence increasing the importance of domestic goods, manufactured via AM.

⁷ For instance, in a study focused on 515 East African processing firms, Franssen (2020) found that those engaged in South-South value chains capture higher value-added shares and also experience less international quality standards than firms engaged in South-North value chains.

“The implementation of the AfCFTA offers opportunities to build stronger RSCs to complement gains from GSCs while boosting the region's economic resilience”

Hence, the free trade area has been touted as an economic game-changer for Africa. The agreement has two main phases⁸ that once completed, the agreement is expected to yield an African market of 55 sovereign nations with a consumer base of 1.3 billion people and a combined GDP valued at US\$ 3.4 trillion (World Bank, 2020). Considering its aspiration and the number of participating countries, therefore, it is the most ambitious effort to liberalize African trade since the General Agreement on Tariffs and Trade (GATT).

While the AfCFTA is regarded as promising by many, there is a polarized debate as to whether it will be able to deliver. Although the optimistic view about the AfCFTA seems to be trumping that of pessimists, it does not entirely discredit the pessimistic view since AfCFTA is not the region's first attempt towards increasing continental trade integration (Leshoele, 2020; Apiko et al., 2020). Over the years, the region has instituted several regional economic communities (RECs), such as the Southern African Development Community (SADC), the East Africa Community (EAC), the Economic Community of West African States (ECOWAS), and the Common Market for Eastern and Southern Africa (COMESA). Despite these, African markets and suppliers remain

inadequately integrated with little or no evidence of tightly knitted regional intra-trade relations that unlock RSCs. This highlights Africa's continuous dependence on global markets and an inherently limited production capability to meet regional demand. As a result, trade in all African RECs has remained abysmally poor, showing little or no evidence of growth over the years (see WEF, 2021; Abreha et al., 2021). Besides most countries in Africa specializing in primary and unprocessed goods exports, high transport costs together with high non-tariff barriers have contributed significantly to the suboptimal performance of African RECs in moving towards regional integration (Stender and Vogel, 2021). It remains to be seen if the AfCFTA will be successfully implemented and, in combination with complementary policies, will turn out to deliver its promises.

Africa's rising urbanization and middle class can also create opportunities for RSC-led development. Africa's urban population has been growing since the 1950s, hitting 40 percent of the continent's total in 2014 and projected to reach 56 percent by 2050 (UNDESA, 2014), which would amount to almost two-thirds of its population growth in that year (Laros & Jones, 2014). Moreover, by 2010, Africa's middle class had risen to 34 percent

⁸ Phase I aims to significantly reduce tariff and non-tariff barriers that constrain trade in goods and services and to set protocols for the settlement of disputes while Phase II will involve agreements on investment, competition policy, and intellectual property rights.

of its population, or nearly 350 million people, up from about 27 percent in 2000 (Ncube et al., 2011). Africa's rising middle class, especially in urban areas, will drive up the demand for products such as high-value agricultural and agro-processed foods, manufactured consumable goods and tradable services (Tschirley et al., 2015; UNECA, 2016). This in turn entails opportunities to stimulate industrial development through RSCs and local production to cater to the rising domestic consumer demands.

2.4. Global trajectories towards stringent environmental sustainability

Global environmental crises, including climate change and the loss of biodiversity, demand the decarbonisation of our economies and the need to reduce our environmental footprint. Tackling these crises requires radically different business models and systemic transformations. Indeed, the global economy is increasingly shaped by an unprecedented rise of a mixture of the market-, industry-, public- and civil organization's-led sustainability standards and regulations. Moreover, the growing number of preferential trade agreements around the world include ever more far-reaching

environmental provisions (Brandi et al., 2020). The greening of economies creates both challenges as well as opportunities for Africa's economic development prospects through GSCs.

The global transformation towards sustainability might limit Africa's prospects for economic development through GSCs by limiting export opportunities, creating barriers to entry and stifling rents. African countries are, on average, more natural resource-dependent than any other region in the world. In 2019, whereas the natural resources share of GDP in SSA was 7.3%, it was 1.6% for Europe and Central Asia, 0.7% for North America, 1.3% for Asia and Pacific, and 2.7% for Latin America.⁹ What is more, many African economies are highly dependent on fossil fuel exports. Hence, stringent environmental regulations, such as the European Union (EU) carbon border adjustment measure (CBAM), which proposes a levy on imported carbon-intensive products as part of the European Green Deal, can put a strain on Africa's integration in fossil fuel-based supply chains (Brandi, 2021). Moreover, the transition to a circular economy, in the EU and beyond Europe, is expected to reduce demand for all types of natural resource imports. Although empirical evidence is lacking

“The global transformation towards sustainability ... may give rise to new economic opportunities for African countries. For example, ... the use of biotechnology ... with potential applications in many sectors, such as pharmaceuticals, green chemicals, industrial materials and energy.”

⁹ Data based on World Development Indicators:
<https://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS?locations=ZG-ZJ-Z4-Z7-XU>

on how stringent environmental sustainability requirements are affecting African firms' integration into GSCs, some authors suggest they might undermine firms' entry into domestic and foreign markets (e.g. Dean & Brown, 1995; Shi & Xu, 2018). For instance, global trajectories to environmental sustainability might limit the extent to which African firms integrate into GSCs as most global lead firms require their input suppliers to comply with stringent environmental sustainability standards in their supply chain. Recent evidence also suggests that mainstreaming environmental sustainability in business operations has allowed global buyers to accumulate "green" profits and capital in ways that extract value from suppliers, especially those based in the Global South (Ponte, 2020).

While the transformation towards sustainability entails the risk of enormous capital losses in high carbon and other unsustainable technologies and products for the continent, it provides a diversification pathway away from production structures that at risk of becoming stranded assets. Firms in Africa can adapt to changing consumer demand for more sustainable products in key consumer markets, which for most of these countries are advanced economies, given the prevailing low intra-African trade. In addition, several studies suggest that environmental sustainability requirements can lead to improved competitiveness, higher value-added and improved products (e.g. Pegels & Altenburg, 2021; Marchi et al., 2013; Kaplinsky & Morris, 2018; Wang et al., 2021), which are imperative for GSCs participation and reaping higher gains through supply chain integration.

The global transformation towards sustainability also creates innovative game-changing technologies, which may give rise to new economic opportunities for African countries. For example, the bioeconomy entails the use of biotechnology and biomass in the production of goods, services, or energy. The production here goes beyond food, feed, and fiber, to include a range of value-added products with potential applications in many sectors, such as pharmaceuticals, green chemicals, industrial materials and energy. Many African countries are endowed with relatively abundant natural resources, including about 60% of the world's arable land, significant potential for solar energy, and vast freshwater and marine resources (Förster & Virgin, 2018). Hence, the region possesses what it takes to move up in the agricultural global value chain and also become industry leaders in some of the chains newly emerging from the global transition to the bioeconomy. Another potentially game-changing opportunity is green hydrogen, an alternative new energy source that is expected to transform industrial production and supply chains by replacing oil and gas (Grinschgl et al., 2021; Altenburg et al. in this report, p. 98 ff.). Countries with abundant solar, wind and geothermal power endowments stand to benefit the most from this new technology. These countries can become exporters of green hydrogen and integrate into and potentially move up the value chains in hard-to-abate sectors (e.g. steel, aluminum, cement, chemical industries, and fertilizers) and manifold end-use industries, such as the automobile industry, aviation and shipping that use green steel or chemical feedstock. With total renewable power generation estimated at 1,475MW – most of which is undeveloped – Africa

“ ... countries can become exporters of green hydrogen and integrate into and potentially move up the value chains in hard-to-abate sectors (e.g. steel, aluminum, cement, chemical industries, and fertilizers) and manifold end-use industries, such as the automobile industry, aviation and shipping”

is well-positioned to become a green energy leader (Hundermark, 2021). Indeed, the IEA (2019) estimates that in addition to the Middle East, Southern Asia and the Western parts of South America, Africa makes it to the list of the most attractive sites for producing green hydrogen based on solar and wind energy.

3. Concluding reflections

This chapter discussed the prospects of a global supply chain-led development strategy for Africa amid four megatrends to identify relevant research gaps. The megatrends considered in the chapter include China's rising global economic power and transition to knowledge-intensive sectors, the global digital transformation, Africa's regional integration, and global trajectories towards stringent environmental sustainability. The overarching conclusion of the paper is that GSCs remain important as a vehicle for economic development in Africa, yet these megatrends hold profound implications for any such prospect, as they present great opportunities to seize as well as risks to mitigate. Concerning relevant research gaps, the chapter points to many important avenues for further research based on the discussions for each megatrend in line with the chapter's objective. We present the main impacts of the megatrends and the resulting research gaps below.

First, the analysis of China's rising global economic power and transition to knowledge-intensive sectors suggests that it provides African countries with important windows of opportunity in the context of light manufacturing and resource-based GSCs. More research is needed to understand how African countries can better exploit the opportunities in light manufacturing. Future research could particularly examine how relatively high labour costs in times of digital transformations constrain Africa's chance of leveraging this development opportunity in light manufacturing. How do geopolitical and business environments in the region enhance or limit these opportunities in the face of other competing countries in South-East countries for similar opportunities? How do the values captured in (resource-based) GSCs with China as the final market compare to those with other emerging markets or advanced economies? What explains these differences, if any, and which final market offers better (functional, product, process, and inter-chain) upgrading opportunities? How can African countries integrated in resource-based GSCs with China as the final market grow capabilities and upgrade? Here, future studies could probe the advantages and disadvantages of multi-chain strategies, as discussed in Sako and Zylberberg (2019) and Pasquali et al. (2021).

Second, the analysis of the global digital transformation indicates that it can limit Africa's development prospects through GSCs, because it may shorten GSCs either through reshoring or disintermediation. At the same time, the digital transformation presents the region with some opportunities to acquire technological capabilities, innovate and/or produce at a lower cost, enter value chains and capture higher value. These conjectures call for rigorous empirical analysis to improve understanding of the effects of the global digital transformation on Africa's development prospects in GSCs. In particular, future studies could examine whether there is reshoring evidence in Africa, and to what extent the trend, if any, is driven by the digital transformation. Future studies can also examine how the global digital transformation is affecting the patterns of African firms' integration into GSCs, and how this varies across high and lower-technology intensive industries. Similarly, future studies can focus on the upgrading opportunities of different digital technologies. Along this line, the role of blockchain technologies deserves more attention across sectors. For instance, the mining sector has for a long time been considered as an economic enclave and a curse rather than a blessing to resource-abundant countries. Some scholars posit that the application of blockchain technologies at different stages of the mining activities changes this narrative by increasing the securitisation of property rights and transparency. Rigorous empirical studies are needed to probe the diffusion of this technology across the region's mining sector, including its application in the supply chain to track materials, from the blocks of ore to the concentrate and metal. Future studies can also examine whether the

adoption of such technology in mining supply chains leads to improvement in economic returns/profits to local firms. Finally, much research is also required on the servicification of manufacturing GSCs enabled by the global digital transformation.

Third, the analysis of Africa's regional integration indicates that Africa's increasing urbanization and growing middle classes offer promising opportunities to stimulate industrial development through regional supply chains (RSC) and local production. RSC provide opportunities for acquiring capabilities that can enhance competitiveness in GSCs. While the African Continental Free Trade Area (AfCFTA) is key to attaining both potentials, this can only happen if it is adequately implemented and numerous additional policy enablers are also put into action. More research is therefore needed to show how, beyond the common narrative on a unified market, AfCFTA could be implemented and used to achieve a resilient and sustainable RSC. There is also a need to investigate how leveraging AfCFTA to build strong RSC could impact the region's global integration and what implications this holds for the region's industrialization and competitiveness. Additional research is also needed to examine the role of RSCs and the AfCFTA for upgrading opportunities and for the sustainability of supply chains. For instance, we still lack an understanding of how these RSCs interact with standards and certification and to what extent value chains with countries in the Global South promote upgrading.

Fourth, the analysis on global trajectories towards environmental sustainability indicates that it might

“Implementing the respective policy strategies requires the active role of governments, the private sector, and the policy coordination of the international development community.”

limit Africa's prospects for economic development through GSCs by limiting export opportunities and creating barriers to and stifling rents in value chains. At the same time, it also presents new game-changing technologies, for example in the context of the bioeconomy and green hydrogen, which in turn can generate new opportunities for African countries. Discussions on this megatrend reveal a surprising dearth of literature on how the global trajectories towards environmental sustainability affect Africa's patterns of integration into GSC as well as the economic returns they derive, despite the region's resource-dependency and limited use of environmentally friendly technologies in their production processes. Future research could examine the implications of increasing sustainability requirements for GSC-participating firms in Africa, and what they mean for competitiveness. How do sustainability standards (e.g., voluntary sustainability standards and certification schemes) and/or regulations (e.g., government or industry self-regulation) shape supplier value chains in Africa, which sustainability standards have proven most attractive to firms, and why? There are also opportunities for natural experiments, say, using the introduction of CBAM as a policy shock and analysing how it affects African firms integrated into GSCs, or the future of African firms' integration into GSCs.

Finally, although much research remains to be done on the topic at hand, the chapter also points to some important policy directions. First, the benefits offered by digital technologies point to the urgent need of addressing the region's huge digital divide (e.g. in terms of digital infrastructure, and skills) and lack of complementary assets (e.g. in terms of connectivity), and supporting institutional frameworks. These factors are crucial if African countries are ever to fully exploit the opportunities offered by the digital transformation. Implementing the respective policy strategies requires the active role of governments, the private sector, and the policy coordination of the international development community. Second, analysis of Africa's regional integration emphasizes the need for Africa to diversify away from primary and unprocessed goods exports to leverage the opportunities of intra-regional trade and integration for upgrading and economic development. While the AfCFTA is key for reaching these goals, numerous additional enablers are needed to unlock the potential of the free trade area, including infrastructure, transport corridors, logistics, and an improved business climate in African countries. Among others, the transition towards green and sustainable supply chains would require the use of advanced digital production technologies and other circular production techniques.

Currently, many SSA countries cannot do so, due to a low initial capacity in these production technologies and limited fiscal space to finance the just transition. A comprehensive global climate finance package is required for the big push to sustainable supply chains that leave no one behind. With support from the UN, there are already some success stories in the region. South Africa, for instance, has made significant progress—rapidly

transitioning to a green economy by implementing initiatives like waste recycling and the issuance of bonds to finance green infrastructure projects in the agriculture, transport, and energy sectors. While more of such international financing support is needed across the region, governments must play a catalytic role by championing large-scale green initiatives while avoiding or mitigating jobless green transition.

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