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# GLOBALIZATION IN TRANSITION: THE FUTURE OF TRADE AND VALUE CHAINS

JANUARY 2019

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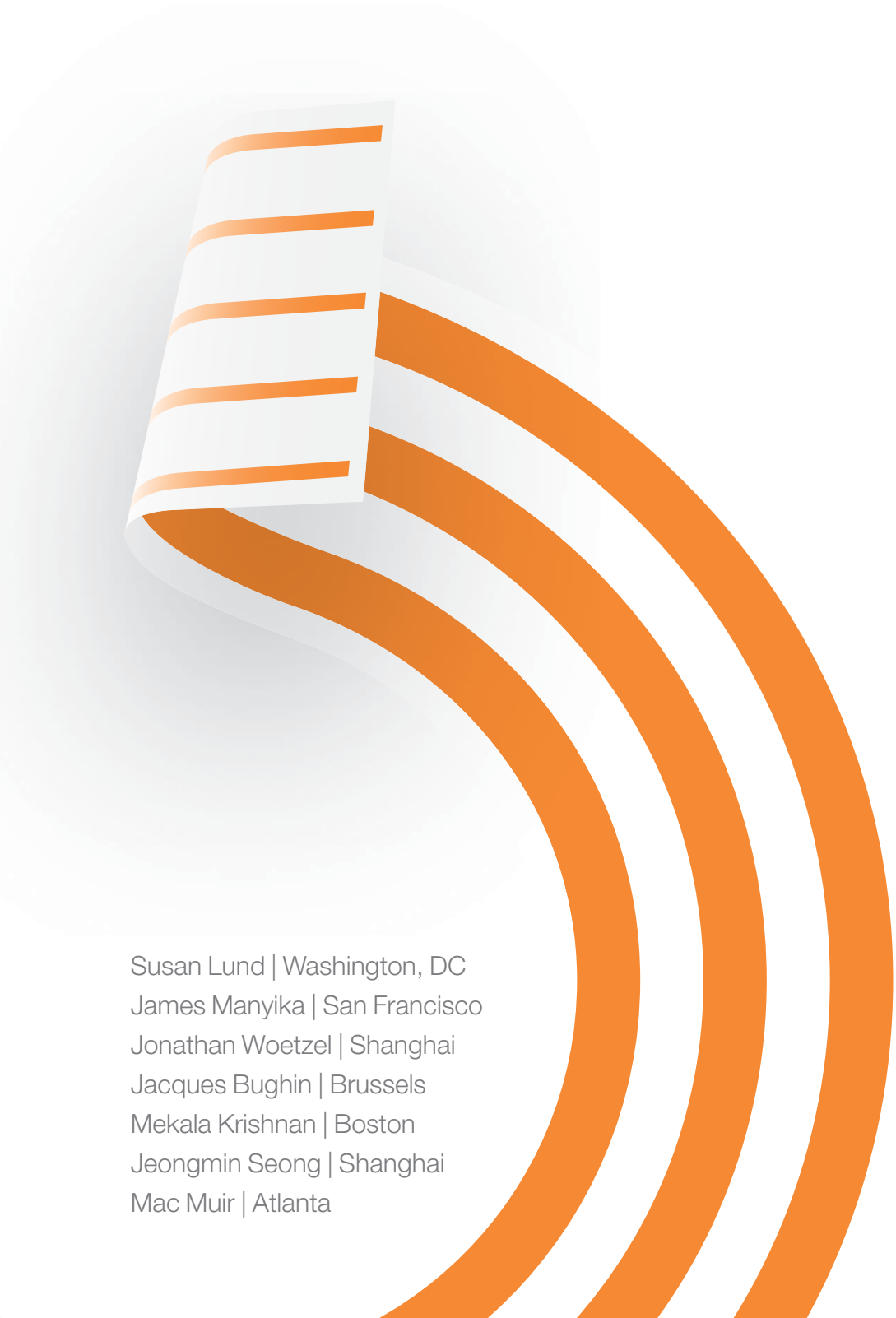

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# PREFACE

In 2014, the McKinsey Global Institute proposed a new way of looking at globalization: by measuring global flows of goods, services, finance, and people. In 2016, we returned to the topic, highlighting the contrast between flattening trade in physical goods and soaring cross-border data flows. That report described a more digital form of globalization that has opened the door to new participants, created new sources of value, and introduced new opportunities and risks.*

Today we take another look at how globalization is evolving, this time viewing it through the lens of global value chains. Trade patterns are shaped by myriad business decisions within these production networks, not by the simple act of one country choosing to buy less from another. Using MGI's signature "micro-to-macro" approach, we look at how companies participating in 23 different industry value chains are responding to global opportunities and pressures. We examine both goods-producing and service industries across 43 countries. Our work also draws on interviews with dozens of industry experts, proprietary industry data, and national accounts trade data. In addition to extending our previous work on global flows and digital globalization, this report builds on a multiyear body of research by MGI on topics that include manufacturing, corporate competition, global consumption trends, technology, and automation as well as economic and labor market trends in specific regions of the world.

This research was led by Susan Lund, an MGI partner based in Washington, DC; James Manyika, MGI's chairman, based in San Francisco; Jonathan Woetzel, an MGI director based in Shanghai; Jacques Bughin, an MGI director based in Brussels; Mekala Krishnan, an MGI senior fellow based in Boston; and Jeongmin Seong, an MGI senior fellow based in Shanghai. The project team, led by Mac Muir, included Colin Britton, Joana Carreiro, Diana Goldshtein, Rensyn Hooi, Sophie Jewsbury, Sue Jia, Prakriti Mishra, Carlos Molina, Khalid Nadiri, Simisola Oyesanya, Jose Maria Quiros, and Saurav Tripathy. We are also grateful to MGI partner Sree Ramaswamy for his thoughtful comments on the manuscript and to Dileep Birur, Jeffrey Condon, Badri Gopalakrishnan, Vivien Singer, and Soyoko Umeno of McKinsey's Economics Research team.

Our academic advisers challenged our thinking and added new insights. We extend sincere thanks to Matthew J. Slaughter, the Paul Danos Dean of the Tuck School of Business and the Earl C. Daum 1924 Professor of International Business at Dartmouth; Michael Spence, Nobel laureate and William R. Berkley Professor in Economics and Business at the NYU Stern School of Business; and Laura Tyson, distinguished professor at the Haas School of Business, University of California, Berkeley.

For their invaluable discussions and insights, many thanks go to: Richard Baldwin of the Graduate Institute, Geneva; Carol Corrado of the Conference Board; Jonathan Haskel of the Imperial College Business School; Michael Mandel of the Progressive Policy Institute; Sebastien Miroudot of the OECD; Hal Varian of Google; Stian Westlake of Nesta; and Wilkie Wou of Esquel. We are very grateful for the collaboration and discussions we had with Michael Mann, Kristy Howell, James Fetzner, and Ryan Noonan of the Bureau of Economic

* See *Global flows in a digital age: How trade, finance, people, and data connect the world economy*, McKinsey Global Institute, April 2014, and *Digital globalization: The new era of global flows*, McKinsey Global Institute, February 2016.

Analysis; and with Caroline Freund, Aaditya Mattoo, and Daria Taglioni of the World Bank Group and Chris Papageorgiou of the IMF.

This project benefited immensely from the industry expertise of many McKinsey colleagues. We thank Wouter Aghina, Knut Alicke, Karla Arias, Munmun Baishya, Urs Binggeli, Adam Bird, Pascal Bornet, Jörg Bromberger, Alexander Brotschi, Charles Carcenac, Aarav Chavda, Hiren Chheda, Michael Chui, Alain Cohen, Tim Ecker, Hauke Engel, Enrico Furnari, Katy George, Madhav Goparaju, Ezra Greenberg, Jonathan Harris, Saskia Hedrich, Matt Higginson, Martin Hirt, Forest Hou, Rahil Jogani, Anuj Kadyan, Greg Kelly, Tim Koller, Brian Ledbetter, Richard Lee, Ying Li, Randy Lim, Anna Littmann, David Mendelsohn, Mehdi Miremadi, Detlev Mohr, Timo Möller, Thomas Morel, Rachel Moss, Florian Neuhaus, Jesse Noffsinger, Alpesh Patel, Lucy Pérez, Grant Riewe, Ingmar Ritzenhofen, Kimberly Rubenstein, David Sayah, Dennis Schwedhelm, Bram Smeets, Eugéne Smit, Jaron Stoffels, Jonathan Tilley, Yury Troshchenko, Michel Van Hoey, Arthur Wang, Nina Wittkamp, Tobias Wölfel, Katherine Wolosz, Ting Wu, and Josie Zhou.

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This report contributes to MGI's mission to help business and policy leaders understand the forces transforming the global economy and prepare for the next wave of growth. As with all MGI research, this work is independent, reflects our own views, and has not been commissioned by any business, government, or other institution. We welcome your comments on the research at MGI@mckinsey.com.

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IN BRIEF

# GLOBALIZATION IN TRANSITION: THE FUTURE OF TRADE AND VALUE CHAINS

Although trade tensions dominate the headlines, deeper changes in the nature of globalization have gone largely unnoticed. We analyze 23 industry value chains spanning 43 countries to understand how trade, production, and participation changed from 1995 to 2017. Grouping these value chains into six archetypes based on their trade intensity, input intensity, and country participation reveals diverging pathways. We see that globalization reached a turning point in the mid-2000s, although the changes were obscured by the Great Recession. Among our key findings:

- First, goods-producing value chains have become less trade-intensive. Output and trade both continue to grow in absolute terms, but a smaller share of the goods rolling off the world's assembly lines is now traded across borders. Between 2007 and 2017, exports declined from 28.1 to 22.5 percent of gross output in goods-producing value chains.
- Second, cross-border services are growing more than 60 percent faster than trade in goods, and they generate far more economic value than traditional trade statistics capture. We assess three uncounted aspects (the value added services contribute to exported goods, the intangibles companies send to foreign affiliates, and free digital services made available to global users). National statistics attribute 23 percent of all trade to services, but including these three channels would increase their share to more than half.
- Third, less than 20 percent of goods trade is based on labor-cost arbitrage, and in many value chains, that share has been declining over the last decade. The fourth and related shift is that global value chains are becoming more knowledge-intensive and reliant on high-skill labor. Across all value chains, investment in intangible assets (such as R&D, brands, and IP) has more than doubled as a share of revenue, from 5.5 to 13.1 percent, since 2000.
- Finally, goods-producing value chains (particularly automotive as well as computers and electronics) are becoming more regionally concentrated, especially within Asia and Europe. Companies are increasingly establishing production in proximity to demand.
- Three forces explain these changes in value chains. First, emerging markets' share of global consumption has risen by roughly 50 percent over the past decade. China and other developing countries are consuming more of what they produce and exporting a smaller share. Second, emerging economies are building more comprehensive domestic supply chains, reducing their reliance on imported intermediate inputs. Lower global trade intensity is a sign that these countries are reaching the next stage of economic development. Finally, global value chains are being reshaped by cross-border data flows and new technologies, including digital platforms, the Internet of Things, and automation and AI. In some scenarios, these technologies could further dampen goods trade while boosting trade in services over the next decade.
- Companies face more complex unknowns than ever before, making flexibility and resilience critical. With the costs and the risks of global operations shifting, companies need to decide where to compete along the value chain, consider new service offerings, and reassess their geographic footprint. Speed to market is becoming a key battleground, and many companies are localizing supply chains for better coordination. Rather than keeping suppliers at arm's length, companies can benefit from more collaborative relationships with those that are core to the business.
- The trends we identify may favor advanced economies, given their strengths in innovation and services as well as their highly skilled workforces. Developing countries with geographic proximity to large consumer markets may benefit as production moves closer to consumers; those with strengths in traded services also stand to gain. But the challenges are getting steeper for countries that missed out on the last wave of globalization. As automation reduces the importance of labor costs, the window is narrowing for low-income countries to use labor-intensive exports as a development strategy. Regional integration offers one possible solution, and digital technologies also hold possibilities for new development paths.

Even as policy makers focus on the trade opportunities of the future, unfinished business remains from the previous wave of globalization. Governments around the world will need to do more to support workers and local communities caught up in global industry shifts and technological change. By fully reckoning with the dislocations of the past, they may be able to make the next chapter of globalization more inclusive.

# Globalization in transition

**WE ANALYZED 23 VALUE CHAINS SPANNING 43 COUNTRIES AND ACCOUNTING FOR 96% OF GLOBAL TRADE. THEY REVEAL 5 STRUCTURAL SHIFTS:**

1. Declining trade intensity in goods
2. Growing (and often unmeasured) trade in services
3. Less labor-cost arbitrage
4. More knowledge intensity
5. More intra-regional trade

## KEY FORCES AFFECTING TRADE

- Consumption in emerging markets up by 50% since 2007
- Growing supply chains in China and other emerging markets
- Next-gen technologies changing logistics, production, and products

**-5.6 p.p.**
decline in trade intensity in goods since 2007

**60%**
faster growth in services trade than in goods trade since 2007

**18%**
goods trade based on labor-cost arbitrage

### New priorities for global companies

- Follow shifts in value creation within your industry
- Consider service offerings
- Assess the full costs and risks of location decisions
- Build flexibility and resilience into operations
- Prioritize speed to market and proximity to customers
- Build closer and more digital supplier relationships

### The challenge for countries

- Build strong service sectors
- Prepare for automation—especially in labor-intensive value chains
- Deepen regional trade ties
- Invest in R&D and skills
- Modernize customs operations and trade agreements
- Look for new opportunities as value chains evolve

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# EXECUTIVE SUMMARY

Even as tariffs dominate the headlines, important structural changes in the nature of globalization have gone largely unnoticed. The global financial crisis and recession obscured some of the shifts. Now, ten years on, our analysis of the dynamics of global value chains in 23 industries reveals several transformations that have been hiding in plain sight.

To begin, although output and trade continue to increase in absolute terms, trade intensity (that is, the share of output that is traded) is declining within almost every goods-producing value chain. Flows of services and data now play a much bigger role in tying the global economy together. Not only is trade in services growing faster than trade in goods, but services are creating value far beyond what national accounts measure. Using alternative measures, we find that services already constitute more value in global trade than goods.

In addition, all global value chains are becoming more knowledge-intensive. Low-skill labor is becoming less important as factor of production. Contrary to popular perception, only about 18 percent of global goods trade is now driven by labor arbitrage.

Three factors explain these changes: growing demand in China and the rest of the developing world, which enables these countries to consume more of what they produce; the development of more comprehensive domestic supply chains in those countries, reducing their imports of intermediate goods; and the growing impact of new technologies. In the past, digital technologies had one clear effect: they accelerated trade by reducing transaction costs. Yet the next generation of technologies will have more complex, multidimensional effects. In some scenarios, they could dampen trade in goods while fueling further growth in services trade.

This report builds on previous McKinsey Global Institute research on global flows and digital globalization.[1] It analyzes 23 global value chains in both goods-producing and service industries, spanning 43 countries, and extends the World Input-Output Database to cover the years from 1995 to 2017. Together the value chains we highlight account for 96 percent of global trade, 69 percent of global output, and 68 percent of global employment. We also draw on dozens of interviews with industry experts, proprietary industry data, and national accounts data.

Our findings reveal that globalization is in the midst of a transformation. Yet the public debate about trade is often about recapturing the past rather than looking toward the future. The mix of countries, companies, and workers that stand to gain in the next era is changing. Understanding how the landscape is shifting will help policy makers and business leaders prepare for globalization's next chapter and the opportunities and challenges it will present.

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1 See *Digital globalization: The new era of global flows*, McKinsey Global Institute, February 2016; *Foreign Affairs*, April 2017; and *Global flows in a digital age: How trade, finance, people, and data connect the world economy*, McKinsey Global Institute, April 2014.

## WE GROUP GLOBAL VALUE CHAINS INTO SIX ARCHETYPES, WITH DISTINCT CHARACTERISTICS AND TRADE PATTERNS

Global value chains reflect millions of decisions made by businesses regarding where to source inputs, where to establish production, and where to sell goods. These decisions shape the movement and volume of global flows of goods, services, finance, people, and data. The simplest value chains, in industries such as basic metals, involve a sequence of production steps that process inputs and raw commodities contributed by firms located in different countries. The most complex, such as those for electronics, automobiles, and aircraft, can involve hundreds of inputs from dozens of countries and subassembly of complex components.[2] Services are also delivered through value chains.[3] Two-thirds of world trade is in intermediate inputs, not final goods and services, underscoring the scale and intricacy of these cross-border production networks.

We group industry value chains into six archetypes: four in goods-producing industries and two in services (Exhibit E1). We classify them by their factor inputs, trade intensity, and country participation. These groupings highlight important differences in dynamics.

- **Global innovations.** Industries including automotive, computers and electronics, and machinery have given rise to the most valuable, highly traded, and knowledge-intensive of all goods-producing value chains. They account for 13 percent of gross output but 35 percent of trade. They involve many sequential steps and intricate components that may require subassembly; in fact, just over half of all trade within these value chains is in intermediate goods rather than finished products. One-third of the workforce in these value chains is highly skilled, a share that is second only to knowledge-intensive services. Spending on R&D and intangible assets averages 30 percent of revenues, two to three times the figure in other value chains. Participation in these value chains is highly concentrated in a small set of advanced economies, although China's role is growing. On average, just 12 countries account for 75 percent of exports.

- **Labor-intensive goods.** These value chains, including textiles and apparel, toys, shoes, and furniture, are highly labor- and trade-intensive. More than two-thirds of income goes to labor, most of which is low-skill. Given their light weight, the products in these industries are highly tradable, and 28 percent of global output is exported. Production shifted to developing countries in the last wave of globalization, and those countries today account for 62 percent of trade, a larger share than in any other archetype. Although these value chains are synonymous in many minds with "globalization," they represent only 3 percent of global gross output and employ only 3 percent of the global workforce (100 million people). China is the largest producer, but new manufacturing technologies and changes in demand are likely to shift country participation in the future.

- **Regional processing.** Industries in this archetype include fabricated metals; rubber and plastics; glass, cement, and ceramics; and food and beverage. These value chains use relatively few intermediate goods. But with the exception of food and beverage, more than two-thirds of the output they produce becomes intermediate input feeding into other value chains, particularly global innovations. For instance, 82 percent of output in fabricated metal products and 74 percent of output in paper and printing are intermediate goods. The defining feature of regional processing is low tradability, due to the weight, bulk, or perishability of the goods produced. Production is therefore

[2] The literature on global value chains is extensive. See, for example, Marcel Timmer et al., *An anatomy of the global trade slowdown based on the WIOD 2016 release*, Groningen Growth and Development Centre, 2016; Koen De Backer and Sébastian Miroudot, *Mapping global value chains*, European Central Bank working paper number 1677, May 2014; *Global value chain development report 2017*, World Bank Group et al., 2017; *The changing nature of international production: Insights from trade in value added and related indicators*, Organisation for Economic Co-operation and Development (OECD), December 2018.

[3] Richard Baldwin and Anthony J. Venables, "Spiders and snakes: Offshoring and agglomeration in the global economy," *Journal of International Economics*, December 2010, Volume 90, Number 2.

distributed around the world, with many countries (including developing economies) participating and a high share of intraregional trade (56 percent). However, trade is growing faster in these value chains than in the global innovations or labor-intensive goods archetypes. These value chains account for 9 percent of global gross output and employ 169 million people, or 5 percent of the global labor force. These value chains are often overlooked, given their relatively low value added per worker, but they are essential industries in all economies.

- **Resource-intensive goods.** This archetype includes agriculture, mining, energy, and basic metals. These value chains generate $20 trillion of gross output annually, nearly as much as global innovations value chains. Much of this output goes to other value chains as intermediate input. In the case of mining and basic metals, all output is intermediate goods. Access to natural resources and proximity to storage and transportation infrastructure determine where production is located. Countries around the world participate; 19 countries account for 75 percent of resource-intensive goods exports. The top five countries make up a lower share of exports in this group than in any other, at just 29 percent. While agriculture employs almost 870 million people globally, the other value chains in this archetype employ only 49 million people in total, or 1.5 percent of the global workforce. Resource-intensive value chains contribute 11 percent of global value added, the highest share among all goods-producing value chains. Mining and energy have the highest value added per employee among all the value chains we studied.

- **Labor-intensive services.** These value chains include retail and wholesale, transportation and storage, and healthcare. Given the in-person nature of these services, trade intensity is low, but trade is growing faster than in any other archetype. Trade in transportation services, for example, has increased with the rise of goods trade, tourism, and business travel; rising trade in wholesale and retail reflects the global expansion of retailers such as Carrefour and Walmart. These value chains are the largest job creators after agriculture, employing more than 740 million people (23 percent of the global workforce), two-thirds of whom are in wholesale and retail trade. While often overlooked by policy makers, these sectors are an important part of the economy in all countries. Their value added per employee is the same as in labor-intensive manufacturing (roughly $25,000), and they employ seven times as many people.

- **Knowledge-intensive services.** These high-value industries include professional services, financial intermediation, and IT services. More than half of the people employed in knowledge-intensive services have bachelor's degrees or above. Although they would seem to be inherently unconstrained by geography, these value chains have lower trade intensity than goods-producing industries, largely due to regulatory barriers. The trade flows that do occur span the entire globe since costs are not directly related to distance. Country participation is highly concentrated in advanced economies; just 21 percent of all exports in this category come from developing economies, the lowest share among all types of value chains. The high concentration among countries reflects the significant investment in a skilled workforce and intangible assets required to succeed in these value chains.

Exhibit E1

**Global value chains are grouped into six archetypes based on their inputs, trade intensity, and country participation.**

Low High

| Archetype | Global value chain | Labor intensity: Labor compensation/ gross value added (%) | Knowledge intensity[1]: % of highly skilled labor | Commodity intensity: Commodity inputs as % of gross output | Regional trade: % of total trade | Trade intensity: Gross exports/gross output (%) | Country participation[2]: Number of countries representing 75% of total exports | Developing economy share of exports (%) | Gross output: $ trillion | Employment: million |
|---|---|---|---|---|---|---|---|---|---|---|
| Global innovations | Chemicals | 43 | 33 | 14 | 49 | 29 | 14 | 25 | 5.5 | 19 |
| | Auto | 58 | 28 | 7 | 59 | 29 | 13 | 30 | 4.5 | 29 |
| | Computers and electronics | 52 | 50 | 3 | 54 | 48 | 8 | 48 | 4.0 | 23 |
| | Machinery and equipment | 61 | 26 | 12 | 46 | 32 | 13 | 29 | 3.6 | 34 |
| | Electrical machinery | 60 | 31 | 18 | 52 | 30 | 14 | 45 | 2.4 | 16 |
| | Transport equipment | 61 | 28 | 8 | 35 | 38 | 12 | 26 | 1.5 | 10 |
| | Average[3] or ***Total*** *(% of global total)* | 56 | 33 | 10 | 49 | 34 | 12 | 34 | ***21.5*** *(13)* | ***131*** *(4)* |
| Labor-intensive goods | Textiles and apparel | 68 | 15 | 9 | 41 | 31 | 13 | 66 | 2.8 | 78 |
| | Furniture and other manufacturing | 65 | 23 | 10 | 42 | 25 | 17 | 58 | 2.5 | 23 |
| | Average[3] or ***Total*** *(% of global total)* | 67 | 19 | 9 | 41 | 28 | 15 | 62 | ***5.3*** *(3)* | ***101*** *(3)* |
| Regional processing | Food and beverage | 52 | 13 | 29 | 55 | 13 | 22 | 43 | 6.9 | 68 |
| | Fabricated metal products | 65 | 16 | 24 | 53 | 18 | 16 | 45 | 2.5 | 34 |
| | Paper and printing | 60 | 37 | 4 | 59 | 16 | 17 | 34 | 2.2 | 11 |
| | Glass, cement, ceramics | 59 | 15 | 18 | 56 | 10 | 16 | 51 | 2.0 | 33 |
| | Rubber and plastics | 60 | 16 | 6 | 57 | 23 | 16 | 42 | 1.8 | 23 |
| | Average[3] or ***Total*** *(% of global total)* | 59 | 19 | 16 | 56 | 16 | 17 | 43 | ***15.3*** *(9)* | ***169*** *(5)* |
| Resource-intensive goods | Mining | 40 | 22 | 72 | 31 | 30 | 16 | 73 | 6.0 | 21 |
| | Agriculture | 63 | 9 | 74 | 43 | 8 | 24 | 50 | 5.7 | 866 |
| | Basic metals | 57 | 15 | 70 | 46 | 20 | 21 | 42 | 4.5 | 24 |
| | Energy | 37 | 25 | 81 | 51 | 23 | 16 | 42 | 3.9 | 4 |
| | Average[3] or ***Total*** *(% of global total)* | 49 | 18 | 74 | 43 | 20 | 19 | 52 | ***20.0*** *(12)* | ***915*** *(28)* |
| Labor-intensive services | Wholesale and retail trade | 61 | 23 | 1 | 41 | 10 | 13 | 28 | 14.3 | 488 |
| | Transport and storage | 56 | 16 | 10 | 35 | 15 | 13 | 31 | 7.2 | 109 |
| | Healthcare | 83 | 36 | 1 | 41 | 1 | 8 | 49 | 6.5 | 145 |
| | Average[3] or ***Total*** *(% of global total)* | 67 | 25 | 4 | 39 | 9 | 11 | 36 | ***28.0*** *(17)* | ***742*** *(23)* |
| Knowledge-intensive services | Professional services | 68 | 56 | 1 | 38 | 10 | 13 | 18 | 10.9 | 52 |
| | Financial intermediation | 47 | 51 | 0.2 | 32 | 8 | 9 | 8 | 7.6 | 65 |
| | IT services | 67 | 56 | 0.3 | 26 | 18 | 13 | 37 | 2.1 | 36 |
| | Average[3] or ***Total*** *(% of global total)* | 61 | 54 | 1 | 32 | 12 | 12 | 21 | ***20.6*** *(13)* | ***153*** *(5)* |
| Global average[3] or ***Total*** *(% of global total covered by focus GVCs)* | | 58 | 28 | 21 | 45 | 21 | 15 | 40 | ***161*** *(69)* | ***3,275*** *(68)* |

1 For the United States.
2 Based on the balance of payments (with the exceptions of wholesale and retail trade as well as healthcare, which are based on the World Input-Output Database).
3 Arithmetic average.

SOURCE: World Input-Output Database; IMF; WTO; UNCTAD; OECD; McKinsey Global Institute analysis

## GLOBAL VALUE CHAINS ARE UNDERGOING FIVE STRUCTURAL SHIFTS

The 1990s and 2000s saw the expansion of complex value chains spanning the globe. But production networks are not immutable; they continue to evolve. We observe five major shifts in global value chains over the past decade.[4] These shifts are occurring against a backdrop of policy uncertainty (see Box E1, "The impact of trade tensions on global value chains").

### 1. Goods-producing value chains have grown less trade-intensive

Trade rose rapidly within nearly all global value chains from 1995 to 2007. More recently, trade intensity (that is, the ratio of gross exports to gross output) in almost all goods-producing value chains has fallen. Trade is still growing in absolute terms, but the share of output moving across the world's borders has fallen from 28.1 percent in 2007 to 22.5 percent in 2017. Trade volume growth has also slowed. Between 1990 and 2007, global trade volumes grew 2.1 times faster than real GDP on average, but they have grown only 1.1 times faster than GDP since 2011.[5] The decline in trade intensity is especially pronounced in the most complex and highly traded value chains (Exhibit E2). However, this trend does not signal that globalization is over. Rather, it reflects the development of China and other emerging economies, which are now consuming more of what they produce.

### 2. Services play a growing and undervalued role in global value chains

In 2017, gross trade in services totaled $5.1 trillion, a figure dwarfed by the $17.3 trillion global goods trade. But trade in services has grown more than 60 percent faster than goods trade over the past decade. Some subsectors, including telecom and IT services, business services, and intellectual property charges, are growing two to three times faster.

Yet the full role of services is obscured in traditional trade statistics. First, services create roughly one-third of the value that goes into traded manufactured goods.[6] R&D, engineering, sales and marketing, finance, and human resources all enable goods to go to market. In addition, we find that imported services are substituting for domestic services in nearly all value chains. In the future, the distinction between goods and services will continue to blur as manufacturers increasingly introduce new types of leasing, subscription, and other "as a service" business models.[7]

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4 Throughout this report, we refer primarily to nominal trade and GDP values reflecting current exchange rates in dollars. These values embody both quantity and prices.

5 Trade volumes are measured by trade in real prices. See *World trade statistical review 2018*, World Trade Organization, 2018.

6 Also see Sébastien Miroudot and Charles Cadestin, *Services in global value chains: From inputs to value-creating activities*, OECD Trade Policy Papers, number 197, March 2017; Aaditya Mattoo et al., *Trade in value added: Developing new measures of cross-border trade*, World Bank Group, 2013; Cecilia Heuser and Aaditya Mattoo, *Services trade and global value chains*, World Bank policy research working paper WPS8126, 2017.

7 "As a service" models replace one-time purchases of physical products with more distributed expenditures. See, for instance, Arul Elumalai, Irina Starikova, and Sid Tandon, "IT as a service: From build to consume," *McKinsey Quarterly*, September 2016.

Exhibit E2

**After increasing prior to 2007, trade intensity has since declined in almost all goods-producing global value chains.**

| Archetypes | | Trade intensity, 2017[1] | Change in trade intensity[1] Percentage points 2000–07 | 2007–17 |
|---|---|---|---|---|
| Global innovations | Chemicals | 27.4 | 7.8 | -5.5 |
| | Transport equipment | 38.0 | 11.0 | -6.2 |
| | Auto | 29.1 | 8.9 | -7.9 |
| | Electrical machinery | 27.9 | 6.2 | -8.3 |
| | Machinery and equipment | 29.5 | 7.3 | -8.9 |
| | Computers and electronics | 43.8 | 13.0 | -12.4 |
| Labor-intensive goods | Furniture and other manufacturing | 24.2 | 7.3 | -0.8 |
| | Textile and apparel | 27.3 | 8.2 | -10.3 |
| Regional processing | Paper and printing | 15.6 | 3.7 | 0.3 |
| | Fabricated metal products | 17.8 | 5.5 | -0.6 |
| | Rubber and plastics | 22.8 | 7.6 | -0.9 |
| | Food and beverage | 12.7 | 2.4 | -0.9 |
| | Glass, cement, ceramics | 8.7 | 2.2 | -3.2 |
| Resource-intensive goods | Agriculture | 8.4 | 0.6 | -0.7 |
| | Energy | 20.6 | 7.4 | -1.2 |
| | Basic metals | 19.6 | 5.1 | -6.2 |
| | Mining | 25.0 | 11.4 | -14.4 |
| Labor-intensive services | Wholesale and retail trade | 10.7 | 3.5 | 2.4 |
| | Healthcare | 0.5 | 0 | 0.1 |
| | Transport and storage | 14.6 | 1.7 | -2.5 |
| Knowledge-intensive services | IT services | 18.4 | 5.6 | 4.9 |
| | Professional services | 9.8 | 2.3 | 0.1 |
| | Financial intermediation | 8.0 | 3.6 | -0.8 |

1 Trade intensity defined as gross exports as a percentage of gross output.

SOURCE: World Input-Output Database; McKinsey Global Institute analysis

Second, the intangible assets that multinational companies send to their affiliates around the world—including software, branding, design, operational processes, and other intellectual property developed at headquarters—represent tremendous value, but they often go

unpriced and untracked unless captured as intellectual property charges.[8] Years of R&D go into developing pharmaceuticals and smartphones, for example, while design and branding enable companies such as Nike and Adidas to charge a premium for their products.[9] However, trade statistics do not capture the use of intangible assets in production and sales around the world.

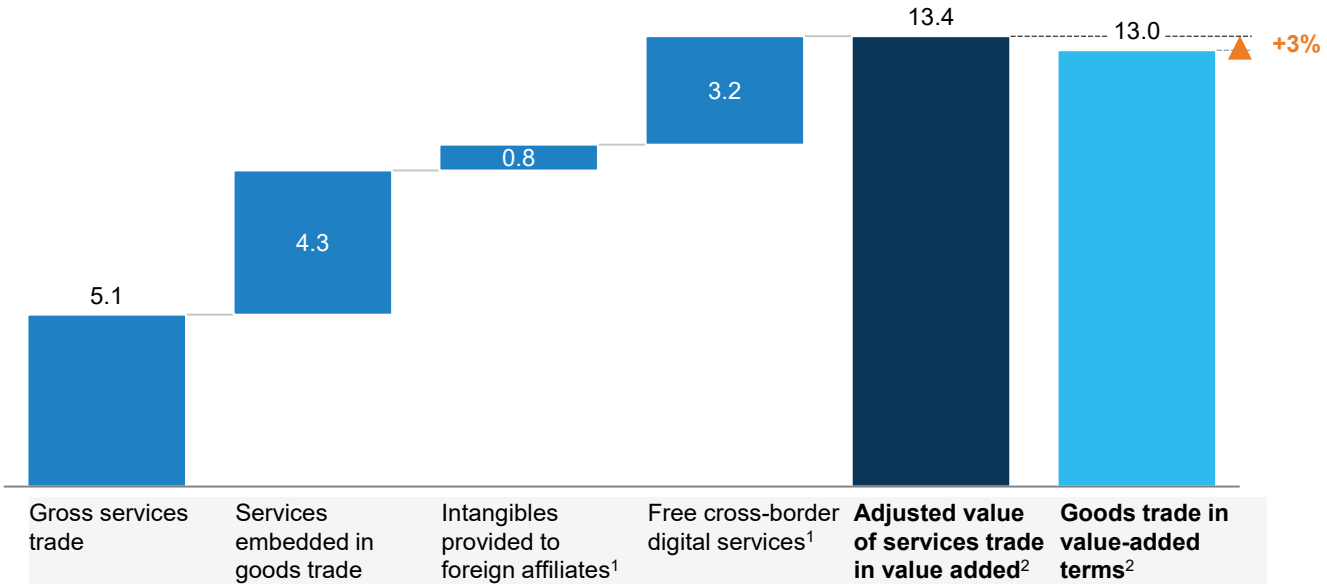
Finally, trade statistics do not track soaring cross-border flows of free digital services, including email, real-time mapping, video conferencing, and social media. Wikipedia, for instance, encompasses 40 million free articles in roughly 300 languages. Every day, users worldwide watch more than a billion hours of YouTube's video content for free, and billions of people use Facebook and WeChat every month. These services undoubtedly create value for users, even without a monetary price.

We estimate that these three channels collectively produce up to $8.3 trillion in value annually—a figure that would increase overall trade flows by $4.0 trillion (or 20 percent) and reallocate another $4.3 trillion currently counted as part of the flow of goods to services. If viewed this way, trade in services is already more valuable than trade in goods (Exhibit E3).[10]

Exhibit E3

**Taking into account the undermeasured aspects of service flows, services account for more than half of value added in overall trade.**

$ trillion, 2017




1 Higher-end estimate.
2 In value-added terms. The value of services embedded in goods trade and the value of goods embedded in services trade have been removed.
NOTE: Services embedded in goods trade defined as services value added in goods trade. Estimate of intangibles provided to foreign affiliates based on company-level data on foreign affiliate economic profit and expenses, adjusted for the share of revenue associated with intangibles produced by headquarters country. Estimate of free cross-border digital services based on the number of foreign users of global websites and the implied value of digital services (such as social media and messaging services).

SOURCE: Capital IQ, WTO, IMF, World Input-Output Database, Alexa Web Information Service, McKinsey Global Institute analysis

[8] Some trade in intangible assets is captured in trade statistics through intellectual property charges. These flows are sometimes driven by decisions of multinationals on where to put ownership of these assets based on tax considerations. See Thomas Tørsløv, Ludvig Wier, and Gabriel Zucman, *The missing profits of nations*, NBER working paper number 24701, June 2018, revised August 2018; and OECD/G20 Base Erosion and Profit Shifting (BEPS) Project, final report, OECD, May 2015.

[9] Carol A. Corrado and Charles R. Hulten, *Internationalization of intangibles*, Measuring the Effects of Globalization, Washington, DC, February 28, 2013.

[10] We remove the value of goods embedded in services trade and the value of services embedded in goods trade.

This perspective would also substantially shift the trade balance for some countries, most notably the United States. This exercise is not meant to argue for redefining national trade statistics. It simply underscores the underappreciated role of services, which will be increasingly important for how companies and countries participate in global value chains and trade in the future.

### 3. Trade based on labor-cost arbitrage is declining in some value chains

As global value chains expanded in the 1990s and early 2000s, many decisions about where to locate production were based on labor costs, particularly in industries producing labor-intensive goods and services. Yet counter to popular perceptions, today only 18 percent of goods trade is based on labor-cost arbitrage (defined as exports from countries whose GDP per capita is one-fifth or less than that of the importing country).[11] In other words, over 80 percent of today's global goods trade is not from a low-wage country to a high-wage country. Considerations other than low wages factor into company decisions about where to base production. These include access to skilled labor or natural resources, proximity to consumers, and the quality of infrastructure.

Moreover, the share of trade based on labor-cost arbitrage has been declining in some value chains, especially labor-intensive goods manufacturing (where it dropped from 55 percent in 2005 to 43 percent in 2017). This mainly reflects rising wages in developing countries. In the future, however, automation and AI may amplify this trend, transforming labor-intensive manufacturing into capital-intensive manufacturing. This shift will have important implications for how low-income countries participate in global value chains.

### 4. Global value chains are growing more knowledge-intensive

Intangibles are playing a bigger role in global value chains. In all value chains, capitalized spending on R&D and intangible assets such as brands, software, and intellectual property (IP) is growing as a share of revenue. [12] Overall, it rose from 5.4 percent of revenue in 2000 to 13.1 percent in 2016. This trend is most apparent in global innovations value chains. Companies in machinery and equipment spend 36 percent of revenue on R&D and intangibles, while those in pharmaceuticals and medical devices average 80 percent (Exhibit E4). The growing emphasis on knowledge and intangibles favors countries with highly skilled labor forces, strong innovation and R&D capabilities, and robust intellectual property protections.[13]

In many value chains, value creation is shifting to upstream activities, such as R&D and design, and to downstream activities, such as distribution, marketing, and after-sales services. The share of value generated by the actual production of goods is declining (in part because offshoring has lowered the price of many goods).[14] This trend is pronounced in pharmaceuticals and consumer electronics, which have seen the rise of "virtual manufacturing" companies that focus on developing goods and outsource their production to contract manufacturers.

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[11] If we vary the ratio of GDP per capita of the exporter and importer from 2 to 10, we find that labor-cost arbitrage ranges from 5 to 30 percent of overall global trade.

[12] See Jonathan Haskel and Stian Westlake, *Capitalism Without Capital: The Rise of the Intangible Economy*, Princeton, NJ: Princeton University Press, 2017.

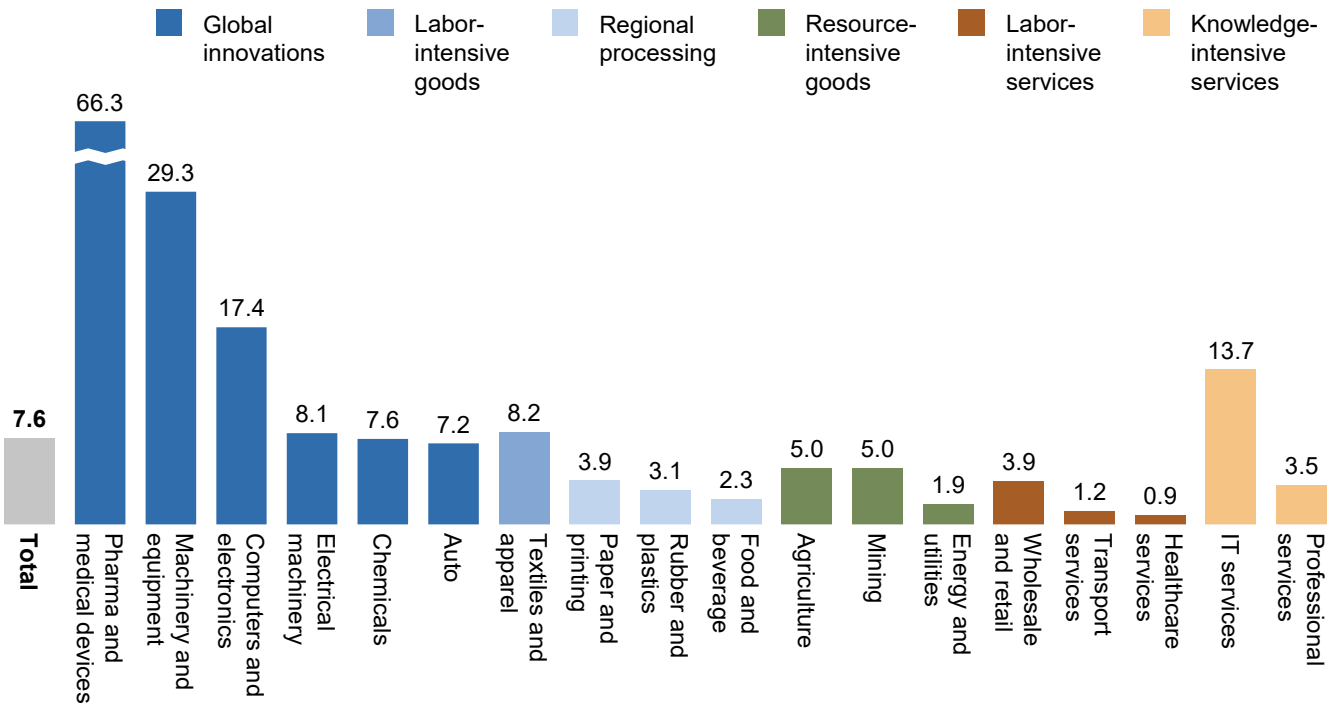
[13] Some trade in intangible assets is captured in trade statistics through intellectual property royalties, which are influenced by tax considerations. But the creation (rather than final ownership location) of intangible assets takes place in countries with talent, legal protections, and innovation ecosystems.

[14] See Mary Hallward-Driemeier and Gaurav Nayyar, *Trouble in the making? The future of manufacturing-led development*, World Bank, 2017.

Exhibit E4

**All global value chains are becoming more knowledge-intensive.**

**Change in capitalized spending on intangibles as share of revenue**[1]
Percentage points, 2000–16




**Capitalized spending on intangibles as % of revenue, 2016**

| **13.1** | 80.0 | 36.4 | 25.4 | 16.4 | 14.9 | 12.2 | 16.6 | 9.8 | 11.5 | 7.1 | 9.1 | 5.0 | 3.9 | 8.9 | 4.1 | 4.2 | 18.9 | 10.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

1 Intangibles include brands, software, and other intellectual property. capitalized based on R&D and selling, general, and administrative (SG&A) expenses of ~24,500 nonfinancial companies (assuming depreciation rate of capitalized SG&A at 20% and capitalized R&D at 15%). Capitalized expenses as of 2000 estimated based on multiplier to annual expenses based on Taylor and Peters (2014), which uses different multipliers depending on company age.

SOURCE: McKinsey Corporate Performance Analytics; McKinsey Global Institute analysis

### 5. Value chains are becoming more regional and less global

Until recently, long-haul trade crisscrossing oceans was becoming more prevalent as transportation and communication costs fell and as global value chains expanded into China and other developing countries. The share of trade in goods between countries within the same region (as opposed to trade between more far-flung buyers and sellers) declined from 51 percent in 2000 to 45 percent in 2012.

That trend has begun to reverse in recent years. The intraregional share of global goods trade has increased by 2.7 percentage points since 2013, partially reflecting the rise of emerging-market consumption. This development is most noticeable for Asia and the EU-28 countries. Regionalization is most apparent in global innovations value chains, given their need to closely integrate many suppliers for just-in-time sequencing. This trend could accelerate in other value chains as well, as automation reduces the importance of labor costs and increases the importance of speed to market in company decisions about where to produce goods.

### Box E1. The impact of trade tensions on global value chains

The general trend of the past 40 years has been toward lowering tariffs and nontariff barriers. But now the pendulum may be swinging in the other direction. As 2018 drew to a close, the United Kingdom's trading relationships were being renegotiated for a post-Brexit world, a revised NAFTA deal (rechristened USMCA) awaited ratification, and rounds of tariffs were clouding the future of US-China trade. Global value chains will respond to the changes in trade policy that ultimately emerge.

It is possible that the direct impact of the new US-China tariffs that were known as of early January 2019 could be relatively limited. China's exports to the United States amount to 4 percent of its GDP, while its imports equal about 1 percent.[1] Similarly, US exports to China are equivalent to 1 percent of its GDP, and its imports amount to 3 percent. According to the International Monetary Fund, a full-blown trade war could have a cumulative negative impact of 1.6 percent on China's GDP and 1.0 percent on US GDP by 2020.[2]

Yet tariffs could have a substantial impact on specific companies, value chains, and regions. As of 2016, there were around 500,000 foreign enterprises operating in China.[3] Roughly 40 percent of China's exports are the products of foreign-owned enterprises and joint ventures between foreign and Chinese firms. The first two rounds of tariffs imposed by the United States on China amounted to $250 billion of goods. Roughly half are on electronics or machinery—and foreign firms produce 87 percent of the electronics and 60 percent of machinery made in China. One possibility is that tariffs accelerate the movement of labor-intensive value chains from China to other developing countries.

Higher tariffs also affect firms in the United States, given that 29 percent of China's exports to the United States are intermediate goods used in producing finished goods. As tariffs increase the cost of production in the United States, the effects can manifest as higher consumer prices and pressure on the bottom line for US manufacturers. Specific local economies dominated by export industries could be particularly vulnerable to the effects if tariffs escalate further.

In a volatile environment, companies need operational flexibility to be able to respond to policy shifts. Volvo and BMW recently canceled plans to export vehicles made in South Carolina to China in response to tariffs.[4] Some manufacturers have similarly warned that they may reduce operations in the United Kingdom if Brexit leads to tariffs or customs delays that slow their supply chains. Others are finding workarounds. Columbia Sportswear, for example, designs products with a specific eye to minimizing tariff costs.[5]

In the September 2018 McKinsey Global Executive Survey, 33 percent of companies said that uncertainty over trade policy was their top concern, and 25 percent said recent tariff increases were their biggest worry. Nearly half of respondents stated that their companies will shift their global footprint in response, and one-quarter said they expect to invest more in local supply chains.

Arguably the biggest risk is the possibility of spillovers into foreign direct investment, immigration, and cross-border sharing of information and scientific data. Rolling back globalization in these broader ways could undermine global productivity growth and innovation. Previous MGI research has found that global flows of goods, services, finance, people, and data boosted world GDP by around 10 percent in a decade over a scenario in which those flows did not exist. While there were individual winners and losers in the last wave of globalization, as we discuss below, openness to both inflows and outflows of all kinds has real economic value.

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1 "Reimagining global ties: How China and the world can win together," McKinsey.com, December 2018. See also research report on China's role in the global economy forthcoming from MGI in early 2019.

2 *World economic outlook: Challenges to steady growth*, International Monetary Fund (IMF), October 2018.

3 Data from China's National Bureau of Statistics.

4 Keith Naughton and Gabrielle Coppola, "Volvo rips up production plans in effort to dodge trade war tariffs," Bloomberg, November 8, 2018; and David Wren, "Trade tiff prompts changes at BMW's SC plant," *Post and Courier*, November 7, 2018.

5 Jim Tankersley, "A winter-coat heavyweight gives Trump's trade war the cold shoulder," *New York Times*, November 23, 2018.

## ONE OF THE FORCES RESHAPING VALUE CHAINS IS A CHANGE IN THE GEOGRAPHY OF GLOBAL DEMAND

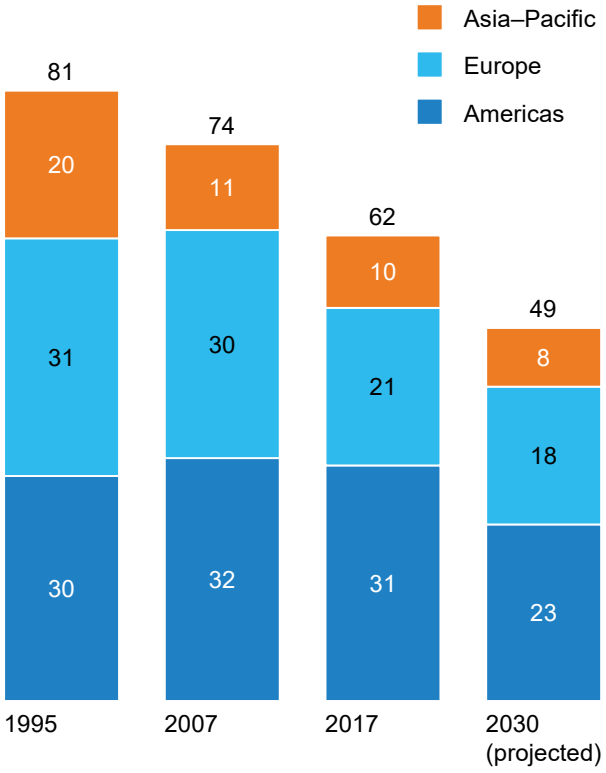
The map of global demand, once heavily tilted toward advanced economies, is being redrawn—and value chains are reconfiguring as companies decide how to compete in the many major consumer markets that are now dotted worldwide. According to current projections, emerging markets will consume almost two-thirds of the world's manufactured goods by 2025, with products such as cars, building products, and machinery leading the way.[15] By 2030, developing countries are projected to account for more than half of all global consumption (Exhibit E5). These nations continue to deepen their participation in global flows of goods, services, finance, people, and data.

Exhibit E5

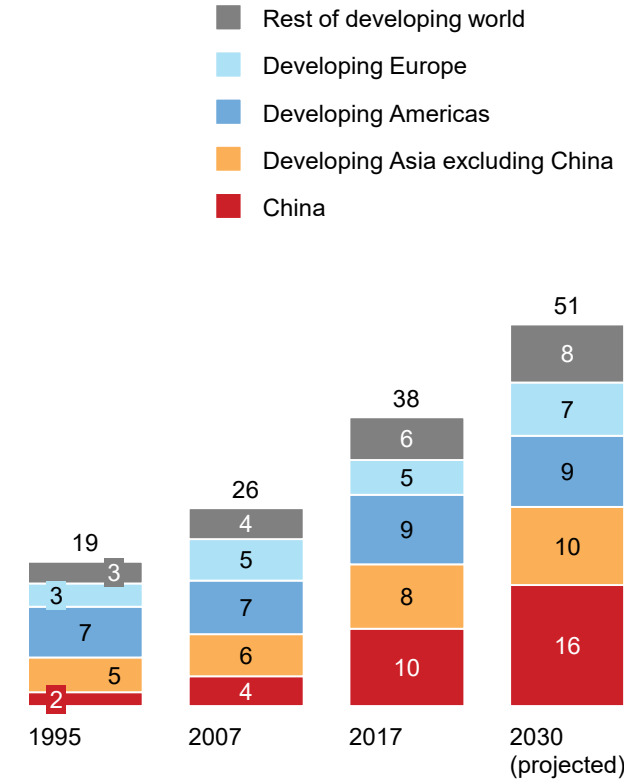
**By 2030, developing countries, led by China and emerging Asia, could account for more than half of global consumption.**

%

**Advanced economies' share of global consumption by region**




**Developing economies' share of global consumption by region**




NOTE: Figures may not sum to 100% because of rounding.

SOURCE: McKinsey Global Growth Model; McKinsey Global Institute analysis

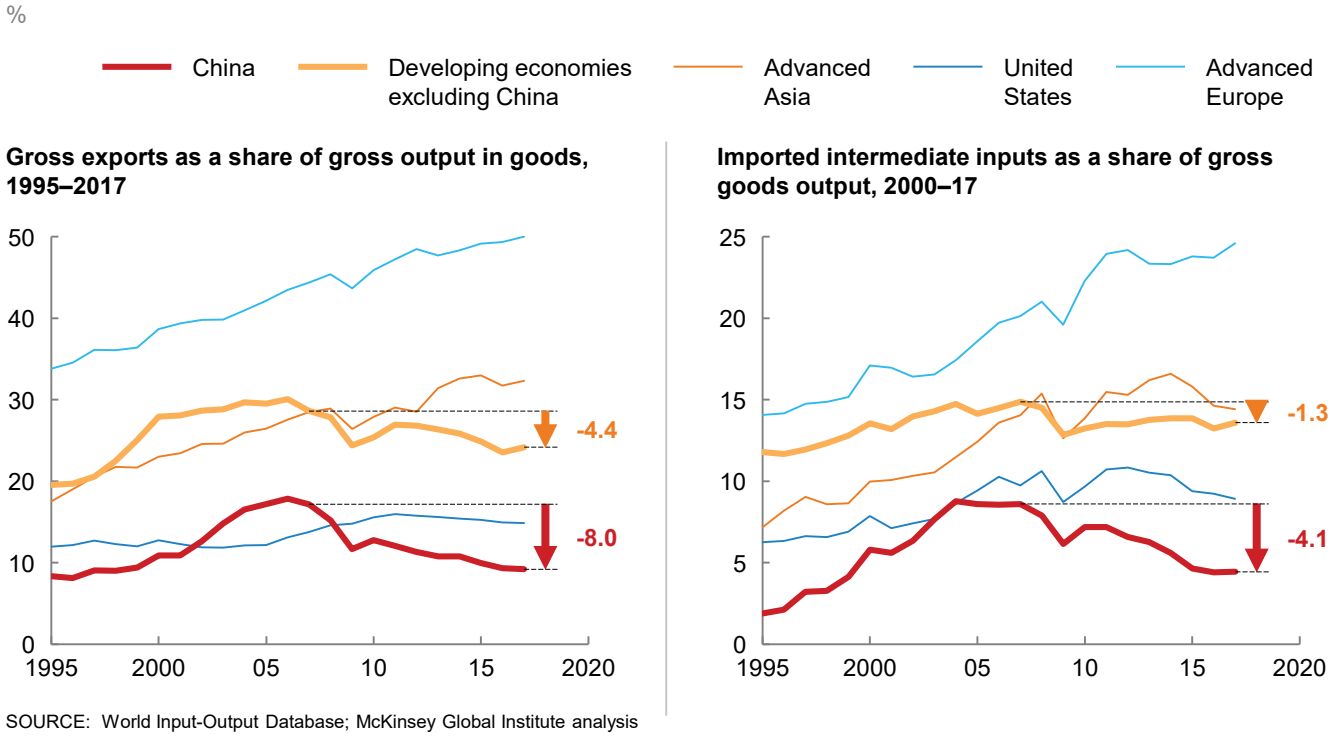
[15] Matteo Mancini, Wiktor Namysl, Rafael Pardo, and Sree Ramaswamy, "Global growth, local roots: The shift toward emerging markets," August 2017, McKinsey.com.

The biggest wave of growth has been happening in China, although there have been recent signs of slowing. Previous MGI research highlighted China's working-age population as one of the key global consumer segments; by 2030, they are projected to account for 12 cents of every $1 of worldwide urban consumption.[16] As it reaches the tipping point of having more millionaires than any other country in the world, China now represents roughly a third of the global market for luxury goods.[17] In 2016, 40 percent more cars were sold in China than in all of Europe, and China also accounts for 40 percent of global textiles and apparel consumption.

As consumption grows, more of what gets made in China is now sold in China (Exhibit E6). This trend is contributing to the decline in trade intensity. Within the industry value chains we studied, China exported 17 percent of what it produced in 2007. By 2017, the share of exports was down to 9 percent. This is on a par with the share in the United States but is far lower than the shares in Germany (34 percent), South Korea (28 percent), and Japan (14 percent). This shift has been largely obscured because the country's output, imports, and exports have all been rising so dramatically in absolute terms. But overall, China is gradually rebalancing toward more domestic consumption.

Exhibit E6

**Since 2007, trade intensity has fallen in China and other developing economies.**




SOURCE: World Input-Output Database; McKinsey Global Institute analysis

[16] *Urban world: The global consumers to watch*, McKinsey Global Institute, April 2016.

[17] *Chinese luxury consumers: The 1 trillion renminbi opportunity*, McKinsey & Company 2017 China Luxury Report, May 2017.

The rising middle class in other developing countries is also flexing new spending power. By 2030, the developing world outside of China is projected to account for 35 percent of global consumption, with countries including India, Indonesia, Thailand, Malaysia, and the Philippines leading the way. In 2002, India, for example, exported 35 percent of its final output in apparel, but by 2017, that share had fallen by half, to 17 percent, as Indian consumers stepped up purchases.

Growing demand in developing countries also offers an opportunity for exporters in advanced countries. Only 3 percent of exports from advanced economies went to China in 1995, but that share was up to 12 percent by 2017. The corresponding share going to other developing countries grew from 20 to 29 percent. In total, advanced economies' exports to developing countries grew from $1 trillion in 1995 to $4.2 trillion in 2017. In the automotive industry, Japan, Germany, and the United States send 42 percent of their car exports to China and the rest of the developing world. In knowledge-intensive services, 45 percent of all exports from advanced economies go to the developing world. The Asia–Pacific region is already a top strategic priority for many Western brands.

### THE RISE OF DOMESTIC SUPPLY CHAINS IN CHINA AND OTHER EMERGING ECONOMIES HAS ALSO DECREASED GLOBAL TRADE INTENSITY

China's rapid growth has made it a major part of virtually every goods-producing global value chain. Overall, it now accounts for 20 percent of global gross output, up from just 4 percent in 1995. In textiles and apparel, electrical machinery, and glass, cement, and ceramics, it now produces nearly half of global output.

But as its economy has matured, China has moved beyond assembling imported inputs into final products. It now produces many intermediate goods and conducts more R&D in its own domestic supply chains. This is the second factor dampening global trade intensity in goods. In computers and electronics, for instance, Chinese companies are developing the kind of sophisticated smartphone chips that China once imported from advanced economies. Building more vertically integrated domestic industries enables China to capture more value added—and simultaneously bring jobs and economic development to its poorer inland provinces.

Other developing countries are beginning to exhibit the same structural shifts seen in China, although they are at earlier stages. In textiles and apparel, for instance, production networks spanning multiple stages are consolidating within individual countries such as Vietnam, Bangladesh, Malaysia, India, and Indonesia.

As a group, emerging Asia has become less reliant on imported intermediate inputs for the production of goods than the rest of the developing world (8.3 percent versus 15.1 percent in 2017). By contrast, in developing Europe, where economic growth has been slower, companies have continued to integrate into the supply chains of companies in Western Europe.

The decline in trade intensity reflects growing industrial maturity in emerging economies. Over time, their production capabilities and consumption are gradually converging with those of advanced economies. Declining trade intensity in goods does not mean globalization is over; rather, digital technologies and data flows are becoming the connective tissue of the global economy.[18]

[18] See Susan Lund and Laura Tyson, "Globalization is not in retreat: Digital technology and the future of trade," *Foreign Affairs*, May 2018.

## NEW TECHNOLOGIES ARE CHANGING COSTS ACROSS GLOBAL VALUE CHAINS

The explosive growth of cross-border data flows, highlighted in MGI's previous research on digital globalization, is ongoing. According to World Bank data, 45.8 percent of the world is now online, up from just 20 percent a decade ago. The number of cellular subscriptions worldwide now exceeds the planet's population. From 2005 to 2017, the amount of cross-border bandwidth in use grew 148 times larger. A torrent of communications and content travels along these digital pathways—and some of this traffic reflects companies interacting with foreign operations, suppliers, and customers.

Instant and low-cost digital communication has had one clear effect: lowering transaction costs and enabling more trade flows. But the impact of next-generation technologies on global flows of goods and services will not be as simple. Some advances, like digital platforms, blockchain, and the Internet of Things, will continue to reduce transaction and logistics costs.[19] Others may reduce trade flows in some cases, either by changing the economics and location of production or by changing the actual goods and services demanded (Exhibit E7). The net impact is uncertain, but in some plausible scenarios, the next wave of technology could dampen global goods trade while continuing to fuel service flows.

### Digital platforms, logistics technologies, and data-processing advances will continue to reduce cross-border transaction costs and enable all types of flows

In goods-producing value chains, logistics costs can be substantial. Companies often lose time and money to customs processing or delays in international payments. Three sets of technologies will continue to reduce these frictions in the years ahead.

Digital platforms can bring together far-flung participants, making cross-border search and coordination more efficient and enabling smaller businesses to participate. E-commerce marketplaces have already enabled significant cross-border flows by aggregating huge selections and making pricing and comparisons more transparent. Alibaba's AliResearch projects that cross-border B2C e-commerce sales will reach approximately $1 trillion by 2020. B2B e-commerce could be five or six times as large. While many of those transactions may substitute for traditional offline trade flows, e-commerce could still spur some $1.3 trillion to $2.1 trillion in incremental trade by 2030, boosting trade in manufactured goods by 6 to 10 percent. Continued rapid growth in small-parcel trade would present a challenge for customs processing, however.

Logistics technologies also continue to improve. The Internet of Things (IoT) can make delivery services more efficient by tracking shipments in real time, and AI can route trucks based on current road conditions. Automated document processing can speed goods through customs. At ports, autonomous vehicles can unload, stack, and reload containers faster and with fewer errors. Blockchain shipping solutions can reduce transit times and speed payments. We calculate that new logistics technologies could reduce shipping and customs processing times by 16 to 28 percent. By removing some of the frictions that slow the movement of goods today, these technologies together could potentially boost overall trade by 6 to 11 percent by 2030.[20]

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[19] *The future of world trade: How digital technologies are transforming global commerce*, World Trade Organization, 2018, focuses on the impact of technologies in reducing trade costs. It finds that global goods trade may grow by two percentage points relative to the baseline scenario as a result.

[20] The academic literature finds that a 1 percent reduction in trade costs can result in a 0.4 percent increase in trade flows. See Simeon Djankov, Caroline Freund, and Cong S. Pham, "Trading on time," *The Review of Economics and Statistics*, 2010, Volume 92, Number 1.

Exhibit E7

**New technologies will have varying impacts on global flows.**

NOT EXHAUSTIVE

| | | Technology[1] | Example | Impact on flows: Primary re-sources | Manu-factured goods | Ser-vices | Data |
|---|---|---|---|---|---|---|---|
| **Reducing trans-action costs** | **Digital platforms** | E-commerce | US consumer buys shoes from UK e-commerce site | — | ▲ | ▲ | ▲ |
| | **Logistics techno-logies** | Automated document processing | Paperless customs documentation processing in India reduces time for loading/unloading ships | ▲ | ▲ | ▲ | ▲ |
| | | Internet of Things | IoT sensors track shipments from Brazil to Angola | ▲ | ▲ | ▲ | ▲ |
| | | Next-gen transportation | New material enables shipping through Arctic route | ▲ | ▲ | — | — |
| | | Autonomous vehicles | Autonomous vehicles move cargo in ports, airports, and warehouses | ▲ | ▲ | — | ▲ |
| | **Data processing techno-logies** | Blockchain | Blockchain enables automated cross-border insurance claims[2] | — | — | ▲ | ▲ |
| | | Cloud | An Australian company utilizes Google Cloud | — | — | ▲ | ▲ |
| **Altering econo-mics of produc-tion** | **Additive manufac-turing** | 3-D printing | 3-D printing of toys at home | — | ▼ | ▲ | ▲ |
| | | | 3-D printing of hearing aids in Vietnam for global distribution | — | ▲ | — | — |
| | **Automation** | Advanced robotics | A company equips a new UK factory with robots to make appliance manufacturing viable | — | ▼ | — | — |
| | | | Bangladesh automates textiles production, boosting productivity to gain global market share | — | ▲ | — | — |
| | **Artificial intelligence** | Virtual assistants | A British retailer deploys virtual assistants for customer service calls, substituting for offshore labor in a call center | — | — | ▼ | ▼ |
| | | Robotic process automation (RPA) | A Philippine company employs RPA in back office processing, reducing cost and increasing volume | — | — | ▲ | ▲ |
| **Transfor-mation of existing products and creation of new products** | **Digital goods** | Streaming movies/music | Drake's new album is streamed a billion times globally in one week | — | ▼ | ▲ | ▲ |
| | **New goods** | Renewable energy | China increases electricity generation from renewables, reducing coal and LNG imports | ▼ | — | — | — |
| | | Electric vehicles | European consumers buy more EVs, requiring fewer imported parts and lower oil imports | ▼ | ▼ | — | — |
| | | Telemedicine | A German doctor relies on 5G to perform remote robotic surgery on a patient in Turkey | — | — | ▲ | ▲ |

1 We focus on a sample of currently available and deployed technologies that materially impact trade. This list is not exhaustive.
2 Blockchain can also make logistics more efficient (eg, automating payments through blockchain-based smart contracts).

SOURCE: McKinsey Global Institute analysis

### Automation and additive manufacturing change production processes and the relative importance of inputs

Previous MGI research has found that roughly half of the tasks that workers are paid to do could technically be automated, suggesting a profound shift in the importance of capital versus labor across industries.[21] The growing adoption of automation and advanced robotics in manufacturing makes proximity to consumer markets, access to resources, workforce skills, and infrastructure quality assume more importance as companies decide where to produce goods. Companies are reconsidering location decisions as a result.

Service processes can also be automated by artificial intelligence (AI) and virtual agents. The addition of machine learning to these virtual assistants means they can perform a growing range of tasks. Companies in advanced economies are already automating some customer support services rather than offshoring them. This could reduce the $160 billion global market for business process outsourcing (BPO), now one of the most heavily traded service sectors.

Additive manufacturing (3-D printing) could also influence future trade flows. Most experts believe it will not replace mass production over the next decade; its cost, speed, and quality are still limitations. But it is gaining traction for prototypes, replacement parts, toys, shoes, and medical devices. While 3-D printing could reduce trade in some specific products substantially, the drop is unlikely to amount to more than a few percentage points across overall trade in manufactured goods by 2030. In some cases, additive manufacturing could even spur trade by enabling customization.[22]

Overall, we estimate that automation, AI, and additive manufacturing could reduce global goods trade by up to 10 percent by 2030, as compared to the baseline. However, this reflects only the direct impact of these technologies on enabling production closer to end consumers in advanced economies. It is also possible that these technologies could lead to nearshoring and regionalization of trade instead of reshoring in advanced economies. Moreover, developing countries could adopt these technologies to improve productivity and retain production, thereby sustaining trade.

### New goods and services enabled by technology will impact trade flows

Technology can transform some products and services, altering the content and volume of trade flows in the process. For example, McKinsey's automotive practice estimates that electric vehicles will make up some 17 percent of total car sales globally by 2030, up from 1 percent in 2017. This could reduce trade in vehicle parts by up to 10 percent (since EVs have many fewer moving parts than traditional models) while also dampening oil imports.

The shift from physical to digital flows that started years ago with individual movies, albums, and games is now evolving once again as companies such as Netflix, Tencent Video, and Spotify popularize streaming and subscription models. Streaming now accounts for nearly 40 percent of global recorded music revenues. In 2018, Drake became the first artist to hit 50 billion streams globally, and his album *Scorpion* was streamed a billion times around the world in just one week. Cloud computing uses a similar pay-as-you-go or subscription model for storage and software, freeing users from making heavy capital investments in their own IT infrastructure.

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[21] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017.

[22] Caroline Freund et al., *Is 3D printing a threat to global trade? The trade effects you didn't hear about*, World Bank Group, forthcoming.

The advent of ultra-fast 5G wireless networks opens new possibilities for delivering services. Remote surgery, for example, may become more viable as networks transmit sharp images without any delays and robots respond more precisely to remote manipulation. In industrial plants, 5G can support augmented and virtual reality–based maintenance from remote locations, creating new service and data flows.

### GIVEN THE SHIFTS IN VALUE CHAINS, COMPANIES NEED TO REEVALUATE THEIR STRATEGIES FOR OPERATING GLOBALLY

Both the costs and the risks of global operations are shifting. The rising importance of knowledge and intangibles raises the stakes for cultivating digital capabilities and workforce skills. Automation in production reduces the value of labor-cost arbitrage and enables location decisions based on proximity to customers. Companies can capture significant efficiencies from new technologies in production and logistics, but they need end-to-end integration across their supplier networks to realize the full potential. Digital disrupters are turning up the pressure on incumbents in industry after industry, and they are expanding up and down the value chain. Several imperatives stand out for global companies in this landscape:

- **Reassess where to compete along the value chain.** Business leaders need to continuously monitor where value is moving in their industry and adapt accordingly.[23] Some companies, like Apple and many pharmaceutical firms, have narrowed their focus to R&D and distribution while outsourcing production. By contrast, many makers of consumer goods take a hyperlocal approach, with customized product portfolios for individual markets. Providers of "global-local" services, such as Airbnb and Uber, have recognized global brands but also extensive local operations that deliver in-person services. Network companies, most of which are knowledge-intensive service providers, create value through a geographically dispersed operating model and global reach. Regardless of the strategy, a key point is to maintain control, trust, and collaboration in all parts of the value chain. For some companies, this might mean bringing more operations in-house. Those that outsource need to re-evaluate supplier relationships and management (see below).

- **Consider how to capture value from services.** Across multiple value chains (including manufacturing), more value is coming from services, whether software, design, intellectual property, distribution, marketing, or after-sales services. Shifting to services can offer advantages: smoothing cyclicality in sales, providing higher-margin revenue streams, and enabling new sales or design ideas due to closer interaction with customers. At its extreme, entire business models shift from producing goods to delivering services (for example, from selling vehicles to offering transportation services, or from selling packaged software and servers to selling cloud subscriptions). To excel in services, companies need to gain insight into customer needs, invest in data and analytics, and develop the right subscription, per-use, or performance-based service contracts.

[23] See Pankaj Ghemawat, *The New Global Road Map: Enduring Strategies for Turbulent Times*, Boston, MA: Harvard Business Review Press, 2018; and Everett Grant and Julieta Young, *The double-edged sword of global integration: Robustness, fragility and contagion in the international firm network*, Globalization and Monetary Policy Institute working paper number 313, 2017.

- **Reconsider your operational footprint to reflect new risks.** One of the most important considerations is where to locate operations and invest in new capacity. The calculus that held in the past is different today. New automation technologies, changing factor costs, an expanding set of risks, and the need for speed and efficiency are all driving regionalization in many goods-producing value chains. As a result, it may make sense to place production in or near key consumer markets around the world. Before investing, companies should consider the full risk-adjusted, end-to-end landed costs of location decisions—and today many do not account for all of the variables. Using a dynamic, risk-adjusted scenario approach rather than a simple point forecast of demand or cost can inform better decisions about shaping an operational footprint.

- **Be flexible and resilient.** Today companies face a more complex set of unknowns as the postwar world order that held for decades seems to be giving way. There is a real chance that tariffs and nontariff barriers will continue to rise, reversing decades of trade liberalization. Tax codes are being reconsidered to account for flows of data and intangibles. Building agile operations can help firms prepare for these types of uncertainties. This can take many forms, such as using versatile common platforms to share components across product lines and multiple plants. In purchasing, companies have achieved flexibility through price hedging, long-term contracting, shaping customer demand to enable using substitutes, and building redundancies into supply chains.

- **Prioritize speed to market and proximity to customers.** Companies in all industries now have a wealth of real-time, granular sales and consumer behavior data at their disposal, but it takes manufacturing and distribution excellence to capitalize on these insights. Speed to market enables faster responses to what customers want and less product waste from forecasting errors. This does not necessarily require large-scale reshoring or full vertical integration in every major market. Companies can opt for postponement—that is, creating a largely standardized product at a distance and then finishing it with custom touches at a facility near the end market.

- **Build closer supplier relationships.** In the last era of globalization, the fragmentation of value chains and the trend toward offshoring led many companies into arm's-length relationships with suppliers across the globe. But that approach involved hidden risks and costs. It makes sense to identify which suppliers are core to the business, then solicit their ideas and deepen relationships with them. With a growing share of product value being provided by the supply chain, firms that genuinely collaborate can secure preferred customer status and benefit from new product ideas or process efficiencies bubbling up from suppliers. Large firms can also bring about systemic changes along the value chain, improving labor and environmental standards. Logistics and production technologies can transform supply chains, but optimizing what they can do requires end-to-end integration. Larger companies may need to help their small and medium-size suppliers upgrade and add digital capabilities to realize the full value.

## THE ROAD AHEAD IS DIVERGING FOR DIFFERENT SETS OF COUNTRIES AND WORKERS

To understand the larger implications of these shifts in global value chains, we group countries into nine categories (Exhibit E8). We first divide them into two groups: advanced and developing. From there, we further segment them based on the global value chain archetype in which they run the largest trade surplus. While countries participate in multiple global value chains (as seen in the diversification metric), these groupings nevertheless offer a useful way to assess their exposure to ongoing structural shifts.

Exhibit E8

**Each country's specialization and diversification in trade determines its exposure to trends in value chains.**

**GDP per capita, 2017**
$ thousand
- High (>20)
- Middle (8–20)
- Low middle (2–8)
- Low (<2)

**MGI Connectedness Index, 2017**[1]
- Very high
- High
- Medium
- Low
- Very low

**Global value chain archetype with largest trade surplus, 2017**
Sector within this archetype with the largest trade surplus
- Global innovation
- Labor-intensive goods
- Regional processing
- Resource-intensive goods
- Services (all)

| | Classification | Country | GDP per capita, 2017 | MGI Connectedness Index, 2017[1] | Global value chain archetype with largest trade surplus, 2017 | Trade intensity (Exports + imports) ÷ GDP % | Diversification of exports Number of sectors accounting for 75% of exports |
|---|---|---|---|---|---|---|---|
| Advanced | Innovation providers | Germany | High (>20) | Very high | Auto | 83 | 10 |
| | | Ireland | High (>20) | Very high | Pharma | 125 | 4 |
| | | Italy | High (>20) | High | Machinery and equipment | 59 | 10 |
| | | Japan | High (>20) | High | Auto | 33 | 7 |
| | | Netherlands | High (>20) | Very high | Chemicals | 175 | 9 |
| | | Singapore | High (>20) | Very high | Computers | 278 | 7 |
| | | South Korea | High (>20) | High | Computers and electronics | 78 | 8 |
| | Regional processors | Austria | High (>20) | Medium | Paper | 96 | 11 |
| | | Finland | High (>20) | Medium | Paper | 69 | 10 |
| | | Spain | High (>20) | High | Food and beverage | 61 | 10 |
| | Resource providers | Australia | High (>20) | High | Mining | 40 | 5 |
| | | Canada | High (>20) | Very high | Oil and gas | 61 | 10 |
| | | Norway | High (>20) | Medium | Oil and gas | 64 | 7 |
| | | Saudi Arabia | High (>20) | Very high | Oil and gas | 52 | 3 |
| | Service providers | France | High (>20) | Very high | Financial intermediation | 59 | 9 |
| | | Sweden | High (>20) | Very high | Telecom and IT | 74 | 11 |
| | | United Kingdom | High (>20) | Very high | Financial intermediation | 55 | 10 |
| | | United States | High (>20) | Very high | IP charges | 25 | 10 |
| Developing | Innovation providers | Hungary | Middle (8–20) | Medium | Auto | 163 | 9 |
| | | Mexico | Middle (8–20) | High | Auto | 78 | 7 |
| | Labor providers | China | Middle (8–20) | Very high | Textiles and apparel | 39 | 8 |
| | | India | Low (<2) | Medium | Furniture | 33 | 9 |
| | | Turkey | Middle (8–20) | Low | Textiles and apparel | 50 | 9 |
| | | Vietnam | Low middle (2–8) | High | Textiles and apparel | 202 | 5 |
| | Regional processors | Argentina | Middle (8–20) | Low | Food and beverage | 24 | 6 |
| | | Indonesia | Low middle (2–8) | Low | Food and beverage | 36 | 8 |
| | | Malaysia | Middle (8–20) | High | Food and beverage | 136 | 8 |
| | | Poland | Middle (8–20) | Medium | Food and beverage | 97 | 12 |
| | | Thailand | Low middle (2–8) | High | Food and beverage | 114 | 9 |
| | Resource providers | Brazil | Middle (8–20) | Low | Agriculture | 22 | 8 |
| | | Colombia | Low middle (2–8) | Very low | Oil and gas | 32 | 6 |
| | | Nigeria | Low middle (2–8) | Very low | Oil and gas | 30 | 1 |
| | | Russia | Middle (8–20) | Medium | Oil and gas | 45 | 6 |
| | | South Africa | Low middle (2–8) | Low | Basic metals | 61 | 8 |
| | Service providers | Costa Rica | Middle (8–20) | Very low | Business services | 54 | 5 |
| | | Kenya | Low (<2) | Very low | Transport services | 30 | 5 |
| | | Morocco | Low middle (2–8) | Low | Telecom and IT | 78 | 7 |
| | | Philippines | Low middle (2–8) | Low | Business services | 62 | 7 |

1 Index based on flows of goods, services, finance, people, and data. For methodology, see *Digital globalization: The new era of global flows*, McKinsey Global Institute, February 2016.

NOTE: We group countries based on the industries in which they run the largest trade surplus, but most countries participate in multiple value chains. This grouping should not be viewed as a ranking.

SOURCE: IMF; WTO; UNCTAD; OECD; McKinsey Global Institute analysis

The specific challenges and opportunities differ for each of these groups. Yet a few priorities apply across the board. No matter where countries specialize today, strengthening service sectors and capabilities is an important opportunity for the future. Investment in R&D will be critical to competing in an increasingly knowledge-intensive global economy. All countries—and particularly those that are major producers of labor-intensive goods—need to prepare for the wider adoption of automation technologies. There is a great deal of unrealized potential in deepening regional trade ties in many parts of the world. Finally, every country can benefit from streamlining customs operations and modernizing trade agreements for a global economy in which flows of services, intellectual property, and data are increasingly vital.

### Shifts in global value chains may favor some advanced economies

There is reason to believe many advanced economies may have already made it through the worst of the disruption stemming from the globalization of value chains. The structural shifts described in this research favor countries with skilled workforces, service capabilities, innovation ecosystems, and lucrative consumer markets—all of which line up with the comparative advantages of advanced economies. These countries will also benefit from the rise of consumers in developing countries if they can tap into export demand. These trends could be good news, especially for highly skilled workers and those in service industries.

Across advanced economies, however, outlooks and priorities vary. Those with strong service sectors and exports, such as the United States, the United Kingdom, France, and Sweden, should be able to capitalize on their existing strengths as trade grows in industries such as IT services, business services, healthcare, and education. In contrast, those that excel mainly in global innovations value chains, such as Germany, Japan, and South Korea, may find a more challenging environment ahead as China expands its capabilities and surpluses in these industries. Advanced economies that excel in regional processing value chains, such as Spain, Portugal, Austria, and Finland, will be more insulated from competition emanating from developing countries, given the lower tradability of those value chains. Indeed, these countries may offer an interesting model for the development of low-income countries. Resource producers, whether high-income or low-income, face a growing imperative to diversify their economies.

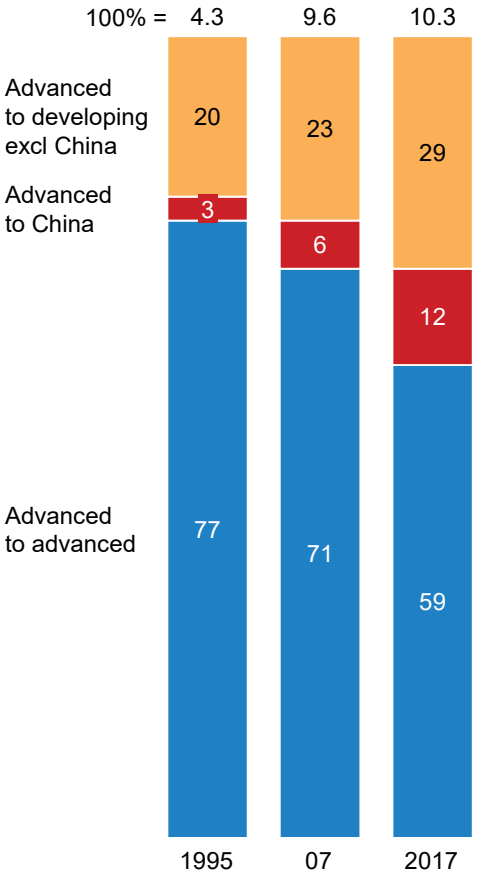
As global demand shifts to the developing world, new opportunities are opening for producers in advanced economies. The share of advanced-economy exports to developing economies increased from 23 percent in 1995 to more than 40 percent in 2017, with notable growth in machinery and equipment along with computers and electronics (Exhibit E9).

For all advanced economies, public and private R&D spending is essential to maintaining an edge in exports. Trade policies need to address issues surrounding cross-border digital flows (including data privacy, cybersecurity, and market access), nontariff barriers to services trade, and intellectual property protections.

Exhibit E9

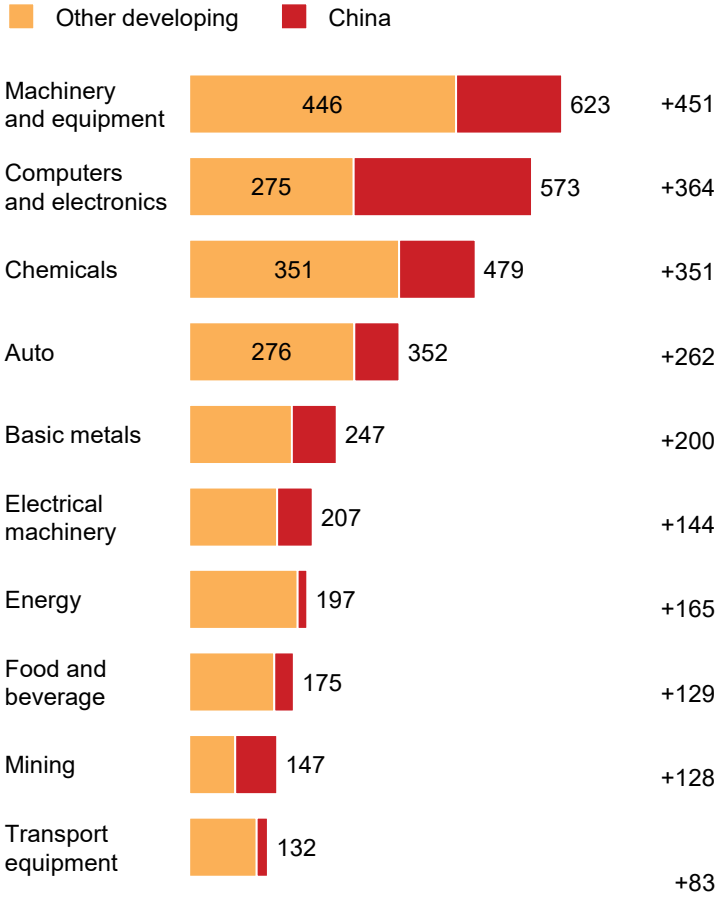
**China and the developing world are an increasingly important source of demand for advanced economies.**

**Advanced economy exports by receiving region**[1]
%; $ trillion




**Top 10 categories of exports from advanced to developing countries, 2017**
$ billion

**Change, 2000–17**
$ billion




1 Based on advanced economy reporting, goods and services.
NOTE: Figures may not sum to 100% because of rounding.

SOURCE: IMF; UNCTAD, OECD, WTO; McKinsey Global Institute analysis

Finally, governments in advanced economies must address the unfinished business of helping the communities and workers that bore disproportionate costs in the previous era of globalization (see Box E2, "The impact of trade on employment and wages"). This will require implementing bolder economic development in hard-hit communities, building more effective education-to-employment systems, and ensuring that social safety nets are up to the task when global forces change local economies.

### Box E2. The impact of trade on employment and wages

The last wave of globalization was accompanied by rising incomes and prosperity for billions of people around the world. But many middle-class workers in advanced economies lost jobs or watched their wages stagnate.[1]

Economists David Autor, David Dorn, and Gordon Hanson document that between 1990 and 2007, US manufacturing industries and communities that were more exposed to increased import competition from China experienced substantially larger reductions in manufacturing employment than their less exposed counterparts.[2] Contrary to the presumption that US labor markets are highly fluid, these authors also find that displaced manufacturing workers did not smoothly transition to new employment. Instead, job losses remained concentrated in local communities, and these shocks persisted for at least a decade.

A study by Daron Acemoglu et al. estimates that import growth from China between 1999 and 2011 led to the loss of 2.4 million out of the 5.8 million US manufacturing jobs lost over that period.[3] They calculate that the impact of import competition on employment is about three times as large as the impact of robotics on employment (although technology could become the larger factor in the future).[4]

Similar patterns have been documented in a range of countries, including Spain, Norway, and Brazil. Yet the story played out differently in Germany, which faced rising import competition from 1991 through 2008 from both Eastern Europe and China. German manufacturers sharply increased exports to both markets, resulting in a more modest trade deficit with China and a trade surplus with Eastern Europe. Employment gains from exports roughly offset German job losses from import competition from China; in the case of trade with Eastern Europe, German employment increased on net.[5]

Trade competition has also affected wages in advanced economies. The studies referenced above find more depressed wage growth in local labor markets that were more exposed to import competition, with the lowest-wage workers hit the hardest. In another study, Autor et al. find that workers whose 1991 industry was exposed to trade accumulated substantially lower earnings through 2007 than peers; they also experienced greater job churn and were more likely to rely on disability benefits. In contrast, high-income workers did not experience the same effects.[6] Research on wages in other countries finds similar results.[7]

The rise and fall of companies and sectors has always accompanied the ongoing reallocation of resources across economies. While it ultimately raises overall productivity and living standards, the process creates winners, losers, and pain along the way. Those who support maintaining globalization will need to acknowledge and address the heavy costs borne by some individuals and communities.

1 Branko Milanovic, *Global Inequality: A New Approach for the Age of Globalization*, Cambridge, MA: Harvard University Press, 2016.

2 David H. Autor, David Dorn, and Gordon H. Hanson, "The China shock: Learning from labor market adjustment to large changes in trade," *Annual Review of Economics*, October 2016, Volume 8.

3 Daron Acemoglu et al., "Import competition and the great US employment sag of the 2000s," *Journal of Labor Economics*, January 2016, Volume 34, Number S1.

4 Daron Acemoglu and Pascual Restrepo, *Robots and jobs: Evidence from US labor markets*, NBER working paper number 23285, March 2017.

5 Wolfgang Dauth, Sebastian Findeisen, and Jens Suedekum, "The rise of the East and the Far East: German labor markets and trade integration," *Journal of the European Economic Association*, December 2014, Volume 12, Issue 6.

6 David H. Autor et al., "Trade adjustment: Worker-level evidence," *The Quarterly Journal of Economics*, November 2014, Volume 129, Issue 4.

7 Joao Paulo Pessoa, *International competition and labor market adjustment*, Center for Economic Performance, discussion paper number 1411, March 2016; and Damoun Ashournia, Jakob Munch, and Daniel Nguyen, *The impact of Chinese import penetration on Danish firms and workers*, IZA discussion paper number 8166, May 2014.

### Developing countries with geographic proximity to large consumer markets or with tradable service expertise also stand to gain

In some middle-income countries, manufacturing workers may face disruptions in the years ahead as some production shifts to lower-wage countries and as automation technologies substitute for some types of labor. Higher levels of productivity and skills will be important for middle-income countries to set themselves apart; this includes keeping pace with technology advances in both manufacturing and logistics. China, for example, is steadily climbing into the higher-value global innovators group by embracing automation and AI. Developing specialized capabilities can help middle-income countries carve out new roles in specific industry value chains and attract more foreign direct investment. But low-skill workers in those countries may struggle to find a place in the new economy.

Historically, labor-intensive manufacturing for export has been the only successful path for low- and middle-income countries to rapidly climb the economic ladder. Now the window of opportunity may be narrowing as automation technologies erode the advantage of large low-wage workforces.[24] But the window is not closed yet. Developing economies such as Bangladesh, India, and Vietnam are managing to achieve solid growth in labor-intensive manufacturing exports, while China continues to develop more knowledge-intensive sectors. Countries pursuing this path will need to invest in transportation and logistics infrastructure and modern, technology-enabled factories that can compete globally. Regional processing value chains may be a promising avenue for diversification.

One subset of developing countries has a critical advantage: geographic proximity to major advanced economy consumer markets. As automation changes the balance of capital and labor, many multinationals are considering investing in new production capabilities closer to end consumer markets to tighten coordination of their supply chains and reduce shipping times. Mexico plays this type of "nearshoring" role for the United States; Turkey and a number of Eastern European countries are linked into value chains based in Western Europe; and Thailand, Malaysia, and Indonesia play the same role for higher-income Asia–Pacific countries. This trend may also lead China to rely more on neighboring countries for production.

Another set of developing countries that specialize in traded BPO and IT services, including the Philippines, Morocco, Costa Rica, and India, will have opportunities as services trade rises. But they will also be challenged, because the ongoing adoption of AI and virtual agents may reduce the market for offshore back-office services. These countries could move into higher-value offerings such as software and web development, graphic design, and data analysis.

Many countries in Africa, Latin America, and Central Asia have limited participation in global value chains, and they are also less connected to the rest of the world in flows of finance, people, and data. Their challenge is to find new openings and to create the necessary business environment, infrastructure, policy foundations, and human capital.

Recent MGI research has also emphasized the role of competition and productive large firms in creating a virtuous cycle of growth.[25] One pathway for the least connected countries may be regional integration. Existing trading blocs in Latin America and Africa could be deepened to create regional trade opportunities, particularly in industries such as food and beverage and regional processing. The digitization of the global economy sets higher hurdles for developing economies, but mobile apps, cloud computing, and digital finance also hold possibilities for leapfrog growth.

•••

Global value chains are changing in fundamental ways as demand soars in the developing world, China and other developing economies build more comprehensive supply chains, and next-generation technologies come online. These shifts have implications for where and how companies compete. This period of transition is an opening for countries and regions to carve out new specializations and new roles in value chains, but policy makers will need to address the dislocations globalization can cause even as they prepare for the opportunities of the future.

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[24] Dani Rodrick, *New technologies, global value chains, and the developing economies*, Pathways for Prosperity Commission Background Paper Series number 1, September 2018.

[25] *Outperformers: High-growth emerging economies and the companies that propel them*, McKinsey Global Institute, September 2018.

# 1. MOVING PARTS: THE EVOLUTION OF GLOBAL VALUE CHAINS

Following the Industrial Revolution, the falling cost of shipping set off an "unbundling" that enabled trade from halfway around the globe.[26] The 1990s and 2000s saw another revolution—this time in information and communications technology (ICT)—that brought about huge transformations in how and where things are made. Companies that once handled all stages of production began to disaggregate them, breaking them into discrete steps and outsourcing some. With falling costs of communication and new types of software and digital platforms, companies could source from a much wider universe of suppliers, coordinate complex processes, and track shipments anywhere in the world in real time. The internet enabled the realignment of global production, with firms and countries specializing in specific parts of different industry value chains. Our 2016 research report documented the soaring volume and value of cross-border data flows, which have become the connective tissue holding the global economy together.[27]

Today two-thirds of world trade is in intermediate inputs rather than finished goods and services.[28] This underscores the extent to which both manufacturing and service industries are now organized into sprawling global value chains that span countries and regions. Yet production networks are not static, and they are continuing to evolve today. Their broad contours determine where things are produced, how they are created, and how they make their way to consumers. Their dynamics are essential to understanding how globalization is evolving and where it may be headed in the future.

In this report, we analyze global value chains within 23 industries across 43 countries (see Box 1, "Methodology, data sources, and new contributions of this report"). Collectively, they represent 96 percent of global trade and roughly 70 percent of both gross output and employment. Examining their dynamics during the period from 1995 through 2017, we see that that the mid-2000s were a turning point.

Global value chains and trade patterns have been changing in fundamental ways. The global financial crisis and the Great Recession did not cause these shifts, but they did obscure them for a time. The pre-recession years, marked by lengthening value chains and soaring growth in trade, were an anomaly as China integrated into the world economy and the ICT revolution made it possible to coordinate far-flung suppliers. Today the world is settling into a new version of normal as China and other developing economies grow and mature, as global demand shifts, and as new technologies reshape production and trade.

The 23 global value chains we study range from sophisticated manufacturing to primary industries to complex services. We classify them into six archetypes to highlight their differing dynamics and diverging paths. Overall, we identify five structural shifts occurring across these value chains. Together they signal that globalization is entering a new chapter as companies and countries alike refine the roles they play within it. Regardless of how changes in trade policy ultimately play out, globalization is still going strong—but it is changing form.

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[26] Richard Baldwin, *Globalisation: The great unbundling(s)*, Economic Council of Finland, September 2006; and Richard Baldwin, *The Great Convergence: Information Technology and the New Globalization*, Cambridge, MA: Harvard University Press, 2016.

[27] *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016.

[28] Based on the World Input-Output Database. Based on the balance of payments, the share of intermediate goods trade stands at 29 percent.

### Box 1. Methodology, data sources, and new contributions of this report

The body of literature on global value chains is large and growing.[1] Our research draws on and extends the 2016 release of the World Input-Output Database (WIOD), which covers 2000 to 2014. To obtain a larger and more current set of data, we extend it backward to 1995 (based on Organisation for Economic Co-operation and Development Inter-Country Input-Output Tables data) and forward through 2017 (based on IHS national accounts data). We supplement and verify these forward- and backward-looking views with country-level data and, in some cases, industry-level data. To offer more industry and product detail as well as more emerging-market findings, we complement the WIOD data with balance-of-payment trade data, drawing from the International Monetary Fund, the World Trade Organization, the UN's Comtrade, and the OECD. See the technical appendix for more details on both sourcing and methodology.

We also draw on a range of industry databases, surveys, and interviews with industry experts to deepen our understanding of global value chains at the firm and industry level. In particular, we rely on these sources to inform our views of changing competitive dynamics, the impact of new technologies, and forecasts of how value chains may shift in coming years.

[1] See, for example, Marcel Timmer et al., *An anatomy of the global trade slowdown based on the WIOD 2016 release*, Groningen Growth and Development Centre memorandum number 192, December 2016; Richard Baldwin and Javier Lopez-Gonzalez, "Supply-chain trade: A portrait of global patterns and several testable hypotheses," *The World Economy*, 2015, Volume 38, Issue 11; Koen De Backer and Sébastian Miroudot, *Mapping global value chains*, European Central Bank working paper number 1677, May 2014; *Global value chain development report 2017: Measuring and analyzing the impact of GVCs on economic development*, Institute of Developing Economies, Organisation for Economic Co-operation and Development, World Bank Group, and World Trade Organization, 2017; and Gary Gereffi and Karina Fernandez-Stark, *Global value chain analysis: A primer*, 2nd edition, Duke Center on Globalization, Governance & Competitiveness, July 2016.

## WHAT IS A GLOBAL VALUE CHAIN?

Simply put, a global value chain includes all the activities and inputs used to create a final good or service. Each one is the product of millions of decisions made by individual businesses about which global growth opportunities to pursue, how to organize operations, which production steps they will conduct themselves, and the extent to which they will rely on suppliers. These decisions shape the movement and volume of global flows of goods, services, finance, data, and even people.

Bananas are an example of a traditionally traded good that does not involve a value chain. A farmer in Brazil, for example, cultivates bananas, which are trucked off to a packaging plant in a coastal port, then boxed up in crates and sent to the United States. The banana in this example goes from the producing country to the consuming country directly, without any other countries performing intermediate steps along the way.

Yet even in primary industries such as agriculture and mining, a certain degree of trade flows through value chains. The farmer may use imported fertilizers and pesticides. Tractors, trucks, and other equipment may also come from other countries. Food and beverage; glass, cement, and ceramics; and basic metals all have relatively simple sequential value chains. Apparel, furniture, and fabricated metals have somewhat more complex sequences, with more traded inputs and intermediate steps before the final good is produced and consumed.

The majority of global trade is actually in intermediate rather than finished goods. The highly complex value chains in industries producing automobiles, computers, and other machinery and transportation equipment involve hundreds of inputs and span dozens of countries. The iPhone, for instance, starts with teams of designers and engineers in California. Although it fits into the palm of your hand, it contains parts from as many as 200 separate suppliers in at least eight countries.[29] All the various parts are manufactured separately, then shipped to a factory in China, where they are assembled into one slim smartphone. It is boxed up and shipped, perhaps arriving at an Apple distributor in Rome, where an Italian consumer will pull it off the shelf. This multistep, multicountry process is a global value chain in action.

Global value chains can also produce services. But rather than following the kind of sequential process that occurs in manufacturing value chains, service value chains resemble networks.[30] A provider of corporate IT services in Bangalore, for example, may use hardware produced in China and software developed in Germany, while working with a local affiliate in Switzerland that communicates directly with clients. Similarly, the value provided by a logistics company such as DHL comes from the many nodes (both company-run and subcontracted) it can mobilize to serve any country of origin and destination. A package from Croatia destined for Russia may pass through nodes in Germany and Poland, each adding value along the way.

## GLOBAL VALUE CHAINS FIT INTO SIX ARCHETYPES THAT EXPLAIN COUNTRY PARTICIPATION AND TRADE PATTERNS

We classify industry value chains into six major archetypes to highlight their reliance on different inputs, their trade patterns, and country participation (Exhibit 1). These groupings explain differences in trade intensity, for example, and therefore the potential for either a broad or narrow set of countries to participate. We base much of the analyses throughout the report on these archetypes.

First, we look at the inputs of each value chain, including its labor intensity (defined as share of labor compensation in gross value added), its knowledge intensity (defined as share of workers with bachelor's degrees or higher), and its commodity intensity (defined as share of commodity inputs in gross output). These input factor intensities influence where firms decide to locate production. The second set of metrics relates to trade and how countries participate in it. We consider each value chain's global trade intensity (the ratio of gross exports to gross output), the share of trade within each value chain that is intraregional, the share of trade accounted for by developing countries, and the number of countries accounting for 75 percent of each value chain's exports. To offer perspective on each value chain's weight in global production and trade, we also provide their gross output, value added, value added per employee, and gross exports in absolute terms.

[29] See Jason Dedrick, Kenneth L. Kraemer, and Greg Linden, "Who profits from global value chains? A story of the iPod and notebook PCs," *Industrial and Corporate Change*, 2010, Volume 19, Issue 1; Yuqing Xing, *Global value chains and the missing exports of the United States*, Asian Development Bank Institute working paper number 791, November 2017.

[30] See Richard Baldwin and Anthony J. Venables, "Spiders and snakes: Offshoring and agglomeration in the global economy," *Journal of International Economics*, 2010, Volume 90, Number 2; and Sébastian Miroudot and Charles Cadestin, *Services in global value chains: From inputs to value-creating activities*, OECD Trade Policy Papers, number 197, March 2017. Baldwin distinguishes between "snakes" (sequential value chains) and "spiders" (networks). All authors agree that global value chains can take different forms depending on the stages of production. Indeed, an automotive value chain is a "spider" before assembly but a "snake" through the manufacturing of the body. Miroudot distinguishes between "facilitated user networks" and "value shops" among service global value chains. Networks create value through their dispersed structure (as in insurance), whereas value shops create value by packaging and customizing a set of inputs for a single customer (as in IT services).

Exhibit 1

**Global value chains are grouped into six archetypes based on their inputs, trade intensity, and country participation.**

Low High

| Archetype | Global value chain | Labor intensity: Labor compensation/ gross value added (%) | Knowledge intensity[1]: % of highly skilled labor | Commodity intensity: Commodity inputs as % of gross output | Regional trade: % of total trade | Trade intensity: Gross exports/gross output (%) | Country participation[2]: Number of countries representing 75% of total exports | Developing economy share of exports (%) | Gross output: $ trillion | Employment: million |
|---|---|---|---|---|---|---|---|---|---|---|
| Global innovations | Chemicals | 43 | 33 | 14 | 49 | 29 | 14 | 25 | 5.5 | 19 |
| | Auto | 58 | 28 | 7 | 59 | 29 | 13 | 30 | 4.5 | 29 |
| | Computers and electronics | 52 | 50 | 3 | 54 | 48 | 8 | 48 | 4.0 | 23 |
| | Machinery and equipment | 61 | 26 | 12 | 46 | 32 | 13 | 29 | 3.6 | 34 |
| | Electrical machinery | 60 | 31 | 18 | 52 | 30 | 14 | 45 | 2.4 | 16 |
| | Transport equipment | 61 | 28 | 8 | 35 | 38 | 12 | 26 | 1.5 | 10 |
| | Average[3] or ***Total*** *(% of global total)* | 56 | 33 | 10 | 49 | 34 | 12 | 34 | ***21.5*** *(13)* | ***131*** *(4)* |
| Labor-intensive goods | Textiles and apparel | 68 | 15 | 9 | 41 | 31 | 13 | 66 | 2.8 | 78 |
| | Furniture and other manufacturing | 65 | 23 | 10 | 42 | 25 | 17 | 58 | 2.5 | 23 |
| | Average[3] or ***Total*** *(% of global total)* | 67 | 19 | 9 | 41 | 28 | 15 | 62 | ***5.3*** *(3)* | ***101*** *(3)* |
| Regional processing | Food and beverage | 52 | 13 | 29 | 55 | 13 | 22 | 43 | 6.9 | 68 |
| | Fabricated metal products | 65 | 16 | 24 | 53 | 18 | 16 | 45 | 2.5 | 34 |
| | Paper and printing | 60 | 37 | 4 | 59 | 16 | 17 | 34 | 2.2 | 11 |
| | Glass, cement, ceramics | 59 | 15 | 18 | 56 | 10 | 16 | 51 | 2.0 | 33 |
| | Rubber and plastics | 60 | 16 | 6 | 57 | 23 | 16 | 42 | 1.8 | 23 |
| | Average[3] or ***Total*** *(% of global total)* | 59 | 19 | 16 | 56 | 16 | 17 | 43 | ***15.3*** *(9)* | ***169*** *(5)* |
| Resource-intensive goods | Mining | 40 | 22 | 72 | 31 | 30 | 16 | 73 | 6.0 | 21 |
| | Agriculture | 63 | 9 | 74 | 43 | 8 | 24 | 50 | 5.7 | 866 |
| | Basic metals | 57 | 15 | 70 | 46 | 20 | 21 | 42 | 4.5 | 24 |
| | Energy | 37 | 25 | 81 | 51 | 23 | 16 | 42 | 3.9 | 4 |
| | Average[3] or ***Total*** *(% of global total)* | 49 | 18 | 74 | 43 | 20 | 19 | 52 | ***20.0*** *(12)* | ***915*** *(28)* |
| Labor-intensive services | Wholesale and retail trade | 61 | 23 | 1 | 41 | 10 | 13 | 28 | 14.3 | 488 |
| | Transport and storage | 56 | 16 | 10 | 35 | 15 | 13 | 31 | 7.2 | 109 |
| | Healthcare | 83 | 36 | 1 | 41 | 1 | 8 | 49 | 6.5 | 145 |
| | Average[3] or ***Total*** *(% of global total)* | 67 | 25 | 4 | 39 | 9 | 11 | 36 | ***28.0*** *(17)* | ***742*** *(23)* |
| Knowledge-intensive services | Professional services | 68 | 56 | 1 | 38 | 10 | 13 | 18 | 10.9 | 52 |
| | Financial intermediation | 47 | 51 | 0.2 | 32 | 8 | 9 | 8 | 7.6 | 65 |
| | IT services | 67 | 56 | 0.3 | 26 | 18 | 13 | 37 | 2.1 | 36 |
| | Average[3] or ***Total*** *(% of global total)* | 61 | 54 | 1 | 32 | 12 | 12 | 21 | ***20.6*** *(13)* | ***153*** *(5)* |
| Global average[3] or ***Total*** *(% of global total covered by focus GVCs)* | | 58 | 28 | 21 | 45 | 21 | 15 | 40 | ***161*** *(69)* | ***3,275*** *(68)* |

1 For the United States.
2 Based on the balance of payments (with the exceptions of wholesale and retail trade as well as healthcare, which are based on the World Input-Output Database).
3 Arithmetic average.

SOURCE: World Input-Output Database; IMF; WTO; UNCTAD; OECD; McKinsey Global Institute analysis

Exhibit 1 (continued)

**Global value chains are grouped into six archetypes based on their inputs, trade intensity, and country participation.**

Low High

| Archetype | Global value chain | Gross exports, 2014[4] $ trillion | Gross exports CAGR, 2007–14, % | Value added, 2017 $ trillion | Value added per employee, 2014 $ thousand | Top 5 countries by gross trade (exports + imports), 2017 |
|---|---|---|---|---|---|---|
| Global innovations | Chemicals | 1.6 | 4.1 | 1.5 | 79 | US, Germany, China, Belgium, Netherlands |
| | Auto | 1.3 | 2.3 | 1.1 | 36 | US, Germany, Japan, Mexico, Canada |
| | Computers and electronics | 1.9 | 3.0 | 1.2 | 52 | China, Hong Kong, US, Singapore, S. Korea |
| | Machinery and equipment | 1.1 | 2.5 | 1.1 | 32 | US, China, Germany, Japan, Netherlands |
| | Electrical machinery | 0.7 | 4.6 | 0.6 | 35 | China, US, Germany, Mexico, Japan |
| | Transport equipment | 0.6 | 5.0 | 0.4 | 42 | France, Germany, China, US, UK |
| | Average[5] or ***Total*** *(% of global total)* | ***7.2*** *(35)* | 3.6 | ***5.8*** *(8)* | 46 | China, US, Germany, Japan, Hong Kong |
| Labor-intensive goods | Textiles and apparel | 0.9 | 3.9 | 0.7 | 9 | China, US, Germany, Italy, Vietnam |
| | Furniture and other manufacturing | 0.6 | 3.0 | 0.9 | 38 | US, China, Hong Kong, Germany, UAE |
| | Average[5] or ***Total*** *(% of global total)* | ***1.5*** *(7)* | 3.4 | ***1.6*** *(2)* | 24 | China, US, Germany, Hong Kong, Italy |
| Regional processing | Food and beverage | 0.9 | 6.3 | 1.8 | 26 | US, Netherlands, Germany, China, France |
| | Fabricated metal products | 0.5 | 3.6 | 0.8 | 23 | China, US, Germany, Italy, France |
| | Paper and printing | 0.3 | 2.5 | 0.8 | 73 | US, China, Germany, Canada, France |
| | Glass, cement, ceramics | 0.2 | 4.2 | 0.6 | 18 | China, US, Germany, Italy, France |
| | Rubber and plastics | 0.4 | 4.6 | 0.5 | 21 | US, China, Germany, France, Japan |
| | Average[5] or ***Total*** *(% of global total)* | ***2.3*** *(11)* | 4.2 | ***4.4*** *(6)* | 32 | US, China, Germany, Netherlands, France |
| Resource-intensive goods | Mining | 1.8 | 4.9 | 3.4 | 160 | Saudi Arabia, Russia, Australia, UAE, Iraq |
| | Agriculture | 0.5 | 6.3 | 3.3 | 4 | US, Netherlands, Brazil, Canada, China |
| | Basic metals | 0.9 | 1.8 | 0.9 | 35 | China, Switzerland, Germany, US, Hong Kong |
| | Energy | 0.9 | 7.5 | 0.7 | 199 | US, Russia, Netherlands, Singapore, S. Korea |
| | Average[5] or ***Total*** *(% of global total)* | ***4.1*** *(20)* | 5.1 | ***8.3*** *(11)* | 100 | US, Russia, UAE, Saudi Arabia, Australia |
| Labor-intensive services | Wholesale and retail trade | 1.4 | 7.4 | 8.9 | 18 | US, China, Germany, France, UK[2] |
| | Transport and storage | 1.1 | 2.8 | 3.3 | 31 | US, China, Germany, Singapore, France |
| | Healthcare | 0.0 | 8.4 | 3.9 | 27 | US, Ireland, UK, Canada, China[2] |
| | Average[5] or ***Total*** *(% of global total)* | ***2.6*** *(12)* | 6.2 | ***16.1*** *(21)* | 25 | US, China, Germany, France, Japan[2] |
| Knowledge-intensive sevives | Professional services | 1.1 | 4.8 | 6.1 | 117 | US, Ireland, UK, Germany, France |
| | Financial intermediation | 0.6 | 2.3 | 4.5 | 70 | US, UK, Luxembourg, Germany, Ireland |
| | IT services | 0.4 | 10.5 | 1.2 | 33 | India, Ireland, US, Germany, China |
| | Average[5] or ***Total*** *(% of global total)* | ***2.1*** *(10)* | 5.9 | ***11.8*** *(16)* | 73 | US, UK, Ireland, Germany, France |
| Global average[5] or ***Total*** *(% of global total covered by focus GVCs)* | | ***20.65*** *(96)* | | ***75.4*** *(64)* | 51 | |

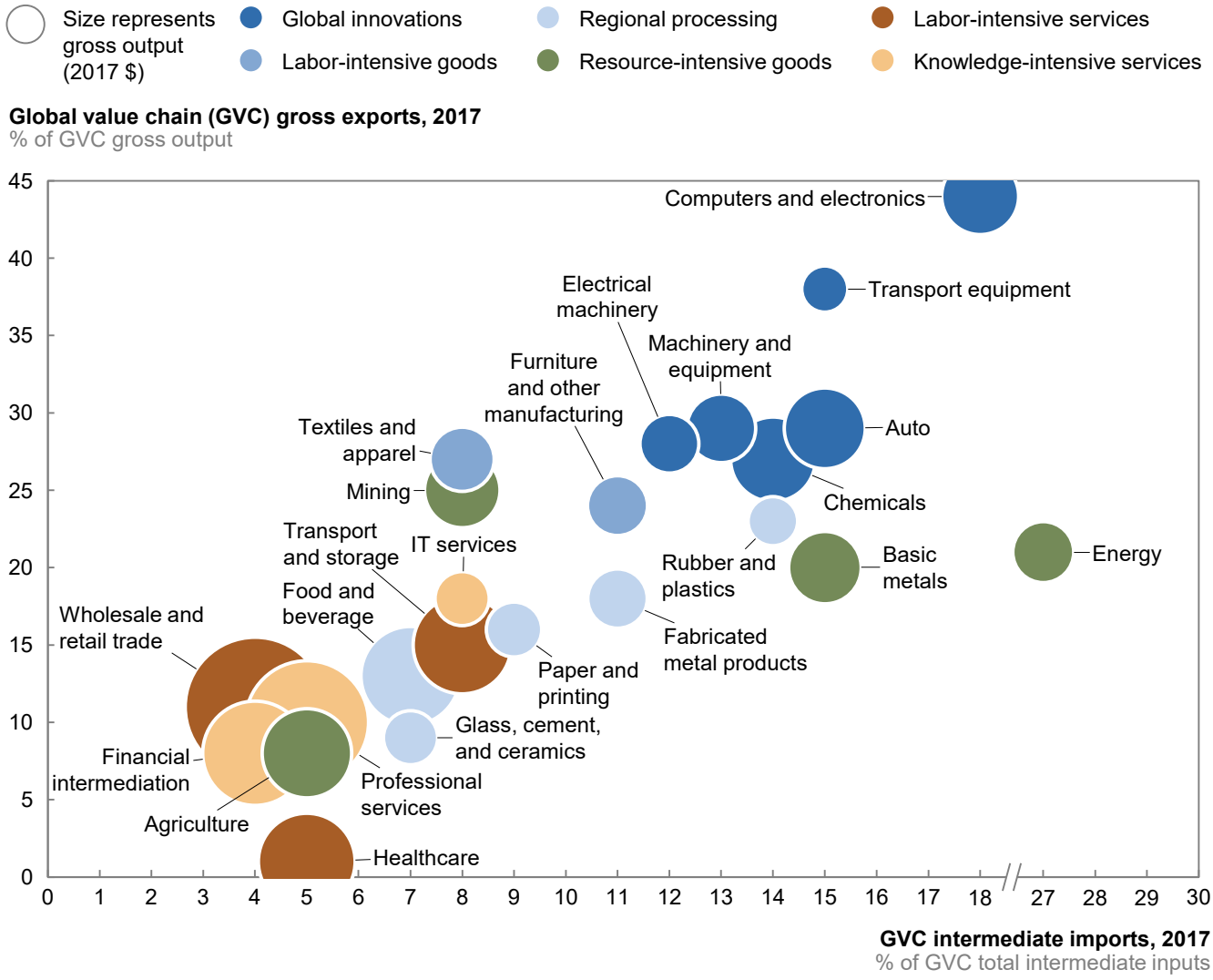
4 Based on World Input-Ouput Database.
5 Arithmetic average.

SOURCE: WIOD; IMF; WTO; UNCTAD; OECD; McKinsey Global Institute analysis

- **Global innovations.** These are the most valuable, knowledge-intensive, and trade-intensive value chains (Exhibit 2). They include computers and electronics, automobiles, other machinery and transportation equipment, and chemicals and pharmaceuticals. The final products tend to be highly modular, bringing together components from multiple countries. They involve many sequential steps and intricate components that may require subassembly; in fact, 51 percent of trade within these value chains is in intermediate goods rather than finished products. In automotive, for example, hundreds of suppliers provide inputs: basic commodities like aluminum, leather-covered door paneling, transmissions, processors and software, and many more.

Exhibit 2

**Trade intensity is highest in global innovations value chains and generally much lower in service value chains.**




SOURCE: World Input-Output Database; McKinsey Global Institute analysis

Relative to other archetypes, global innovations value chains employ a small workforce to make high-value products. They employ only 4 percent of the world's workforce (131 million people), which collectively produces 13 percent of global output and 35 percent of global exports. These are the most knowledge-intensive of all goods-producing value chains: one-third of the workers have bachelor's degrees or above. Competition in these industries is based on innovation and product quality, so R&D is a crucial step that generates the lion's share of the value. This group's spending on intangible assets such as R&D, innovation, and IP averages 30 percent of revenues,

compared to 10 percent on average for all other goods-producing value chains. These value chains are also geographically concentrated, with fewer countries participating. Just eight countries drive more than 75 percent of trade in computers and electronics. Advanced economies account for two-thirds of trade in global innovations value chains, and China is the largest single exporter in the group, representing 14 percent of trade (up from 2 percent in 1995).

- **Labor-intensive goods.** These value chains include textiles and apparel, toys, shoes, and furniture. Their defining feature is their heavy reliance on low-skill labor. Labor compensation accounts for over two-thirds of value added in the sector. The value added per worker is low ($24,000 on average, compared to $46,000 in global innovations). Much of this production shifted to the developing world in the last wave of globalization; today those nations represent 62 percent of global trade in these value chains, a higher share than in any other archetype. Given their light weight, the products in these value chains are highly tradable; 28 percent of global output is exported.

  Although labor-intensive manufacturing value chains are synonymous in many people's minds with globalization, they make up only 7 percent of the world's trade, 3 percent of gross output, and 3 percent of the global workforce (100 million people). Even in China, which accounts for one-third of the trade in these value chains, labor-intensive goods make up only 5 percent of the nation's own gross output, value added, and employment. As we discuss in Chapter 4, new automation technologies are poised to reshape which countries participate in these value chains.

- **Regional processing.** These simple sequential value chains process commodities into basic goods, such as paper, steel, fabricated metal, food and beverage, and rubber goods. Their defining feature is relatively low tradability due to the weight, bulk, or perishability of the goods, or to varying regional tastes. However, trade is growing faster in these value chains than in the global innovations or labor-intensive goods archetypes.

  These value chains use relatively few intermediate inputs. With the exception of food and beverage, more than two-thirds of the output they produce becomes intermediate input that feeds into other value chains, particularly global innovations. For instance, 82 percent of output in fabricated metal products value chains and 74 percent of output in paper and printing are intermediate goods. Yet only 16 percent of gross output is traded, the lowest share of any of our goods value chain archetypes. Because of this, production is distributed around the world. The top five countries by exports make up only 39 percent of this group's total exports, while the top five in global innovations and labor-intensive goods account for more than half of total exports. Developing countries participate moderately in these value chains, representing 43 percent of exports, and China is the largest exporter. Trade tends to occur among neighboring countries; intraregional trade makes up 56 percent of total trade, compared to less than 50 percent in other groups of value chains. Globally, regional processing value chains employ 5 percent of the global workforce (169 million people), far more than labor-intensive goods or global innovations.

- **Resource-intensive goods.** This archetype includes agriculture, mining, energy, and basic metals. Its gross output stands at around $20 trillion, approaching that of global innovations value chains. Much of that output feeds into other value chains as intermediate input. Access to natural resources as well as proximity to storage and transportation infrastructure determines where production is located. Countries around the world participate, with 19 countries generating 75 percent of resource-intensive goods exports. The top five countries account for a lower share of exports in this group than in any other, at just 29 percent. While agriculture employs almost 870 million people globally, the other industries in this category employ only 49 million people in

total, or 1.5 percent of the global workforce. Resource-intensive value chains contribute 11 percent of global value added, the highest share among all goods-producing archetypes. Mining and energy have the highest value added per employee among all goods-producing value chains we studied.

- **Labor-intensive services.** These large and labor-intensive value chains include retail and wholesale, transportation and storage, and healthcare. Given the in-person nature of these services, trade intensity is low, but trade is growing faster in these value chains than in any other archetype. Transportation, for example, has increased with the rise of goods trade and tourism and business travel; rising trade in wholesale and retail reflects the global expansion of retailers such as Carrefour and Walmart. These value chains are the largest job creators after agriculture, employing more than 740 million people globally (23 percent), two-thirds of whom are in wholesale and retail trade. This is seven times higher than employment in labor-intensive manufacturing value chains. Labor-intensive services generate the highest gross output ($28 trillion) of all groups of value chains, and half is generated by wholesale and retail trade. While often overlooked by policy makers, these sectors are an important part of the economy in all countries. Their value added per employee is the same as in labor-intensive manufacturing (roughly $25,000).

- **Knowledge-intensive services.** These value chains include professional services, financial intermediation, and IT services. They depend on skilled labor and derive substantial value from intangible assets. More than half of the people they employ have a bachelor's degree or above. Although they would seem to be inherently unconstrained by geography, these value chains have lower trade intensity than goods-producing industries, largely due to regulatory barriers. Because costs are not directly related to distance, the trade flows that do occur span the globe. Many of the participating companies are headquartered in advanced economies; just 21 percent of all exports come from developing economies, the lowest share among all value chain archetypes. The United States is the leading exporter of knowledge-intensive services (and services exports in general), representing 17 percent of trade in this group. The top five exporting countries (the United States, the United Kingdom, Ireland, Germany, and France) together represent 46 percent of global exports. Relatively high concentration reflects the significant investment in intangibles required to participate in these value chains.

## GLOBAL VALUE CHAINS ARE UNDERGOING FIVE STRUCTURAL SHIFTS

The 1990s and early 2000s saw industry value chains expand around the globe. Over the most recent decade, they have evolved yet again. Today it is becoming clear that global trade flows will not necessarily return to their earlier levels or patterns. Indeed, the 1990s and early 2000s were an exceptional growth period marked by China's integration into the global economy and the ICT revolution. Our analysis documents five structural changes in global value chains. In subsequent chapters, we explore the reasons for these changes—and conclude they are likely to continue into the future.

### 1. Goods-producing value chains have grown less trade-intensive

Nearly all global value chains expanded rapidly from 1995 to 2007. On average, global trade in intermediate inputs rose from 6.8 percent of gross output in 1995 to 10.0 percent in 2007, increasing threefold, from $2.5 trillion to $7.5 trillion. This growth was fueled in particular by makers of computers and electronics, vehicles, chemicals, and machinery. These changes reflected the unbundling of production, which allowed for offshoring and outsourcing to improve efficiency.

But since the Great Recession, the world has entered a new phase. We find that this was not simply a secular trend, but a reflection of deeper structural shifts. Sixteen of the 17 goods-producing global value chains we examined contracted between 2007 and 2017 (Exhibit 3).

Trade has continued to grow in absolute terms. But over the past decade, exports declined from 28.1 to 22.5 percent of gross output in goods-producing value chains.

Exhibit 3

**After increasing prior to 2007, trade intensity has since declined in almost all goods-producing global value chains.**

| Archetypes | | Trade intensity, 2017[1] | Change in trade intensity[1] Percentage points 2000–07 | 2007–17 |
|---|---|---|---|---|
| Global innovations | Chemicals | 27.4 | 7.8 | -5.5 |
| | Transport equipment | 38.0 | 11.0 | -6.2 |
| | Auto | 29.1 | 8.9 | -7.9 |
| | Electrical machinery | 27.9 | 6.2 | -8.3 |
| | Machinery and equipment | 29.5 | 7.3 | -8.9 |
| | Computers and electronics | 43.8 | 13.0 | -12.4 |
| Labor-intensive goods | Furniture and other manufacturing | 24.2 | 7.3 | -0.8 |
| | Textile and apparel | 27.3 | 8.2 | -10.3 |
| Regional processing | Paper and printing | 15.6 | 3.7 | 0.3 |
| | Fabricated metal products | 17.8 | 5.5 | -0.6 |
| | Rubber and plastics | 22.8 | 7.6 | -0.9 |
| | Food and beverage | 12.7 | 2.4 | -0.9 |
| | Glass, cement, ceramics | 8.7 | 2.2 | -3.2 |
| Resource-intensive goods | Agriculture | 8.4 | 0.6 | -0.7 |
| | Energy | 20.6 | 7.4 | -1.2 |
| | Basic metals | 19.6 | 5.1 | -6.2 |
| | Mining | 25.0 | 11.4 | -14.4 |
| Labor-intensive services | Wholesale and retail trade | 10.7 | 3.5 | 2.4 |
| | Healthcare | 0.5 | 0 | 0.1 |
| | Transport and storage | 14.6 | 1.7 | -2.5 |
| Knowledge-intensive services | IT services | 18.4 | 5.6 | 4.9 |
| | Professional services | 9.8 | 2.3 | 0.1 |
| | Financial intermediation | 8.0 | 3.6 | -0.8 |

1 Trade intensity defined as gross exports as a percentage of gross output.

SOURCE: World Input-Output Database; McKinsey Global Institute analysis

While part of the decline in trade intensity is due to price effects, growth in the volume of global goods trade has also slowed since 2007. Between 1990 and 2007, global trade volumes grew 2.1 times faster than real GDP on average. Between 2011 and 2017, they grew only 1.1 times faster on average.[31]

The largest declines in trade intensity were in the most heavily traded and complex global value chains (the groups we refer to as global innovations and labor-intensive goods). The trend is apparent in industries that include computers and electronics, electrical machinery, automotive, chemicals, transportation equipment, and textiles and apparel. But it has not occurred in service value chains, as we will discuss below.

Much of the reduction in trade intensity is due to shifts within China and, to a lesser extent, in other developing countries. As the consuming class expands and gains new spending power, these countries are selling more of what they produce domestically rather than exporting it.[32] China and other developing countries are driving the world's output growth, and companies based there see soaring consumer demand within their own borders as the biggest and most easily captured opportunity. Trade intensity is also falling as these countries develop domestic supply chains and vertically integrated industries, reducing their need to import intermediate goods. In computers and electronics, for example, China has begun producing a wider range of components and is moving into higher-value parts of the value chain as it builds a semiconductor industry.

The trend toward decreasing trade intensity does not signal that globalization is over. It is a sign of the gradual and ongoing convergence between developing and advanced economies in terms of both consumption and production capabilities, and especially the changes within China's economy. More production is happening in proximity to major consumer markets. We discuss these shifts in detail in Chapter 3.

### 2. Services play a growing and undervalued role in trade

While global goods trade has fallen relative to GDP, trade in services is moving in the opposite direction. Over the last 10 years, trade in services has grown more than 60 percent faster than global goods trade (Exhibit 4). In some industries—including IT services, business services, and IP charges—growth is two to three times faster.

Traditional trade statistics do not capture the full scope of services in global trade. First, services provide a large and growing share of the value of traded goods. Second, intracompany transfers of intangibles such as brands, intellectual property, software, and operational processes tend to be underreported in trade statistics. Third, free digital services offered globally create substantial value for consumers. Finally, the line between goods and services is blurring as they are increasingly bundled together. We focus more fully on services in Chapter 2.

Services create 31 percent of the value that goes into traded manufactured goods.[33] R&D, engineering, sales and marketing, finance, and human resources all enable goods to go to market. Moreover, there has been a shift toward more of those service inputs coming from international providers. In all goods-producing global value chains, traded service inputs are growing substantially while domestic service inputs are declining somewhat. Although

[31] Trade volumes are measured by trade in real prices. See *World Trade Statistical Review 2018*, World Trade Organization, 2018.

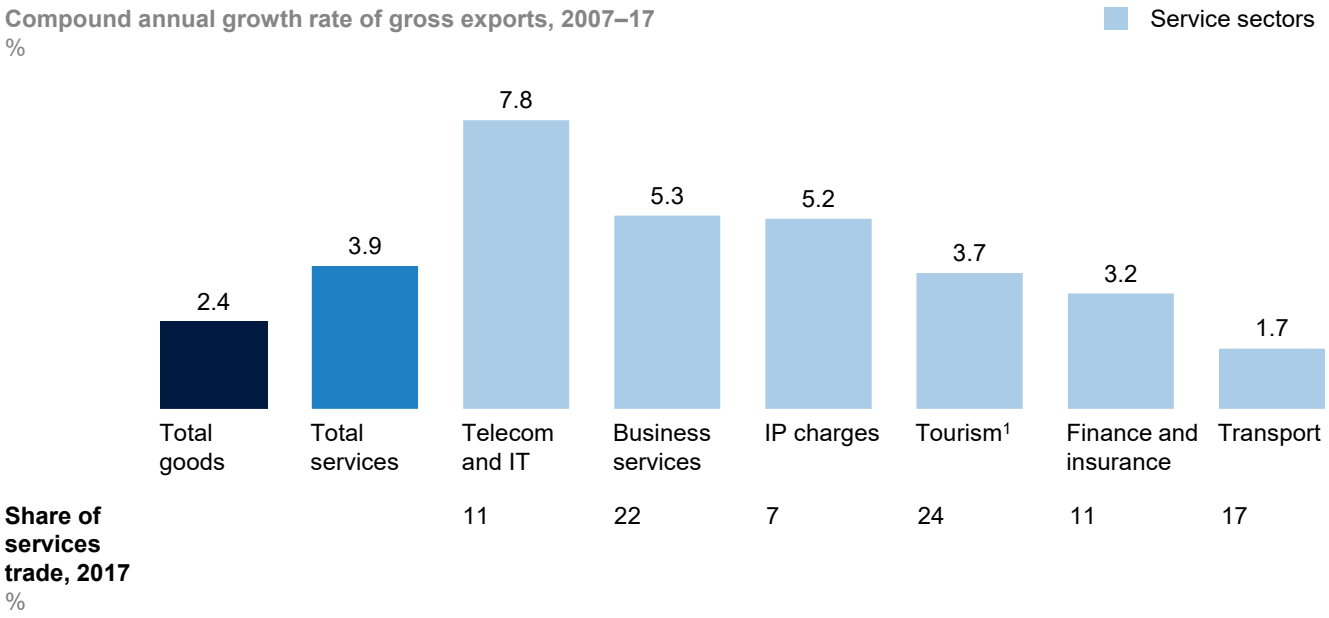
[32] The 2018 update of the OECD–World Trade Organization Trade in Value Added database supports this finding. See *The changing nature of international production: Insights from Trade in Value Added and related indicators*, OECD, December 2018.

[33] Also see Sébastien Miroudot and Charles Cadestin, *Services in global value chains: From inputs to value-creating activities*, OECD Trade Policy Papers, number 197, March 2017; Aaditya Mattoo et al., *Trade in value added: Developing new measures of cross-border trade*, World Bank Group, 2013; and Cecilia Heuser and Aaditya Mattoo, *Services trade and global value chains*, World Bank policy research working paper WPS8126, 2017.

directly measured service flows are only 23 percent of total trade flows, they now account for 45 percent of the value added in trade flows.

Exhibit 4

**The services trade is increasing faster than the goods trade, with some types of services growing two to three times faster.**




1 Travel services.

SOURCE: IMF; WTO; OECD; UNCTAD; McKinsey Global Institute analysis

Yet even looking at value added reveals only a partial picture. The intangible assets that multinational companies send to their affiliates around the world, as well as soaring cross-border flows of free digital goods (such as email, search, and music and video services), often go untracked in trade statistics.[34] Our work to value these undercounted aspects suggests that if they were counted, services would account for more than half of the value added in all trade—exceeding the value of trade in goods. This view would also substantially shift the trade balance for some countries, particularly the United States.

The distinction between goods and services is also becoming more blurred as manufacturers and retailers increasingly introduce "as a service" models. McKinsey projects that automotive manufacturers, for example, may derive up to 30 percent of their revenues from service offerings by 2030 as they shift from one-time car purchases to providing a more comprehensive range of mobility services (such as car sharing, ride hailing, transit services, bike sharing, and parking).

### 3. Trade based on labor-cost arbitrage is declining in many goods-producing value chains

A common perception is that trade flows are driven by multinational corporations searching for the lowest possible labor costs. But our analysis finds that trade based on labor-cost arbitrage represents only 18 percent of overall goods trade today. We define this as exports from low-wage countries to high-wage ones, where the differential in wages is five times or

[34] While some studies suggest that services trade could be overrepresented due to profit shifting that is reflected as IP charges, our estimate of intracompany flows of intangibles crossing borders suggests that their value exceeds officially reported IP charges for most large suppliers of intangibles (for instance, the United States, Germany, the United Kingdom, and Switzerland). Given that IP charges also include flows between companies, cross-border flows of intangibles are likely to be underrepresented in official statistics.

higher.[35] In other words, the vast majority of trade flows today are based on specialization, resource scarcity, proximity to markets, access to talent, and other factors—not only wage costs.[36]

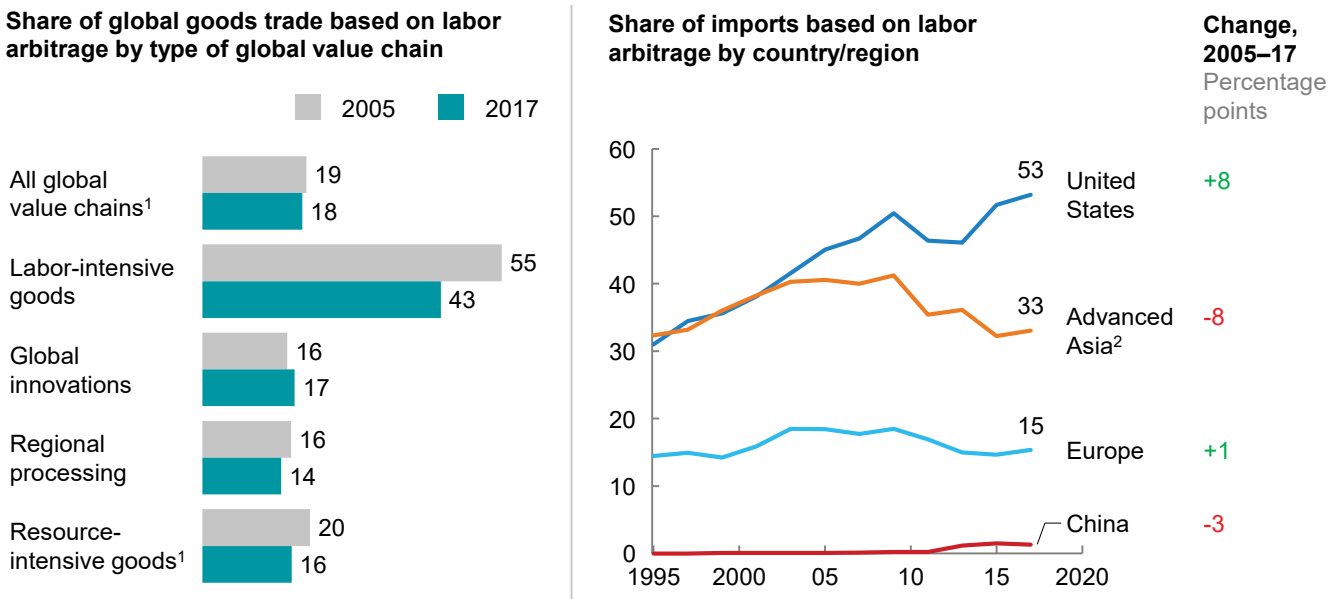
Moreover, over the last decade, the share of trade based on labor-cost arbitrage has declined in many value chains. From 1995 to 2005, exports from low-wage countries to high-wage countries grew in nearly all value chains as industries fragmented and production moved to China and other developing countries. But this share has more recently been declining in many value chains. In labor-intensive goods, such as textiles and apparel, exports from low-wage to high-wage countries fell from 55 percent of all exports in 2007 to 43 percent in 2017 (Exhibit 5). While trade in these value chains has been growing, the portion based on labor-cost arbitrage has declined; some of this is due to the convergence of incomes across countries and the shift toward South-South trade. But the trend is not universal: in contrast, the automotive sector's share of trade based on labor-cost arbitrage almost doubled from 6 percent in 2007 to 11 percent in 2017.

This pattern is also uneven across geographies. The United States increased its share of imports from low-wage countries from 47 to 53 percent between 2007 and 2017; this was driven mainly by China's growing share of US goods imports, which rose from 17 to 22 percent during that period. The share of imports from low-wage countries fell in advanced Asian economies and in the EU (by eight and three percentage points, respectively). This trend reflects the fact that wages and GDP per capita in developing economies are slowly catching up with those in advanced economies over time.

Exhibit 5

**The share of global trade based on labor-cost arbitrage is less than 20 percent.**

%




1 Excluding energy, mining, and agriculture.
2 Australia, Hong Kong, Japan, New Zealand, Singapore, and South Korea.
NOTE: Labor arbitrage defined as exports from a country whose GDP per capita is one-fifth or less than that of the importing country. Figures may not sum to 100% because of rounding.

SOURCE: IMF; WTO; OECD, UNCTAD; McKinsey Global Institute analysis

[35] If we vary the ratio of GDP per capita of the exporter and importer from 2 to 10, we find that labor-cost arbitrage ranges from 5 to 30 percent of overall global trade. At any level within this broader range, we continue to see a decline in labor-cost arbitrage in value chains producing labor-intensive goods.

[36] This analysis excludes trade in commodities, as those flows are defined by access to commodities rather than labor costs.

### 4. Global value chains are growing more knowledge-intensive

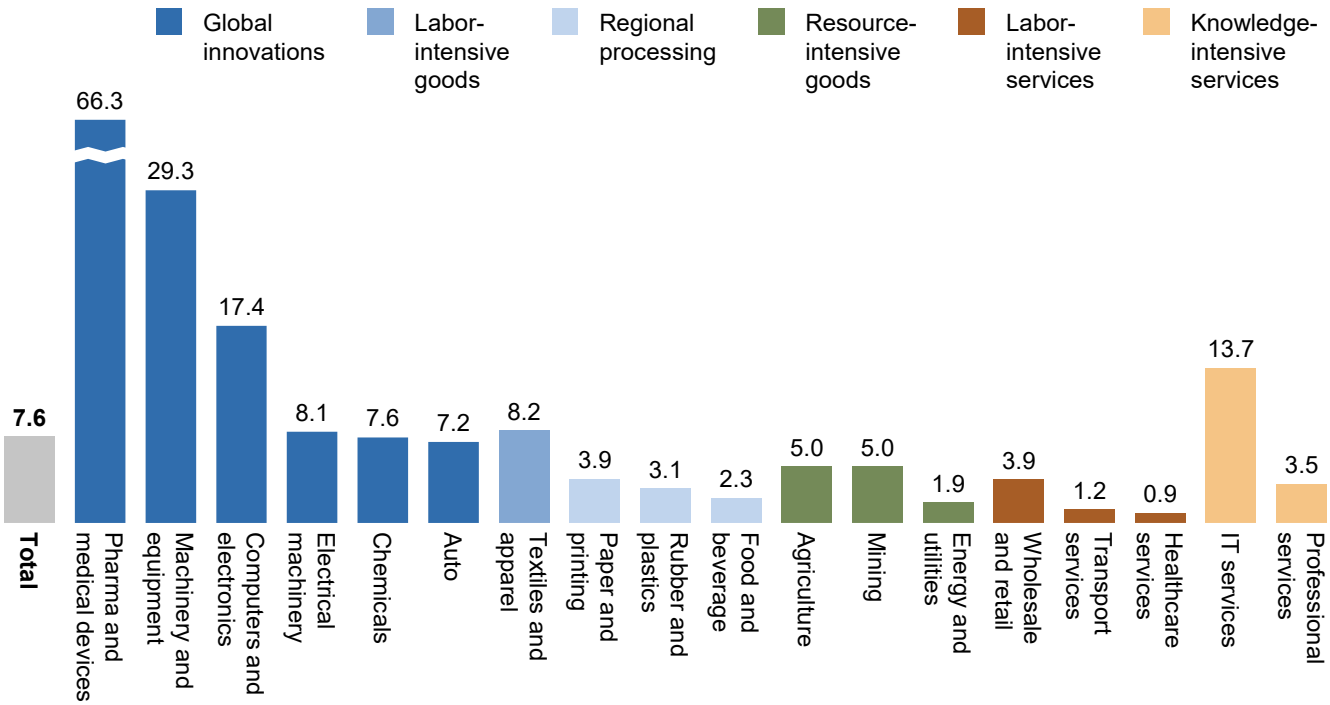
A corollary to the decline of labor-cost arbitrage is that global value chains are growing more knowledge-intensive. Within many industries, value creation is shifting to upstream activities such as R&D and design and to downstream activities such as distribution, marketing, and after-sales services. The share of value created by the actual production of a good is declining.[37] This explains the rise of "virtual manufacturing" companies such as Apple and Nike that use contract manufacturers to produce their products but maintain the upstream and downstream functions themselves. In some industries, R&D, software, design, and other intangibles are adding more value to goods than production.

Overall, investment in intangible assets now outpaces investment in physical plants and equipment. In all value chains, capitalized spending on R&D and intangible assets such as brands, software, and IP is growing as a share of revenue, rising from 5.4 percent of revenue in 2000 to 13.1 percent in 2016 (Exhibit 6).[38] The increase was highest in value chains producing global innovations. Companies in the machinery and equipment value chain, for example, spend 36 percent of revenues on R&D and intangibles, while those in pharmaceuticals and medical devices average 80 percent.

Exhibit 6

**All global value chains are becoming more knowledge-intensive.**

**Change in capitalized spending on intangibles as share of revenue**[1]
Percentage points, 2000–16




**Capitalized spending on intangibles as % of revenue, 2016**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **13.1** | 80.0 | 36.4 | 25.4 | 16.4 | 14.9 | 12.2 | 16.6 | 9.8 | 11.5 | 7.1 | 9.1 | 5.0 | 3.9 | 8.9 | 4.1 | 4.2 | 18.9 | 10.3 |

1 Intangibles include brands, software, and other intellectual property. capitalized based on R&D and selling, general, and administrative (SG&A) expenses of ~24,500 nonfinancial companies (assuming depreciation rate of capitalized SG&A at 20% and capitalized R&D at 15%). Capitalized expenses as of 2000 estimated based on multiplier to annual expenses based on Taylor and Peters (2014), which uses different multipliers depending on company age.

SOURCE: McKinsey Corporate Performance Analytics; McKinsey Global Institute analysis

[37] *Interconnected economies: Benefiting from global value chains*, OECD, 2013.

[38] See Jonathan Haskel and Stian Westlake, *Capitalism Without Capital: The Rise of the Intangible Economy*, Princeton, NJ: Princeton University Press, 2017.

We also see growing knowledge intensity in value chains as products themselves now involve more sophisticated, proprietary inputs. In autos, for example, software accounts for 10 percent of the value of a car, and McKinsey expects that share to rise to 30 percent by 2030.[39] In apparel, low-priced goods in natural fibers and polyester still dominate world output, but new synthetic fabrics are gaining ground. In athletic clothing, microfibers that wick sweat away from the body and dry quickly are replacing basic cotton shorts and T-shirts. The quality of synthetic suedes and leathers is improving, and they are being used in more innovative ways. Complex hand finishes can raise the price of even a once-basic item such as a pair of jeans to over $200.

As value chains become more knowledge-intensive, they also employ a larger share of highly skilled labor. We find that the share of income going to high-skill labor has increased in all value chains.[40] In US manufacturing, the share of compensation going to high-skill workers increased 5.5 percentage points between 1995 and 2009, while the share going to medium-skill workers fell 6.1 points and to low-skill workers 2.5 points.[41] This is not only a US phenomenon: we see similar patterns in Chinese manufacturing.[42]

### 5. Value chains are starting to become more regionally concentrated

Long-haul trade that spanned the globe became more prevalent after China entered the WTO in 2001 and other developing countries assumed a more prominent role in global value chains. The share of trade in goods that occurred within a given region, rather than between more far-flung regions, declined from 51 percent in 2000 to 45 percent in 2012. Now that trend is reversing. The intraregional share of world trade has increased by 2.7 percentage points since 2013 (Exhibit 7). The biggest drivers of the trend toward regionalization are increasing trade flows within the EU-28 and within the Asia–Pacific region, particularly trade centered on China.

Global innovations value chains have experienced the most pronounced shift toward regionalization, given their need for just-in-time sequencing. Intricate value chains in industries such as automotive and electronics span multiple countries within the Asia–Pacific region. Outside of China (which has a largely self-contained auto market with parts sourced locally), automotive value chains operate mostly in regional blocs centered on Germany, the United States, Japan, and South Korea. Supply chains extend into smaller neighboring economies with lower labor costs. This trend could accelerate in other value chains as well, as automation reduces the importance of labor costs and increases the importance of speed to market in company decisions about where to produce goods.

Intraregional trade has also been on the rise since 2007 in other parts of the developing world, including the Middle East and North Africa (up 5.6 percentage points) and Sub-Saharan Africa (up 1.0 point). This is good news for these countries, which historically have had very low shares of intraregional trade and small economies that lack scale. In a framework announced in 2018, the Africa Continental Free Trade Area merges several existing customs unions. Although many negotiations still remain and not all African countries have yet joined, it has the potential to create a continent-wide single market that could unleash more intraregional trade in the future.

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[39] Ondrej Burkacky, Johannes Deichmann, Georg Doll, and Christian Knochenhauer, "Rethinking car software and electronics architecture," February 2018, McKinsey.com.

[40] See, for example, Daron Acemoglu and David Autor, "Skills, tasks, and technologies: Implications for employment and earnings," in *Handbook of Labor Economics*, Volume 4B, Orley Ashenfelter and David Card, eds., San Diego, CA: Elsevier, 2010.

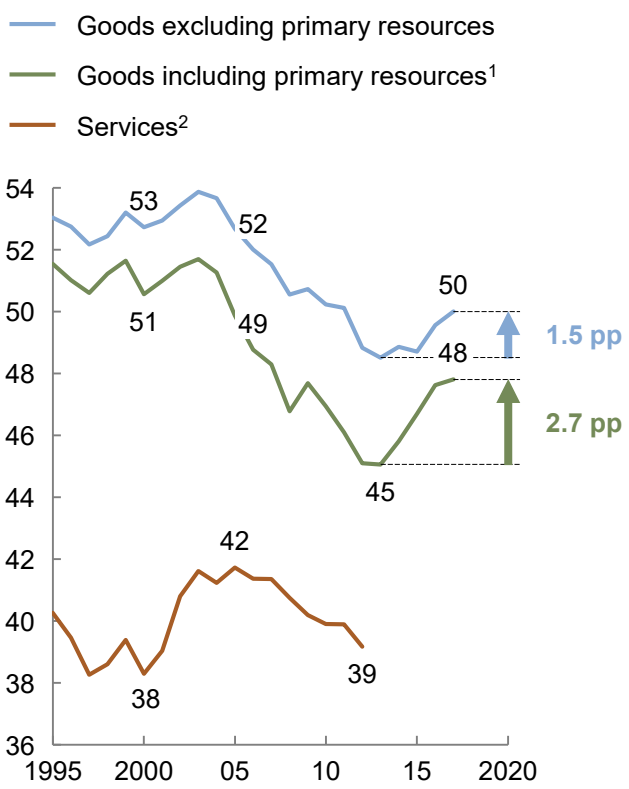
[41] The "hollowing out" of the workforce and loss of middle-skill jobs is well documented. See David H. Autor and David Dorn, "The growth of low-skill service jobs and the polarization of the US labor market," *American Economic Review*, 2013, Volume 103, Number 5.

[42] No post-2009 data available.

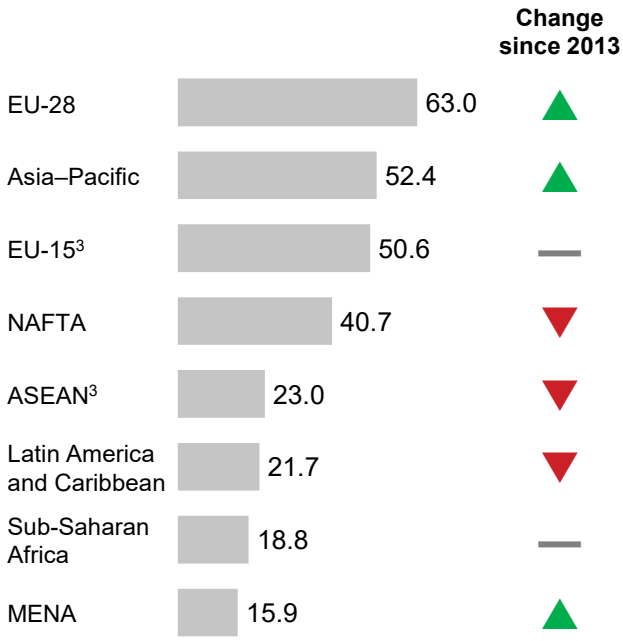
Exhibit 7

**The intraregional share of the global goods trade declined from 2000 to 2013 but has since been increasing.**

**Share of intraregional trade over time**
% of trade (imports + exports)




**Share of intraregional goods trade by region (including primary resources), 2017**[1]
% of trade (imports + exports)




1 Primary resources include mining and quarrying (uranium, thorium ores, metal ores, coal, lignite, crude petroleum, and natural gas), peat, forestry and logging, fishing, agriculture, and hunting.
2 No data since 2012 due to limited availability of bilateral services trade data.
3 EU-15 and ASEAN are subsets of EU-28 and Asia–Pacific, respectively.

SOURCE: IMF; WTO; OECD, UNCTAD; McKinsey Global Institute analysis

New technologies, increasing consumption in the developing world, and shifts in China's economy (not to mention tariffs) all set the stage for goods-producing value chains to continue to make their production footprints more regional and less long-haul. Indeed, McKinsey estimates that nearshoring of apparel production (that is, production in places like Turkey for the European market and Mexico for the US market) can already be profitable today and is likely to become more so in the decade ahead.[43]

•••

Production networks, even if based on deeply rooted traditional industries, never stay frozen in a highly connected world. They continue to be shaped and reshaped by changing global consumption patterns, new technologies, trade policy, and competitive dynamics. In the next chapter, we take a deeper look at the growth of service flows in the global economy, including their unmeasured effects. Subsequent chapters will focus on two of the biggest forces altering globalization today: structural shifts in China and other developing countries, and advances in technology.

[43] Johanna Andersson, Achim Berg, Saskia Hedrich, and Karl-Hendrik Magnus, *Is apparel manufacturing coming home? Nearshoring, automation, and sustainability—establishing a demand-focused apparel value chain*, McKinsey & Company, October 2018, McKinsey.com.

# 2. A NEW LENS FOR VALUING TRADE IN SERVICES

More often than not, when policy makers and pundits argue over trade agreements and tariffs, they are talking only about the flow of goods—and where the associated manufacturing jobs will be supported. Services trade, if mentioned at all, is typically an afterthought. While gross trade in services totaled $5.1 trillion in 2017, it was dwarfed by the $17.3 trillion global goods trade.[44]

The relatively small weight of services in global trade stands in contrast to the outsize role they play in the rest of the economy. Globally, services account for almost two-thirds of GDP and half of all jobs. In advanced economies like the United States, services can account for around 80 percent of GDP and private-sector employment. But many types of services inherently do not lend themselves to trade. The people who cut your hair, repair your car, take your dinner order, and tend your garden have to do so in person. Even those services that are more tradable have historically been subject to many barriers. Varying national regulations and certification standards can limit competition from foreign services providers. Doctors and lawyers who are licensed in their home country, for example, often find that their credentials do not allow them to practice in another.[45] Accounting standards and engineering requirements in buildings also vary by country.

Despite these limitations, global services trade overall has continued to grow faster than global GDP. It has posted brisk annual growth of 3.9 percent annually over the past decade—outpacing growth in global goods trade by more than 60 percent. Some subsectors, including telecom and IT services, business services, and intellectual property charges, are now growing two to three times faster than goods trade (Exhibit 8). As discussed in Chapter 1, service value chains continue to increase in trade and expand globally even as goods-producing value chains contract. Moreover, services trade spans the entire globe and is less regionally concentrated than goods trade.

Despite its growing importance, the full scope of services in global trade is obscured in traditional trade statistics. In this chapter, we examine just how much value they generate that goes uncounted in metrics that directly measure services trade. We consider three channels: the increasing share of value that services add to exported goods, the intracompany exchange of intangibles across borders, and free digital services made available to global users.

Our analysis suggests that these three channels collectively produce up to $8.3 trillion in value annually—a figure that would increase overall trade flows by $4.0 trillion and reallocate another $4.3 trillion currently counted as part of the flow of goods. Viewed through this alternative lens, trade in services would already exceed trade in goods in value-added terms. Moreover, the continuing march of new technologies will likely make this shift more pronounced over time (see Chapter 4 for more on this topic). The momentum in services underscores the fact that globalization is still moving forward in other forms, even as growth slows in goods trade. Furthermore, the growing weight of services indicates that these are sectors that need more attention from governments in trade agreements and national policy agendas.

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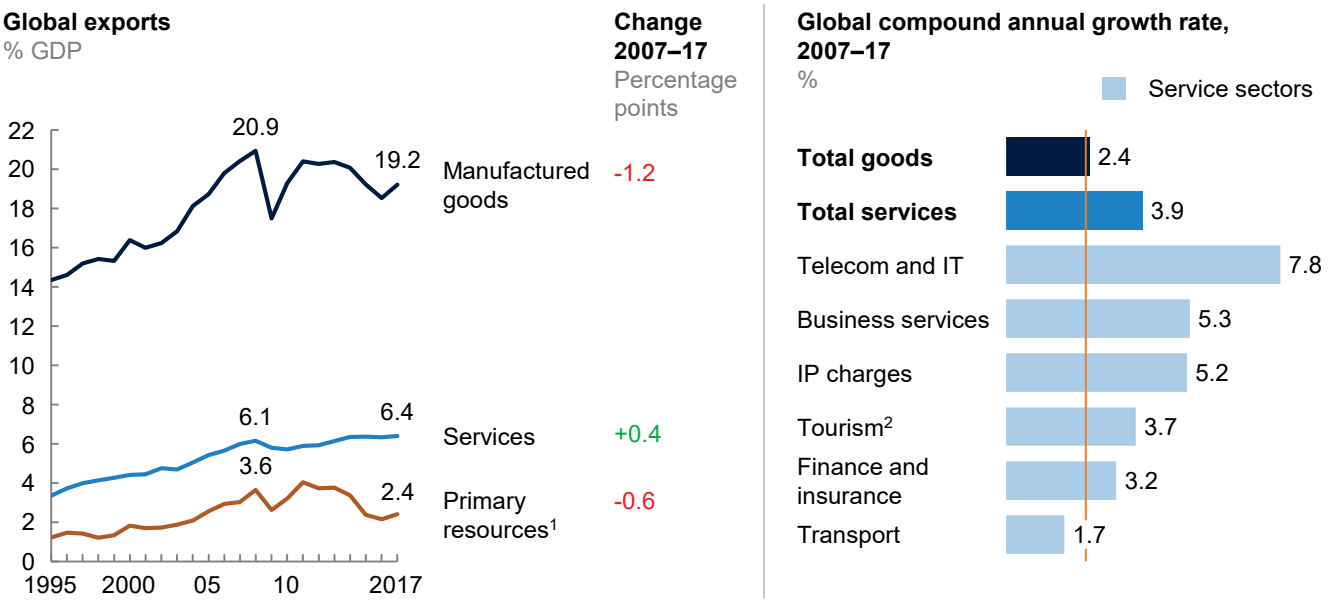
[44] Includes trade between mainland China, Macau, Taiwan, and Hong Kong. Excluding this trade, global goods trade stood at $16.6 trillion and global services trade at $4.8 trillion in 2017.

[45] *Services trade policies and the global economy*, OECD, 2017. See also Dean Baker, "Globalization hurt factory workers. Why not doctors?" *Los Angeles Times*, November 27, 2016.

Exhibit 8

**The services trade is increasing faster than the goods trade, with some types of services growing two to three times faster.**




1 Includes mining and quarrying (uranium, thorium ores, metal ores, coal, lignite, crude petroleum, and natural gas), peat, forestry and logging, fishing, agriculture, and hunting.
2 Travel services.

SOURCE: IMF; WTO;OECD, UNCTAD; McKinsey Global Institute analysis

## SERVICES FEED INTO THE PRODUCTION OF MANY GOODS AND ACCOUNT FOR 45 PERCENT OF VALUE ADDED IN TRADE FLOWS

Trade statistics count services that are delivered internationally, but they do not separate out the services that go into the production of traded goods.[46] In many cases, those services—which include elements such as design, marketing, R&D, and other types of intellectual property—are what sets a manufactured good apart and makes it a desirable product.

Consider an oncology drug. In trade statistics, any type of exported medication is booked as a manufactured good.[47] But to the cancer patients who take it to extend their lives, the greatest value does not come from the manufacturing process that turns out physical pills (although the safety and accuracy of that process is vital). It stems from the years of R&D by highly credentialed scientists that went into the drug's discovery and development as well as rounds of clinical trials that went into proving its efficacy and determining the safe dosage.

Services also shape more everyday products. The production of a car begins with substantial investment in R&D to engineer fuel-efficient, safe vehicles that deliver a good driving experience, style, and comfort. This process determines the exact specifications that will define the manufacturing process, down to the last component. After the car rolls off the assembly line, services come into play again as each model is marketed, shipped to dealers, and sold. Services also make smartphones distinctive. For a smartphone running

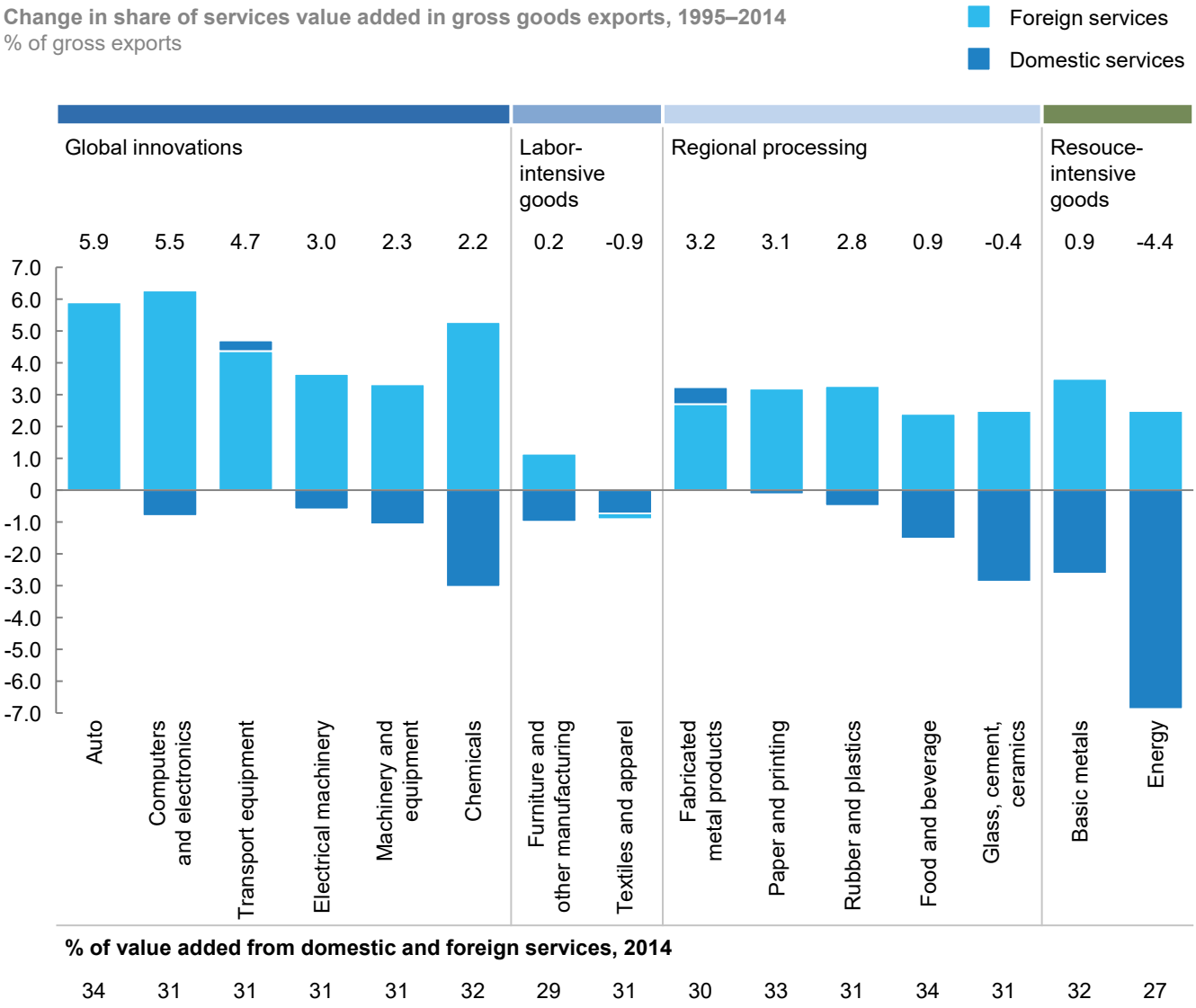
46 Similarly, trade statistics do not count the value of goods used in services (e.g., paper and equipment used at an accounting firm providing services across borders).
47 This assumes that the drug is manufactured and then exported. In some instances, pharmaceutical companies license drugs to be both manufactured and delivered abroad; when that is the case, the transactions are counted as traded services.

on Android, more than half of the value of the device comes from the software rather than the hardware.[48]

This concept enables a different view of the importance of services by taking into account not only their direct trade but also the extent to which they are embodied in exported goods (or trade in value added).[49] Within goods-producing global value chains we examined, services represent 31 percent of the value of traded goods today—a share that has gone up by 2.3 percentage points since 1995 (Exhibit 9). The share has risen even more clearly, by around five percentage points, in the most complex value chains we refer to as global innovations (including automotive, computers and electronics, and transportation equipment).

Exhibit 9

**Value added from services has increased significantly in all goods value chains, and imported services are substituting for domestic services.**




SOURCE: World Input-Output Database; McKinsey Global Institute analysis

[48] Hal Varian, *Measurement challenges in high tech: Silicon and statistics*, Economic Statistics Centre of Excellence (ESCoE) Conference on Economic Measurement 2018, London, UK, May 16–17, 2018.

[49] Sébastien Miroudot and Charles Cadestin, *Services in global value chains: From inputs to value-creating activities*, OECD Trade Policy Papers, number 197, March 2017; and Cecilia Heuser and Aaditya Mattoo, *Services trade and global value chains*, World Bank policy research working paper WPS8126, 2017.

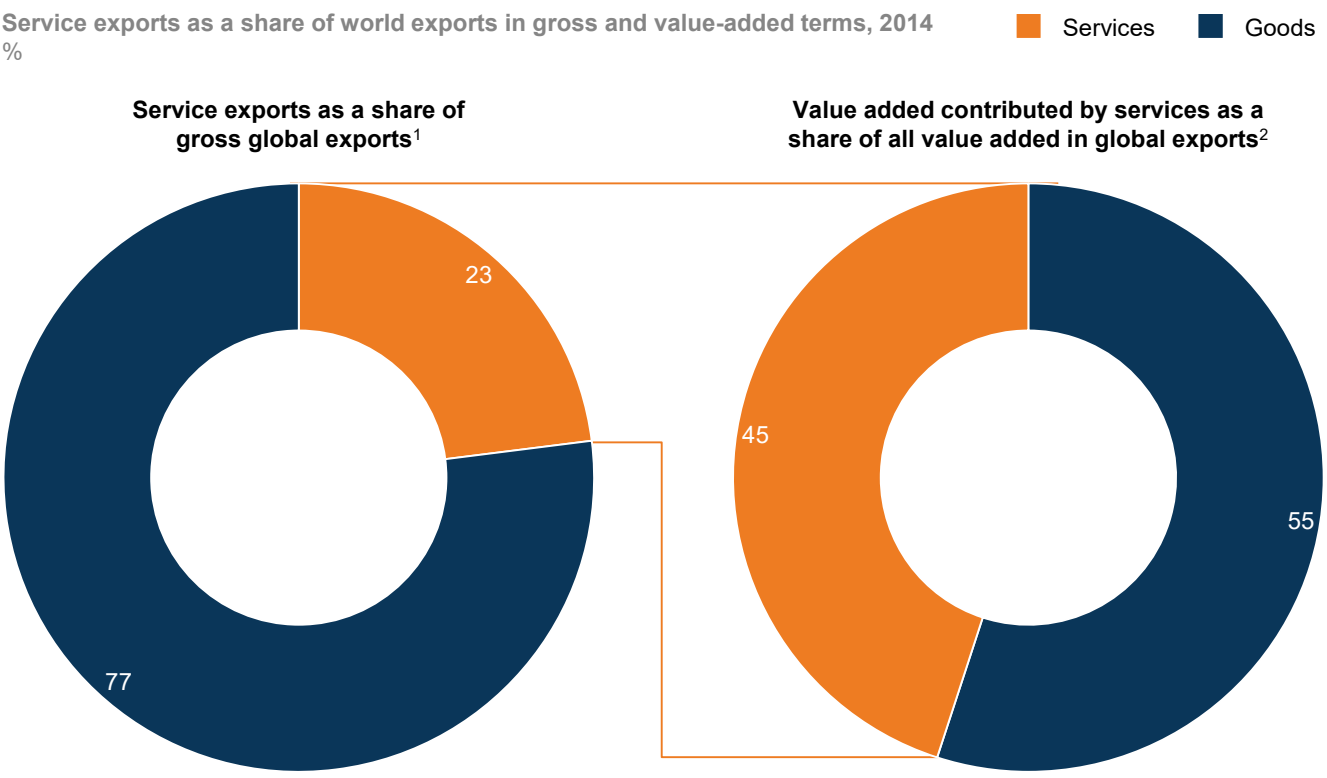
Moreover, foreign services inputs have been assuming greater weight over time. In some countries, including Ireland, Hungary, and Estonia, the foreign share of services value added is greater than the domestic share.[50] For instance, global pharmaceutical companies are increasingly turning to contract development and manufacturing organizations such as Wuxi AppTec in China and Intas in India to handle their clinical trials and manufacture drugs. The growth in business process outsourcing also contributed to this trend, as companies in the West have turned to support services and call centers in hubs such as the Philippines and India.

In conventional statistics that measure gross trade flows, direct trade in services accounts for only 23 percent of the value of all global trade, a figure that has changed little since 1990. But in an expanded view that also includes services that feed into the creation of goods, services account for 45 percent of the value added in global trade (Exhibit 10).[51]

Exhibit 10

**Although services directly make up only 23 percent of global trade, they contribute 45 percent of the total value added.**

Service exports as a share of world exports in gross and value-added terms, 2014
%




1 Share based on WTO and IMF.
2 Share based on World Input-Output Database.

SOURCE: WTO; IMF; World Input-Output Database; McKinsey Global Institute analysis

[50] *The changing nature of international production: Insights from Trade in Value Added and related indicators*, OECD, December 2018.

[51] This calculation takes into account the fact that some goods are used in the production of services, such as computers and ICT equipment.

## MULTINATIONALS USE INTANGIBLE ASSETS IN OPERATIONS AROUND THE WORLD, A PHENOMENON THAT IS OFTEN INVISIBLE IN TRADE STATISTICS

Since the early 1970s, corporate investment in physical assets like equipment and structures has gradually declined as a share of GDP in favor of greater investment in so-called intangibles such as design, brands, and software.[52] Previous MGI research has found that the most profitable firms, regardless of their sector, build intellectual property and secure competitive advantages by investing in R&D, brands, and other intangible assets.[53] National accounts adjusted the treatment of intangibles in 2008 as they began to count R&D and software expenditures as investments.[54]

Many of the defining aspects that consumers value in goods reflect investment in intangibles. Nike shoes will keep an athlete comfortable when she runs, but her purchase was influenced by a combination of design, brand, and marketing.[55] Apple offers sleek design and a novel in-store retail experience—not to mention brand cachet that has been enhanced by decades of renowned advertising. Globally, the value of these brands, including the marketing, design, and R&D that goes into their products, extends into the trillions.[56]

Creating the signature look and feel of a product is often the result of large up-front R&D expenditures that are treated as expenses rather than investments in reporting. But viewing a core set of intangibles (including design, brand, organizational capital, and training) as capitalized investments rather than current expenses shows that European and US companies are now spending more on intangible assets than on tangible assets (Exhibit 11). The share of income from intangibles accounts for around one-third of production value—twice as high as the income generated from tangible capital.[57]

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52 Carol A. Corrado and Charles R. Hulten, "How do you measure a 'technological revolution'?," *American Economic Review*, 2010, Volume 100, Issue 2.

53 *Playing to win: The new global competition for corporate profits*, McKinsey Global Institute, September 2015.

54 Expenditures on R&D and software were previously considered intermediate goods and hence did not contribute to GDP. Starting in 2008, the UN Statistical Commission revised the System of National Accounts to classify these expenditures as investment and therefore part of GDP. The adoption of this revision raised the GDP of the United States and Europe by several percent.

55 Carol Corrado et al., *Intangible capital and growth in advanced economies: Measurement methods and comparative results*, IZA discussion paper number 6733, July 2012.

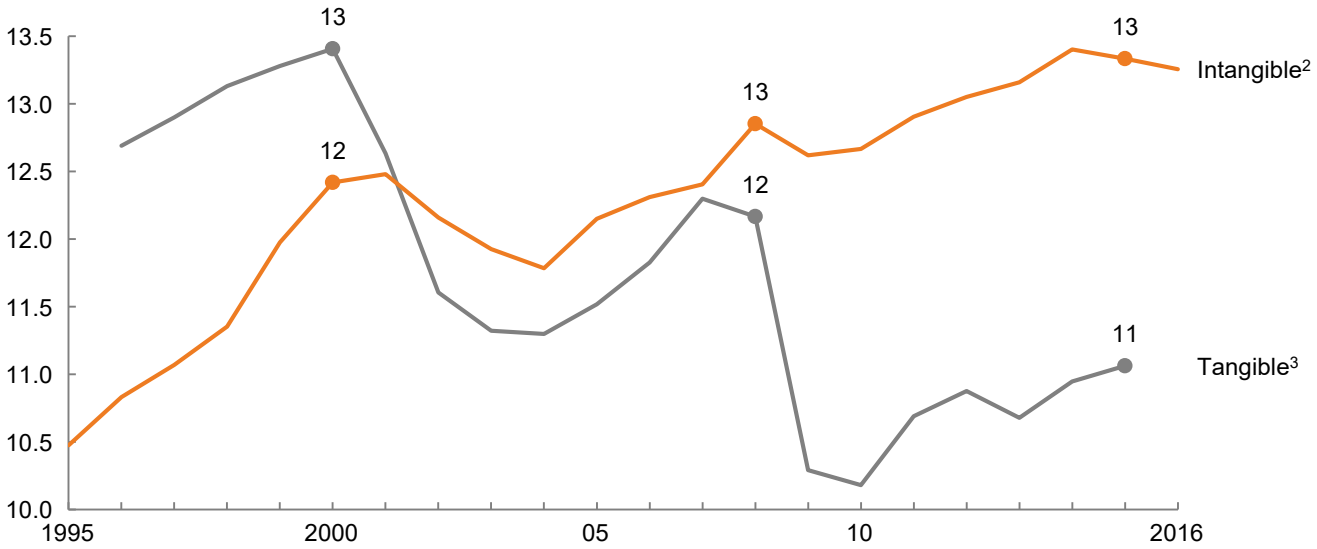
56 See the *Forbes* list of the world's most value brands at forbes.com/powerful-brands/list/#tab:rank

57 *World intellectual property report 2017: Intangible capital in global value chains*, World Intellectual Property Organization, 2017.

Exhibit 11

**Corporate investment in intangible assets now exceeds investment in physical assets.**

Total private investment in Europe and the United States[1]
% GDP




1 Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.
2 Intangible investment as a share of GDP adjusted for real estate activities, public administration, education, and healthcare.
3 Calculated as gross fixed capital formation (excluding real estate activities, public administration, education, and healthcare) minus intangible investment captured in statistics/GDP adjusted for real estate activities, public administration, education, and healthcare. 1996–99 estimated based on trend in Haskel and Westlake, *Capitalism Without Capital,* 2017.

SOURCE: Corrado et al., *Intangible investment in the EU and US before and since the Great Recession and its contribution to productivity growth,* European Investment Bank working paper, 2017; McKinsey Global Institute analysis

## Invisible trade: The problem with intangibles

Intangibles are an enormous force in the global economy, but they create measurement problems for company, trade, and GDP reporting. To understand the challenges, we focus on the distinguishing characteristics of intangibles: their sunk costs, scalability, spillovers, and synergies.[58] These qualities make intangibles inherently difficult to measure.

To be recognized in official accounts, a trade transaction must have a non-zero actual or implied price and a transfer of "economic ownership."[59] Multinationals are required to report services rendered to foreign affiliates, but intangibles do not always cross borders as discrete transactions. Companies spend hundreds of millions on branding, software, design, and operational systems in their headquarters or R&D hubs, and then they can use these elements in their operations around the world while the headquarters or R&D hub

[58] See Jonathan Haskel and Stian Westlake, *Capitalism Without Capital: The Rise of the Intangible Economy*, Princeton, NJ: Princeton University Press, 2017. Sunk costs refer to the inability to recoup the investment if an intangible does not pay off. Scalability means that companies can use their intangible asset broadly for the same cost as using it narrowly. Spillovers refers to the ease with which other firms can copy the investment, and synergies indicate the way that intangibles often evolve and mix into new and better ideas.

[59] The balance of payments captures monetary and nonmonetary transactions. While a monetary transaction has an actual price, a nonmonetary transaction is one not initially stated in units of currency by the transacting parties (barter transactions, remuneration in kind, payments in kind, compensation in kind, and transfers in kind). The monetary values of nonmonetary transactions need to be indirectly measured or otherwise estimated. According to the IMF's *Balance of payments and international investment position manual* (BPM6), transfer of economic ownership implies that that all risks, rewards, and rights and responsibilities of ownership in practice are transferred. In some cases (e.g., financial leases and transactions between an enterprise and its foreign branches), a change of "economic ownership" takes place even though "legal ownership" remains unchanged.

maintains ownership of them.[60] There is no priced transaction since the company is not reporting a change in ownership—and the scalability of an intangible like a brand, a store format, or an operational system means it can be sent to multiple affiliates in other countries to copy at no incremental cost. Something valuable has moved across borders, but current trade statistics do not necessarily capture it.[61]

Consider how Starbucks operates in France. The company's French stores use local labor and are predisposed to source most of their offerings regionally (except perhaps the coffee beans themselves). Corporate headquarters in the United States, however, has developed the recipes, the brands, the marketing, and the operational system that allow local affiliates like the Starbucks on the Champs-Elysées to have the look and feel of a Starbucks in Seattle or anywhere else in the world. The value of these intangibles is why Starbucks can charge a premium on its drinks relative to a generic coffee shop. But none of this is captured in trade statistics since the brand, recipes, and processes are not leased or transferred to the affiliate (although franchise agreements with licensed Starbucks shops may apply).[62] Despite this, there is clearly a type of trade happening, since the American traveler who spots the green mermaid logo and stops in for a familiar Frappuccino is drawn in at least partially by the intangibles.

Another example is a smartphone assembled in China with parts sourced globally. The components that make up the manufactured good itself might cost only $200 (roughly 40 percent of the final retail price). When the phone is ultimately sold for $499, it reflects the high costs of R&D, software development, and marketing that are provided in the United States, as well as the value that consumers place on the design and brand.[63] The difference between the cost and the retail price is the gross margin, which would add to GDP in the country where the good is sold. Now consider the impact on trade. Today, when that same smartphone is bought in Australia, the only trade that is likely to be registered is the $200 wholesale cost as the physical good is shipped from China to Australia.[64] Although it is the primary source of value, the US contribution may never be accounted for since the software is not "leased" or transferred to the contract manufacturer. Trade statistics therefore would miss the $300 trade of software and R&D from the United States to China. Counting this type of transaction would cast the US trade balance in a sharply different light. One study estimates that in the smartphone trade alone, counting services could add $120 billion annually to the US trade surplus in services.[65]

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60 See, for instance, Carol A. Corrado and Charles R. Hulten, *Internationalization of intangibles*, Measuring the Effects of Globalization, Washington, DC, February 28, 2013.

61 While income from the foreign affiliate may not be captured in trade figures, it would be captured as receipts of direct investment income.

62 Roughly one-sixth of Starbucks stores in Europe and the Middle East are company operated, accordingly to the company's annual report.

63 Fatih Guvenen et al., *Offshore profit shifting and domestic productivity measurement*, Federal Reserve Bank of Minneapolis working paper number 751, April 2018; Hal Varian, *Measurement challenges in high tech: Silicon and statistics*, Economic Statistics Centre of Excellence (ESCoE) Conference on Economic Measurement 2018, London, UK, May 16–17, 2018; Kenneth L. Kraemer, Greg Linden, and Jason Dedrick, *Capturing value in global networks: Apple's iPad and iPhone*, 2011; Yuqing Xing, *Global value chains and the missing exports of the United States*, Asian Development Bank Institute working paper number 791, 2017.

64 According to IMF guidelines, this transaction should be captured as exports from China to the United States ($200) and exports from the United States to Australia ($499), even though the phone never physically crosses the US border. In this case, net exports of $299 would reflect US exports of intangibles. However, most statistical agencies report only the export from China to Australia ($200).

65 The same issue applies to the value of the Android software provided by Google, which is given free to contract manufacturers and others. See Hal Varian, *Measurement challenges in high tech: Silicon and statistics*, Economic Statistics Centre of Excellence (ESCoE) Conference on Economic Measurement 2018, London, UK, May 16–17, 2018.

In some cases, when the intellectual property associated with pharmaceuticals or brand trademarks is patented, intangibles are in fact recognized as trade through royalty payments.[66] Often these royalty flows are driven by the decisions of multinationals to place intellectual property in low-cost tax havens.[67] These intellectual property charges are one of the fastest-growing categories of global trade. In 2017, they amounted to $366 billion globally, but this is only a fraction of the flows associated with intangible assets.

### Cross-border flows of intangible assets could be worth up to $770 billion annually

We set out to estimate the potential value of trade in intangible goods that is missing from trade statistics, considering four types of intangibles used in a variety of industries: software, brands, design, and operating processes. Given the challenges in measurement, even for companies themselves, we take a simplified approach to estimate the value of trade in these intangibles. Using publicly available financial reporting for about 1,300 public companies, we first determine the total value associated with cross-border flows of intangibles and then allocate a share of this value as trade from each company's headquarters to its local affiliates (see the technical appendix for details on how we determined the value of intangibles).

We estimate that global trade flows of intangible assets in 2017 amounted to anywhere from $330 billion to $770 billion annually.[68] Our conservative estimate of the value of cross-border flows of intangibles includes only costs associated with them that are attributed to the country of headquarters, whereas the upper range of the estimate reflects cross-border revenues to be allocated to the country of headquarters, including both costs and profit above cost of capital associated with intangibles.

The main sectors generating cross-border flows of intangibles are technology (about $230 billion annually), healthcare and pharmaceuticals (approximately $160 billion), and consumer goods (about $110 billion). At the firm level, a handful of large multinationals stand out as the major drivers of intangible value moving across borders. At the top of the list are Samsung and Apple.

The United States generates almost one-third of the annual value of intangibles crossing borders ($275 billion), with nearly half of this coming from the IT sector (Exhibit 12). This is slightly more than US exports of intellectual property ($256 billion in 2017) and 50 percent above repatriated profits of US multinational companies (which stood at $182 billion in 2017). Japan (about $80 billion) and Germany (more than $70 billion) rank next in the annual value of intangibles crossing borders. In both cases, exported intangibles originate mainly in the consumer goods sector, driven by automotive companies. If these figures were factored into trade statistics, they would significantly alter trade balances for major economies. Most

[66] We do not estimate the value of the share of cross-border flows of intangibles that is already reflected in IP charges.

[67] See Thomas R. Tørsløv, Ludvig S. Wier, and Gabriel Zucman, *The missing profits of nations*, NBER working paper number 24701, June 2018, revised August 2018.

[68] In 2014, foreign affiliates of multinationals generated revenues of more than $18 trillion in all goods and service sectors in 24 OECD countries. Part of these revenues came from foreign affiliate trade recorded in official statistics (for instance, 17 percent in service sectors). See Andrea Andrenelli et al., *Multinational production and trade in services*, OECD Trade Policy Papers, number 212, March 2018. However, only about 40 percent of foreign affiliate revenues are generated by sectors in which intangibles play a major role (including IT, pharmaceuticals, food and beverage, textiles and apparel, and automotive). If we adjust for the exports of foreign affiliates recorded in official statistics and sectors that are not intangible-heavy, the domestic revenues of foreign affiliates of intangible-heavy multinationals stand at around $6 trillion. Based on our estimates, cross-border flows of intangibles attributable to the country of headquarters are from 6 to 13 percent of domestic revenues of foreign affiliates in intangible-heavy sectors.

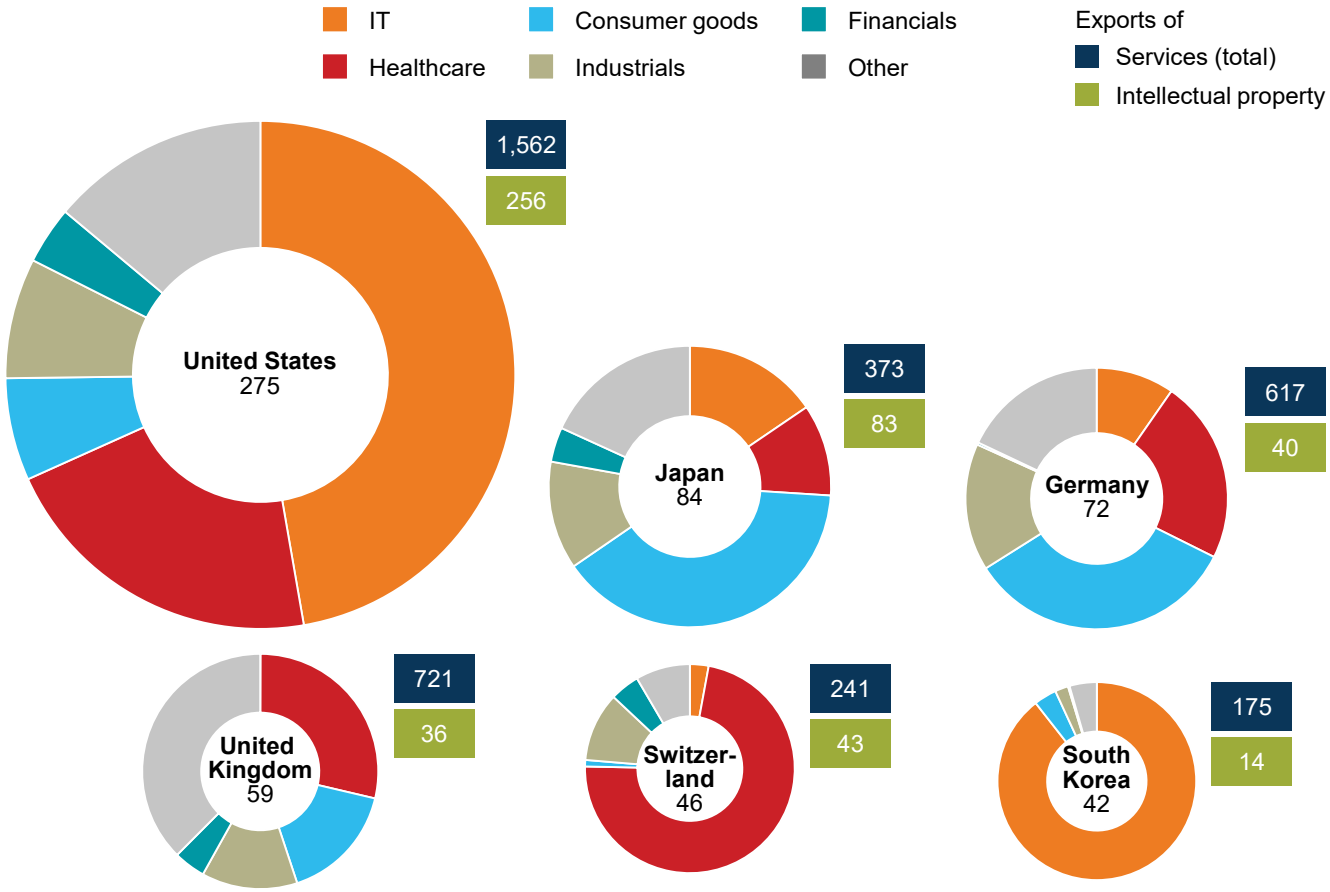
notably, the adjustment would cut the US trade deficit by almost one-third, reducing it from $566 billion to $392 billion.[69]

While services trade could be overrepresented due to profit shifting that is reflected as intellectual property charges, our estimate of intracompany flows of intangibles crossing borders exceeds officially reported IP charges for most large suppliers of intangibles (for instance, the United States, Germany, the United Kingdom, and Switzerland).[70] Given that IP charges also include flows between companies, cross-border flows of intangibles are likely to be underrepresented in official statistics.

Exhibit 12

**The United States generates one-third of the value of intangibles crossing the world's borders, with half coming from its IT sector.**

**Estimated outflows of Intangibles from corporate headquarters to foreign affiliates, 2017**
$ billion




NOTE: Figures may not sum to 100% because of rounding. Labels for values <1 percent not shown. Flows of intangibles represent brands, software, and other intellectual property sent from corporate headquarters to foreign affiliates. They are estimated based on company-level data on foreign affiliate economic profit and expenses, adjusted for the share of revenue associated with intangibles produced by headquarters country.

SOURCE: McKinsey Corporate Performance Analytics; Capital IQ; IMF; OECD; McKinsey Global Institute analysis

[69] Multiple factors affect the size and direction of cross-border flows of intangibles, including legal frameworks and client preferences. Another factor is the capability of foreign affiliates to absorb and adapt intangibles to local demand and context; see Michael Mandel, "Moving beyond the balance-sheet economy," in *Policy choices for a digital age: Taking a whole economy, whole society approach*, Friends of Europe, June 2017.

[70] See, for instance, Matthias Dischinger and Nadine Riedel, "Corporate taxes and the location of intangible assets within multinational firms," *Journal of Public Economics*, August 2011, Volume 95, Issues 7–8.

## UNTRACKED CROSS-BORDER FLOWS OF FREE DIGITAL SERVICES COULD BE WORTH UP TO $3.2 TRILLION ANNUALLY

From e-mail and social media to mapping and search, many of the digital services we rely on daily are free.[71] The English-language version of Wikipedia, for example, contains some 5.8 million articles, and the full website encompasses 40 million articles in roughly 300 languages. Every day, users worldwide watch more than a billion hours of YouTube's video content. On Spotify, roughly 100 million people use the platform's free tier, where they gain access to personalized playlists and hundreds of songs to stream on demand every day.[72]

Free digital services have always posed a measurement challenge for economists—and that puzzle becomes particularly vexing in the context of trade. How do we account for the fact that digital services and content created in one country can attract hundreds of millions of nonpaying users worldwide?

The most popular free digital services are the products of a relatively small group of companies. Google serves about 60 percent of global search users, for example, processing 1.2 trillion information requests a year. Facebook represents 24 percent of global social media use. This leads to stark geographic concentration, especially given that most employees of tech companies are based in the countries where they are headquartered. These services have large domestic user bases, but they are also offered all over the world—at near-zero cost since the trade is virtual.

Taken together, these facts suggest that substantial value is moving across borders in the form of free digital services.[73] But beyond records of cross-border advertising revenue, this value is invisible in trade statistics. If it were recorded, the biggest impact in absolute terms would be altering the US trade balance, since so many of the digital platforms operating in this arena are based in the United States.

### The potential value of free digital services trade ranges from $240 billion to $3.2 trillion annually

We set out to estimate the value of free digital services moving across borders. Our first step was estimating the global value of these services, then allocating a portion of that estimated value to trade flows based on the headquarters country of a given website and page views from outside the country. (See the technical appendix for full details on methodology.) We used two approaches to measuring the value.

First, we considered the consumer surplus generated by the free digital service. Economist and technologist Erik Brynjolfsson has estimated the implied value of free digital goods by conducting surveys and asking respondents whether they would give up access to a set of free services in exchange for payment to test where they would set the value. This is known as "willingness to accept" (Exhibit 13). The median US participant set the value of search engines at around $1,100 per month, or nearly $14,000 annually, and email at almost $600 per month, or around $7,000 annually.[74]

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[71] While search engines, maps, messengers, social networks, and other "free" digital services do not explicitly charge users, user data could be considered an implied price of these services, as most free digital services monetize the data they collect from users. See Wendy C. Y. Li, Makoto Nirei, and Kazufumi Yamana, *Value of data: There's no such thing as a free lunch in the digital economy*, Sixth IMF Statistical Forum, Washington, DC, November 19–20, 2018.

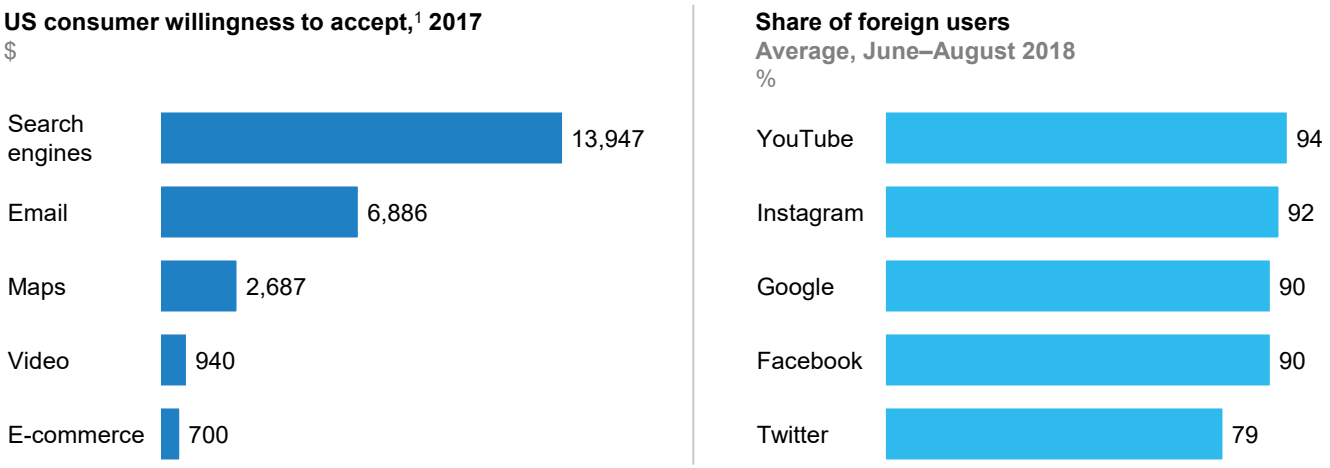
[72] Spotify, June 2018.

[73] See, for instance, Michael Mandel, "Data, trade, and growth," in *Measuring Globalization: Better Trade Statistics for Better Policy*, Susan N. Houseman and Michael J. Mandel, eds., Kalamazoo, MI: Upjohn Press, 2015.

[74] See Erik Brynjolfsson, Felix Eggers, and Avinash Gannamaneni, *Using massive online choice experiments to measure changes in well-being*, NBER working paper number 24514, April 2018; Erik Brynjolfsson, Felix Eggers, and Avinash Gannamaneni, "Measuring welfare with massive online choice experiments: A brief introduction," *AEA Papers and Proceedings 2018*; and Erik Brynjolfsson et al., *The digital economy, GDP, and consumer welfare: Theory and evidence*, Economic Statistics Centre of Excellence (ESCoE) Conference on Economic Measurement 2018, London, UK, May 16–17, 2018.

Exhibit 13

**Many digital services are free to global consumers and therefore not captured in trade statistics, but they create substantial value that moves across borders.**




1 Based on consumer surveys conducted by Eric Brynjolfsson. Willingness to accept is a measure of how much money consumers report they would have to be paid in exchange for giving up a service. Lower end of 95 percent confidence interval.

SOURCE: Brynjolfsson, Eggers, and Gannamaneni, *Using massive online choice experiments to measure changes in well-being*, 2018; Brynjolfsson, Eggers, and Gannamaneni, *Measuring welfare with massive online choice experiments: A brief introduction*, 2018; Alexa Web Information Service; McKinsey Global Institute analysis

Several caveats apply when using this approach. First, the willingness-to-accept approach provides a measure of consumer surplus (that is, the difference between the price consumers pay for goods or services and the value they would have been willing to pay). Both goods and services may offer consumer surplus, but we measure it in services only. Second, setting aside the challenges of using a consumer surplus approach, contingent valuation surveys have long been criticized for inaccuracy; willingness to pay and willingness to accept frequently deviate.[75] Despite these issues, we use Brynjolfsson's estimates in an effort to provide a sense of the value of these services.

Since the willingness-to-accept survey data puts the value to consumers at very high levels, we also consider what the price for a particular free service might be based on similarities to other services that do have prices. For example, we consider the implied price of video services like YouTube to be equivalent to the price of a standard Netflix subscription ($132 annually). We estimate the price of messaging at $365, which is equivalent to the annualized price of five text messages per day at 20 cents each. This approach yields a much lower figure on the value of cross-border flows of free digital services ($240 billion annually).

Using these two approaches, we estimate that free digital services would add anywhere from $240 billion to $3.2 trillion to trade in services. The lower estimate is based on substitute prices, while the higher estimate is based on consumer willingness-to-accept measures. This very broad range reflects uncertainty surrounding what consumers would pay for the suite of free digital services they consume, and about the business models and bundled services that might emerge if companies charged for these services. The reality is likely somewhere between these two figures. Either case, however, would represent a sizable addition to global services trade flows.

[75] See Maria L. Loureiro and Justus Lotade, "Interviewer effects on the valuation of goods with ethical and environmental attributes," *Environmental and Resource Economics*, January 2005, Volume 30, Issue 1; and Jonathan Chapman et al., *Willingness to pay and willingness to accept are probably less correlated than you think*, NBER working paper number 23954, October 2017.

In the willingness-to-accept approach, the majority of the value is created by search engines ($2.8 billion out of $3.2 billion) due to the outsize consumer value. More than 90 percent of this value is "exported" by the United States, mainly through Google. However, using the approach of the substitute prices, search engines represent only 23 percent of total value of free cross-border digital services. Search engines along with social media and video services constitute almost 70 percent of the estimated value of free digital services based on the prices of similar goods.

It should be noted, however, that many "free" digital services are lucrative businesses that extract value from users in other ways. In the case of YouTube and social media platforms, users themselves contribute the content that makes the sites entertaining and valuable. When digital services are supported by advertising, users can decide whether to make the trade-off of sitting through an ad in order to use the service. But many users do not realize that digital platforms are capturing, tracking, and even selling their data. These services are having a broader economic impact beyond their user bases as well. The internet has created an entrenched expectation that content should always be free—and that expectation has made it harder for news organizations, writers, musicians, and artists everywhere to survive.

### ACCOUNTING FOR THE VARIOUS WAYS THEY CREATE INVISIBLE VALUE, SERVICES WOULD MAKE UP MORE THAN HALF OF GLOBAL TRADE

In the traditional view, global flows of services in gross terms are much smaller than flows of goods. But as detailed above, the true value of services in trade is obscured in three areas: the value added they contribute to the production of goods, cross-border flows of intangibles, and global access to free digital services.

Our analysis suggests that these three channels collectively produce up to $8.3 trillion in value annually—a figure that would increase overall trade flows by $4.0 trillion and reallocate another $4.3 trillion currently counted as part of the flow of goods.

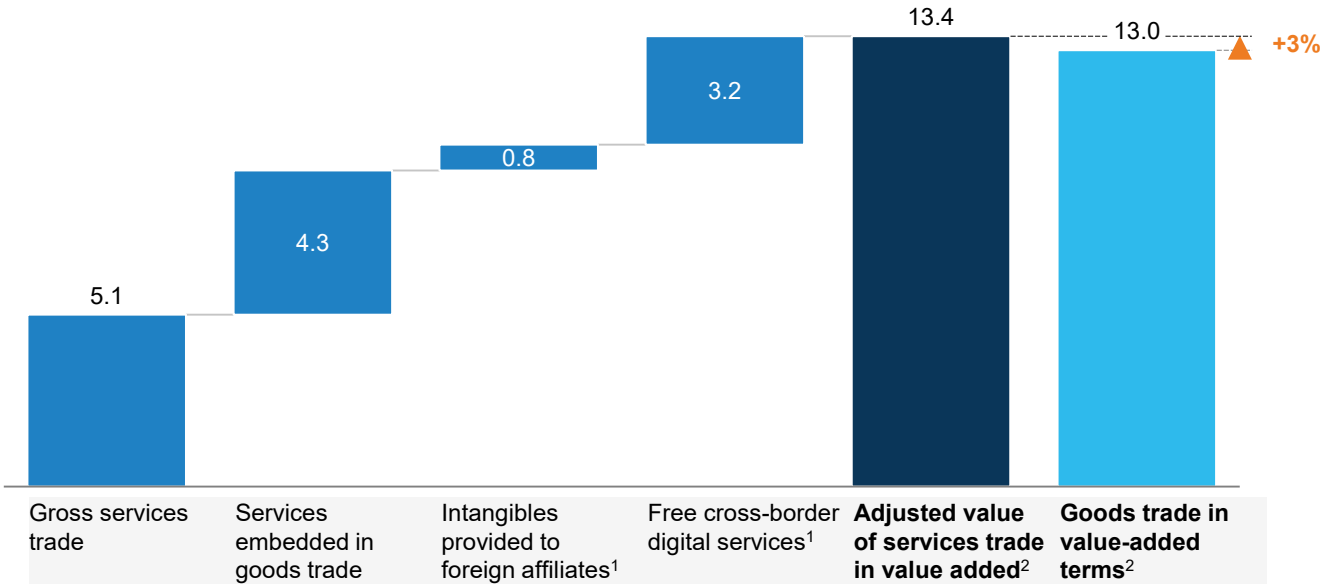
If we add our estimates of these three channels to directly observed service flows, the total value of services trade in value-added terms would be an estimated $13.4 trillion, a figure that would exceed the $13.0 trillion value added of goods trade (Exhibit 14). That would mean that services would account for more than half of all value added in global trade. Accounting for intangibles and free digital services would increase trade in services by almost 80 percent, or $4 trillion, in gross terms. It would also increase global trade from 28 percent of GDP to 33 percent.

This analysis is not meant to present an argument for redefining trade statistics. Our aim is simply to highlight the hidden scope of services in trade flows and the global economy.

Exhibit 14

**Taking into account the undermeasured aspects of service flows, services account for more than half of value added in overall trade.**

$ trillion, 2017




1 Higher-end estimate.
2 In value-added terms. The value of services embedded in goods trade and the value of goods embedded in services trade have been removed.
NOTE: Services embedded in goods trade defined as services value added in goods trade. Estimate of intangibles provided to foreign affiliates based on company-level data on foreign affiliate economic profit and expenses, adjusted for the share of revenue associated with intangibles produced by headquarters country. Estimate of free cross-border digital services based on the number of foreign users of global websites and the implied value of digital services (such as social media and messaging services).

SOURCE: Capital IQ, WTO, IMF, World Input-Output Database, Alexa Web Information Service, McKinsey Global Institute analysis

## TECHNOLOGY CONTINUES TO MAKE SERVICES MORE TRADABLE

Services are poised for continued growth in the future as more of them (such as installation, training, maintenance, and leasing) are bundled with goods. New technologies are making it feasible to deliver more types of services remotely. Some of this business will be domestic, but a significant slice of it may occur across borders.

Many services, such as providing train transportation or painting a house, require a physical presence and must be delivered locally by their very nature. But a growing range of services can be delivered virtually—and because transmission is instant and low cost, digitally delivered services are inherently tradable.[76]

Digital delivery is already commonplace in professional, technical, and R&D services; telecom and IT; financial, insurance, and pension services; intellectual property charges; and audiovisual and other related services. Digitally deliverable services made up 46 percent of total services trade in 2005. By 2017, that share had risen to 53 percent, with professional, technical, and R&D services the largest category. While the United States and the United Kingdom are still the largest net exporters of digitally deliverable services, India now ranks third. A major global hub of the BPO trade, India also exports accounting, customer care, medical transcription, engineering, and many other services.[77]

[76] Diana Korka, *UNCTAD project on measuring exports of ICT-enabled services (digitally-delivered services)*, Simply Services: A Trade in Services Speaker Series, World Trade Organization, Geneva, Switzerland, March 1, 2018.

[77] *UNCTAD information economy report 2017: Digitalization, trade and development*, October 2017.

Technology has expanded the range of services that can be delivered digitally—and it will continue to do so in the future. The build-out of 5G, for example, paves the way for more types of healthcare services to be delivered across borders. These networks are 20 times faster than 4G connections, allowing real-time interactions. The speed and bandwidth allowed will revolutionize telemedicine and even allow remote surgical operations via robotics. By connecting patients from around the world with specialized medical care that may not be available locally, it opens up a new form of trade in services.

Cloud computing, a $120 billion market in 2017, is already one of the fastest-growing components of IT services trade.[78] Providers furnish robust digital infrastructure, and their customers essentially lease the storage space, bandwidth, and software applications in a subscription or pay-as-you-go model. The biggest cloud providers to date are headquartered in the United States but have large server farms around the world for global customers. Cloud platforms are a pioneering part of a broader trend of "as a service" business models that shift customers away from purchasing assets and into subscription models for a stream of services (see Box 2, "The rise of 'anything as a service' business models").

Furthermore, increasingly sophisticated communications and file-sharing technologies are enabling more remote work, reducing the need for in-person meetings and collaboration. This could pave the way for more internationally dispersed teams, globalizing the market for talent and knowledge work. Technologies such as remote file sharing and video conferencing, and collaboration platforms like Slack have been driving this shift for years. Online labor platforms such as Upwork help companies find independent contractors wherever they may be. Now companies such as STRIVR and Doghead Simulations are going even further by developing virtual reality tools for training sessions and meetings, with participants wearing headsets and working together in virtual spaces. These tools can replace some people flows with digital flows.

Although it is possible that deployment of automation and AI could reduce the roughly $160 billion global market for business process outsourcing, one of the most heavily traded service sectors, the net effect of new technologies is likely to be an increase in traded services. Chapter 4 analyzes a number of specific new technologies in detail and explores their potential impact on trade in both goods and services.

•••

Services often play an invisible role in creating value that moves across the world's borders. Considering their full scope reveals the shift that is under way to a more knowledge-intensive and digital economy. In the chapters that follow, we analyze two of the biggest drivers of change in the current landscape of trade: shifts within the Chinese economy and the adoption of next-generation technologies.

[78] *Worldwide semiannual public cloud services spending guide*, International Data Corporation, 2018.

### Box 2. The rise of "anything as a service" business models

The traditional lines separating physical products and services have begun to blur as more and more companies make the shift from thinking of themselves strictly as makers of goods and begin introducing more service offerings. The rise of "anything as a service" means that customers can opt to replace large one-time capital investments with smaller and more distributed payments to use the service in question. "IT as a service" (ITaaS) is the most established model, making up around a quarter of the IT services market in the United States and still growing briskly. It represents a shift from companies building their own IT infrastructure and departments to contracting with service providers for all or part of their business technology needs. This enables companies to purchase only the hardware, software, and support services they actually need. Salesforce, for example, offers its suite of cloud-based customer relationship management tools on a subscription basis. Adobe and other software providers have pivoted away from one-time software sales to offering subscription-based services that can incorporate updates more flexibly. Instead of requiring major capital expenditures that lock consumers and companies into yesterday's tools for the long term, subscriptions models reduce operating costs and enable providers to offer a steady stream of upgrades and greater flexibility.

The "as a service" model has moved well beyond IT, encouraging people to shift away from goods consumption to more flexible options. The ubiquitous availability of ride-sharing services in major cities, for example, changes the economics of personal vehicle ownership for some people. Car leasing continues to grow as a share of new vehicle sales. In 2016, 31 percent of new vehicle sales in the United States were leases, up from 20 percent a decade earlier.[1] Broader changes are yet to come in transportation services. Several startups have begun experimenting with mobility as a service, integrating all modes of transportation into a single application with subscription models. Whim, for example, allows customers to pay a flat subscription fee in exchange for unlimited access to car rentals, taxis, city bikes, and public transit.

"As-a-service" business models are gaining steam in other consumer-facing industries as well. Streaming services became the top-selling music format in the United States in 2016, generating $2.3 billion in paid subscriptions—far outweighing $1.2 billion in CD sales. Adjusted for inflation, sales of CDs in 2017 were at their lowest level since 1985, the second year they were available.[2] Even fashion and clothing can now be rented instead of bought, using platforms such as Rent the Runway and Le Tote.

While many of these types of services are delivered locally, they can contribute to trade when the lessor and renter are in different countries and when the services being piloted are replicated in international markets. Given that many of the services that substitute for goods are digitally enabled (including streaming, car sharing, and taxi and rental apps), their growth will also contribute to cross-border data flows.

1 Edmunds Lease Market report, January 2017.

2 Mark J. Perry, "How CDs have been supplanted by music streaming," *Newsweek*, April 2017.

# 3. SHIFTING GLOBAL DEMAND AND THE NEW CHINA EFFECT

One of the most profound changes of the past half century was China's emergence as a hub for global trade. From 1995 to 2007, global value chains in virtually all goods-producing industries expanded as companies increasingly sourced inputs and produced goods in China and other developing countries. Because of its enormous market, its investment in industrial capacity, and its rapidly expanding capabilities, China gradually assumed a greater share of the world's production. Today it accounts for 20 percent of all goods production in global value chains, up from just 4 percent in 1995. The share produced in all other developing countries has also risen, from 19 percent to 26 percent.

Yet trade patterns are not static. As discussed in Chapter 1, nearly all goods-producing value chains have become less trade-intensive over the last decade. This trend was masked during the Great Recession and anemic recovery; many observers expected trade to return to "normal" patterns once economies around the world got past the crisis. But today, a decade after the crisis, it is clear that global value chains and trade patterns have structurally changed. Goods-producing value chains are less trade-intensive; services have assumed greater importance in trade; trade based on labor-cost arbitrage is declining across many value chains, while all are becoming more knowledge-intensive; and intraregional trade is growing.

These shifts are occurring for three main reasons. First, China and other developing economies have become drivers of global demand growth, leading them to consume more of what they produce. China alone went from 4 percent of the world's consumption in 2007 to 10 percent just a decade later. Second, emerging economies are reaching a new level of industrial maturity. They are building out domestic supply chains and exporting fewer of the intermediate inputs they need to keep their factories humming. China is progressing rapidly in this regard as it modernizes multiple industries and strengthens its capabilities in design, engineering, and high-tech manufacturing. Finally, new technologies are altering trade patterns by changing the economics of production, creating new goods, and reducing transaction costs.

This chapter analyzes rising demand and the creation of domestic value chains in China and other developing countries—shifts that together explain the recent decline in trade intensity at the global level. This drop is not a sign that globalization is over, nor does it mean that the world economy is in peril. It reflects an ongoing evolution. Economies generally become more self-sustaining as they grow (and in the case of China, any country with a very large land mass and population will naturally trade across national borders less than a small country). The world is still full of trade opportunities for companies that keep abreast of how markets are changing.

## GLOBAL DEMAND IS SHIFTING TO DEVELOPING ECONOMIES

Over the past quarter century, more than a billion people worldwide have exited poverty. As their incomes rise, many of them are passing the point at which they can begin to make significant discretionary purchases and join the consuming class. Not only have millions of households gained spending power for the first time, but millions more are moving up into higher income segments, passing the point at which consumption accelerates sharply. One recent study estimates that the global middle class had expanded to 3.2 billion people as of 2016 and posits that we have almost reached a tipping point at which middle-class

or affluent households account for a majority of the world's population for the first time in history.[79]

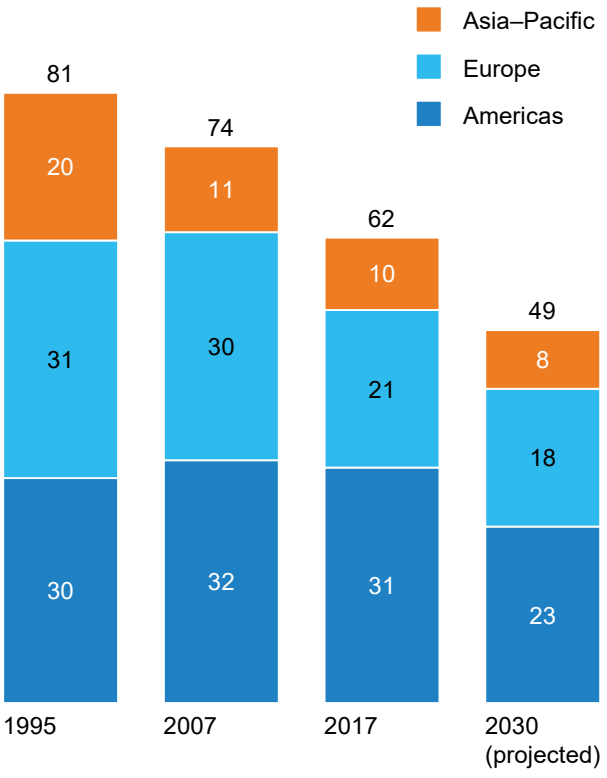
In the years ahead, emerging economies are projected to be the world's fastest-growing pockets of demand. By 2030, overall global consumption is forecast to reach $106 trillion, twice its 2017 level, with 60 percent of this increase coming from the developing world (Exhibit 15). McKinsey estimates that emerging markets will likely consume almost two-thirds of the world's manufactured goods by 2025, with products such as cars, building products, and machinery leading the way.[80] The map of global demand, once heavily tilted toward advanced economies, is being completely redrawn—and global value chains are reconfiguring accordingly. While China is the largest part of this story, other developing countries also play a role.

Exhibit 15

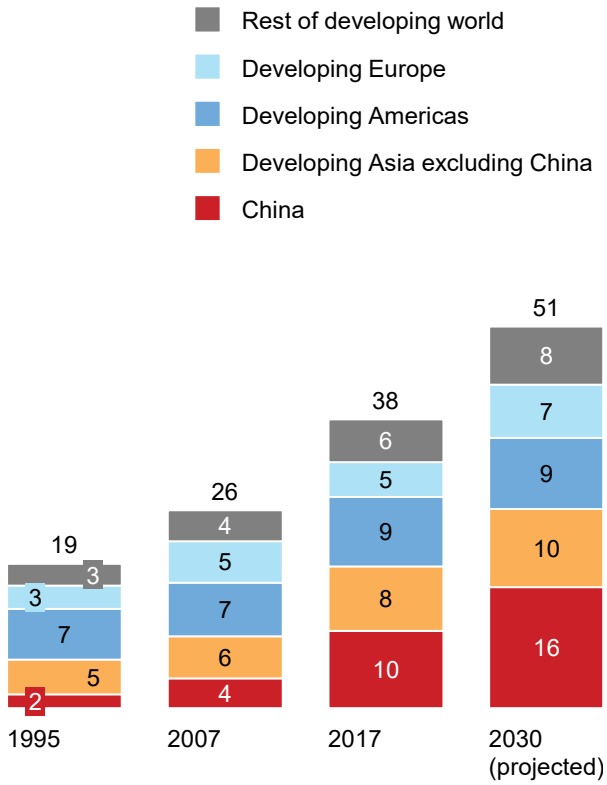
**By 2030, developing countries, led by China and emerging Asia, could account for more than half of global consumption.**

%

**Advanced economies' share of global consumption by region**




**Developing economies' share of global consumption by region**




NOTE: Figures may not sum to 100% because of rounding.

SOURCE: McKinsey Global Growth Model; McKinsey Global Institute analysis

[79] Homi Kharas, *The unprecedented expansion of the global middle class: An update*, Brookings Institution, Global Economy & Development working paper number 100, February 2017.

[80] Matteo Mancini, Wiktor Namysl, Rafael Pardo, and Sree Ramaswamy, "Global growth, local roots: The shift toward emerging markets," August 2017, McKinsey.com.

### With domestic consumption rising, Chinese companies can serve local customers rather than exporting

Despite recent indicators of slowing growth, China has given rise to a vast middle class that is an engine of global demand. Previous MGI research highlighted China's working-age population as a key consumer demographic. At current projections, it could account for 12 cents of every $1 of worldwide urban consumption by 2030.[81] More recent McKinsey research specifically highlighted the "post-90s" generation, which has grown up with unprecedented wealth, greater exposure to Western culture, and access to new technologies. This group will likely account for more than 20 percent of China's total consumption growth through 2030.[82]

As it reaches the point of having more millionaires than any other country in the world, China now represents roughly a third of the global market for luxury goods, with an estimated $7.4 billion in annual spending. By 2025, McKinsey projects that it could account for 44 percent of the total global market for luxury goods. In 2016, luxury purchases were made by an estimated 7.6 million Chinese households—more than the total number of households in all of Malaysia or the Netherlands. On average, those households spent twice as much on luxury items as French or Italian households.[83]

China's consumers have turned the country into the largest market for online retail in the world. The best illustration of this is the explosive growth of "Singles Day," a one-day annual frenzy of e-commerce that rang up an estimated $30 billion in sales in 2018, far surpassing Black Friday and Cyber Monday in the United States combined.

The nation's consumption is equally remarkable when viewed through the lens of specific product categories. China became the world's largest market for automobiles in 2009 and has continued to grow at double-digit rates each year. In 2016, 40 percent more cars were sold in China than in all of Europe (although vehicle sales have since declined).[84] China's smartphone market is also the largest in the world, with 444 million shipments in 2017.[85] The rise of Chinese smartphone brands such as Vivo and Oppo, mainly sold domestically, is a testament to the growth of Chinese consumption. China now accounts for 40 percent of the world's consumption in textiles and apparel, 28 percent in automotive, and 38 percent in computers and electronics.

As a result of this demand growth, more of what gets made in China is now sold in China. Within the industry value chains we studied, China exported 17 percent of the gross output it produced in 2007. By 2017, it was exporting just 9 percent of its output. This is roughly on a par with the United States, but a far smaller share than in Germany (34 percent), South Korea (28 percent), or Japan (14 percent).

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81 *Urban world: The global consumers to watch*, McKinsey Global Institute, April 2016.

82 *Double-clicking on the Chinese consumer*, McKinsey & Company, November 2017.

83 *Chinese luxury consumers: The 1 trillion renminbi opportunity*, McKinsey & Company 2017 China Luxury Report, May 2017.

84 Arthur Wang, Ting Wu, and Tony Zhou, "Riding China's huge, high-flying car market," October 2017, McKinsey.com.

85 Yu Nakamura and Aya Onishi, "China's smartphone war escalates as largest market matures," *Nikkei Asian Review*, March 1, 2018.

### Other developing countries are also consuming more of what they produce

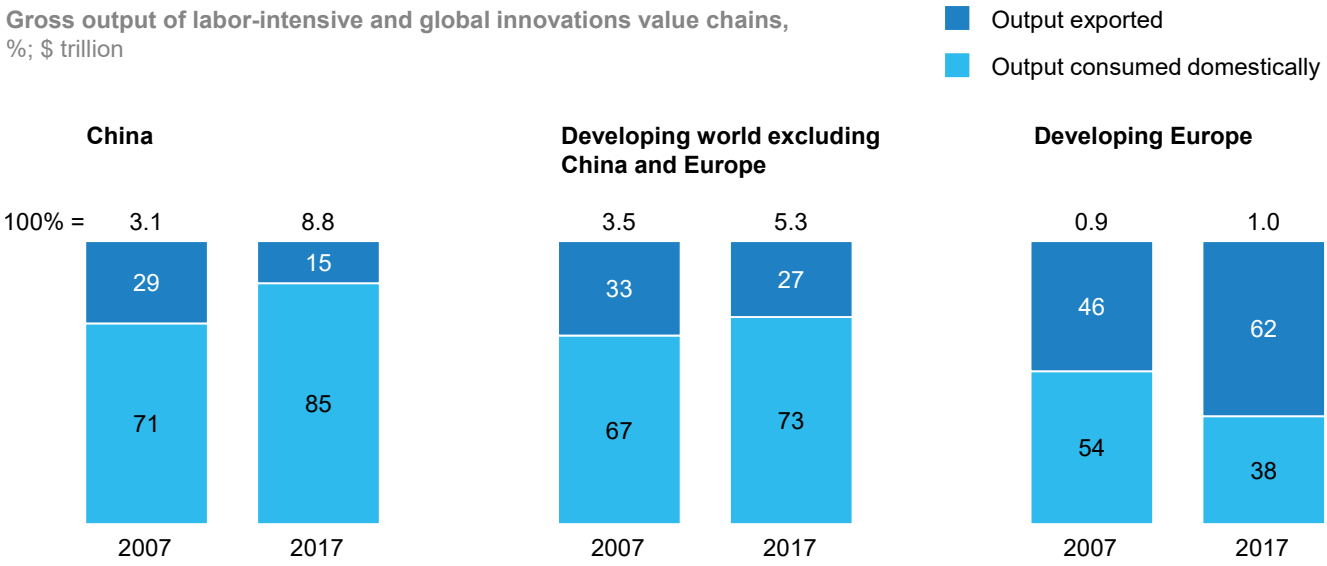
Consumption is also rising more broadly across the rest of the developing world as more countries urbanize, industrialize, and plug into global value chains. By 2030, the developing world outside of China is projected to account for 35 percent of global consumption (see Exhibit 15, above). Demand is growing in countries including India, Indonesia, Thailand, Malaysia, and the Philippines.

The trend of developing countries consuming more of what they produce is most apparent in labor-intensive and global innovations value chains (Exhibit 16). Between 2007 and 2017, the share of output in these value chains that is exported dropped by more than half in China (from 29 to 15 percent) and declined from 33 to 27 percent in other developing economies, excluding Europe. Developing Europe (which includes the Czech Republic, Poland, and Romania, among others) is the only region that defies this trend; those countries are important suppliers for Western Europe.

Exhibit 16

**A larger share of output is being consumed domestically in emerging markets, except developing Europe.**

**Gross output of labor-intensive and global innovations value chains,**
%; $ trillion




NOTE: Figures may not sum to 100% because of rounding.

SOURCE: World Input-Output Database; McKinsey Global Institute analysis

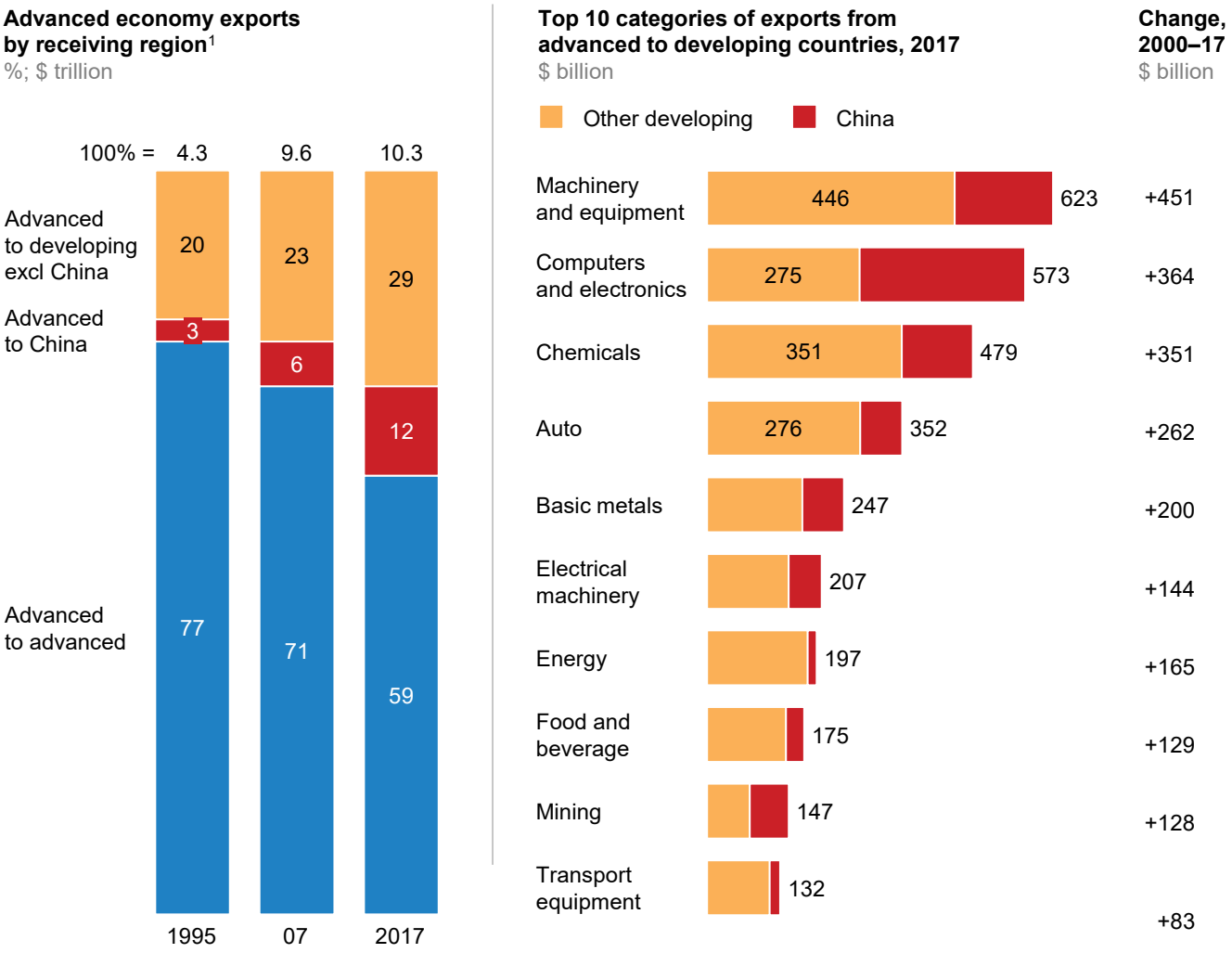
Decreased trade intensity in industries like apparel reflects rising incomes and demand in countries that have taken on more of the world's labor-intensive manufacturing. At its peak in 2002, India, for example, exported 35 percent of its final output in apparel. But by 2017, that figure was down to 17 percent—not because India lost its share of the global export market, but because Indian apparel makers, like their counterparts in China, no longer need to ship as many of their products halfway around the world to find buyers. They can sell more garments to local consumers. India's average spending on apparel and footwear rose from $40 per person in 2007 to $64 in 2017, with population growth expanding the market at the same time.

## Growing consumption in the developing world creates export opportunities

As global demand shifts to the developing world, new opportunities are opening for producers in advanced economies. In 1995, only 3 percent of exports from advanced economies went to China, but that share was up to 12 percent by 2017 as exports rose from $130 billion to $1.2 trillion. Over the same period, the share of advanced-economy exports going to other developing countries grew from 20 to 29 percent, climbing in absolute terms from $860 billion to $3 trillion (Exhibit 17). This trend occurred in both final goods and intermediate goods.

Exhibit 17

**China and the developing world are an increasingly important source of demand for advanced economies.**




1 Based on advanced economy reporting, goods and services.
NOTE: Figures may not sum to 100% because of rounding.

SOURCE: IMF; UNCTAD, OECD, WTO; McKinsey Global Institute analysis

In the automotive industry, for instance, Japan, Germany, and the United States send 38 percent of their exports of auto parts and cars to China and the rest of the developing world. In knowledge-intensive services, including IT services, financial services, and business services, 45 percent of all exports from advanced economies go to the developing world. China's imports of final goods now match those of Germany and exceed those of Japan, the United Kingdom, France, and Russia.

Over the past decade, growing exports to the developing world helped advanced economies mitigate the impact of weak demand at home, which persisted for years after the Great Recession. In industries such as furniture and apparel, France, Germany, and the United States saw demand from their advanced economy trading partners fall from 2007 to 2017, but rising exports to the developing world cushioned the blow.

The Asia–Pacific region is already a top strategic priority for many Western brands. Danish brewer Carlsberg, for example, recently reported flat revenue growth in Western Europe but double-digit growth in Asian markets (most notably India).[86] Cosmetics giant Estée Lauder recently reported 2 percent sales growth in the Americas but 11 percent growth in emerging markets, propelled in part by teaming up with local social media influencers such as Chinese actress Yang Mi.[87] In the first half of 2018, Hermès reported that the Asia–Pacific region outside of Japan accounted for 38 percent of its revenue—a share that exceeds its revenue in all of Europe.[88]

After several decades of participating in global value chains mainly as producers, developing economies are now important consumers as well. This is not only creating export opportunities for advanced economies; developing countries are also increasingly trading with each other (see Box 3, "China and the expansion of South-South trade").

China's trade policies have come under criticism from other countries, however. According to WTO data, China's average tariffs on imported goods are double the EU's average tariff rate and three times higher than the US average, not having significantly changed over the past decade.[89] Other points of contention include restricted foreign access to some Chinese markets, subsidies for key domestic industries, and restrictions on foreign data flows. Among the biggest areas of concern for foreign companies are technology transfer and IP protection and enforcement. In some markets, China allows foreign companies to enter only through joint ventures with Chinese companies. While this has been an effective strategy for rapidly building new industries and capabilities, joint ventures can be mechanisms for facilitating technology transfer from foreign firms to their domestic partners through both direct and indirect channels. China is gradually easing foreign investment restrictions in sectors such as finance, energy, automotive, energy, and ship and aircraft manufacturing.[90] But market access continues to be a point of controversy with many of its trading partners.

[86] Carlsberg Group, interim financial statement H1, August 2018.
[87] Estée Lauder 2017 annual report.
[88] Hermès first half 2018 results presentation, September 2018.
[89] *World tariff profiles 2018*, World Trade Organization, International Trade Centre, and UNCTAD.
[90] Se Young Lee and Yawen Chen, "China further eases foreign investment curbs," Reuters, June 28, 2018.

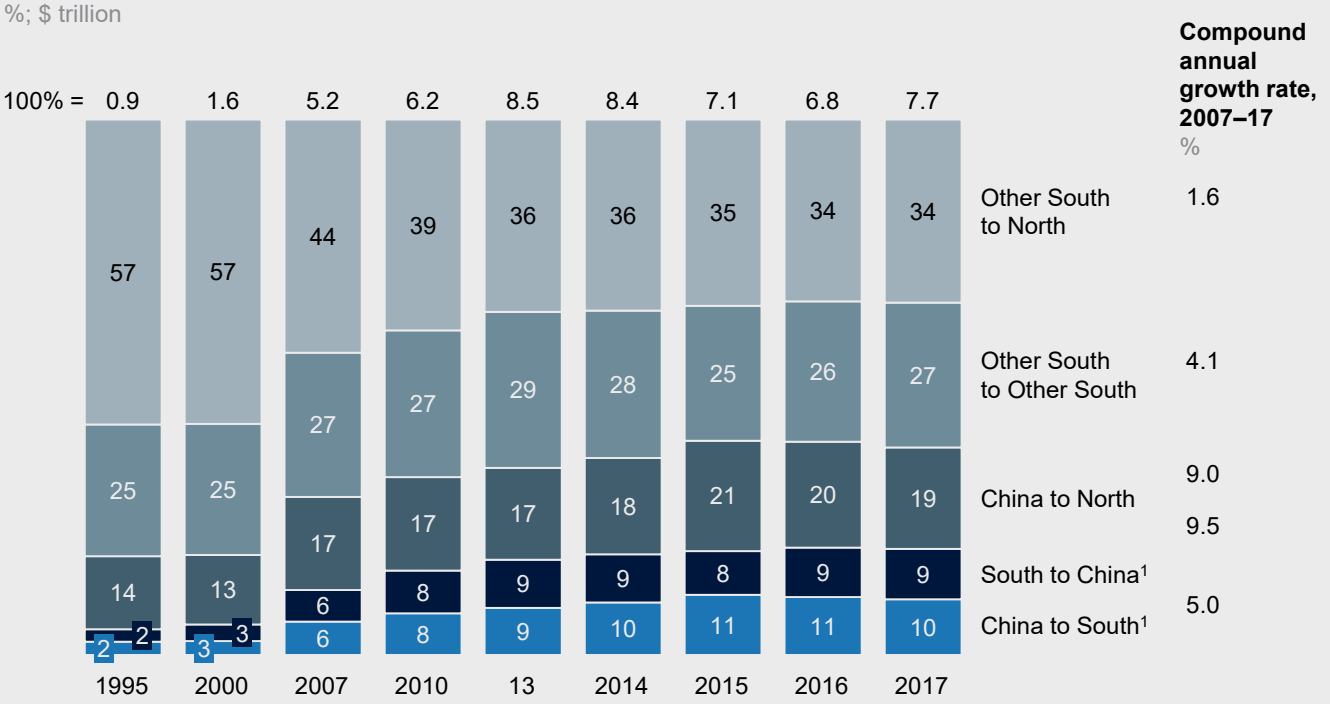
## Box 3. China and the expansion of South-South trade

Today, developing economies are counterparts on more than 40 percent of the world's trade in goods—and increasingly, they are trading with one another (Exhibit 18). This so-called South-South trade currently stands at $3.6 trillion. It represents almost half of all exports from developing countries, up from 39 percent a decade ago.

Exhibit 18

**The export markets for developing economies have changed over time.**

Developing economy goods exports
%; $ trillion




1 Based on Chinese trade reporting.
NOTE: Figures may not sum to 100% because of rounding.

SOURCE: WTO; UNCTAD; McKinsey Global Institute analysis

China accounts for 29 percent of the exports from all developing economies—and it increasingly sells to trading partners across the developing world, not just to advanced economies. Its exports to developing economies soared from $42 billion in 2000 to $800 billion in 2017; they now constitute 22 percent of all South-South trade. China is Africa's largest trading partner. Its goods trade with Africa is more than triple the amount Africa trades with India, France, the United States, or Germany. Economic growth in some African economies is dependent on China; half of exports from Angola, for instance, go to China.[1] China is financing infrastructure and construction projects in multiple developing countries with an eye toward opening new markets for Chinese manufactured goods.

Chinese imports from other developing countries rose from $50 billion in 2000 to $727 billion in 2017. Although commodities such as oil, iron ore, and soybeans make up 37 percent of these imports, China also sources a range of other goods, both intermediate and final, from across the developing world. Yet as of 2017, China's surplus with other developing countries stood at $75 billion.

1 *Dance of the lions and dragons. How are Africa and China engaging, and how will the partnership evolve?*, McKinsey & Company, June 2017.

## CHINA AND OTHER DEVELOPING ECONOMIES ARE BUILDING DOMESTIC SUPPLY CHAINS

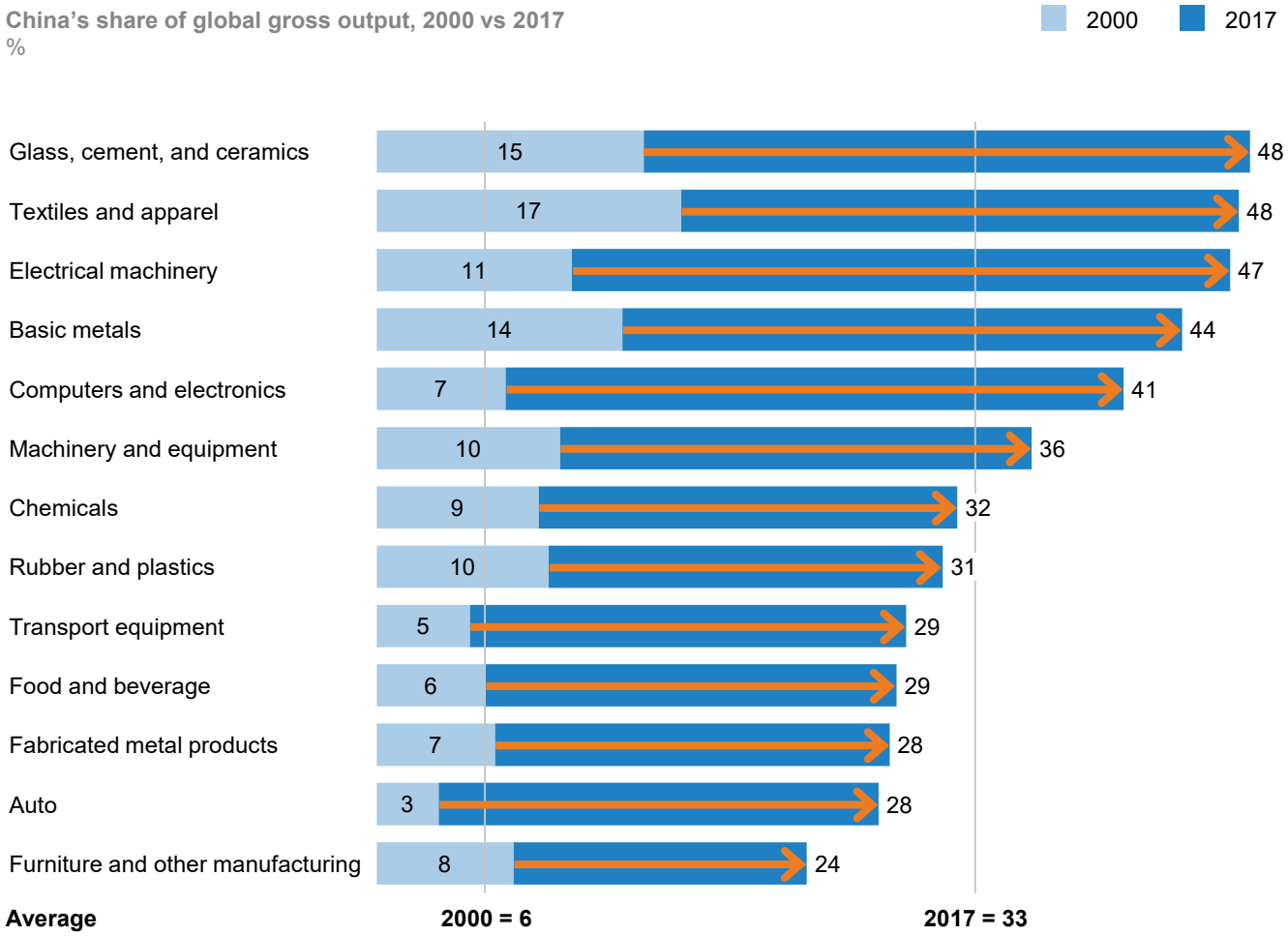
In many industries, companies see an advantage in placing production close to their customers and building networks of suppliers in closer proximity to one another to improve coordination. We see production networks deepening in developing countries as local industries become more vertically integrated and multinationals build out foreign affiliates to serve these fast-growing markets. This trend is taking hold in countries including China, India, and Indonesia.

### China, which drove the expansion of global value chains, has now developed more comprehensive domestic supply chains

Soon after China entered the WTO in 2001, its manufacturing output began to soar. Its share of overall global goods production, which stood at 6 percent in 1995, rose rapidly to hit 16 percent in 2007 and 32 percent by 2017 (Exhibit 19). Automotive, transportation equipment, and computers and electronics saw especially large increases. China now produces almost half of global output in three industries: glass, cement, and ceramics; electrical machinery; and textiles and apparel.

Exhibit 19

**China's share of global output has increased dramatically in every global value chain since 2000.**




SOURCE: World Input-Output Database; McKinsey Global Institute analysis

China's rise in global trade began with importing intermediate goods and re-exporting assembled products to the world. In the past decade, however, it has developed more comprehensive domestic supply chains and more vertically integrated industries, with homegrown companies stepping into many new market niches.

As China builds new industrial capacity, it is modernizing industries at the same time, phasing out aging factories and building more technologically advanced new plants. In computers and electronics, for instance, China first emerged as a place for low-cost assembly and re-export. Now China is developing its own capabilities to manufacture components, including sophisticated chips that it previously imported from advanced economies. Xiaomi, for instance, launched a homegrown chip in 2017 with Chinese-based subsidiary Pinecone.[91] Foxconn has established a new base in the inland province of Henan; Intel and Hewlett Packard have done the same in Sichuan (see Box 4, "China's industrial growth moves inland," for more on this trend).

[91] Aaron Tilley, "Xiaomi follows in footsteps of Apple and Samsung with its own smartphone chip," *Forbes*, February 28, 2017.

### Box 4. China's industrial growth moves inland

Building out domestic supply chains is enabling China to bring new jobs to its inland provinces—regions that did not make the same kind of economic gains as the coastal provinces during the recent export-led boom. Today, with the coastal provinces enjoying greater prosperity than ever before, the next generation no longer aspires to the same kind of factory jobs that their parents regarded as their ticket to a better life. China is now focusing on economic development in parts of the country that were left behind, and it has invested heavily in transportation infrastructure (including high-speed rail) to move goods and people from the heartland to the coast. In undertaking this policy, China hopes to take some of the pressure off its biggest megacities and encourage more balanced development across a greater number of smaller cities.

Wages in Chinese coastal provinces have been rising above the going rates in other developing countries, such as Vietnam and Bangladesh. But China can retain many types of manufacturing by moving production inland. In essence, Chinese companies can engage in labor-cost arbitrage within the country's own borders. In 2016, the prevailing annual wage for a factory worker in the coastal province of Jiangsu was 67,000 RMB, but it was just under 50,000 RMB in the inland provinces of Jiangxi and Yunnan (figures not adjusted for productivity differences).

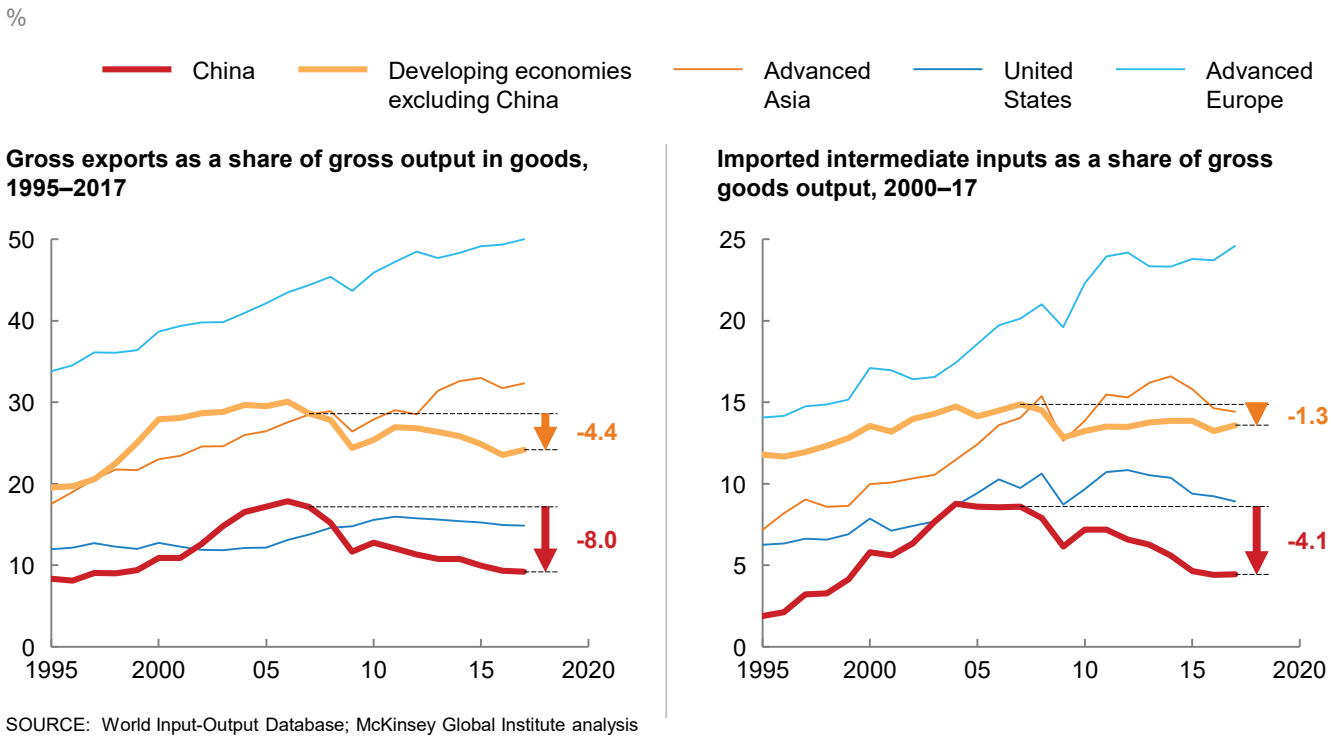
The "Made in China 2025" policy designates dozens of inland pilot cities for industrial upgrades. Hefei, for instance, has an existing base of appliance manufacturing, and it benefits from the presence of the Hefei State High-Tech Industry Development Zone and the University of Science and Technology of China. Now the city is branching out into areas such as voice-recognition technology and next-generation vehicles.[1]

[1] Andrew Moody and Zhu Lixin, "Inland innovators," *China Daily*, December 9, 2017.

As a result of China's growing domestic supply chains, its trade intensity has fallen. The same trend can be observed to a lesser degree in other developing countries, such as India and Brazil, but China's size ensures that its economic shifts register at the global level (Exhibit 20).

Exhibit 20

**Since 2007, trade intensity has fallen in China and other developing economies.**




SOURCE: World Input-Output Database; McKinsey Global Institute analysis

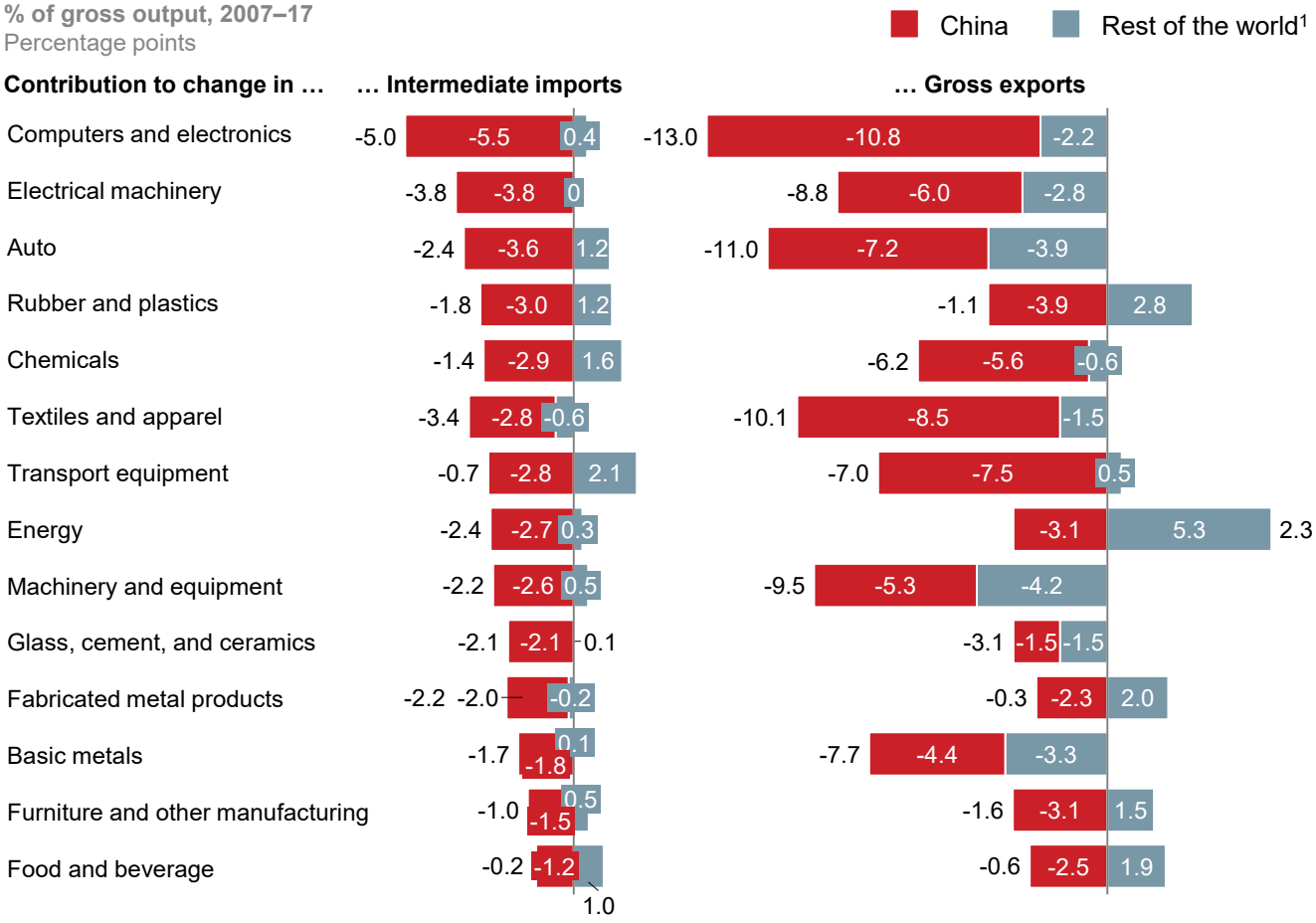
This new China effect explains the entirety of the recent slowdown in goods trade that has been observed at the global level. The steepest fall-off in China's intermediate trade has occurred in computers and electronics (Exhibit 21). Measured as a share of global output, trade in intermediate inputs fell by 5.1 percentage points between 2007 and 2017. China fully accounted for the fall; in fact, trade in intermediate inputs actually expanded slightly among other countries participating in this value chain. The industry's overall trade intensity (that is, exports of intermediate and final goods as a share of gross output) fell sharply over the decade as China's industry became more vertically integrated and more of the computers, phones, and devices it turns out were sold to Chinese consumers rather than being shipped abroad.

The automotive industry's global trade intensity similarly fell by 7.9 percentage points between 2007 and 2017. Two-thirds of this decline can be traced to the millions of vehicles being both made and sold in China. Trade intensity also tumbled by ten percentage points in the textiles and apparel industry during this period, with China accounting for 80 percent of the drop. China remains the world's largest importer and exporter of goods. But in relative terms, its focus on building domestic supply chains and vertically integrated industries has dampened the scope of the trading opportunities foreign companies once envisioned.

Exhibit 21

**China has influenced the contraction of all goods-producing global value chains since 2007.**

% of gross output, 2007–17
Percentage points




1 All countries except China.

SOURCE: World Input-Output Database; McKinsey Global Institute analysis

## More comprehensive domestic supply chains are similarly taking root in other developing economies

The trend toward adding domestic production across more segments of various industry value chains is most pronounced in China, but it is apparent in other developing economies as well. Textiles and apparel offers the clearest illustration. In this industry, a growing emphasis on speed and time to market requires keeping tight coordination between suppliers at different stages of the value chain. In the developing world outside China, the share of traded intermediate inputs relative to the industry's overall output shrank from 18 percent at its peak in 2002 to 13 percent in 2017. Instead of fragmenting production across multiple far-flung countries, production networks spanning multiple stages are consolidating within individual countries such as Vietnam, Bangladesh, Malaysia, India, and Indonesia. Even Ethiopia, a newer player in textiles production, is beginning to expand its own cotton production to serve its apparel manufacturers.

Other emerging economies have been developing more extensive supply chains in food and beverage. In Senegal, for instance, millet was originally grown and processed by individual households for their own consumption. By the early 2000s, commercial facilities were

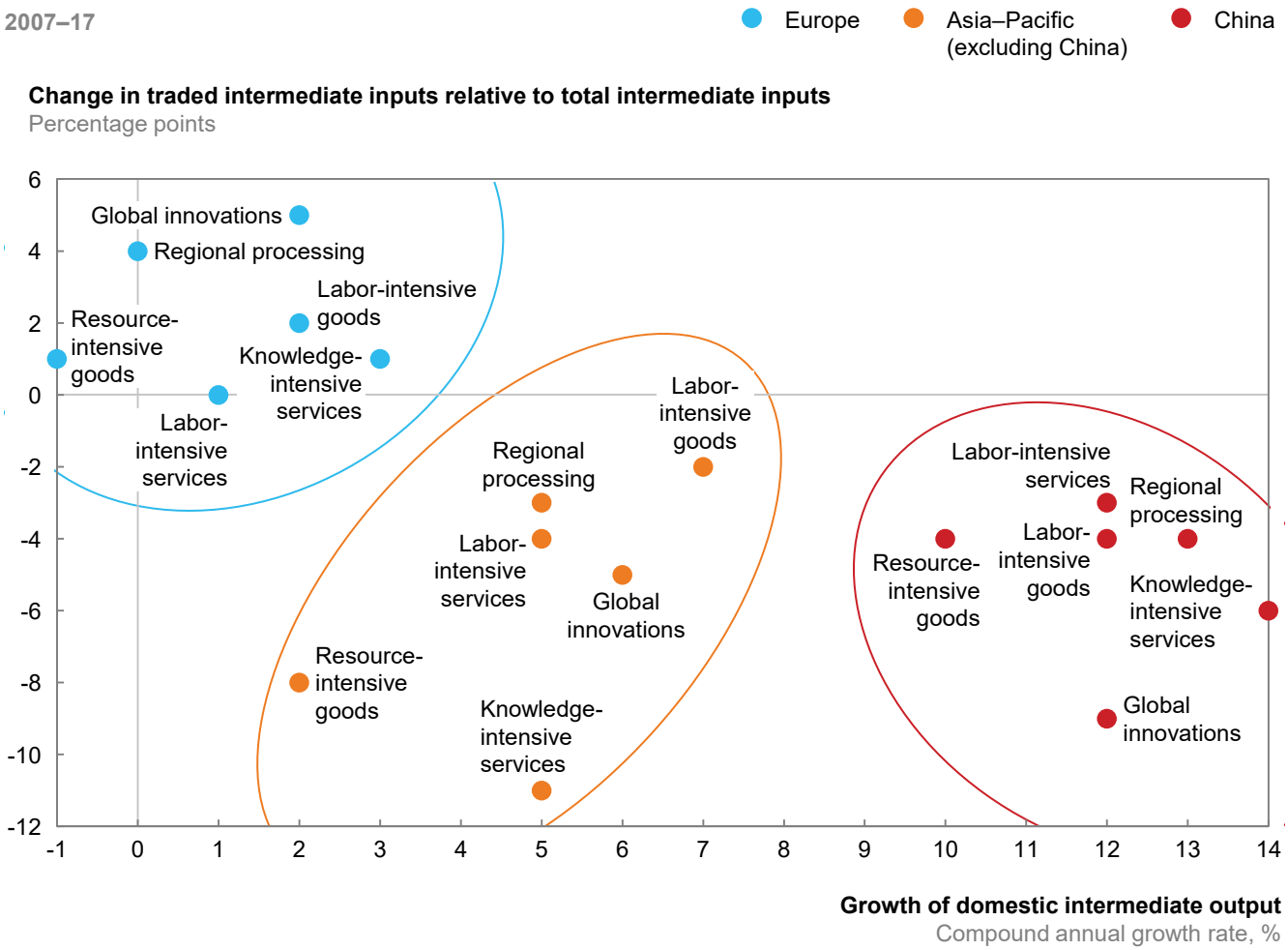
processing millet flour. Now Senegal has an initiative to develop more advanced processing for commercial products such as ready-to-eat millet meals.[92]

Expansion into new parts of the value chain is playing out differently in various parts of the developing world (Exhibit 22). In emerging Asia outside of China, strong economic growth has created robust consumer markets, supporting more self-contained domestic industries. The region has consistently relied less on imported intermediate inputs than the rest of the developing world (9.5 percent of goods output in 2017, as opposed to 18.7 percent). In the global innovations category (which includes automotive, chemicals, machinery, computers, and electronics), the region's domestic intermediate output grew by 6 percent annually from 2007 to 2017, and the share of traded intermediate inputs going into these products dropped by some five percentage points. In global value chains offering knowledge-intensive services, the region has similarly posted 5 percent annual growth in output, while the share of traded intermediate inputs supporting that output shrank by 11 percentage points over the decade. Some industries within these countries are becoming less dependent on foreign suppliers for certain inputs.

Exhibit 22

**China and emerging Asia are building domestic supply chains, while Central and Eastern Europe continues to integrate with Western Europe.**

2007–17




SOURCE: World Input-Output Database; McKinsey Global Institute analysis

[92] *Africa Agriculture Status Report 2017: The business of smallholder agriculture in sub-Saharan Africa*, Alliance for a Green Revolution in Africa.

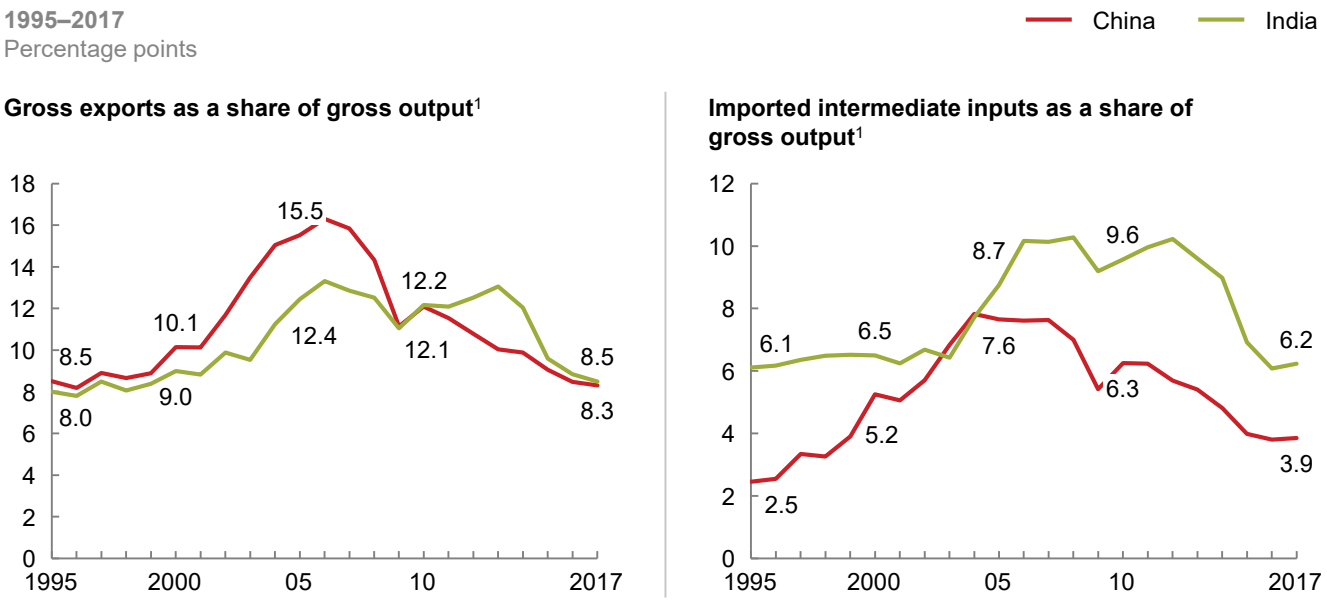
Industries in developing Europe, by contrast, are integrating more deeply into the supply chains of larger advanced economies nearby. In the case of countries like the Czech Republic, Slovakia, Romania, and Poland, many manufacturers have joined the production networks of Western European carmakers (especially German firms). Between 2007 and 2017, output climbed by 2 percent annually in the region's global innovations industries, and the share of traded intermediate inputs rose by two percentage points. That trend holds true more broadly across other types of value chains as well.

In industries that manufacture global innovations, multinationals sometimes provide the momentum that helps developing countries move beyond the assembly stage and into other types of production since they want to keep more phases of production together. In India's automotive manufacturing, for example, imported intermediate inputs fell from 14 percent of gross output in 2007 to 10.1 percent in 2017 as the presence of multinational carmakers supported the proliferation of more local specialist suppliers. In 2017, Ford exported 180,000 cars from India, and Hyundai exported another 153,000. Like China, India is producing and consuming more of what it makes, reducing trade intensity in both final and intermediate goods (Exhibit 23).

Exhibit 23

**Like China, India has reduced its trade intensity and begun to build out domestic supply chains.**

1995–2017
Percentage points




1 Analysis completed for all value chains studied other than resource-intensive value chains.

SOURCE: World Input-Output Database; McKinsey Global Institute analysis

•••

The growing industrial maturity in many developing economies, combined with soaring demand growth, is already altering the landscape of global trade—and these changes are likely to become even more pronounced in the years ahead. In the next chapter, we look at another major shift that is well under way and soon to accelerate: a wave of new technologies that will change how things are made, where they are made, and even the products that are traded.

# 4. THE NEXT WAVE OF TECHNOLOGIES IN GLOBAL VALUE CHAINS

Global value chains as we know them today could not exist without technology. The previous wave of digital technologies—from instant communications to supply chain management software—reduced barriers of distance and complexity, enabling companies to interact with suppliers and customers anywhere around the world. By reducing transaction costs, digital technologies enabled trade in goods and services to soar.

Today a new set of technologies—including advanced robotics, AI, the Internet of Things, 3-D printing, and blockchain—has already begun to penetrate global value chains, and its impact will grow in the years ahead. Some of these technologies, including digital platforms and logistics applications, will continue to reduce transaction costs and facilitate trade flows.[93] Automation technologies in manufacturing will change the way goods are made and the relative cost of different inputs, including labor. This could amplify the trend of more localized production near key consumer markets. Finally, technology-enabled innovations such as renewable energy, electric vehicles, and augmented and virtual reality can change the content and patterns of trade flows.

The net impact of these next-generation technologies on trade flows is unclear, but in some scenarios, they could dampen goods trade and further boost flows of services and data. As they diffuse through global value chains, they will create openings for new players and opportunities for incumbents to shift their business models. Different regions of the world may also be able to develop new competitive advantages. In this chapter, we take a detailed look at some of these new technologies and their applications for global production networks.

## THE ICT REVOLUTION TRANSFORMED THE PREVIOUS ERA OF GLOBALIZATION, AND NEW TECHNOLOGIES WILL RESHAPE THE NEXT

Economist Richard Baldwin frames the history of globalization as waves of "unbundling."[94] The first wave came after the Industrial Revolution, when the introduction of steamships and railroads reduced the cost of moving goods. This changed the economics of buying things made halfway around the world; think British ladies drinking tea from China or French chocolatiers turning African-grown cocoa beans into confections. This trend continued through the 20th century. From 1930 to 2000, the price of shipping fell by approximately two-thirds.[95] Production could now occur far from the final consumer.

Baldwin's second great unbundling was the more recent ICT revolution, which made it possible for companies to disaggregate linear production processes—that is, breaking them into discrete steps and outsourcing some of those steps to external suppliers. Global value chains existed before the internet, but the internet helped to fuel further fragmentation and realignment. Many more countries began participating in all types of value chains, and networks of specialized suppliers and assembly plants sprang up worldwide.

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93 For further discussion, see *World trade report 2018: The future of world trade: How digital technologies are transforming global commerce*, World Trade Organization, October 2018.

94 Richard Baldwin, *Globalisation: The great unbundling(s)*, Economic Council of Finland, September 2006; and Richard Baldwin, *The Great Convergence: Information Technology and the New Globalization*, Cambridge, MA: Harvard University Press, 2016.

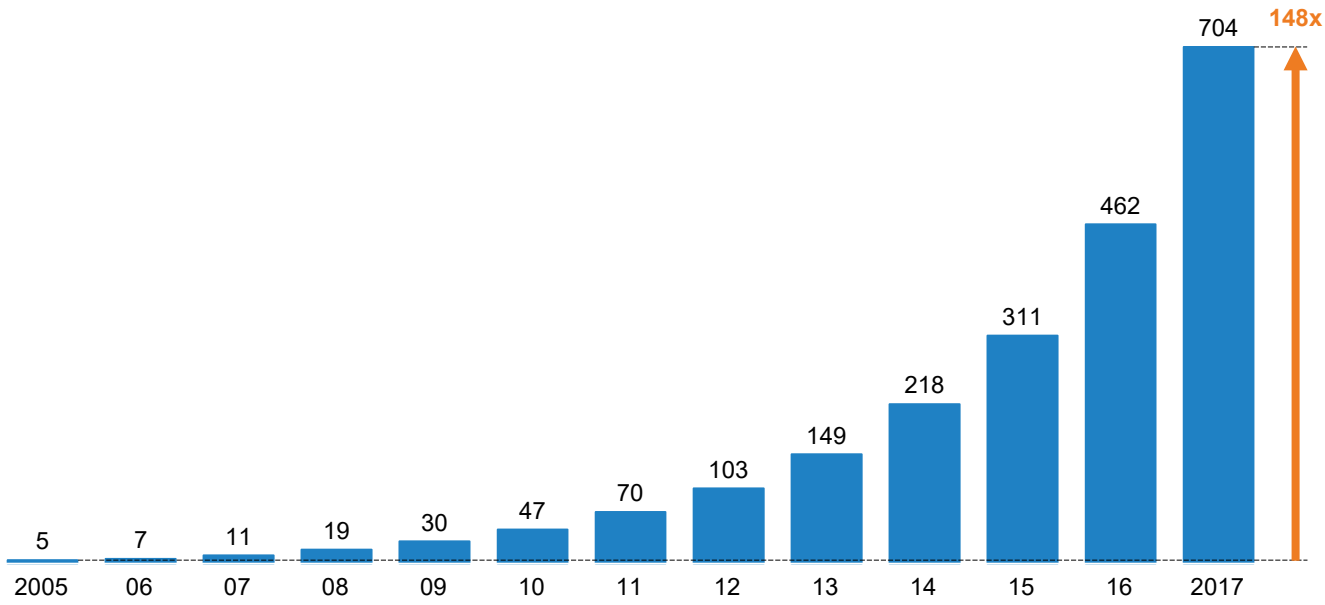
95 Matthias Busse, "Tariffs, transport costs, and the WTO Doha Round: The case of developing countries," *Estey Centre Journal of International Law and Trade Policy*, 2003, Volume 4, Number 1.

The ICT revolution also paved the way for the explosive growth of cross-border data flows noted in MGI's previous research on digital globalization. According to World Bank data, 46 percent of the world is online, up from 20 percent a decade ago. The number of cellular subscriptions worldwide now exceeds the planet's population (since many users have multiple devices). From 2005 to 2017, the amount of cross-border bandwidth in use grew 148 times larger (Exhibit 24). Some of the traffic being carried reflects companies interacting with their foreign operations, suppliers, and customers.

Exhibit 24

**Cross-border data flows have grown 148 times larger since 2005.**

**Used cross-border bandwidth, global**
Terabits per second




SOURCE: Telegeography; McKinsey Global Institute analysis

While ICT and the internet accelerated trade by reducing transaction costs, the next wave of technologies will have a more varied and complex effect. This chapter examines three major types of impact (Exhibit 25).

- **Reducing transaction costs.** Some new technologies (including digital platforms for e-commerce, digital payments, automated document processing, autonomous vehicles, and the IoT) will smooth transportation, logistics, financing, and search and coordination—all of which enables increased trade in goods, services, commodities, and digital flows.[96]

- **Altering production processes.** Advanced robotics, AI, and analytics are the building blocks of a more automated and efficient form of digitized manufacturing—and because they substitute for labor, they may reduce the importance of wage differentials in location decisions. Additive manufacturing (3-D printing) makes it possible to produce goods even closer to the end consumer; it also supports speed and customization.

- **Creating and transforming products.** From renewable energy and electric vehicles to music streaming, technology is transforming some existing products and services as well as creating entirely new ones.

[96] Avi Goldfarb and Catherine Tucker, *Digital economics*, NBER working paper number 23684, August 2017.

Exhibit 25

**New technologies will have varying impacts on global flows.**

NOT EXHAUSTIVE

| | | Technology[1] | Example | Impact on flows: Primary re-sources | Manu-factured goods | Ser-vices | Data |
|---|---|---|---|---|---|---|---|
| **Reducing trans-action costs** | **Digital platforms** | E-commerce | US consumer buys shoes from UK e-commerce site | — | ▲ | ▲ | ▲ |
| | **Logistics techno-logies** | Automated document processing | Paperless customs documentation processing in India reduces time for loading/unloading ships | ▲ | ▲ | ▲ | ▲ |
| | | Internet of Things | IoT sensors track shipments from Brazil to Angola | ▲ | ▲ | ▲ | ▲ |
| | | Next-gen transportation | New material enables shipping through Arctic route | ▲ | ▲ | — | — |
| | | Autonomous vehicles | Autonomous vehicles move cargo in ports, airports, and warehouses | ▲ | ▲ | — | ▲ |
| | **Data processing techno-logies** | Blockchain | Blockchain enables automated cross-border insurance claims[2] | — | — | ▲ | ▲ |
| | | Cloud | An Australian company utilizes Google Cloud | — | — | ▲ | ▲ |
| **Altering econo-mics of produc-tion** | **Additive manufac-turing** | 3-D printing | 3-D printing of toys at home | — | ▼ | ▲ | ▲ |
| | | | 3-D printing of hearing aids in Vietnam for global distribution | — | ▲ | — | — |
| | **Automation** | Advanced robotics | A company equips a new UK factory with robots to make appliance manufacturing viable | — | ▼ | — | — |
| | | | Bangladesh automates textiles production, boosting productivity to gain global market share | — | ▲ | — | — |
| | **Artificial intelligence** | Virtual assistants | A British retailer deploys virtual assistants for customer service calls, substituting for offshore labor in a call center | — | — | ▼ | ▼ |
| | | Robotic process automation (RPA) | A Philippine company employs RPA in back office processing, reducing cost and increasing volume | — | — | ▲ | ▲ |
| **Transfor-mation of existing products and creation of new products** | **Digital goods** | Streaming movies/music | Drake's new album is streamed a billion times globally in one week | — | ▼ | ▲ | ▲ |
| | **New goods** | Renewable energy | China increases electricity generation from renewables, reducing coal and LNG imports | ▼ | — | — | — |
| | | Electric vehicles | European consumers buy more EVs, requiring fewer imported parts and lower oil imports | ▼ | ▼ | — | — |
| | | Telemedicine | A German doctor relies on 5G to perform remote robotic surgery on a patient in Turkey | — | — | ▲ | ▲ |

1 We focus on a sample of currently available and deployed technologies that materially impact trade. This list is not exhaustive.
2 Blockchain can also make logistics more efficient (eg, automating payments through blockchain-based smart contracts).

SOURCE: McKinsey Global Institute analysis

## DIGITAL PLATFORMS, THE IOT, AND OTHER TECHNOLOGIES CONTINUE TO REDUCE TRANSACTION COSTS, FUELING ALL TYPES OF FLOWS

The costs of transportation and logistics, financing, and search and coordination, as well as time in transit, are among the biggest barriers to trade. But digital platforms, logistics technologies, and data-processing technologies reduce these frictions.

### Digital platforms create new markets and reduce coordination costs

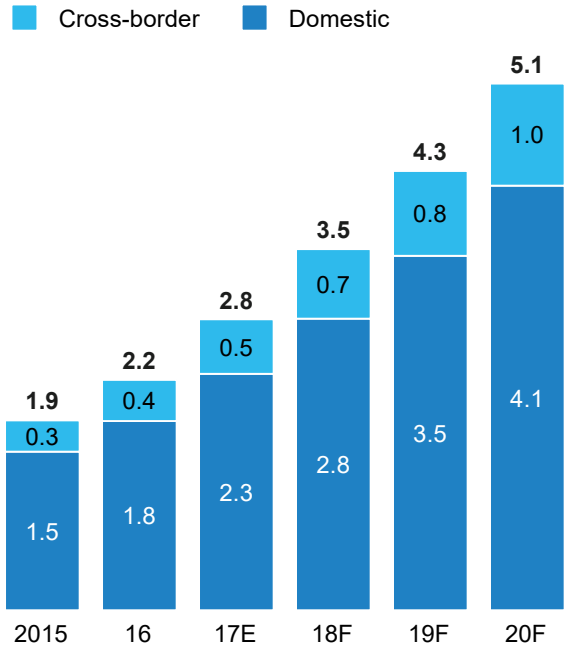
Digital platforms for e-commerce, social media, payments, travel, learning, and labor services connect buyers and sellers directly, lowering the costs of search and coordination between buyers and sellers.[97]

E-commerce has already enabled significant cross-border flows by aggregating huge selections and making pricing and comparisons more transparent.[98] It has also reduced the impact of distance on trade flows.[99] Alibaba's AliResearch projects that cross-border B2C e-commerce alone will grow to approximately $1 trillion by 2020 (Exhibit 26). Cross-border B2B e-commerce is likely to be several times larger.

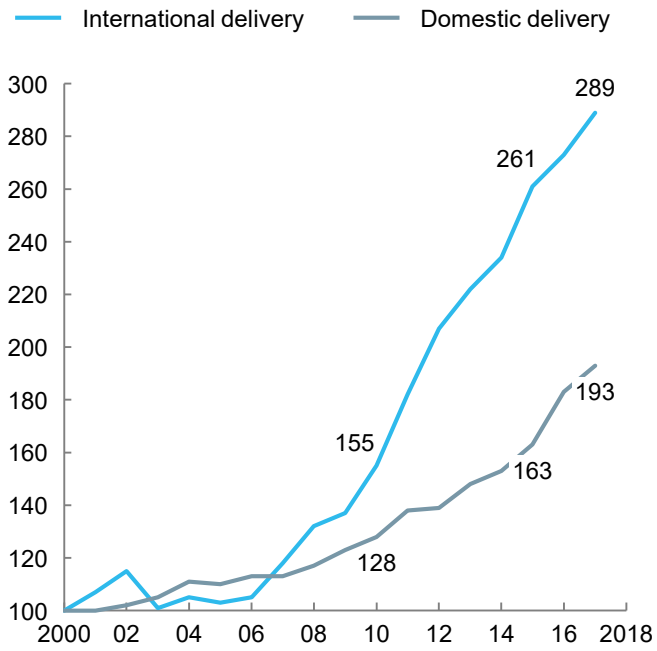
Exhibit 26

**By 2020, cross-border B2C e-commerce is projected to grow to $1 trillion.**

**Global B2C e-commerce transaction volume**
$ trillion




**Number of parcels sent by postal services**[1]
%, annual growth rate, indexed to 2000




1 2017 numbers not available and has been estimated based on 5-year CAGR.
NOTE: Figures may not sum to 100% because of rounding.

SOURCE: AliResearch; UNCTAD; Universal Postal Union; World Trade Report 2018; McKinsey Global Institute analysis

97 See Andrew McAfee and Eric Brynjolfsson, *Machine, Platform, Crowd: Harnessing Our Digital Future*, New York, NY: W. W. Norton & Company, 2017; Geoffrey G. Parker, Marshall W. Van Alstyne, and Sangeet Paul Choudary, *Platform Revolution: How Networked Markets Are Transforming the Economy—and How to Make Them Work for You*, New York, NY: W. W. Norton & Company, 2016.

98 Defining what qualifies as e-commerce can be challenging. The broadest definition would include any transaction that takes place on an online portal. E-commerce platforms can offer some or all of the following functions: matching customers to suppliers, facilitating ordering, accepting payments, and coordinating delivery. The matching component is the most relevant for increasing trade.

99 Andreas Lendle et al., "There goes gravity: eBay and the death of distance," *Economic Journal*, March 2016, Volume 126, Number 591.

As a result of these platforms, the number of parcels sent by postal services internationally rose by more than 80 percent between 2010 and 2017. This growth has implications for customs processing. The WTO's Trade Facilitation Agreement, which came into effect in 2017, is a first step in harmonizing and streamlining customs procedures. One study found that its implementation could significantly reduce trade costs, with developing economies standing to gain the most.[100] The continuation of small-parcel trade fueled by e-commerce has come into question, however. The United States recently announced its withdrawal from the Universal Postal Union agreement, a 144-year-old treaty that allowed companies in China and the rest of the developing world to ship small packages to the United States at discounted rates.

While B2C e-commerce marketplaces are well known, a growing number of B2B platforms have been springing up—and all can facilitate more cross-border transactions. Xometry, for example, provides a marketplace for on-demand manufacturing capacity. EC21, a South Korean platform that serves 3.5 million monthly users globally, offers B2B e-commerce across a wide range of products. It recently partnered with Payoneer, an international payment platform, to integrate escrow services that secure transactions for businesses.

Digital platforms offer small and medium-size companies exposure to international customers as well as the services and support they may need to grow, including funding, talent, and marketing tools. Sites such as Upwork, Fiverr, Freelancer.com, and Maistro connect freelancers around the world with clients in need of services such as coding, website development, graphic design, and marketing. The ability to turn to digital platforms for specialized help on an as-needed basis lowers the barriers to starting a business.[101]

### The Internet of Things, blockchain, and automation can improve logistics

Improving the time and cost of logistics contributes to increased trade.[102] Today a range of new technologies promises to revolutionize the way goods are sent around the world.

First, the Internet of Things creates the ability to monitor and control objects in the physical world.[103] As it is more widely adopted, Cisco estimates that machine-to-machine connections will account for 51 percent of global devices and connections by 2021 (Exhibit 27). The IoT can speed the flow of goods by tracking shipments and routing delivery trucks based on current road conditions. An application called SenseAware, for example, monitors the location, temperature, and humidity of international shipments in real time.

[100] Yann Duval, Chorthip Utoktham, and Alexey Kravchenko, *Impact of implementation of digital trade facilitation on trade costs*, UN Economic and Social Commission for Asia and the Pacific, ARTNeT working paper series number 174, January 2018.

[101] For more on these types of platforms, see *A labor market that works: Connecting talent with opportunity in the digital age*, McKinsey Global Institute, June 2015; and *Independent work: Choice, necessity, and the gig economy*, McKinsey Global Institute, October 2016.

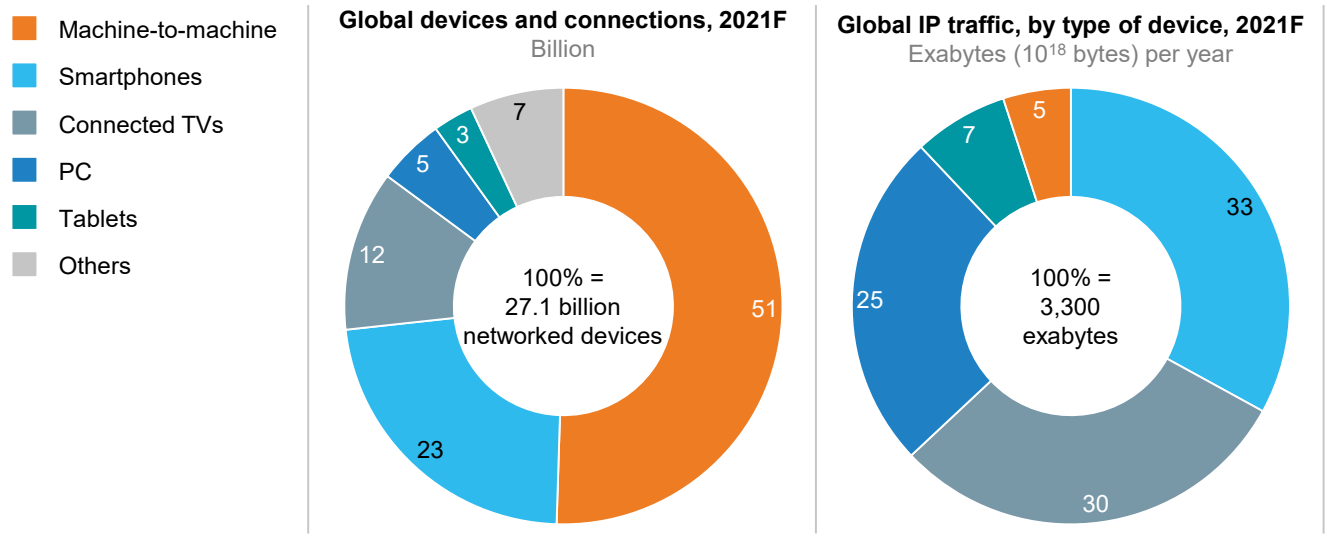
[102] Simeon Djankov, Caroline Freund, and Cong S. Pham, "Trading on time," *The Review of Economics and Statistics*, 2010, Volume 92, Number 1.

[103] See *The Internet of Things: Mapping the value beyond the hype*, McKinsey Global Institute, June 2015.

Automated document processing can help to speed goods through customs. Digital documents can be scanned for keywords and automatically checked against requirements for customs clearance. The World Bank found that shipments can clear the average fully electronic customs process in around 25 hours, compared to more than 80 hours for paper-based procedures.[104] This could be a leap forward for many developing countries. A shipment of imports entering India takes an average of 61 hours to go through documentary compliance, while border compliance takes 265 hours. Both of these steps take one hour of less in Germany.[105] Some AI applications can also help to reduce errors rates in customs processing and overcome language barriers.[106]

Exhibit 27

**By 2021, machine-to-machine connections will account for half of all global devices and connections, but only 5 percent of global IP traffic.**




NOTE: Figures may not sum to 100% because of rounding.

SOURCE: Cisco; McKinsey Global Institute analysis

Autonomous vehicles have substantial potential in logistics. A fleet of self-driving trucks run by Embark is hauling appliance deliveries from Texas to California. Other companies (including Volvo, Daimler, Tesla, Uber, and Waymo) also have robo-trucking business lines in development.[107] Automated cranes and guided vehicles are being deployed in ports from Rotterdam to Singapore to Long Beach; China is close to opening a fully autonomous harbor port, Caofeidian. Autonomous vehicles are also being tested at London's Heathrow and Gatwick airports to assist with cargo handling on airfields.

Although it is an ominous sign of global warming, the Northern Sea Route from Alaska to the top of Scandinavia along the Siberian coastline may be opening up, providing a faster and cheaper route between ports in Europe, Asia, and the Americas. A container ship takes an average of 46 days to travel from South Korea to Germany via the Cape of Good Hope and 34 days to go through the Suez Canal—but the trip could take just 23 days via

[104] "Trading across borders: Technology gains in trade facilitation," *Doing business 2017: Equal opportunity for all*, World Bank, 2017.

[105] World Bank, *Doing business 2018: Reforming to create jobs*, 2018. Documentary compliance refers to preparing the bundle of documents required to complete an international trade. Border compliance refers to customs procedures and inspections at ports or borders.

[106] *Notes from the AI frontier: Modeling the impact of AI on the world economy*, McKinsey Global Institute, September 2018.

[107] Alex Davies, "Self-driving trucks are now delivering refrigerators," *Wired*, November 13, 2017.

the Northern Sea Route. It is still a perilous undertaking, however, relying on a new breed of ice-class container ships built with advanced materials (with Russian nuclear-powered icebreakers on call if needed).[108] Russia is also developing unmanned ships to ply this route. In air transportation, possibilities include planes made from advanced materials such as lightweight graphene, and electric-powered planes.

Blockchain technologies also have potential to reduce trade costs while creating the transparency and trust needed to underpin international transactions.[109] Maersk and IBM have developed a blockchain shipping solution called TradeLens. In a pilot conducted on flower exports from Kenya to the Netherlands, it reduced transit times by 40 percent, with confirmations delivered every step of the way. Yet it will be some time before the scalability and success of blockchain technologies in trade can be determined.

Blockchain can also be used to create "smart contracts," replacing paper-based documentation systems in trade finance. Transactions can be executed immediately when goods are received, and every party can be alerted at each stage of the journey. Because transactions are permanently recorded in a distributed ledger (that is, confirmed by consensus), they are less susceptible to tampering, which provides an additional layer of security.[110] HSBC recently executed what may be the world's first trade-finance transaction on blockchain, using a single, shared digital application for a shipment of soybeans from Argentina to Malaysia. The exchange was completed in 24 hours, compared to the usual five to ten days it typically takes with a paper-based system.[111]

## AUTOMATION, AI, AND ADDITIVE MANUFACTURING CHANGE PRODUCTION PROCESSES AND THE RELATIVE IMPORTANCE OF INPUTS

Automation technologies, including advanced robotics, artificial intelligence, and additive manufacturing, alter production processes—and the economics of production.

### Automation enhances quality and efficiency while diminishing the importance of labor costs

Automation systems and advanced robotics can make a range of production processes more efficient and precise. The diffusion of these technologies and their productivity benefits through entire industries and national economies will have ramifications for the way global value chains are organized.

The work activities that lend themselves to automation tend to be physical and repetitive, or cognitive tasks that can be clearly codified. Previous MGI research found that in the United States, for example, the industries with the highest automation potential are manufacturing, accommodation and food services, and transportation and warehousing (Exhibit 28).

Companies consider a range of factors before adopting automation technologies, including the costs of the systems themselves, the transition costs, the relative cost of labor, the strength of the business case, customer acceptance, and regulation.[112] Where technology systems are expensive and labor is cheap, they feel less urgency. But the price of robots has fallen by more than half since 1990, and as demand for robots grows, cost will continue to become less of a barrier.[113] Adoption is likely to be much greater in advanced economies than in developing economies. Previous MGI research found that in a midrange adoption

[108] William Booth and Aimee Ferris-Rotman, "Russia's Suez Canal? Ships start plying a less-icy Arctic, thanks to climate change," *Washington Post*, September 8, 2018.

[109] See, for example, *World trade report 2018: The future of world trade: How digital technologies are transforming global commerce*, World Trade Organization, October 2018; and Emmanuelle Ganne, *Can blockchain revolutionize international trade?* World Trade Organization, 2018.

[110] Bhavya Bhandari, *Supply chain management, blockchains, and smart contracts*, 2018.

[111] Don Weinland, "HSBC claims first trade-finance deal with blockchain," *Financial Times*, May 13, 2018.

[112] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

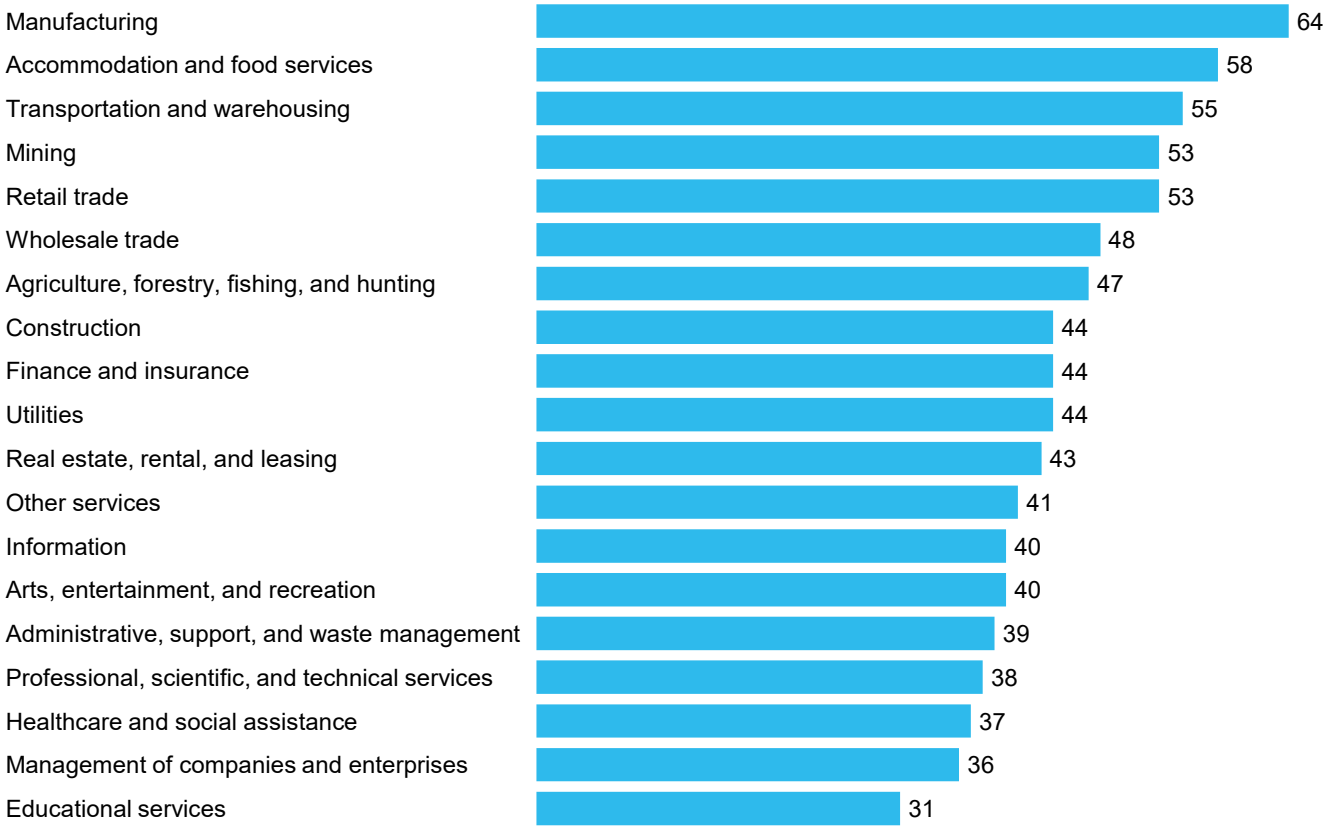
[113] International Federation of Robotics

scenario, automation could potentially substitute for up to one-quarter of work activities in advanced economies but only 9 percent in India and 16 percent in China.[114]

Exhibit 28

**The share of work activities that can feasibly be automated varies by sector.**

**Impact of automation by industry in the United States**
FTE weighted % of technically automatable activities by industry in the United States




1 We define automation potential by the work activities that can be automated by adapting currently demonstrated technology.

SOURCE: MGI Global Automation Impact Model; IMF; WTO; OECD; UNCTAD; McKinsey Global Institute analysis

Originally developed for producing goods made of metal, plastics, and wood, robots in manufacturing can now handle a wider variety of processes and industries. They can even cut and sew delicate materials. SoftWear Automation, an Atlanta-based startup, is developing a line of "sewbots" that can automate textile production, for example.

In value chains producing labor-intensive goods and global innovations, a significant share of trade flows from developing to advanced economies. But because automation technologies reduce the importance of labor costs, companies may decide to shift some production closer to end markets in advanced economies. This is not yet happening on a significant scale, although there are a few cases. This trend is most likely to take root in industries where speed to market is an important factor.

A prime example is fashion and apparel. Taking advantage of customer insights requires rapid turnaround times in manufacturing and distribution, and it favors locating apparel manufacturing closer to the consumer. In a survey of US and EU purchasing managers,

[114] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017.

54 percent said that geographic proximity is becoming more important, and another 22 percent said it may be more important in the coming years.[115] More than half of Zara's thousands of suppliers, for instance, are concentrated in Spain, Portugal, Turkey, and Morocco to serve the European market.[116] Adidas is building new automated "Speedfactories" in Germany and the United States to produce athletic shoes that were traditionally hand sewn in Indonesia.

Automation in manufacturing will not necessarily cause an exodus of production from the developing world.[117] Because it can reduce error rates in production, improve product quality, and boost output, it could help some developing economies develop a competitive edge that extends beyond low-wage labor. China is pursuing automation in manufacturing as a strategy to retain its share of global production even as wages rise. Foxconn, for instance, plans to upgrade its plants across China with next-generation robots and high-resolution sensors to spot defects that human eyes cannot see.[118] Thailand's industrial robotics industry has expanded, with 133 percent growth in shipments of industrial robots between 2013 and 2018.[119] One of the country's key adopters is the Thai Beverage Group, which set up a subsidiary called BevTech to develop robots and automation technologies to support its operations.[120] Furthermore, some production could be "nearshored" rather than reshored—that is, based in neighboring middle-income countries that offer a combination of relatively lower wages and geographic proximity. Wherever it is based, a more automated and digital form of manufacturing no longer requires a large, low-skill workforce. (See Chapter 6 for more on this topic.)

### Artificial intelligence and virtual agents could reduce trade in back-office services

Automation technologies are a broader set of tools than simple industrial robots in factories. Many back-office processes in areas such as finance and accounting, human resources, and IT support involve repetitive tasks that can be automated with artificial intelligence.

Many call center and help desk activities are already "staffed" by virtual agents, which are progressing from rule-based bots to models with natural language processing abilities. IPSoft's Amelia, for example, is a "cognitive agent" platform for handling customer service, drawing business intelligence from interactions, and passing requests into the right workflow.[121] It took 140 human representatives to handle the more than 65,000 monthly calls that came into one media company's customer service center, but Amelia was able to handle two-thirds of that volume—and it reduced the average resolution time from 18 minutes to just five.

MGI's automation model finds that up to 80 percent of the work activities in business and IT services could theoretically be performed by machines (although companies will not necessarily adopt to that degree). Given that business process outsourcing services involve many repetitive tasks such as data entry, they have even higher potential. Today BPO is one of the most heavily traded service sectors, but companies in advanced economies could begin to use AI tools to handle these functions rather than offshoring them. Yet countries

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[115] *McKinsey apparel CFO survey 2017: The apparel sourcing caravan's next stop: Digitization*, McKinsey Apparel, Fashion & Luxury Group, September 2017.

[116] Zara, zara.com/us/en/sustainability-suppliers-l1456.html.

[117] Erhan Artuc, Paulo Bastos, and Bob Rijkers, *Robots, tasks, and trade*, World Bank policy research working paper WPS8674, December 2018.

[118] Kensaku Ihara, "Foxconn plots $4 billion automation push as labor costs bite," *Nikkei Asia Review*, February 24, 2018.

[119] Thailand Board of Investment, boi.go.th/upload/content/Article%201_Robotics%20Final_74926_5a78029944a36.pdf.

[120] Pitsinee Jitpleecheep, "Push for robots in Thailand 4.0 planning," *Bangkok Post*, May 15, 2017.

[121] IPSoft, "Meet Amelia: Your intelligent digital workforce," ipsoft.com/wp-content/uploads/2017/06/Meet_Amelia-1.pdf.

that are already leaders in BPO services (such as India, Costa Rica, and the Philippines) could retain their position or even expand their markets if they can use AI themselves to improve the quality and cost of BPO services or deliver higher-value services.

AI can also create trade in new types of services. Algorithms "learn" by reviewing vast quantities of data that humans have already labeled. Tagging data for machine learning could become a significant source of work in lower-wage countries in the coming years. Outsourcing companies such as US-based Samasource are already developing these capabilities for computer vision and natural language recognition.

### Additive manufacturing could reduce trade in replacement parts and in manufactured goods

Additive manufacturing, or 3-D printing, builds physical objects based on graphical data input from computers, adding layers of raw materials to match the intended design. It frees designers to create products with better performance, new features, or reduced weight. Because objects can be created at the point of use (for example, a construction site, mining operation, or factory), production is dispersed and more nimble. It may also require less working capital.[122]

Additive manufacturing can be used to produce objects according to highly detailed specifications—and even enable products that could not have been built with traditional manufacturing. GE and CFM International adopted additive manufacturing to develop a complex fuel nozzle for a jet engine, combining 20 parts into a single unit with 25 percent less weight.[123] The technology has multiple healthcare applications, including patient-specific implants that enable higher success rates and reduce time in surgery.

Additive manufacturing could dampen trade in some goods as on-demand production near the consumer replaces the global distribution of mass-produced goods. Toybox, a home-based 3-D printer, enables customers to design their own toys or purchase specifications from the printer maker's web catalog. With consumers making the final product in their own homes, trade in toys decreases, but data flows and IP charges for designs increase.

In some cases, additive manufacturing could spur trade by enabling customization that generates more consumer demand. After producing 100,000 pairs in 2018, Adidas aims to produce millions of Futurecraft 4D athletic shoes with 3-D-printed custom soles in the coming years. Today virtually all hearing aids are 3-D printed—and World Bank research finds that trade in hearing aids has increased 60 percent since 3-D printing was introduced.[124] The countries that moved into this specialty first (Switzerland, Denmark, and Singapore) remain large exporters, and they have been joined by China, Mexico, and Vietnam.

Most experts believe that additive manufacturing will not replace mass production for many types of goods over the next decade, if ever, due to technical limitations and the fact that the cost and speed are not competitive for large volumes. Its greatest promise is in prototyping, replacement parts, and products that require customization. Only very limited trade flows will likely be affected by the use of 3-D printing to move production closer to the point of consumption.

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[122] Jörg Bromberger and Richard Kelly, "Additive manufacturing: A long-term game-changer for manufacturers," September 2017, McKinsey.com; *Adding it up: The economic impact of additive manufacturing*, Economist Intelligence Unit, 2018.

[123] *GE Reports*, "An epiphany of disruption: GE additive chief explains how 3D printing will upend manufacturing," blog entry by Tomas Kellner, November 13, 2017, ge.com/reports/epiphany-disruption-ge-additive-chief-explains-3d-printing-will-upend-manufacturing/.

[124] Freund et al., *Is 3D printing a threat to global trade? The trade effects you didn't hear about*, World Bank Group, forthcoming.

## TECHNOLOGY IS CHANGING THE GOODS AND SERVICES TRADED ACROSS BORDERS

In addition to changes in transaction costs and factor costs, technology is transforming some products and services as well as giving rise to some entirely new ones. These may change both the content and volume of trade flows. Here we look at the effects of digital goods, electric vehicles, and 5G wireless networks.

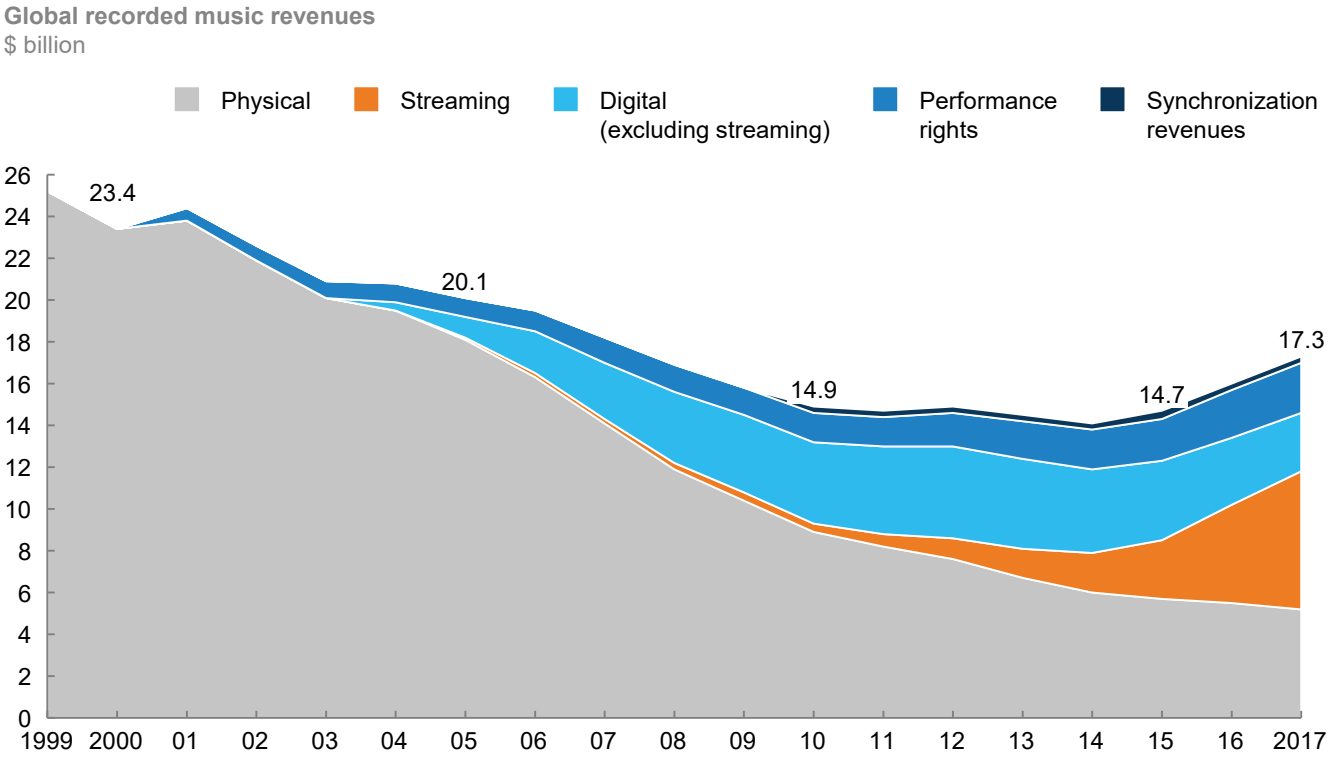
### Some digital innovations replace trade in goods with service and data flows

As some goods are digitized, they become more tradable—and may even be transformed into flows of data and services. This trend began with music, video, and games and is now moving into cloud computing, 3-D printing, and, increasingly, "as a service" business models.

For years, books, movies, games, music, and media content have been moving away from physical printed copies to digital files that can be sold at near-zero cost to customers anywhere in the world. More recently, these products have morphed yet again from stand-alone digital files to streaming and subscription models. Consumption of mobile audio and online audio has grown by 23 and 14 percent, respectively, over the past decade.[125] Revenues from music streaming more than doubled between 2015 and 2017, and they now account for nearly 40 percent of global recorded music revenues (Exhibit 29). More than half of Netflix's 118 million subscribers are outside the United States. An online streaming service launched by Baidu, iQiyi, recently averaged 420 million mobile monthly viewers.[126]

Exhibit 29

**Streaming now accounts for nearly 40 percent of recorded music revenues globally.**




SOURCE: IFPI Global Music Report 2018; *World Trade Report 2018;* McKinsey Global Institute analysis

[125] MGI analysis of PQ Media data.

[126] Ciara Linnane, "The 'Chinese Netflix' iQiyi is gearing up for $2 billion-plus IPO: Four things to know," MarketWatch, March 29, 2018.

Cloud computing uses a similar subscription or pay-as-you-go model. Many businesses turn to cloud providers for a seamless package of storage, business software, and regular upgrades rather than building their own IT infrastructure. This frees them from making heavy capital investments and locking into systems that can quickly become outdated. Spending on cloud services is expected to grow at more than six times the rate of general IT spending through 2020.[127]

Cloud computing is one aspect of a broader trend toward leasing assets or purchasing services on demand. The rise of on-demand ride sharing is projected to reduce car ownership substantially, while increasing utilization of each vehicle. McKinsey has estimated that ride sharing could offset a third of the growth in auto sales by 2030.[128] This could have large implications for the entire automotive industry, shifting value from vehicle sales to after-sales services.

Overall, the rise of digital goods tends to shift value from manufacturing to service provision and distribution. Value creation within industries is migrating to upstream R&D and design and to downstream distribution and marketing. In the case of digital goods, the manufacturing processes in the middle of the value chain disappear altogether.

### Growth in electric vehicles and renewable resources could reduce trade in auto parts and commodities

Electric vehicles (EVs) are gaining momentum, particularly in China, the United States, and Europe. In 2017, global sales of electric and hybrid vehicles topped one million for the first time. McKinsey estimates that battery-powered EVs and plug-in hybrid EVs will make up 17 percent of global car sales by 2030, up from approximately 1 percent in 2017.[129] This trend will be driven by regulatory pushes, new models, and falling battery prices.

The adoption of EVs could disrupt automotive value chains and trade. Battery-powered EVs have only 20 to 30 moving parts in their drivetrains, compared to 130 to 170 moving parts in an internal combustion engine. We estimate that EVs could reduce trade in auto parts (which totals some $700 billion today) by up to 10 percent while also reducing demand for crude oil and petroleum (Exhibit 30).

But the shift to EVs could also generate new flows within automotive value chains. Trade in batteries will depend on how the footprint of battery manufacturing evolves in the next few years; it is likely to mirror existing regional networks. Battery manufacturing was previously concentrated in China, Japan, and South Korea. Now Tesla has established its Gigafactory for battery production in the United States. Other battery plants are already under development in Hungary, Poland, Thailand, and Morocco. Trade in raw materials for batteries, such as nickel, cobalt, and copper, could also increase.

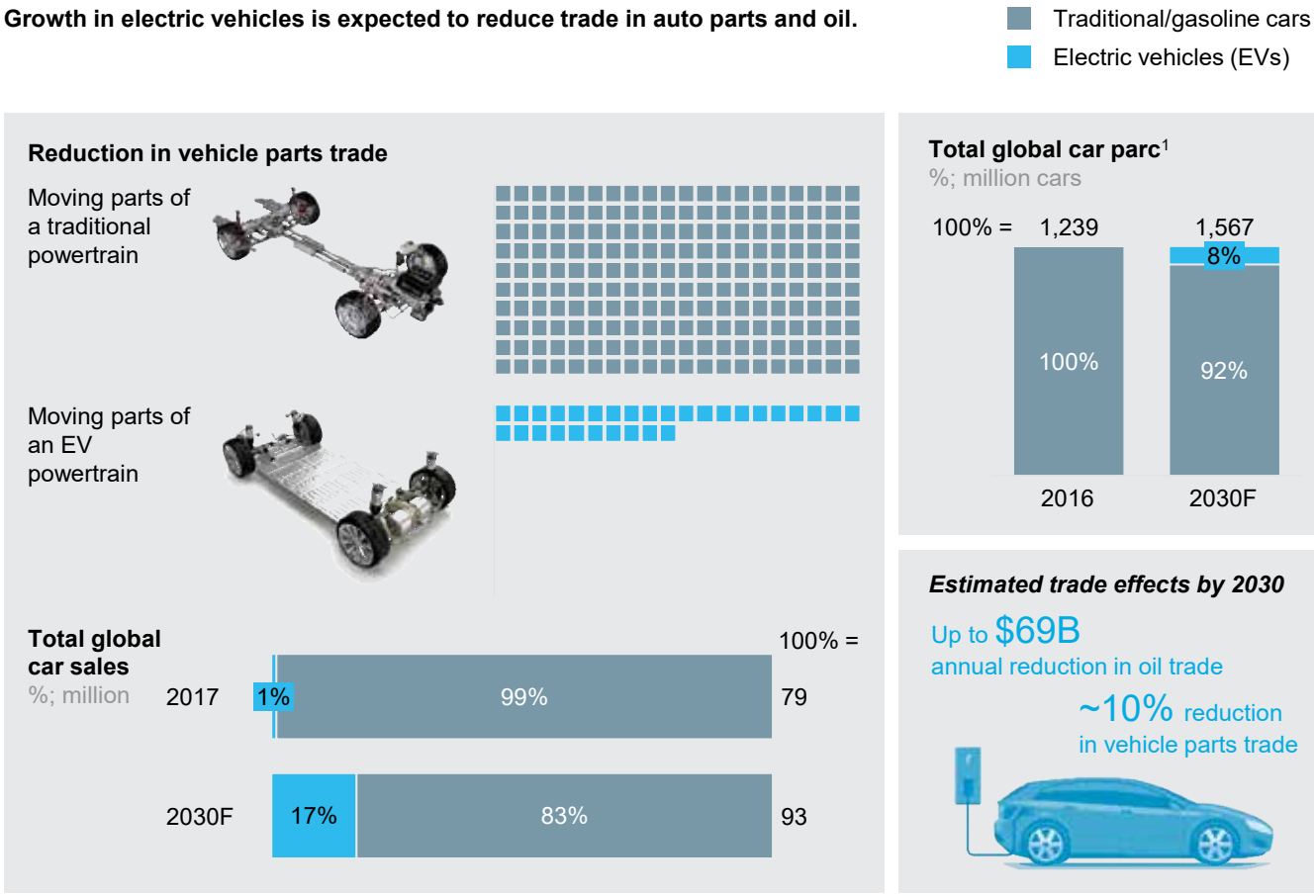
[127] Nagendra Bommadevara, Andrea Del Miglio, and Steve Jansen, "Cloud adoption to accelerate IT modernization," April 2018, McKinsey.com.

[128] Anne Grosse-Ophoff, Saskia Hausler, Kersten Heineke, and Timo Möller, "How shared mobility will change the automotive industry," April 2017, McKinsey.com.

[129] Patrick Hertzke, Nicolai Müller, Stephanie Schenk, and Ting Wu, "The global electric-vehicle market is amped up and on the rise," May 2018, McKinsey.com.

Exhibit 30

**Growth in electric vehicles is expected to reduce trade in auto parts and oil.**




1 Refers to the total of all registered cars on the road.
NOTE: Figures may not sum to 100% because of rounding.

SOURCE: UBS; McKinsey Global Energy Projection, IMF; WTO; OECD, UNCTAD; McKinsey Global Institute analysis

The world is also shifting toward greater use of renewable energy, driven by a combination of technology improvements and regulatory mandates in places including the EU and California. McKinsey's Global Energy Perspective projects that the world's electricity generation mix will have a very different look by 2030, with the share of electricity generated from solar and wind energy increasing by 4 times and 2.5 times, respectively. These sources could account for almost 20 percent of electricity generation in 2030, up from just 6 percent today.

Since solar and wind power are not heavily traded, this scenario would lead to a drop in the commodities trade. But advances in storage and transmission could eventually lead to new trade channels. For example, the Japanese conglomerate SoftBank Group has an ambitious plan to develop the Asian Super Grid, which can transmit electricity from Mongolia to other countries such as Japan and Korea.[130] There are also preliminary plans to distribute solar power from the North African and Sahara deserts to parts of Europe.

[130] Takashi Sugimoto, "Asia Super Grid: SoftBank's latest dream stretches over 6 countries," *Nikkei Asian Review*, October 13, 2017.

### 5G makes telemedicine, virtual reality, and new service flows possible

A large-scale migration to 5G is still some years away, but networks are being built out and tested (including splashy demonstrations at the 2018 Olympic Winter Games in South Korea and the 2018 Super Bowl in Minneapolis). With connections that are roughly 20 times faster than 4G, 5G will embed the internet into the world around us like electricity. Ultrafast speeds and reliability will provide a backbone for the IoT, smarter grids, autonomous vehicles, and virtual reality to realize more of their potential.[131]

The rollout of 5G may reshape global flows in complex ways. Virtual reality and virtual meetings, which are subject to technology snags of all kinds today, could be run more smoothly and with new possibilities for interactivity and presentations. Shared documents, sophisticated visualizations, and even holograms could be transmitted instantly—all of which reduces the need for workers to travel for business meetings.

In industrial plants, 5G can support augmented and virtual reality–based remote maintenance. Intelligent video surveillance combined with AI-based video recognition algorithms can detect issues in real time. Maintenance experts no longer need to be near maintenance activities; they can even be in a different country, creating new flows of services and data.

Telemedicine and remote surgery will become more viable as 5G networks transmit sharp images without any delays and robots become more highly responsive to precise remote manipulation. Verizon's precommercial 5G has been tested for use in telemedicine through a pilot by Columbia University. With a 5G connection and headsets, therapists conducted physical motor rehabilitation with patients in remote locations.

## NEW TECHNOLOGIES WILL HAVE A MIXED IMPACT ON TRADE FLOWS AND ARE LIKELY TO ACCELERATE THE SHIFT FROM GOODS TO SERVICE FLOWS

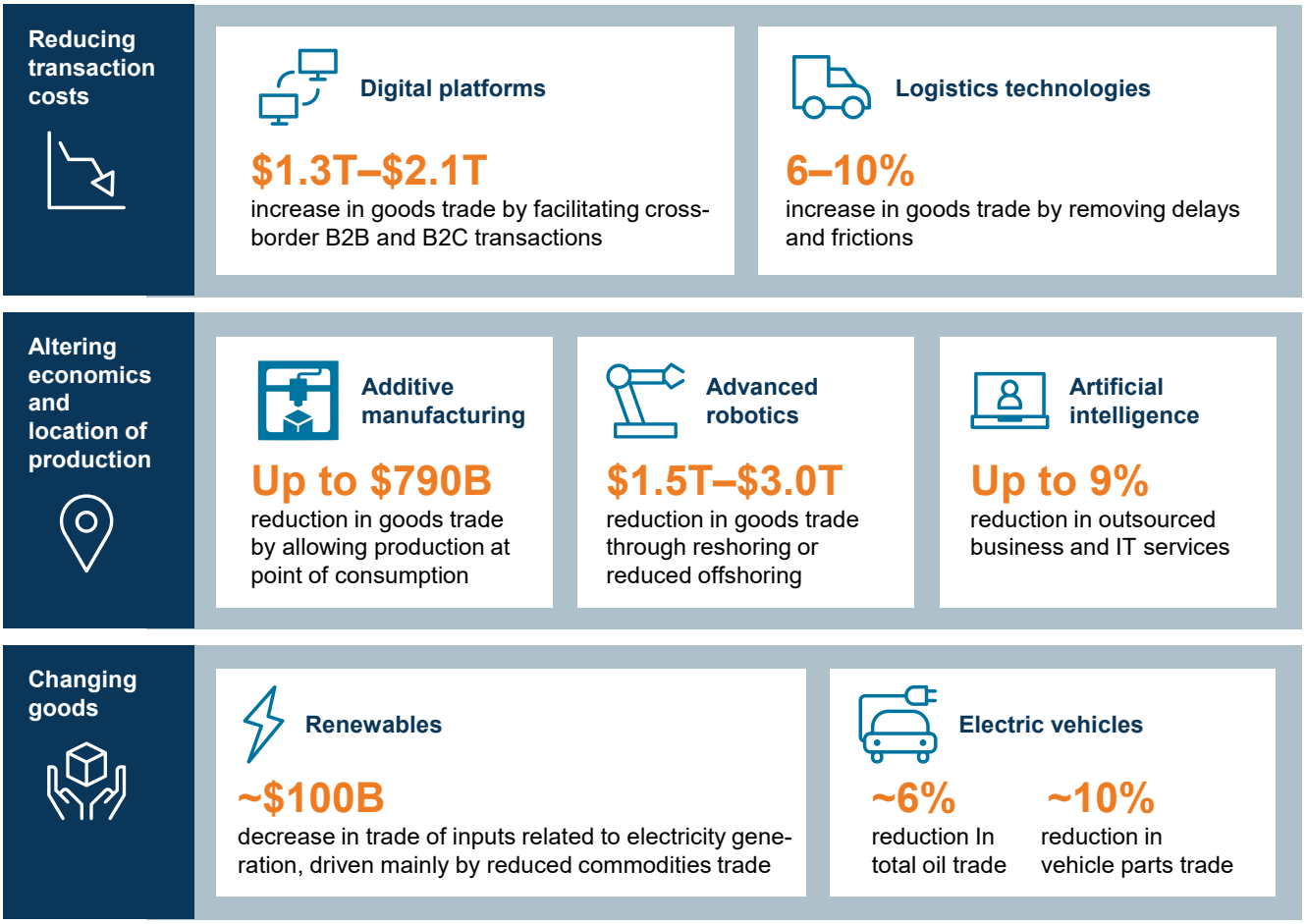
We size the potential impact on flows created by six next-generation technologies: digital platforms, logistics technologies, additive manufacturing, automation technologies (advanced robotics and AI), electric vehicles, and renewable resources (Exhibit 31). We do not size every new technology on the horizon, nor do we undertake general equilibrium modeling that incorporates second- and third-order impacts on prices, productivity, and demand. But this exercise does illustrate the degree to which technologies could affect trade flows. Some of these effects are already unfolding, while others will likely occur in the next five to ten years. Some other technologies discussed above (such as autonomous vehicles and 5G) could be tremendously important, but we excluded them due to greater uncertainty surrounding the timing and scope of their adoption. See the technical appendix for details on our methodology.

[131] Mark Collins, Arnab Das, Alexandre Ménard, and Dev Patel, "Are you ready for 5G?," February 2018, McKinsey.com; and "The 5G economy: How 5G will impact industries, the economy, and you," *MIT Technology Review*, March 2017.

Exhibit 31

**New technologies have the potential to alter global trade.**

Projected impact by 2030




SOURCE: IMF; WTO; OECD; UNCTAD; McKinsey Global Institute analysis

### Technologies that reduce transaction costs could increase trade

- **Cross-border e-commerce.** This already-huge market has great potential for continued growth. Forecasts vary significantly by country, based on their current maturity. In the United States, for example, growth has been strong since the early 2000s but is now slowing. Countries such as India have a great deal of room for future growth.

  In the aggregate, we estimate that e-commerce could boost goods trade by $1.3 trillion to $2.1 trillion (4 to 6 percent) by 2030.[132] One caveat is that the recent US withdrawal from the Universal Postal Union agreement, which set low international shipping rates for small orders from China to the United States, may affect trade flows.

[132] Some e-commerce purchases from foreign sellers may simply substitute for traditional trade flows that would have taken place in offline channels. To avoid double counting because of this effect, we use a range of assumptions on what we believe will be incremental trade created as e-commerce platforms give people access to goods that were not previously available and stimulate additional demand.

- **Logistics technologies.** Based on evidence to date, we conservatively assume that the IoT and other forms of digitization such as blockchain could improve shipment and logistics times for traded goods by 10 to 20 percent. We also make a conservative estimate that 20 percent of ports could be automated by 2030, reducing global processing times for shipments of goods by 6 to 8 percent.

  Combining these technologies, we see potential to improve transit times for traded goods by 16 to 28 percent by 2030. Using trade elasticities found in the literature, we assume a 0.4 percent increase in trade flows for every 1 percent reduction in processing times.[133] Looking at each country's average processing time today and its bilateral flows of both exports and imports, we see that Bangladesh, India, and Indonesia—all of which have lengthy and cumbersome logistics and customs procedures—are among the countries that could make the biggest gains.

Altogether, we calculate that these technologies could boost trade in manufactured goods and agriculture by $1.5 trillion to $2.6 trillion annually by 2030, an increase of 6 to 10 percent.

### Technologies that alter the economics of production could reduce trade, with some exceptions

- **Advanced robotics and AI.** Overall, these technologies in manufacturing could enable more production near key markets as labor costs become less important in location decisions.

  We derive each country's adoption potential by 2030 using a model developed for MGI's previous research on automation.[134] To assess the potential disruption to trade flows, we look specifically at exports from developing countries to developed countries, as well as exports from developing countries to China. We model a scenario in which companies in advanced markets that automate a significant proportion of their processes decide to reshore production or refrain from offshoring future production.

  Using these assumptions, automation could reduce goods trade by up to $3.0 trillion annually by 2030, a 5 to 10 percent decrease (Exhibit 32). The largest shares of affected trade flows are likely to be in value chains that produce labor-intensive goods. A significant share of production in regional processing and resource-intensive goods value chains could also be automated, but these goods are already less traded. While automation could disrupt trade flows, it is worth noting two countervailing factors. First, developing countries can use automation to become more competitive and develop new specializations. Second, as advanced economies automate, their higher output will require more inputs, some of which may be imported.

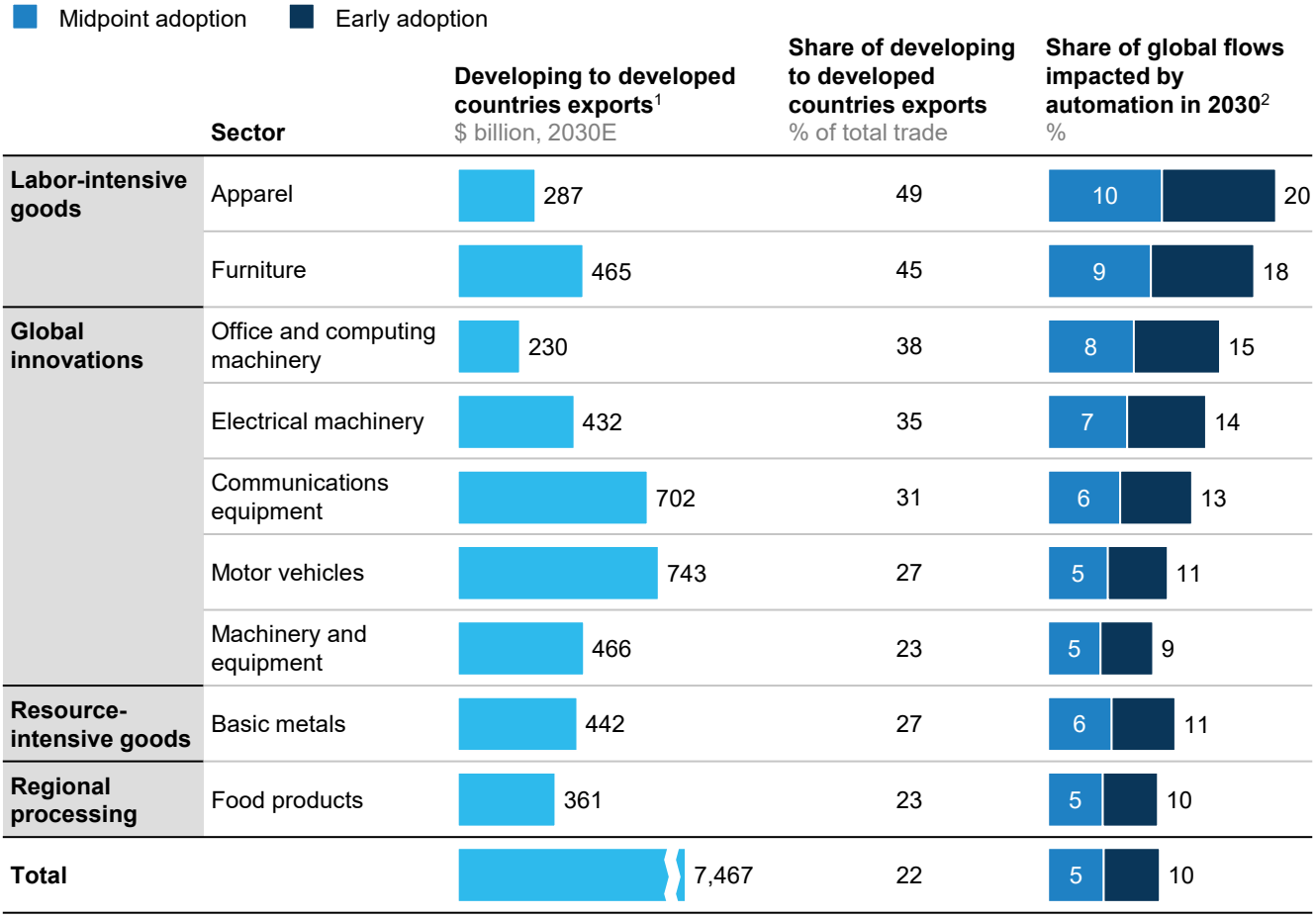
  In addition, we find that AI, virtual agents, and robotic process automation could reduce trade in business and IT services by $130 billion to $270 billion annually by 2030, or 5 to 9 percent. The impact is likely to be much higher in the BPO subset of these services, given the high tradability and repetitive nature of BPO work and the fact that companies in advanced economies could turn to AI tools rather than offshoring those services.

[133] Warren H. Hausman, Hau L. Lee, and Uma Subramanian, "The impact of logistics performance on trade," *Production and Operations Management*, March–April 2013, Volume 22, Number 2.

[134] See *A future that works: Automation, productivity, and the future of work*, McKinsey Global Institute, January 2017.

Exhibit 32

**Automation could have the largest impact on trade in apparel and furniture manufacturing.**




| | Sector | Developing to developed countries exports[1] $ billion, 2030E | Share of developing to developed countries exports % of total trade | Share of global flows impacted by automation in 2030[2] % |
|---|---|---|---|---|
| **Labor-intensive goods** | Apparel | 287 | 49 | 10 20 |
| | Furniture | 465 | 45 | 9 18 |
| **Global innovations** | Office and computing machinery | 230 | 38 | 8 15 |
| | Electrical machinery | 432 | 35 | 7 14 |
| | Communications equipment | 702 | 31 | 6 13 |
| | Motor vehicles | 743 | 27 | 5 11 |
| | Machinery and equipment | 466 | 23 | 5 9 |
| **Resource-intensive goods** | Basic metals | 442 | 27 | 6 11 |
| **Regional processing** | Food products | 361 | 23 | 5 10 |
| **Total** | | 7,467 | 22 | 5 10 |

1 Refers to exports from all developing countries including China to developed countries, as well as all exports from developing countries to China.
2 From early and midpoint adoption case in MGI's Future of Work automation model, based on automation adoption of partner countries.
NOTE: Trade impact of advanced robotics and AI is modeled at a bilateral flow and sectoral level. Figures may not sum to 100% because of rounding.

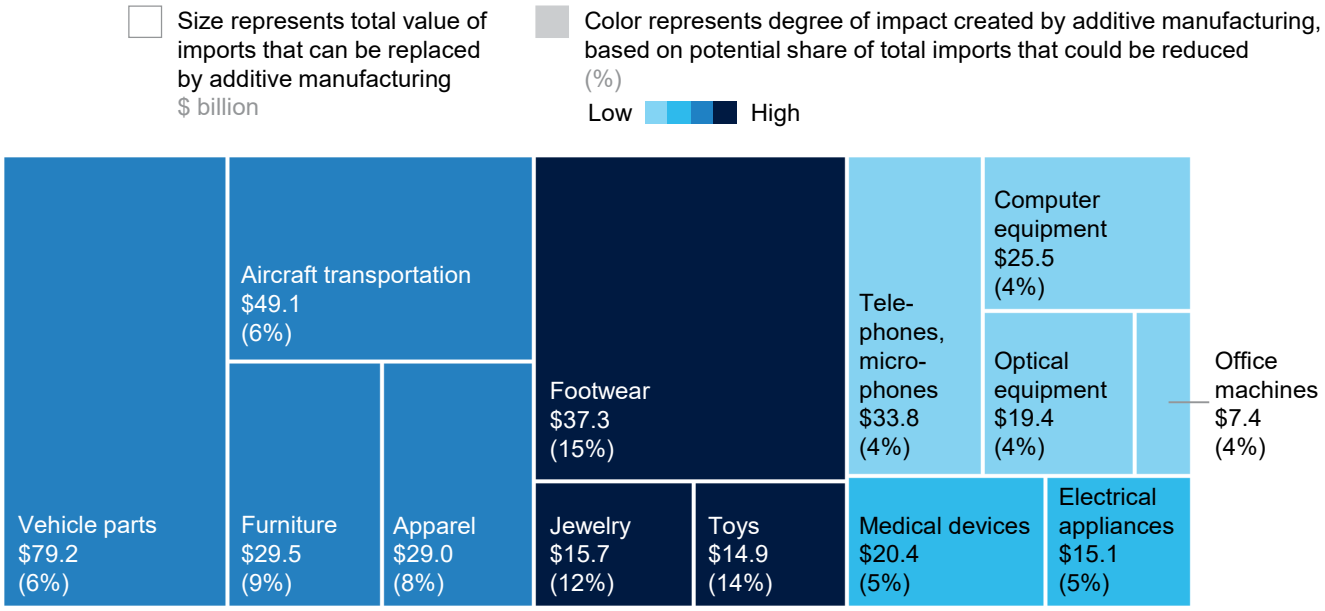
SOURCE: IMF; WTO; OECD; UNCTAD; McKinsey Global Institute analysis

- **Additive manufacturing.** We consider specific product categories and estimate the share of printable parts in each, based on technical feasibility and interviews with experts. This share ranges widely across products, from 20 percent in aircraft to 70 percent in toys. We then consider the economic viability of 3-D printing for each product category.

  We estimate that additive manufacturing could reduce goods trade by only 1 to 2 percent (or some $350 billion to $790 billion annually) by 2030. The largest potential impact on trade in dollar terms is in vehicle and aircraft parts, while the highest share of impact is in footwear and toys (Exhibit 33). As noted above, additive manufacturing can increase trade in certain product categories, but it is not competitive for mass production in most industries today.

Exhibit 33

**Additive manufacturing is expected to have the largest dollar impact on trade in vehicle parts and aircraft by 2030.**




SOURCE: UNCTAD; WTO; McKinsey Global Institute analysis

## New goods and services, such as electric vehicles and renewable energy, could reduce trade flows

- **Electric vehicles.** As EVs become a bigger share of the automotive market, they will likely reduce trade in both oil and vehicle parts. By 2030, the oil trade could potentially fall by $39 billion to $69 billion annually, for a drop of 3 to 6 percent in traded crude and refined petroleum. This estimate is based on both expected oil consumption and expected penetration of EVs by 2030.

  Trade in vehicle engines and parts will likely decline as EVs gain market share, since they have fewer moving parts than vehicles with internal combustion engines. We identified which car parts are not required in EVs and estimate that they account for approximately 35 percent of the total value of trade in parts. To determine the impact on trade, we consider market projections for EV sales in each country by 2030. All told, we estimate that EVs could reduce the $1.4 trillion trade in vehicle parts by $86 billion to $140 billion, or 6 to 10 percent, by 2030.

- **Renewable energy.** The switch to less traded solar photovoltaic and wind power for electricity generation could dampen the commodities trade. Renewables will likely produce minimal trade flows, since solar and wind power are typically harnessed in the same country where they are generated. In total, we estimate that imports of commodities for energy production could decline by 23 percent relative to the base case by 2030, for a drop of $78 billion. Imports of related equipment could decline by 20 percent relative to the base case, a $26 billion decrease. Together this produces a $104 billion decline in annual trade by 2030.

•••

The continuing march of technology is reshaping individual industries as well as the comparative advantages of nations. It underscores the rising importance of traded services, knowledge flows, and skills. The chapters that follow examine how companies are competing in this new landscape and the implications for policy makers and workers.

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# 5. HOW COMPANIES ARE RESPONDING TO VALUE CHAIN DISRUPTION

The previous chapters paint a picture of global value chains in transition, and these changes hold significant implications for where and how companies compete. The rising importance of knowledge and intangibles, for example, raises the stakes for cultivating digital capabilities and workforce skills. Many companies are altering their operating models as services offer new sources of value across industries. Automation reduces the value of labor-cost arbitrage and enables placing production closer to customers. The changing map of global demand may require setting up new regional supply chains. Tighter coordination with supplier networks is becoming necessary—not only to reduce production cycle times but also to capture the full potential of new technologies in production and logistics. On top of these structural shifts, global companies must now contend with new and rising risks, not least of which are tariffs and other trade barriers (see Box 5, "How companies are responding to rising trade tensions").

All of this adds up to a more challenging landscape—and one in which competitors are coming from all sides. Global companies must reassess periodically whether they are competing in the right part of the value chain and whether they have the organizational structure to operate effectively across borders. Speed to market and seamless coordination across supplier ecosystems are growing imperatives. In this chapter, we explore five imperatives for companies to adapt to these changes.

## NEW ENTRANTS ARE DISRUPTING VALUE CHAINS, CREATING NEW WINNERS AND LOSERS

In industry after industry, new entrants are shifting the competitive dynamics, introducing radically different business models, and turning up the pressure on incumbents.

### Tech companies are disrupting value chains

New entrants are striking in faster and more unpredictable ways than ever before. In some cases, they have not only scaled up and rapidly gained market share in a particular niche; they have also integrated vertically and pushed beyond traditional sector boundaries. This is not just a Silicon Valley phenomenon. In China, the digital ecosystem, once led by a few giants, is rapidly expanding. One-third of the world's "unicorns" (privately held startups valued at over $1 billion) are now based in China.[135]

New tech disrupters are expanding up and down the value chain. Netflix, for example, has moved from acquiring licensing and distribution rights to existing movies and TV shows to producing its own content. Venturing upstream gave Netflix differentiation and momentum for its rapid international scale-up. More than half of its approximately 118 million subscribers are located outside of the United States, and they contribute slightly over 45 percent of the company's revenues.[136] Netflix now has titles in more than 20 viewing languages and is filming original content in languages other than English. Amazon is integrating downstream into distribution by building out its own fleets of cargo planes, delivery trucks, and delivery drones. The company has even begun to act as a freight operator, arranging ocean shipments to the United States for Chinese vendors. In 2018, Amazon announced a new delivery service to pick up merchandise from small retailers and move it to the company's own fulfillment centers. These moves pose a new competitive challenge to incumbents in

[135] *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.
[136] Netflix 2017 annual report.

the shipping and logistics industry.[137] Ocado, a UK-based online-only grocer known for its distinctive logistics solutions, has moved into licensing its proprietary hardware and software to retailers around the world.

### New competition is coming from the developing world

While the previous wave of globalization was characterized by Western multinationals entering developing economies, the next phase is seeing a wave move in the opposite direction. Companies headquartered in the developing world are expanding into new markets worldwide—and in some cases, they are challenging Western incumbents in their own backyards. They now have the scale and know-how to take on incumbents that may have held comfortable market positions for decades. Chinese, Indian, and other emerging-market companies are increasingly using M&A strategies to expand into global markets.[138] China's outbound M&A flows soared from $49 billion in 2010 to $227 billion in 2016, when they were six times higher than the amount foreign companies spent on acquiring Chinese firms.[139]

[137] Laura Stevens, "Amazon drives deeper into package delivery," *Wall Street Journal*, June 28, 2018; Sam Shead, "Amazon has entered the trillion-dollar ocean freight business," Business Insider, January 26, 2017.

[138] *Playing to win: The new global competition for corporate profits*, McKinsey Global Institute, September 2015.

[139] David Cogman, Paul Gao, and Nick Leung, "Making sense of Chinese outbound M&A," July 2017, McKinsey.com.

### Box 5. How companies are responding to rising trade tensions

From Brexit to the ongoing trade disputes between the United States and China, companies that operate across borders face a new level of uncertainty. Policy shifts may demand agile responses. Volvo, now owned by Chinese company Geely, is changing planned exports across its global operations; part of the adjustment involves canceling plans to sell sedans made in South Carolina to China.[1] BMW has similarly halted exports from South Carolina to China and is considering producing more vehicles in China as a result.[2] Companies that can alter production and export flows rapidly will be able to respond dynamically to policy moves that affect their bottom line. Columbia Sportswear, for example, pairs designers with trade experts to adjust clothing content as needed to avoid tariffs.[3]

The September 2018 McKinsey Global Executive Survey on economic sentiment included questions about trade and globalization.[4] Thirty-three percent of respondents said that uncertainty over trade policy is their top concern, while another 25 percent specifically pointed to recent tariff increases (Exhibit 34). Many expect these pressures to affect their financial performance. If current tariffs persist and escalate, 46 percent of respondents expect lower revenue growth, 36 percent expect to reduce head count in regional offices and foreign affiliates, and 30 percent foresee reduced head count in their headquarters.

Three-quarters of companies say they are adjusting their strategies, although only one-quarter are taking "moderate" or "significant" action immediately. Nearly half of respondents state that their companies will build out operations in one or more key countries in response to new trade policies. Meanwhile, 24 percent of companies expect to step up investment in local supply chains in response to tariffs, potentially reversing years of global fragmentation.

[1] Keith Naughton and Gabrielle Coppola, "Volvo rips up production plans in effort to dodge trade war tariffs," Bloomberg, November 8, 2018.

[2] David Wren, "Trade tiff prompts changes at BMW's SC plant," *Post and Courier*, November 7, 2018.

[3] Jim Tankersley, "A winter-coat heavyweight gives Trump's trade war the cold shoulder," *New York Times*, November 23, 2018.

[4] "Economic conditions snapshot, September 2018: McKinsey Global Survey results," McKinsey.com.

## SMEs have new opportunities to participate directly in globalization

While giant multinational corporations have long dominated trade in goods and services, the internet can be a great equalizer. Today's more digital form of globalization opens the door for businesses of any size to participate—and even go head-to-head with bigger players.

Many small and medium-size companies have joined e-commerce marketplaces where they can gain direct exposure to global customers. Amazon hosts two million third-party sellers, and Alibaba hosts more than ten million. Some 80 million small and medium-size enterprises use Facebook for marketing, and nearly 40 percent of their fans are foreign. Lazada, a leading e-commerce platform in Southeast Asia, offers a marketplace where sellers can hire service providers for functions such as graphic design and accounting.

Beyond the ability to use platforms, enterprise software and cheap computing power on the cloud have changed the economics of working with collaborators, suppliers, and customers in different countries. Furthermore, some digital players have sprung up to help serve the needs of "micromultinationals." Shippo, for instance, helps online businesses streamline shipping. It makes multiple service providers available and even automates the process of filling out customs forms. Zendesk offers a package of tools and services to help small businesses manage customer service. Based in the United States, it serves businesses in 60 geographies.

Exhibit 34

**Executives responding to a McKinsey survey are concerned about changes in trade policy.**

%


SOURCE: McKinsey Economic Conditions Survey, September 2018; McKinsey Global Institute analysis

## GLOBAL COMPANIES NEED TO REASSESS WHERE THEY OPERATE ALONG THE VALUE CHAIN

A real profitability premium is associated with globalization. Recent MGI analysis of the 5,750 largest firms by revenue found that the best-performing "superstar" firms have a foreign-to-domestic sales ratio nearly twice as high as that of median firms in the sample.[140] Furthermore, a large body of research shows that globalized companies tend to be significantly more productive. This may be because of self-selection (that is, the most productive firms choose to become exporters) or because exposure to trade, investment, and foreign competition helps firms gain know-how and become more productive.[141]

But capturing global opportunities is not easy. While there is no one-size-fits-all formula for every industry and market, we do see companies sharpening their strategies and homing in more directly on different parts of the value chain. The models below, while not mutually exclusive, offer a framework for viewing these challenges (Exhibit 35).[142]

### Global offerings

Companies with global offerings minimize complexity by selling standardized products across multiple markets. Although distinct local capabilities are still needed for distribution and sales, and manufacturing can be done globally, they concentrate their design functions in headquarters or regional hubs. This model is often seen in the aerospace, electronics, and steel industries. But it is difficult to maintain profitability with this approach in industries where value is shifting, as in automotive (which is becoming more R&D-intensive) or even food and beverage (where the trend is toward customizing for local tastes).

Sticking with the global offerings strategy requires doubling down on core competencies and efficiency to realize economies of scale, applying time-tested "continuous improvement" models such as lean operations or Six Sigma. Many companies with global offerings are focused on agile manufacturing, with highly integrated, digitally enabled production systems. In these operations, factory floors become information networks that harness data to make instant, autonomous adjustments. The goals are minimizing energy consumption, rework, and waste while maximizing output and quality. Productivity, responsiveness, and smoother collaboration with suppliers are the core goals. The Tata Group's Tata Steel, for example, is prioritizing automation and other technologies to be as labor- and energy-efficient as possible.

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[140] *Superstars: The dynamics of firms, sectors, and cities leading the global economy*, McKinsey Global Institute, October 2018.

[141] See, for instance, Chad Syverson, *What determines productivity?* NBER working paper number 15712, January 2010; and Jan De Loecker, "Detecting learning by exporting," *American Economic Journal: Microeconomics*, August 2013. Also see reports by public-sector agencies, such as *Small and medium-sized enterprises: Characteristics and performance*, United States International Trade Commission, November 2010.

[142] For further exploration of this topic, see Pankaj Ghemawat, *The New Global Road Map: Enduring Strategies for Turbulent Times*, Boston, MA: Harvard Business Review Press, 2018; and Everett Grant and Julieta Young, *The double-edged sword of global integration: Robustness, fragility and contagion in the international firm network*, Globalization and Monetary Policy Institute working paper number 313, 2017.

### Researcher

The rising importance of innovation and intangibles has caused some companies to pursue a strategy squarely focused on those types of assets. Companies in the researcher model tend to centralize decision making and R&D in headquarters or regional hubs and outsource production processes, whether through franchising or contract manufacturing—and this unbundling creates opportunities for other suppliers to step into the value chain with their own specialized capabilities. For these companies, it is now possible to achieve higher gains from innovation than from manufacturing excellence, so they structure their organizations around the backbone functions they see as the real drivers of value. Global pharmaceutical giants are among the companies pursuing this strategy. Some turn to contract development and manufacturing organizations (such as Wuxi AppTec in China and Intas Pharmaceuticals in India) to handle their clinical trials and the physical production of drugs. These CDMOs provide lower costs but also specialized expertise; they are typically important strategic partners for pharmaceutical firms.

While it is no surprise to see this kind of strategy in a scientific field such as pharmaceuticals or an engineering field such as software, the researcher model is also prevalent in consumer goods industries. It may seem strange to associate an everyday product such as athletic shoes, for example, with research, but a company such as Nike is highly focused on design and marketing in its corporate operations and reliant on international contract manufacturing for the actual production of its shoes. In fact, the Nike Explore Team Sport Research Lab at the company's Oregon headquarters is a research facility staffed with dozens of scientists who study and test athletic performance to inform product development.[143]

### Customizer

The shift in global demand toward developing countries means that companies must take a wider variety of local consumer tastes into account. A contrasting alternative to the researcher model involves focusing downstream on expanding and customizing product portfolios to fit the profusion of local tastes. This strategy leads companies to a decentralized, hyperlocal structure. As companies sell in multiple markets, it takes careful analytical research to understand which products and services will resonate and how to market them in a way that will suit the local context.[144] The key for companies is striking the right balance between staying in tune with local customers and realizing economies of scale.

Customizer strategies are most often seen among food and beverage, apparel, and retail companies. Swiss food giant Nestlé, for example, tapped into a huge vein of demand in Japan for its Kit Kat candy bars, offered in hundreds of unique flavors such as wasabi, azuki bean, and green tea. New digital supply chain technologies have made it possible to manage this proliferation of products. Now technology is enabling companies to experiment with customizing not only for different regional markets but for individual customers. Levi's, for instance, has developed a digital prototyping and automated finishing process that allows customers to order jeans with custom fits and finishes.

Two of the world's most iconic brands—Coke and Pepsi—illustrate how companies are mixing and matching strategies. Both have clear, recognizable global offerings that remain flagship products, yet both have increased their local focus in recent years to win market share in diverse new markets.

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[143] See Nike's website, about.nike.com/pages/nike-explore-team-sport-research-lab.

[144] McLeish Ukomatimi Otuedon, "Standardisation versus adaptation as an international marketing strategy: The role of cultural pattern in a society and its effect on consumption," *Journal of Marketing and Consumer Research*, 2016, Volume 23.

The flagship Coca-Cola beverage, which is distributed in every country on earth except Cuba and North Korea, is no longer a monolithic product; its formulation varies across geographies, using different types and degrees of sweetening to accommodate local tastes. In addition, Coca-Cola owns many brands with only local or regional distribution, including Thumbs Up in India, Georgia Coffee in Japan, and both Costa Coffee and Innocent juices in the United Kingdom. The company maximizes the potential of these local brands through its "lift and shift" strategy: when a product is successful in one part of the world, Coca-Cola "lifts" it and "shifts" it to another market.[145]

Similarly, PepsiCo's corporate structure consists of six global divisions so that the firm can focus strategy by region. One of the company's flagship brands is Lay's Potato Chips, which has been introduced to markets worldwide—and then tailored with a huge variety of flavors that appeal to local palates. These include hot chili squid in Thailand, blueberry in China, "magic masala" in India, feta cheese in Greece, and ketchup in Canada. Like Coca-Cola, PepsiCo has either acquired or developed local brands in markets around the world.

### Global-local services

As services assume a greater role in trade and economic growth, some multinational companies are pursuing a global-local services strategy. These companies have recognized global brands but also extensive local operations that they use to deliver in-person services.

The classic example of this model is the fast-food franchise model pioneered by McDonald's and followed by many other fast-food and fast-casual restaurants chains. Today McDonald's has some 36,000 restaurants in more than 100 countries worldwide—with more locations outside the United States than within it. Its model is based on providing a familiar experience anywhere in the world (although some menu items are added or subtracted in different countries to appeal to local tastes). To deliver consistency, McDonald's has strict franchise agreements, approved suppliers, and an institutional training program for franchisees. Similarly, Starbucks may vary its product offerings by market, but its brand and in-person customer experience are highly recognizable and standardized across its more than 28,000 stores in 75 countries. These intangibles were developed at headquarters.

This model has more recently been adopted by some digital platform companies. These firms use efficiencies of scale to expand their recognizable brands worldwide, providing one global platform that matches buyers and sellers. But at the same time, their value proposition is a highly local and personal customer touchpoint. With more than five million properties in more than 190 countries, Airbnb, for example, provides the platform architecture and payment systems so that users can browse and book accommodations. Its guidelines, standards, and reviews create the trust needed to underpin these transactions, but a loose network of hosts provides the actual accommodations and the hospitality. Uber similarly provides a global platform for a highly local service in more than 600 cities.

[145] Coca-Cola, 2017 annual review.

### Platform

Some of the world's biggest companies operate technology-enabled marketplaces that either facilitate exchanges between counterparties (for example, Amazon, Alibaba, and Flipkart) or provide tailored offerings to large captive customer bases (for example, Tencent Video and Spotify). While the term "platform company" is often discussed, it is not well defined. Digital platforms can play several functions in facilitating transactions: search, coordination, payment, and product delivery. Companies can play in one or more of the parts in a platform value chain. E-commerce platform providers, for instance, play all functions. PayPal strictly facilitates payments. Other platforms, such as Facebook and Baidu, enable customers to search for sellers and may even coordinate transactions, but they do not collect payments or deliver goods. For all platform companies, a capital-light business model enables them to scale up rapidly—and because of increasing returns to scale, only a few companies will succeed globally in each product or service market. Their operations remain highly centralized.

The biggest hyperscale platforms host billions of users and interactions. Delivering an additional song through iTunes or welcoming a new user to a social network results in effectively no cost for Apple or Facebook, respectively, whether it is the tenth unit or the ten billionth. This kind of scale gives platform operators a prime position to capture troves of valuable behavioral data that they can monetize, employ to make continuous improvements to the ecosystem, or even use to add new business lines (as with Amazon's move into cloud computing, Apple's move into digital payments, or Alibaba's move into financial services).[146]

While the biggest consumer-facing social media, entertainment, and e-commerce sites are well known, some platform companies are focusing on the B2B space. These include Xometry, a US-based marketplace for on-demand manufacturing capacity, and EC21, a South Korean B2B e-commerce platform for small and medium-size exporting firms.

### Networker

Networked companies, most of which are service providers, have multiple decentralized and geographically dispersed operational nodes. Examples include financial services, business and professional service providers, telecom companies, and transportation companies. Their sales, operations, and supply chains are often local, exclusively serving one node, but value is created through their global reach and expertise.

This approach is often taken in banking, IT services, and business services—industries where knowledge flows, customized to serve client needs, are the heart of the offering and the competitive advantage. HSBC, for example, is a wholesale and retail bank with its core markets in Hong Kong (where it originated) and the United Kingdom (its official headquarters). But it has a presence in almost 70 geographies globally, including major trade hubs, with an extensive footprint in Asia. Business consulting is also built around the networker strategy. Many firms maintain offices in cities worldwide. The business model involves assembling the right combination of expertise from across a widely dispersed organization and continuously forming teams for client engagements. This is made possible not only through travel and face-to-face work but also through a wide variety of communications and collaboration tools.

[146] Michael Chui and James Manyika, "Competition at the digital edge: Hyperscale businesses," *McKinsey Quarterly*, March 2015, McKinsey.com.

Exhibit 35

**Global companies are reconsidering where to play along the value chain.**

| Company strategy | Description | Typical org-anizational structure<br>● HQ<br>○ Local affiliate | Source of value creation | Centrali-zation in HQ<br>● Highly applicable<br>◐ Minimally applicable | Product/service customization for local market | Company examples |
|---|---|---|---|---|---|---|
| **Global offerings** | Offers a single product design and brand globally |  | ▪ Global product quality<br>▪ Manufacturing processes |  |  | ▪ Airbus<br>▪ Tata |
| **Research-er** | Captures value through superior innovation and R&D, often outsources production |  | ▪ Intellectual property<br>▪ R&D |  |  | ▪ GSK<br>▪ Apple |
| **Custom-izer** | Tailors product assortment to local market tastes |  | ▪ Local customer insights<br>▪ Sales and distribution |  |  | ▪ Nestlé<br>▪ Diageo |
| **Net-worker** | Captures value from global reach and network connections |  | ▪ Network connections<br>▪ Global reach |  |  | ▪ HSBC<br>▪ Deloitte |
| **Global-local services** | Provides in-person services while maintaining a standardized global brand |  | ▪ Brand<br>▪ Global reach |  |  | ▪ Uber<br>▪ Starbucks |
| **Platform** | Creates marketplace for global exchange of goods, services, or free content |  | ▪ Product quality<br>▪ User network |  |  | ▪ Google<br>▪ Facebook |
| **Resource seeker** | Produces commodity and primary resource products |  | ▪ Access to commodities<br>▪ Operational efficiencies |  |  | ▪ Rio Tinto<br>▪ Anglo-American |

SOURCE: McKinsey Global Institute analysis

## FIVE IMPERATIVES FOR OPERATING IN THE NEW ERA OF GLOBALIZATION

In addition to deciding where to play along the value chain, companies must also reassess their own global operations. This includes looking at where to locate operations, prioritizing proximity to customers and speed to market, building flexibility and resiliency to manage rising uncertainty, developing closer supply chain relationships, and considering how services can add new sources of value.

### Reconsider operational footprint to reflect new risks

One of the most important considerations is where to locate operations and invest in new capacity. The calculus that held in the past is different today. New automation technologies, an expanding set of risks, changing wage differentials, and the increasing importance of speed to market in some industries are all driving regionalization in many goods-producing value chains. As a result, it may make sense to place production in or near key consumer markets around the world.[147] Before investing, companies must consider the full risk-adjusted, end-to-end landed costs of location decisions. Today many do not account for all of the variables (including the potential backlash and societal costs of offshoring). Using a dynamic, risk-adjusted scenario approach, rather than a simple point forecast of demand or cost, can inform better decisions about defining an operational footprint.

### Build flexible, agile operations to cope with uncertainty

Companies have long created future risk scenarios, but today they face a more complex set of unknowns than ever before as the postwar world order that held for decades seems to be giving way. There is a real chance that tariffs and nontariff barriers will continue rise, reversing decades of trade liberalization. Tax codes are being reconsidered for the digital and intangible era, and the US tax reforms of December 2017 will have important implications for location decisions, including those governing intangible assets. In light of these uncertainties, building flexibility and resiliency into operations and strategy is imperative.[148]

This can take many forms across the value chain. Some manufacturers use platforms to share components across product lines and multiple plants. Toyota, for example, is rolling out a versatile manufacturing platform with more common parts across various models. The company recently invested $1.3 billion to upgrade its factory in Georgetown, Kentucky, improving the plant's ability to accommodate different body styles and power trains seamlessly. Toyota is introducing this new manufacturing system in its plants worldwide.[149] In the purchasing process, flexibility can come from strategies such as price hedging, long-term contracting, shaping customer demand to enable using substitutes, and integrating upstream supply chains.

### Prioritize speed to market and proximity to customers

Staying in sync with customers and maintaining the ability to deliver to them quickly is an increasingly important point of competition for companies serving retail consumers. In some markets, excellence in marketing, distribution, sales, and consumer insights may be enough, but a growing number of companies are now establishing production in or near key consumer markets around the world for better delivery and responsiveness.

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147 Katy George, Sree Ramaswamy, and Lou Rassey, "Next-shoring: A CEO's guide," *McKinsey Quarterly*, January 2014, McKinsey.com.

148 Wouter Aghina, Aaron De Smet, and Kirsten Weerda, "Agility: It rhymes with stability," *McKinsey Quarterly*, December 2015, McKinsey.com.

149 David E. Zoia, "Massive retooling readies Toyota Georgetown for another 30 years," Wards Auto, July 10, 2017.

Speed to market enables faster responses to customer preferences and less product waste from forecasting errors. In apparel, the fast-fashion industry is predicated on spotting trends, capitalizing on them immediately, and getting new styles into stores in a matter of weeks. Zara is able to deliver products in two to five weeks by keeping its sourcing within geographic proximity of the retail market and relying on quick manufacturing turnarounds.[150] Even traditional labels are trying to cut lead times before introducing new seasonal offerings so they can get a better read on sales figures from the current season and tweak their lineups accordingly, reducing unsold goods. Companies in all industries now have a wealth of real-time, granular sales and consumer behavior data at their disposal, but capitalizing on these insights requires speed in manufacturing.

Serving customers with maximum responsiveness and optimal speed does not necessarily involve large-scale reshoring or full vertical integration in every major market. Companies can opt for postponement—that is, creating a largely standardized product at a distance and then finishing it with custom touches at a facility near the end market. The final step can vary from simple labeling changes to more significant product tailoring. Mastering postponement technologies and techniques enables companies to take advantage of distant, cost-efficient manufacturing while also allowing for late-stage customization for either government compliance or customer personalization.

### Offer everything as a service

Across value chains, more value is coming from services, whether in software, design, and intellectual property or in distribution, marketing, and after-sales services. Even manufacturers are increasingly finding value in service offerings. Shifting to services can offer advantages: smoothing cyclicality in sales, providing higher-margin revenue streams, and enabling new sales or design ideas through closer interaction with customers. At its extreme, entire business models shift from producing goods to delivering services (for example, from selling vehicles to offering transportation services, or from selling software packages to renting cloud storage and services). Services can be far more varied than traditional maintenance, repair, and overhaul activities. They can maximize product utilization (for example, reducing downtime and outages for transformers in utility grids), minimize the total cost of ownership (improving the operational efficiency of aircraft engines), or optimize how a product works (by capturing data from medical devices for better diagnoses). For service models to succeed, companies often need to make large commitments to understanding the customer's needs, invest in data and analytics, and develop the right subscription, per-use, or performance-based service contracts.

### Build closer supplier relationships

In the last era of globalization, the fragmentation of value chains and the trend toward offshoring led many companies into dozens, if not hundreds, of arm's-length relationships with suppliers scattered across the globe. But these involved many hidden risks and costs. In many industries, companies are realizing that arm's-length supplier interactions are often inefficient—and this can add real development, tooling, and product costs. Even firms that work closely with their tier-one suppliers may have little visibility into their tier-two and -three suppliers, especially if they are overseas.

Logistics and production technologies can transform supply chains, but optimizing what they can do requires end-to-end integration. Larger companies may need to help their small and medium-size suppliers upgrade and add digital capabilities to realize their full value. Large firms can benefit from a thorough analysis of which suppliers are core to the business—and may learn that these are not always the largest accounts. Some may involve

[150] Ian Malcolm Taplin, "Global commodity chains and fast fashion: How the apparel industry continues to reinvent itself," *Competition & Change*, 2014, Volume 18, Issue 3.

critical components deep in the supply chain.[151] Once these key suppliers are identified, companies can solicit their ideas and build a deeper relationship based on trust.

Firms at the head of a global value chain that genuinely collaborate ensure that they remain the preferred customer and are the first to benefit from new product ideas or process efficiencies bubbling up from suppliers. They can also enable systemic changes along the value chain, improving labor and environmental standards.[152]

Few firms have managed to digitize the entire value chain, creating a single digital thread that provides transparency and control from prototyping and design through production, distribution, and sales.[153] But building closer relationships can accelerate this transformation—especially in cases where smaller suppliers need help with the investment or capability building needed to make the leap.[154]

•••

In the last wave of globalization, many companies developed sprawling global footprints that spanned different parts of the value chain. But as those footprints grew, they also grew unwieldy. Faced with increasing competition, many firms are sharpening their organizational structures and strategies, in some cases opting to localize and consolidate production.

[151] Thomas Y. Choi, Benjamin B. M. Shao, and Zhan Michael Shi, "Hidden suppliers can make or break your operations," *Harvard Business Review*, May 2015.

[152] The typical consumer company's supply chain accounts for more than 80 percent of greenhouse-gas emissions and more than 90 percent of the impact on air, land, water, biodiversity, and geological resources. More global companies are now working closely with suppliers to address this challenge.

[153] See Knut Alicke, Daniel Rexhausen, and Andreas Seyfer, "Supply chain 4.0 in consumer goods," April 2017, McKinsey.com; and John Nanry, Subu Narayanan, and Louis Rassey, "Digitizing the value chain," *McKinsey Quarterly*, March 2015, McKinsey.com.

[154] Susan Helper, *Supply chains and equitable growth*, Washington Center for Equitable Growth, October 2016.

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# 6. THE ROAD AHEAD FOR COUNTRIES AND WORKERS

Globalization is not an immutable or monolithic trend. It is shaped by multilateral and bilateral trade agreements, national policies, technology, changing global demand, and decisions made by millions of individual companies and consumers.

The previous wave of globalization, combined with unprecedented urbanization, fed into a virtuous cycle of growth that lifted hundreds of millions of people in developing countries out of poverty. But it was also intertwined with a range of issues in those regions, including environmental degradation and poor working conditions. Meanwhile, many low- and medium-skill workers in advanced economies were left behind (even as those same countries benefited from lower prices on consumer goods).

As we publish this report in January 2019, the world is facing uncertainty. The United Kingdom has not finalized the terms surrounding its exit from the European Union, and the United States and China are exchanging rounds of retaliatory tariffs. Anti-globalization sentiment has been percolating through political movements worldwide. In countries around the world, the backlash is forcing a belated acknowledgement that globalization produces winners and losers—and its dislocations and negative externalities have not been adequately addressed.

Yet globalization is not what it was even a decade ago. As we have documented, global value chains are being reshaped by rising demand and new industry capabilities in the developing world as well as a wave of new technologies. Labor-cost arbitrage is on the wane in most value chains, while services, intangibles, and knowledge intensity are on the rise. These shifts may favor some advanced economies, while posing steeper challenges for countries that did not participate fully in the last wave of value chain expansion. Policy agendas shaped by old assumptions may not be effective in the next phase of globalization, which demands more attention to digital infrastructure, service capabilities, and workforce skills.

Countries of all income levels may alter their specializations and global partnerships in the years to come. But this calls for more than simply adding up a ledger of export surpluses and trade deficits. Countries reap economic gains from all aspects of their give and take with the rest of the world. The nature of globalization is changing, but one thing remains constant: the countries that open themselves to foreign competition, foreign investment, and foreign talent stand to benefit most. Previous MGI research has found that participation in global flows—both outflows and inflows—accounted for 15 to 25 percent of GDP growth between 1997 and 2012.[155] Countries that are more open to all types of cross-border flows can absorb the best ideas and innovations from around the world. Moreover, our work found that countries that are more central in networks of global flows gain even more than those that have fewer and less diverse connections in the global economy.

[155] *Global flows in a digital age: How trade, finance, people, and data connect the world economy*, McKinsey Global Institute, April 2014.

## COUNTRIES PLAY DIFFERENT ROLES IN GLOBAL VALUE CHAINS

There are as many ways to participate in globalization as there are nations on earth. Each country's profile is different, with its weight and role varying across industry value chains. Yet some general patterns emerge that can illuminate how current and future shifts will affect countries and workers. To highlight them, we group countries into categories based on their income level, their connectedness to the global economy, their specialization, and the diversity of their trade (Exhibit 36).

Exhibit 36

**Each country's specialization and diversification in trade determines its exposure to trends in value chains.**

**GDP per capita, 2017**
$ thousand
- High (>20)
- Middle (8–20)
- Low middle (2–8)
- Low (<2)

**MGI Connectedness Index, 2017**[1]
- Very high
- High
- Medium
- Low
- Very low

**Global value chain archetype with largest trade surplus, 2017**
Sector within this archetype with the largest trade surplus
- Global innovation
- Labor-intensive goods
- Regional processing
- Resource-intensive goods
- Services (all)

| | Classification | Country | GDP per capita | MGI Connectedness | Sector with largest trade surplus | Trade intensity (Exports + imports) ÷ GDP % | Diversification of exports Number of sectors accounting for 75% of exports |
|---|---|---|---|---|---|---|---|
| Advanced | Innovation providers | Belgium | High (>20) | Very high | Chemicals | 200 | 10 |
| | | Czech Republic | High (>20) | High | Auto | 175 | 10 |
| | | Germany | High (>20) | Very high | Auto | 83 | 10 |
| | | Ireland | High (>20) | Very high | Pharma | 125 | 4 |
| | | Italy | High (>20) | High | Machinery and equipment | 59 | 10 |
| | | Japan | High (>20) | High | Auto | 33 | 7 |
| | | Netherlands | High (>20) | Very high | Chemicals | 175 | 9 |
| | | Singapore | High (>20) | Very high | Computers | 278 | 7 |
| | | South Korea | High (>20) | High | Computers and electronics | 78 | 8 |
| | | Switzerland | High (>20) | Very high | Pharma | 105 | 6 |
| | Regional processors | Austria | High (>20) | High | Paper | 96 | 11 |
| | | Finland | High (>20) | High | Paper | 69 | 10 |
| | | New Zealand | High (>20) | Medium | Food and beverage | 48 | 5 |
| | | Spain | High (>20) | High | Food and beverage | 61 | 10 |
| | Resource providers | Australia | High (>20) | High | Mining | 40 | 5 |
| | | Canada | High (>20) | Very high | Oil and gas | 61 | 10 |
| | | Kuwait | High (>20) | High | Oil and gas | 76 | 2 |
| | | Norway | High (>20) | High | Oil and gas | 64 | 7 |
| | | Qatar | High (>20) | High | Oil and gas | 77 | 2 |
| | | Saudi Arabia | High (>20) | Very high | Oil and gas | 52 | 3 |
| | Service providers | Denmark | High (>20) | High | Transport services | 88 | 8 |
| | | France | High (>20) | Very high | Financial intermediation | 59 | 9 |
| | | Sweden | High (>20) | Very high | Telecom and IT | 74 | 11 |
| | | United Kingdom | High (>20) | Very high | Financial intermediation | 55 | 10 |
| | | United States | High (>20) | Very high | IP charges | 25 | 10 |

1 Index based on flows of goods, services, finance, people, and data. *Digital globalization: The new era of global flows*, McKinsey Global Institute, February 2016.

NOTE: We group countries based on the industries in which they run the largest trade surplus, but most countries participate in multiple value chains. This grouping should not be viewed as a ranking.

SOURCE: IMF; WTO; UNCTAD; OECD; McKinsey Global Institute analysis

Exhibit 36 (continued)

**Each country's specialization and diversification in trade determines its exposure to trends in value chains.**

**GDP per capita, 2017**
$ thousand
- High (>20)
- Middle (8–20)
- Low middle (2–8)
- Low (<2)

**MGI Connectedness Index, 2017**[1]
- Very high
- High
- Medium
- Low
- Very low

**Global value chain archetype with largest trade surplus, 2017**
Sector within this archetype with the largest trade surplus
- Global innovation
- Labor-intensive goods
- Regional processing
- Resource-intensive goods
- Services (all)

| | Classification | Country | Global value chain archetype with largest trade surplus, 2017 | Trade intensity (Exports + imports) ÷ GDP % | Diversification of exports Number of sectors accounting for 75% of exports |
|---|---|---|---|---|---|
| Developing | Innovation providers | Hungary | Auto | 163 | 9 |
| | | Mexico | Auto | 78 | 7 |
| | | Slovak Republic | Auto | 189 | 9 |
| | Labor providers | Bangladesh | Textiles and apparel | 38 | 0 |
| | | China | Textiles and apparel | 39 | 8 |
| | | India | Furniture | 33 | 9 |
| | | Turkey | Textiles and apparel | 50 | 9 |
| | | Vietnam | Textiles and apparel | 202 | 5 |
| | Regional processors | Argentina | Food and beverage | 24 | 6 |
| | | Indonesia | Food and beverage | 36 | 8 |
| | | Malaysia | Food and beverage | 136 | 8 |
| | | Poland | Food and beverage | 97 | 12 |
| | | Thailand | Food and beverage | 114 | 9 |
| | Resource providers | Algeria | Oil and gas | 52 | 2 |
| | | Brazil | Agriculture | 22 | 8 |
| | | Chile | Mining | 55 | 6 |
| | | Colombia | Oil and gas | 32 | 6 |
| | | Ecuador | Oil and gas | 42 | 3 |
| | | Nigeria | Oil and gas | 30 | 1 |
| | | Oman | Oil and gas | 77 | 3 |
| | | Peru | Mining | 40 | 5 |
| | | Russia | Oil and gas | 45 | 6 |
| | | South Africa | Basic metals | 61 | 8 |
| | | Tanzania | Basic metals | 30 | n/a |
| | | Ukraine | Basic metals | 102 | 7 |
| | | Venezuela | Oil and gas | 21 | 1 |
| | Service providers | Bulgaria | Telecom and IT | 126 | 10 |
| | | Costa Rica | Business services | 54 | 5 |
| | | Croatia | Transport services | 94 | 9 |
| | | Egypt | Transport services | 41 | 8 |
| | | Greece | Transport services | 61 | 7 |
| | | Kenya | Transport services | 30 | 5 |
| | | Morocco | Telecom and IT | 78 | 7 |
| | | Philippines | Business services | 62 | 7 |
| | | Romania | Transport services | 82 | 10 |

1 Index based on goods, services, financial, people, and data flows. *Digital globalization: The new area of global flows*, McKinsey Global Institute, February 2016.

SOURCE: IMF; WTO; UNCTAD; OECD; McKinsey Global Institute analysis

We first divide countries into two groups: advanced and developing. Advanced economies tend to specialize in activities that demand a higher level of skills, such as producing global innovations or services, while developing countries tend to focus on resource- or labor-intensive activities.[156]

To measure each country's level of connectedness to the global economy, we update the MGI Connectedness Index, developed in our previous research on globalization. It is based on the size of each country's inflows and outflows of goods, services, finance, people, and data.[157] To assess each country's specialization in value chains, we measure the global value chain archetype in which it runs the largest trade surplus.[158] While countries participate in multiple global value chains, the groupings shown here nevertheless offer a useful way to assess their exposure to the structural shifts that are unfolding. Finally, we look at each country's trade intensity and the diversification of its exports (represented as the number of sectors required to reach 75 percent of its gross exports).

Using these metrics, we identify four groups of advanced economies: service providers, global innovators, regional processors, and resource providers. Developing countries are split into five categories. Innovation providers are major trading partners and suppliers for companies in nearby advanced economies that produce global innovations such as automobiles. Labor providers specialize in labor-intensive manufacturing—and that is still where China runs its largest trade surplus today, although it is making a singular, rapid rise across multiple value chains. Other developing countries specialize in regional processing, natural resources, or services.

Below we discuss the specific challenges and opportunities facing each of these groups. Yet a few priorities apply more generally. No matter where countries specialize today, developing service sectors and capabilities is an important opportunity for the future. Investment in R&D will be critical to competing in an increasingly knowledge-intensive global economy. All countries—and particularly those that are major producers of labor-intensive goods—need to prepare for the wider adoption of automation technologies. A great deal of potential remains to be realized in deepening regional trade ties in many parts of the world. Finally, every country can benefit from streamlining customs operations and modernizing trade agreements.

[156] Marcel P. Timmer, "Slicing up global value chains," *The Journal of Economic Perspectives*, spring 2014, Volume 28, Number 2.

[157] *Digital globalization: The new era of global flows*, McKinsey Global Institute, February 2016.

[158] It is worth noting that many countries run surpluses across several value chains and almost all countries participate across all value chains, so while we have classified each country into a single group, the implications are likely to be relevant to different extents across archetypes.

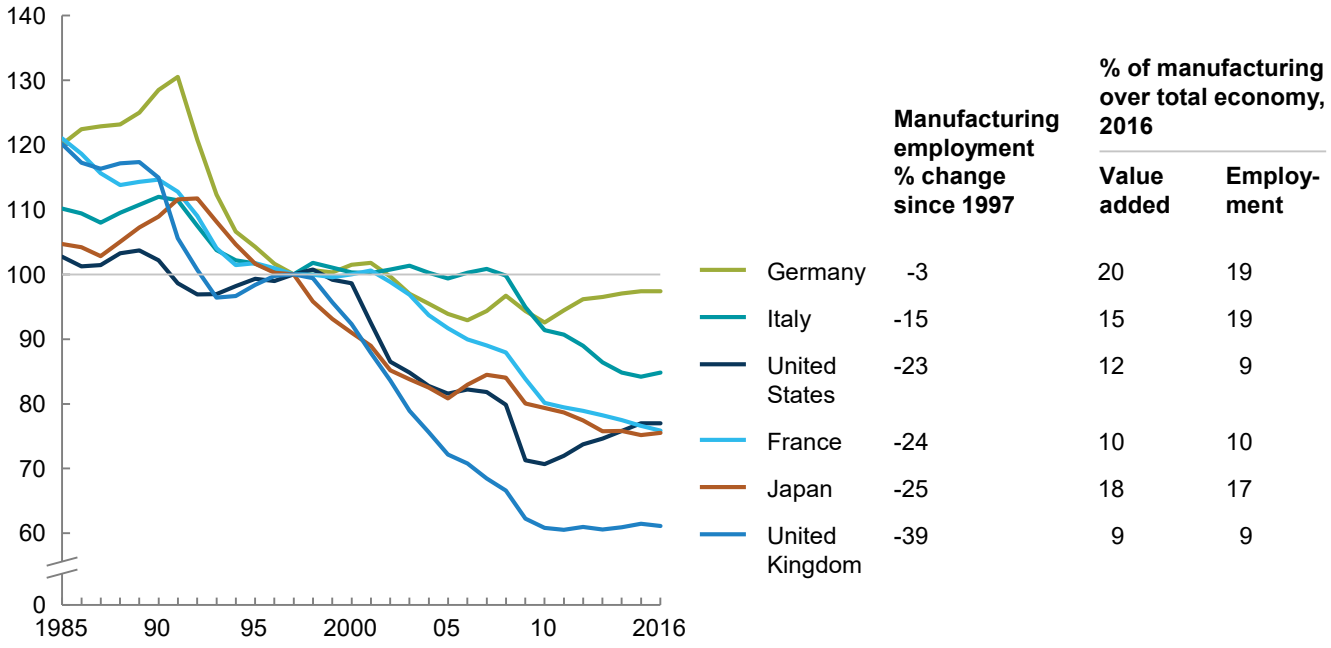
## SHIFTS IN GLOBAL VALUE CHAINS COULD FAVOR ADVANCED ECONOMIES

As value chains expanded into developing economies in recent decades, the resulting investment and industrialization gave hundreds of millions of their workers new pathways out of poverty. Advanced economies benefited as well, but their gains were more diffuse. One study estimates that international trade may have been responsible for about one-quarter of total US productivity growth over the 1990s and 2000s, and that it provides middle-class consumers with more than a quarter of their purchasing power.[159]

But one group conspicuously lost out: low- and medium-skill workers in advanced economies.[160] Manufacturing employment has declined substantially in most of these countries (Exhibit 37). While the relative importance of automation and trade in explaining this decline is debated, millions of individuals lost their livelihoods in the transition (see Box 6, "The impact of trade on employment and wages in advanced economies").

Exhibit 37

**Most advanced economies have lost manufacturing jobs since the 1990s.**




SOURCE: The Conference Board, OECD; International Labor Comparisons program, May 2017; McKinsey Global Institute analysis

[159] *The economic benefits of US trade*, Executive Office of the President, May 2015.

[160] Branko Milanovic, *Global Inequality: A New Approach for the Age of Globalization*, Cambridge, MA: Harvard University Press, 2016.

### Box 6. The impact of trade on employment and wages in advanced economies

The decline of manufacturing in advanced economies hit particularly hard in smaller cities and towns that lacked diversified economies. When major employers closed down, some local economies collapsed.[1] Debate continues about whether trade or the first wave of automation technologies played the biggest role in this phenomenon—but foreign competition was a prime target for blame in many of those communities.

Academic research has found that between 1990 and 2007, US manufacturing subsectors and communities that were more exposed to increased import competition from China experienced substantially larger reductions in manufacturing employment. These trade shocks were not fully offset by a rise in employment elsewhere in the community, and employment declined for both manufacturing and nonmanufacturing sectors, suggesting negative spillover effects from reduced demand to other parts of the local economy.[2] Contrary to the common presumption that US labor markets are highly fluid, these authors also find that displaced manufacturing workers did not smoothly transition to new employment. These shocks persisted for at least a decade. Job losses remained concentrated; they coincided with a long-term decline in geographic mobility in the United States.

Another study estimates that import growth from China between 1999 and 2011 led to the loss of 2.0 million to 2.4 million US jobs, including workers directly affected by import competition, workers indirectly affected through the supply chain, and workers in other sectors. This compares to total US manufacturing job losses of 5.8 million over that period.[3]

Similar patterns have been documented in a range of countries, including Spain, Norway, and Brazil. Yet the story played out differently in Germany. In contrast to findings from the United States, German manufacturers sharply increased exports to both China and Eastern Europe, resulting in a more modest trade deficit with China and a trade surplus with Eastern Europe. Employment gains from these export opportunities roughly offset job losses from import competition from China; in the case of trade with Eastern Europe, they increased German employment.[4]

Trade has also affected wages. The studies referenced above find that local labor markets that were more exposed to import competition experienced larger reductions in average weekly wages; these effects hit low-wage workers the hardest. The reduction in wages was not limited to manufacturing but was also felt outside that sector in local communities. Workers exposed to trade also experienced greater job churn over their careers and spent more years receiving Social Security Disability Insurance.[5] The evidence suggests wages in other advanced countries were similarly depressed by trade.[6]

The rise and fall of individual companies and sectors has always accompanied the ongoing reallocation of resources across economies. While it ultimately raises overall productivity and living standards, the process creates winners, losers, and pain along the way. In theory, the overall gains from globalization exceed its costs, allowing the net benefits to be redistributed to compensate the losers. But in practice, this has not yet happened.

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1 Amy Goldstein, *Janesville: An American Story*, New York, NY: Simon & Schuster, 2017.

2 David H. Autor, David Dorn, and Gordon H. Hanson, "The China shock: Learning from labor market adjustment to large changes in trade," *American Economic Review*, October 2016, Volume 8.

3 Daron Acemoglu et al., "Import competition and the great US employment sag of the 2000s," *Journal of Labor Economics*, January 2016, Volume 34, Number S1.

4 Wolfgang Dauth, Sebastian Findeisen, and Jens Suedekum, "The rise of the East and the Far East: German labor markets and trade integration," *Journal of the European Economic Association*, December 2014, Volume 12, Issue 6.

5 David H. Autor et al., "Trade adjustment: Worker-level evidence," *The Quarterly Journal of Economics*, 2014, Volume 129, Issue 4.

6 Joao Paulo Pessoa, *International competition and labor market adjustment*, Center for Economic Performance, discussion paper number 1411, March 2016; and Damoun Ashournia, Jakob Munch, and Daniel Nguyen, *The impact of Chinese import penetration on Danish firms and workers*, IZA discussion paper number 8166, May 2014.

### Advanced economies that specialize in services and regional processing could benefit, while global innovators will face rising competition from China

The shifts in global value chains described in this report may work in favor of advanced economies in the years ahead. Wages are rising in developing countries, and automation technologies may render labor costs less important as companies decide where to locate production. Value chains are becoming more knowledge-intensive, which favors countries with highly skilled workforces, innovation ecosystems, and robust intellectual property protections. Speed to market is increasingly important, making strong logistics infrastructure a must. Finally, advanced economies will benefit from the expansion of the middle class worldwide. Since 1995, their exports of goods and services to developing economies have grown from $1 trillion to $4.2 trillion.

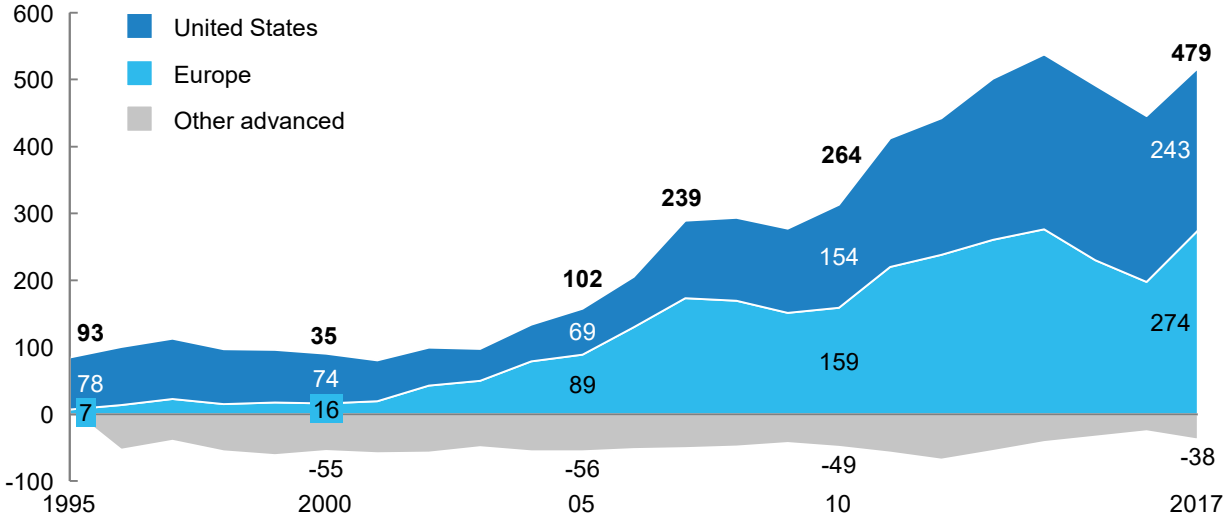
But while current trends will generally enhance the comparative advantages of advanced economies, the outlook and priorities vary for individual countries.

- **Service providers stand to gain.** Collectively, advanced economies run a trade surplus in services of almost $480 billion, twice as high as a decade ago (Exhibit 38). The United States accounts for half of this. The opportunities are expanding. Over the past decade, trade in IT services, professional services, and IP charges have grown two to three times faster than trade in goods. Services are playing a bigger role in goods-producing value chains, and the range of services that can be delivered digitally and remotely continues to grow, including new areas such as education and healthcare. Countries with a strong presence in services (such as the United States, the United Kingdom, France, and Sweden) are in a good position to capitalize on these trends.

Exhibit 38

**Advanced economies' trade surplus in services has doubled over the past decade.**

**Trade surplus in services, all advanced economies**
$ billion




**Advanced economy service flows**
$ billion

| | | | | | |
|---|---|---|---|---|---|
| **Exports** | 823 | 1,165 | 2,012 | 2,817 | 3,758 |
| **Imports** | 729 | 1,130 | 1,910 | 2,553 | 3,279 |

SOURCE: IMF; OECD; McKinsey Global Institute analysis

- **Global innovators will face greater competition from China and other developing countries.** Advanced economies such as Germany, Japan, and South Korea run large surpluses in value chains that produce global innovations. But they may find a more challenging environment ahead as China expands its capabilities in these industries and grows less reliant on inputs from advanced economies. Its imports of intermediate goods from Germany in global innovations value chains peaked in 2014 at $44 billion; by 2017, the figure was $37 billion. South Korea and Japan have also seen their exports of intermediate goods to China in these value chains decline in recent years. In computers and electronics, China has moved upstream and is now manufacturing chips for its handsets. The Made in China 2025 agenda aims to build the nation's strengths in cutting-edge areas such as 5G, AI, and smart robotics. China is already the world's largest consumer of industrial robots, ahead of the United States.

  Of course, the rise of a new competitor means that companies elsewhere need to hone their strategies—not only through operational excellence in manufacturing but by focusing on the upstream and downstream functions where more value is being generated. Areas such as R&D, design, customer insights, and marketing require more highly skilled labor and are disproportionately dominated by multinationals based in advanced economies.

- **Countries that specialize in regional processing may be more insulated from developing-economy competition.** Given the lower tradability of regionally processed goods, the advanced economies that specialize in these value chains (such as Spain, Austria, and Finland) will be relatively insulated from the rise of producers in China and other developing countries. Indeed, these countries may offer an interesting template for developing economies. For instance, Spain's trade surplus in the food and beverage sector has gone from virtually zero a decade ago to $10 billion today. By increasing its specialization in a highly regional sector, Spain is securing its place in value chains that are less susceptible to truly global competition. In contrast, Austria and Finland are losing their position as net suppliers of regionally processed goods. Both of their trade surpluses are driven by the paper and paper products sector, and both are declining.

- **Resource producers, whether high-income or low-income, face a growing imperative to diversify their economies.** This is especially relevant for OPEC countries where growth depends on global trends in oil prices; these economies are exposed to boom-and-bust cycles. Some OPEC countries have long-term economic development agendas for reducing dependence on oil exports. The United Arab Emirates, for example, is expanding into areas such as renewable energy, tourism, aviation and ports, and manufacturing. The risks are lower for resource-producing advanced economies with higher diversification, such as Canada and Australia, but even those countries could benefit from continuing to develop the service sectors that are expected to demonstrate steady trade growth.

### To capture these opportunities, policy makers in advanced economies must refocus national competitiveness and trade agendas

Policy makers in advanced economies need to look toward a future in which innovation, intellectual property, specialized skills, and digital technologies are increasing sources of competitive advantage. Yet they also must reckon with the past. The workers and communities that suffered setbacks during the last era of globalization still need help in finding a way forward.

Maintaining public and private R&D spending is essential for advanced economies as value chains shift to more knowledge-intensive activities. R&D is the bedrock of new technology formation, innovation, and the production of intangible assets. Yet in the United States, federal R&D spending has fallen from around 1 percent of GDP a decade ago to

0.67 percent in 2017 (although private R&D spending has been maintained). While advanced economies dominate the top ranks of the Bloomberg Innovation Index, some (including the United States, Germany, Finland, and Canada) have been slipping. China rose from number 21 in the 2017 index to number 19 in the 2018 version.[161]

Another policy priority is setting the rules and standards for the new era of digital globalization. The virtual nature of the internet and the many novel business models it has launched often raced ahead of traditional regulation and policy, and now officials are beginning to grapple with complex issues surrounding the new digital economy. Countries will have to address issues such as market access, censorship, intellectual property protection, privacy standards, and cybersecurity. But it is important to do so in a way that does not balkanize the internet. Today such efforts tend to be fragmented. The EU recently enacted the General Data Protection Regulation, while many nations require companies to store locally generated data on servers physically located within their borders. A 2 percent sales tax on the locally generated revenues of global technology companies is set to take effect in the United Kingdom in 2020. Multilateral frameworks and consistent standards would move the world closer to realizing the full economic potential of digital flows.

Building strong intellectual property protections is increasingly important in the age of intangibles. Services and intellectual property are the frontiers of trade growth, and they need to be more central in future trade agreements. Yet harmonizing the nontariff policies that restrict trade in services is more complex than negotiating tariff levels. Varying national regulations and certification standards can limit competition from foreign services providers in fields such as medicine, law, engineering, and accounting. These types of entry barriers prevent foreign competition and restrict choice, driving up the price of these services for local consumers. The OECD estimates that the cost of these types of trade barriers on services exceeds the average tariff on traded goods—and in some sectors and countries, the cost is so large that it imposes the equivalent of an 80 percent tax, making trade economically unviable.[162]

The next wave of technologies, including automation, AI, and 3-D printing, could make some reshoring (or nearshoring) of manufacturing economically viable. Yet evidence is mixed.[163] Proximity to the huge and lucrative US, European, and Japanese markets has always been important, and the growing premium on speed to market, combined with shorter product life cycles and opportunities for product customization, should reinforce this trend. However, if some production does return to advanced economies, it is unlikely to be in a form that would restore millions of low-skill assembly line jobs.

Perhaps the biggest policy challenge in advanced economies involves unfinished business from the past—and the need to prepare for what comes next. No country has sufficiently addressed the transitional costs borne disproportionately by certain industries, companies, and workers. Local governments have often been overwhelmed when their communities were caught up in national, global, and technological currents. Regions built on declining industries need bolder initiatives and investment to nurture new industries.

The solutions will not be uniform everywhere, but the menu of options is far broader than what has been tried to date. It includes transitional income support and other social safety net programs for displaced workers. In the United States, portable benefits (health, retirement, and family leave benefits that are not tied to a single employer) can also help

[161] The Bloomberg Innovation Index is based on multiple indicators measuring each country's R&D intensity, manufacturing value added, productivity, high-tech density, tertiary efficiency, researcher concentration, and patent activity.

[162] *OECD Services Trade Restrictiveness Index: Policy trends up to 2018*, January 2018.

[163] Koen De Backer et al., *Reshoring: Myth or reality?* OECD Science, Technology and Industry Policy Papers, number 27, 2016.

workers move more fluidly between jobs and employers. Workforce training programs will also need to be overhauled to ensure that midcareer workers can shift into occupations that are in demand. Creating incentives to boost workforce mobility may be helpful, and relocation payments could help workers defray moving costs while seeking economic opportunities elsewhere. Another priority for making globalization more inclusive is to ensure that more small and medium-size firms can participate in exporting.

## DEVELOPING COUNTRIES FACE HEADWINDS, BUT NEARSHORING AND THE GROWTH OF SERVICES OFFER OPPORTUNITIES

While the trends favor advanced economies with skilled workforces, innovation ecosystems, infrastructure, and institutions, developing countries that lack those comparative advantages will need to carefully consider how and where to play in global value chains. The emerging economies that have posted the fastest income growth over recent decades offer some clues, although policy makers need to focus on the opportunities of the future.

- **Labor-intensive manufacturing still offers some opportunities, but the window will not remain open indefinitely.** For decades, fostering labor-intensive manufacturing for export was seen as the best strategy for low-income countries to climb the economic ladder. Now the window of opportunity is narrowing. As automation technologies are adopted more widely in global manufacturing, the advantage of having a large low-wage workforce is eroding.[164] But the window is not closed yet, and countries that move decisively may still be able to take advantage of this strategy.

  Some low-income countries—most notably Vietnam, but also Bangladesh and India—are still managing to achieve growth in labor-intensive manufacturing exports (Exhibit 39). To continue to pursue this development path, these countries will need to invest in transportation and logistics infrastructure, and encourage private and foreign investment in modern, technology-enabled factories. Yet automation may limit job creation in labor-intensive manufacturing in the years ahead, even as output continues to grow. These countries will need to map out strategies for diversification. China is already making great strides on this front and producing more intricate, innovative goods. India is also a major player in IT services. Regional processing value chains may be a promising avenue for other countries, since these industries are structured around the location of end markets.

- **Developing countries near large consumer markets may benefit from the growing importance of speed to market, particularly in global innovations value chains.** One subset of developing countries has a critical advantage: geographic proximity to major advanced-economy trading partners. Many of these countries already specialize in global innovations value chains, and opportunities may grow. The growing premium on locating production closer to end markets discussed in Chapter 5 works in their favor, and automation will make continuously chasing the lowest-wage suppliers less attractive for their advanced-economy trading partners. Companies are increasingly looking for a balance that emphasizes proximity to demand and innovation.[165] Several developing countries with surpluses in global innovations (typically automotive) are taking this development path. Just as Mexico has become an important trading partner for the United States, Turkey and a number of Eastern European countries play this role in value chains linked to Western Europe. Thailand, Malaysia, and Indonesia do the same for higher-income Asia–Pacific countries (in addition to exporting more globally to Europe and the United States). As labor costs rise in China, a growing number of Western multinationals are considering nearshoring as a way to maintain tighter coordination in their supply chains and cut down on shipping times. In some cases, nearshoring

[164] Dani Rodrick, *New technologies, global value chains, and the developing economies*, Pathways for Prosperity Commission Background Paper series number 1, September 2018.

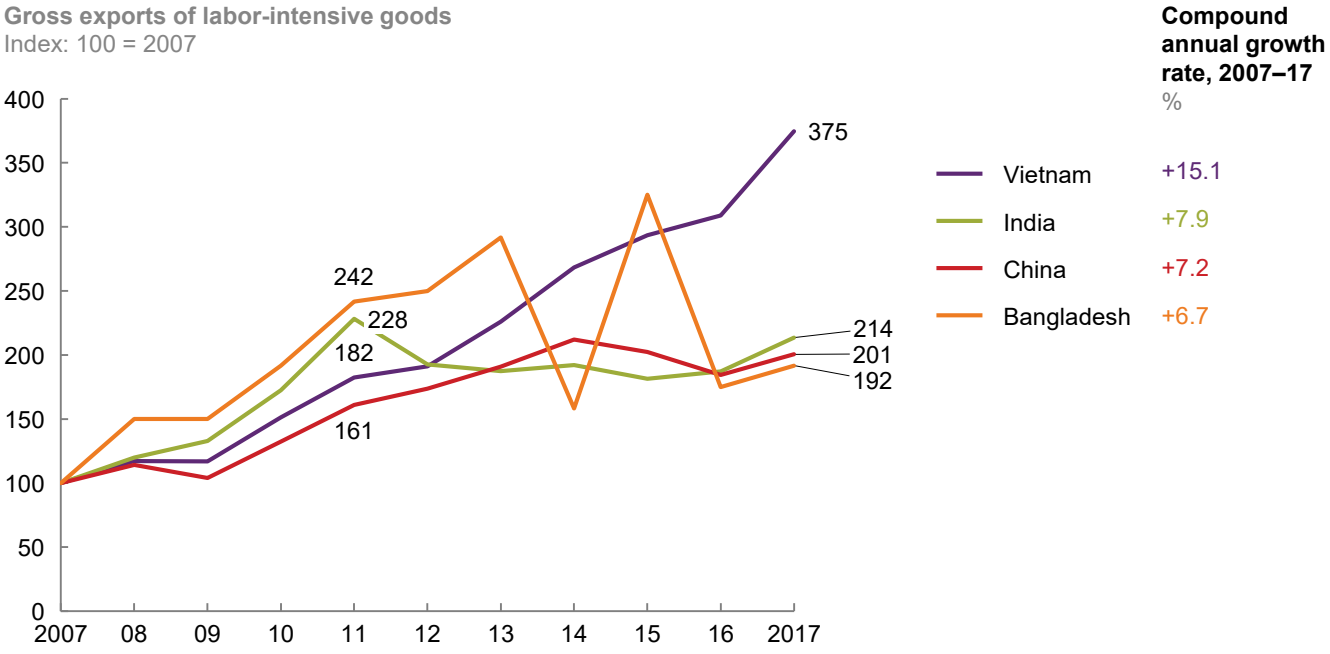
[165] Katy George, Sree Ramaswamy, and Lou Rassey, "Next-shoring: A CEO's guide," *McKinsey Quarterly*, January 2014, McKinsey.com.

alternatives may offer fewer cultural, language, and time-zone difficulties than suppliers halfway around the world.

- **Developing-country service providers stand to gain from growth in services trade, if they can move up the value chain as automation performs basic tasks.** Another group of developing countries, including the Philippines, Morocco, and Costa Rica, specializes in traded BPO and IT services.[166] (India, too, is a major provider of offshore services, although its biggest exports are still labor-intensive goods.) Their industries will be well positioned to expand as technology gives rise to new services and makes it possible to deliver others remotely. However, the ongoing development of AI and virtual agent tools may eat into the market for some of the services that are traded today, including customer service calls, data entry, and administrative work. These countries need to move into higher-value offerings where demand is growing. Some of the most promising areas appear to be software and web development, graphic design, and advanced data analysis.

Exhibit 39

**Some developing economies are still increasing their exports of labor-intensive goods.**




SOURCE: IMF; WTO; McKinsey Global Institute analysis

## The challenges are getting steeper for the developing countries that missed out on the last wave of globalization

Globalization has passed by many countries in Africa, Latin America, and Central Asia. Not only is their participation in global value chains limited, but they are also less connected to the rest of the world in flows of finance, people, and data (as reflected in lower scores on the MGI Connectedness Index, shown in Exhibit 37, earlier in this chapter). These countries are at risk of falling further behind as new technologies substitute for labor and global value chains become more knowledge-intensive. Across the board, developing countries face a squeeze. On one side, their comparative advantage in traditional industries is eroding; on

[166] See, for instance, Calin Buia, Christiaan Heyning, and Fiona Lander, "The risks and rewards of outsourcing," August 2018, McKinsey.com; and Puneet Chandok, Shailesh Kekre, and Sameer Khetarpal, "Taking captive offshoring to the next level," *McKinsey on Business Technology*, number 32, winter 2013, McKinsey.com.

the other, the bar is being set higher for the skills, infrastructure, and technologies required to participate in the industries of the future.

One of the most important pathways for many developing countries may be deeper regional integration in trade. Already we see the world shifting toward more intraregional and less long-haul trade. Lowering tariffs on traded goods is only one aspect of regional integration; it also involves harmonizing regulations, product and technical standards, customs procedures, and capital markets as well as facilitating more seamless flows of people, traded services, and data. In Southeast Asia, the ASEAN Economic Community is focused on trying to achieve these goals across ten countries at widely varying stages of economic development. The existing trading blocs in Latin America and Africa in particular could be further developed to create trade opportunities. Since manufacturing industries such as food processing are highly regional rather than long-haul, trade blocs can spur demand. Spain has demonstrated that even in wealthier trading blocs, there is room to specialize, particularly in food and beverage. In addition to regional processing, developing countries can look at parts of the value chain that are more difficult to automate (focusing on complex apparel, for instance, rather than simple commoditized garments).

Recent MGI research looked into what sets apart developing countries that manage to achieve faster growth. The common pattern was a focus on increasing productivity growth (often through incentives), enabling competition within sectors, and attracting foreign investment and joint ventures to capture knowledge and technology spillovers.[167] Another common characteristic was a focus on making government services more efficient and streamlining bureaucracy to create more business-friendly climates. The role of productive and globally competitive large firms in creating a virtuous cycle of growth is often underappreciated.

One clear no-regrets move for all developing countries to deepen their participation in global value chains is taking steps to reduce trade transaction costs. In many of these nations, customs processing takes days, roads are poor, and ports are inefficient. According to World Bank data, it takes 25 days on average in Gabon and 14 days in Uganda and Malawi to deliver imported goods by land, compared to three days in France and Japan. Technologies such as automated document processing and blockchain, combined with investment in modernizing ports, could remove some of the frictions that constrain trade growth, although the investment and implementation will be challenging.

The digital economy offers opportunities but also challenges. Internet penetration in the developing world was estimated at 41 percent as of the end of 2017, but it remains much lower in low-income countries.[168] Internet access is trending in the right direction, but much more work remains to be done to build out digital networks and bring the rest of the population online. As the flow of ideas, information, and innovation becomes more central to participating in the global economy, access to digital platforms and communication has become an urgent development issue.

Yet new technologies hold possibilities for leapfrog growth. Not that long ago, these same countries were held back by the poor quality of landline phone networks, but mobile phones enabled them to bypass those infrastructure issues altogether, moving rapidly into a new and more connected era of communications. Today mobile apps give small businesses and entrepreneurs across the developing world new tools for analysis, sales, procurement,

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[167] *Outperformers: High-growth emerging economies and the companies that propel them*, McKinsey Global Institute, September 2018. See also John Van Reenan and Linda Yueh, *Why has China grown so fast? The role of international technology transfers*, Center for Economic Performance discussion paper number 1121, February 2012.

[168] *The state of broadband 2017: Broadband catalyzing sustainable development*, Broadband Commission for Sustainable Development, ITU, and UNESCO, 2017.

and marketing—putting the same capabilities in their hands that large companies spent hundreds of millions of dollars to develop in the 1990s and 2000s. Cloud computing amplifies these trends, and it is taking off rapidly across Latin America and Africa. Amazon Web Services, and Microsoft have recently announced the expansion of data centers and public cloud services in Africa. Mobile banking could make financial inclusion for nearly one billion individuals a reality.[169] For businesses, financial-services providers, and governments, digital payments and digital financial services can erase huge inefficiencies and unlock significant productivity gains.

E-commerce marketplaces give small and medium-size businesses in developing countries global exposure to customers and suppliers, payment infrastructure, and logistics services. Taking advantage of their troves of data on small vendors, a number of the largest e-commerce platforms offer additional small business services such as microloans. Digital marketplaces for freelance labor (such as Upwork, Freelancer.com, Guru, and Fiverr) match workers in the developing world with potential clients worldwide for tasks such as software development, sales and marketing support, and creative work. One study analyzing four of the largest labor platforms found that India was the top source of labor, followed by Bangladesh, the United States, Pakistan, and the Philippines.[170]

Education and skills determine any country's ability to participate in a more digital global economy, particularly as value chains become more knowledge-intensive. This is particularly true for countries attempting to build tradable service sectors, which are more dependent on skilled workers.[171] Once countries begin to participate, however, they can set off a virtuous circle of benefits, as trade and foreign direct investment lead to knowledge and technology spillovers.[172]

•••

This period of disruption represents an opening for countries and regions to carve out new roles in global value chains. Policy makers everywhere are rightly concerned about the impact of globalization on the welfare of workers and societies—and these questions will deepen as new technologies replace labor in manufacturing and shift where production takes place.

[169] For more on this topic, see *Digital finance for all: Powering inclusive growth in emerging economies*, McKinsey Global Institute, September 2016.

[170] "Where are online workers located? The international division of digital gig work," Online Labour Index worker supplement, Oxford Internet Institute, July 2017.

[171] *Trade in services and employment*, UNCTAD, 2018.

[172] *Investing in skills for inclusive trade*, World Trade Organization and the International Labour Office, 2017.

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# APPENDIX: TECHNICAL NOTES

1. Sources for industry- and country-level trade data

2. Methodology for Global Trade Flows Database

3. Methodology for extending the time frame of WIOD data

4. Methodology for estimates of cross-border service flows not fully captured in trade statistics

5. Methodology for estimating the potential impact of new technologies on trade flows in 2030

## 1. SOURCES FOR INDUSTRY- AND COUNTRY-LEVEL TRADE DATA

We relied on the 2016 release of the World-Input Output Database (WIOD) and extended it to obtain a longer time series covering 1995 to 2017, as described in the following section of this appendix. The 2016 WIOD release contains input, output, and trade data for 43 countries (plus estimated rest of the world), covering the years from 2000 to 2014.[173] Together, these countries account for more than 85 percent of world GDP and 96 percent of world trade. The WIOD 2016 release conforms to the International Standard Industrial Classification (ISIC) revision 4, which includes 56 industries. Together these industries represent the overall economy for each country. When aggregated, they represent the world economy.

We compiled a global trade flows database covering bilateral cross-border imports and exports of goods by sector and of services by type (see details below). The database distinguishes between intermediate and final goods. In some cases, we included trade data at the product level (for example, our analysis of the potential associated with additive manufacturing required us to look at the different kinds of products included in a sector). In those cases, we relied solely on the goods data set with details to a product level. The data set draws on multiple sources, including the World Trade Organization (WTO) and World Integrated Trade Solution (WITS) for goods, and the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD) for services.

### Country classification

For some analyses, we classify each of the 244 geographies in our sample as either a developing or an advanced economy. We also refer to developing economies as emerging markets or emerging economies interchangeably. Exhibit A1 lists the breakdown.

## 2. METHODOLOGY FOR GLOBAL TRADE FLOWS DATABASE

### Goods trade

We relied primarily on the WTO's bilateral data on trade in goods, which covers 1980 to 2017 for more than 200 countries. We also applied the shares of 32 ISIC sectors and intermediate versus final goods in imports and exports by country from WITS to WTO data to gain a more detailed view by sector and stage of production. Given that WITS 2017 data is limited, we estimated the breakdown by sector and stage of production based on historical trends for countries with missing data.

We combined these two sources to obtain the most comprehensive time series for goods trade by direction of flow, partner, stage of production, and sector. We also consulted other sources for goods trade data, including UNCTAD, the OECD, and the International Trade Centre's Trade Map. The value of global goods trade and of the goods trade of individual leading economies is generally aligned across all these sources.

### Services trade

We used the IMF data set to build a unilateral services trade database by 12 types of services for 153 countries. We then applied the OECD's Extended Balance of Payments Services (EBOPS) 2002 and 2010 editions shares by partner in order to build a bilateral services trade database. Given limited data availability in the 2010 edition of EBOPS, bilateral data is missing for a significant number of countries after 2012. For some analyses, we estimated missing data by country based on annual growth rates from 2009 to 2012.

The combination of these two sources provides the most comprehensive view of services trade over time by partner and type of services. We further consulted other sources including the WTO, UNCTAD, UN Comtrade, and the IMF's World Trade in Services data.

[173] For further details on the World Input-Output Database, see Marcel P. Timmer et al., "An illustrated user guide to the World Input-Output Database: The case of global automotive production," *Review of International Economics*, August 2015, Volume 23, Issue 3.

Exhibit A1

**Classification of countries into regions and level of economic development.**

244 geographies covered in global trade analyses[1]

| | Developed regions | Emerging regions | |
|---|---|---|---|
| **Europe, Middle East, and Africa** | **Western Europe**<br>▪ Andorra ▪ Austria ▪ Belgium ▪ Denmark ▪ Finland ▪ France ▪ Germany ▪ Greece ▪ Iceland ▪ Ireland ▪ Italy ▪ Luxembourg ▪ Malta ▪ Netherlands ▪ Norway ▪ Portugal ▪ Spain ▪ Sweden ▪ Switzerland ▪ United Kingdom | **Eastern Europe and Central Asia**<br>▪ Bulgaria ▪ Czech Republic ▪ Hungary ▪ Kazakhstan ▪ Lithuania ▪ Latvia ▪ Poland ▪ Russia ▪ Slovakia ▪ Turkey<br>Plus 23 other countries | **Africa and Middle East**<br>▪ Algeria ▪ Angola ▪ Botswana ▪ Cameroon ▪ Egypt ▪ Ghana ▪ Iran ▪ Israel ▪ Jordan ▪ Kenya ▪ Kuwait ▪ Lebanon ▪ Morocco ▪ Nigeria ▪ Saudi Arabia ▪ South Africa ▪ Tunisia ▪ United Arab Emirates<br>Plus 48 other countries |
| **Americas** | **North America**<br>▪ Canada ▪ United States | **Latin America**<br>▪ Argentina ▪ Bolivia ▪ Brazil ▪ Chile ▪ Colombia ▪ Costa Rica ▪ Dominican Republic ▪ Ecuador ▪ Guatemala ▪ Jamaica ▪ Mexico ▪ Panama ▪ Uruguay ▪ Venezuela<br>Plus 8 other countries | |
| **Asia** | **Northeast**<br>▪ Japan ▪ South Korea<br>**Australasia**<br>▪ Australia ▪ New Zealand | **China region**<br>▪ China ▪ Hong Kong[2] ▪ Macao<br>**South Asia**<br>▪ Afghanistan ▪ Bangladesh ▪ India ▪ Pakistan ▪ Sri Lanka<br>Plus 3 other countries | **Southeast**<br>▪ Cambodia ▪ Indonesia ▪ Malaysia ▪ Philippines ▪ Singapore[2] ▪ Thailand ▪ Vietnam<br>Plus 8 other countries |

1 We include 173 geographies in our database. The remaining small economies are grouped into "Other Latin America," "Other Asia," and "Rest of World."
2 Classified as advanced economies despite being located in regions classified as emerging.

SOURCE: McKinsey Global Institute analysis

## 3. METHODOLOGY FOR EXTENDING THE TIME FRAME OF WIOD DATA

### Back-casting methodology

We extended the 2016 release of the WIOD back to 1995 to obtain a larger set of data to analyze. To do this, we relied on the 2016 edition of the OECD Inter-Country Input-Output Tables (OECD ICIO), which contain data extending back to 1995. The OECD ICIO tables contain input and output data for 63 counties (plus estimates for the rest of the world) for 34 industries and commodities based on ISIC revision 3 classifications.

Because the WIOD database and the OECD ICIO databases have different levels of country and industry granularity, and they were compiled using different sources and methods, a direct extension of WIOD data using OECD ICIO data would have led to a discontinuous time series. We therefore followed a two-step approach:

- **Step 1.** We mapped the WIOD industry and country classifications to the OECD's ICIO industry and country classifications. While the OECD's ICIO database has more granular country information, the WIOD database is more detailed at the industry level. Countries were mapped on a one-to-one basis between the two data series, which left us with 43 countries (plus estimated rest of world). The 56 industries in the WIOD 2016 release were mapped to the 34 industries in the OECD's ICIO tables by aggregating the more granular industries to their higher-level counterparts in the OECD's ICIO tables. This left us with a consistent set of 34 industries. The result was a common set of 43 countries (plus estimated rest of world) and 34 industries across the two data sets.

- **Step 2.** For each common country and industry pair (i.e., each row in the input-output table), we calculated the change in the share of gross output for all flows and applied them to the 2000 levels for the WIOD database for each year back to 1995.

### Now-casting methodology

We extended the 2016 release of the WIOD database forward to 2017 to obtain a more current set of data for analysis. To do this, we used IHS data and OECD data for 2014 to 2017.

- **Step 1.** For each WIOD country-industry pair:
  - Where data were available from IHS, we calculated the gross exports to gross output (GX/GO) ratio using IHS gross exports (GX) and gross output (GO).
  - Where data were not available from IHS, we used the average annual 2007–14 change in the GX/GO ratio the using WIOD data for gross exports and gross output.
- **Step 2.** For years 2014–17, we calculated the difference in the GX/GO ratios calculated from step 1.
- **Step 3.** For each set of 2014 country-industry data in WIOD, we calculated 2015 gross output as follows:
  - We applied the IHS gross output growth rate for 2015 if available.
  - If the IHS growth rate was not available, we calculated using the OECD gross output growth rate.
  - If the growth rate was not available from either of these sources, we calculated 2015 gross output using a growth rate derived from assuming that world gross output growth is equal to IHS world gross output growth.
- **Step 4.** For each WIOD country-industry's exported flows, we took the change in GX/GO calculated from step 2 and applied the change proportionally to the share of each exported flow in the row.
- **Step 5.** For each WIOD country-industry's nonexported flows, we took the change in GD/GO ratio (domestic output to gross output) calculated from step 2 and applied the change proportionally to the share of each nonexported flow in the row. This does not change the country-industry's projected gross output in 2015; it yields the shares of exported flows relative to nonexported flows.
- **Step 6.** For each WIOD country-industry (i.e., each row in the input-output tables), we obtained the historical change in the input-output coefficients among exported flows using WIOD. We calculated the average annual change between 2007 and 2014 in the share of each exported flow relative to the total share of gross exports (i.e., keeping GX/GO constant but incorporating the 2007–14 trend in exported flows). We then derived the historical change in the input-output coefficients among nonexported flows using WIOD (by calculating the average annual change between 2007 and 2014 in the share of each nonexported flow relative to the total share of gross domestic output).
- **Step 7.** For each WIOD country-industry's exported flows, we incorporated the trend in the input-output coefficients by summing the results of step 5 (the row shares after incorporating the export trend) to the changes in the input-output coefficients calculated from step 6.
- **Step 8.** For each WIOD country-industry, we calculated 2015 intermediate and final flows by multiplying shares from step 7 against the value of gross output from step 3.
- **Step 9.** For each WIOD column, we calculated 2015 value added by subtracting the column sum of intermediate flows from gross output.
- **Step 10.** We repeated steps 1 through 9 for years 2016 and 2017.

### Assumptions, limitations, and weaknesses of back-casted and now-casted data

The methods and sources used to populate the WIOD tables and the OECD ICIO tables are different, so extending one to the other opens up the possibility of magnifying the differences in the methodologies. Indeed, there are many differences in levels across the OECD and WIOD estimates in 2000. Our approach assumes that, while the nominal levels are different, both the numerator and denominator in our shares would be different in a correlated way.

In general, the now-casting methodology is intended to be suggestive. It is an extrapolation of a complex multidimensional data set with a much smaller number of specifications. We therefore confirm our findings are directionally true in the base years (2000–14) to ensure that errors in forecasting are not driving the results.

More specifically, while input-output tables break down flows into intermediate and final goods as well as specifying a supplying and using industry, the IHS data we employed to extend the data series forward does not. Therefore, we assumed that the ratio between final and intermediate flows would remain the same and infer the change in the imports of the using industry based on the change in exports in the overall supplying industry.

Forward-looking services data were not broadly available, so we assumed that historical growth would continue.

Additional care should therefore be taken with any projections apart from industry-level gross export and gross output growth in goods sectors, as they embed several simplifying assumptions that may differ materially from reported data.

WIOD source data, too, has some limitations. The "rest of the world" is treated as a single entity, so trade between these countries is not captured, nor can we tell which countries in this group are receiving and providing the flows. Additionally, since a model was used to calculate the split between intermediate and final flows in this region, the data are constrained by the same limitations of that modelling approach. Furthermore, the WIOD has limited granularity in industry classifications.

## 4. METHODOLOGY FOR ESTIMATES OF CROSS-BORDER SERVICE FLOWS NOT FULLY CAPTURED IN TRADE STATISTICS

### Services embedded in goods trade

The difference between services trade in gross terms and in value-added terms represents the value of services that are embodied in goods trade. As the first step, we calculated the value of services embedded in goods based on the WIOD. However, the total trade value reported by WIOD ($20.6 trillion) differs from the value reported in the balance of payments ($22.4 trillion). Given that we use gross trade numbers based on the balance of payments as a baseline for estimating the value of services crossing borders, we adjusted the value of services embodied in goods from WIOD based on gross trade as reported in the balance of payments. For the sake of consistency, we calculated goods trade in value-added terms by subtracting the adjusted value of services embodied in goods trade from gross goods trade reported in the balance of payments.

### Cross-border flows of intangibles

We applied two approaches to measuring flows of intangibles between the country where a multinational corporation is headquartered and its foreign affiliates in order to provide a range of estimates of their value. The first is a revenue approach, based on the revenue generated outside of the country of headquarters associated with intangibles (assuming that this revenue represents the implied value of gross flows of intangibles provided by headquarters to the foreign affiliates). The second is a cost approach. This is based on foreign affiliate R&D and selling, general, and administrative (SG&A) expenses associated with intangibles that are attributable to the country of headquarters (assuming that these expenses are equivalent to the implied value of cross-border flows of intangibles).

Conceptually, we took two steps to measure the value of intangibles crossing borders. First, we determined the total value associated with intangibles. Then we allocated a share of this as trade from the country of headquarters to local affiliates (Exhibit A2). Calculations are based on company-level data as of 2017 for 1,328 multinational companies for which foreign affiliate revenues, economic profit, R&D expenses, and SG&A expenses were available as of 2017 and the sum of foreign affiliate economic profit and costs attributable to intangibles generated by headquarters is above zero.

- **Step 1: Determining the total value associated with intangibles.** We attempted to calculate the costs associated with the production of intangibles and the share of income that can be attributed to intangibles. In the revenue approach, we summed profit and costs; in the cost approach, we used only the costs associated with intangibles. The costs consist of both R&D expenses (which account for software development and design) and a share of SG&A associated with intangibles (specifically marketing and IT). The profit is then considered to be the economic profit of the company. This assumes that traditional capital will receive "ordinary" returns (meaning that any extraordinary returns to invested capital are attributable to structural advantages from intangible assets). Economic profit is based on data from McKinsey's own Corporate Performance Analysis Tool (CPAT), while R&D and SG&A expenses are based on Capital IQ data. The share of IT and marketing is in SG&A expenses and is based on McKinsey benchmarks.

- **Step 2: Estimating traded share of value associated with intangibles.** To arrive at a trade number, we needed to exclude the affiliates' local production of intangibles (e.g., customization of ad campaigns, local recipes) and to isolate the share of headquarters-generated intangibles used by foreign affiliates (the rest is domestic production).

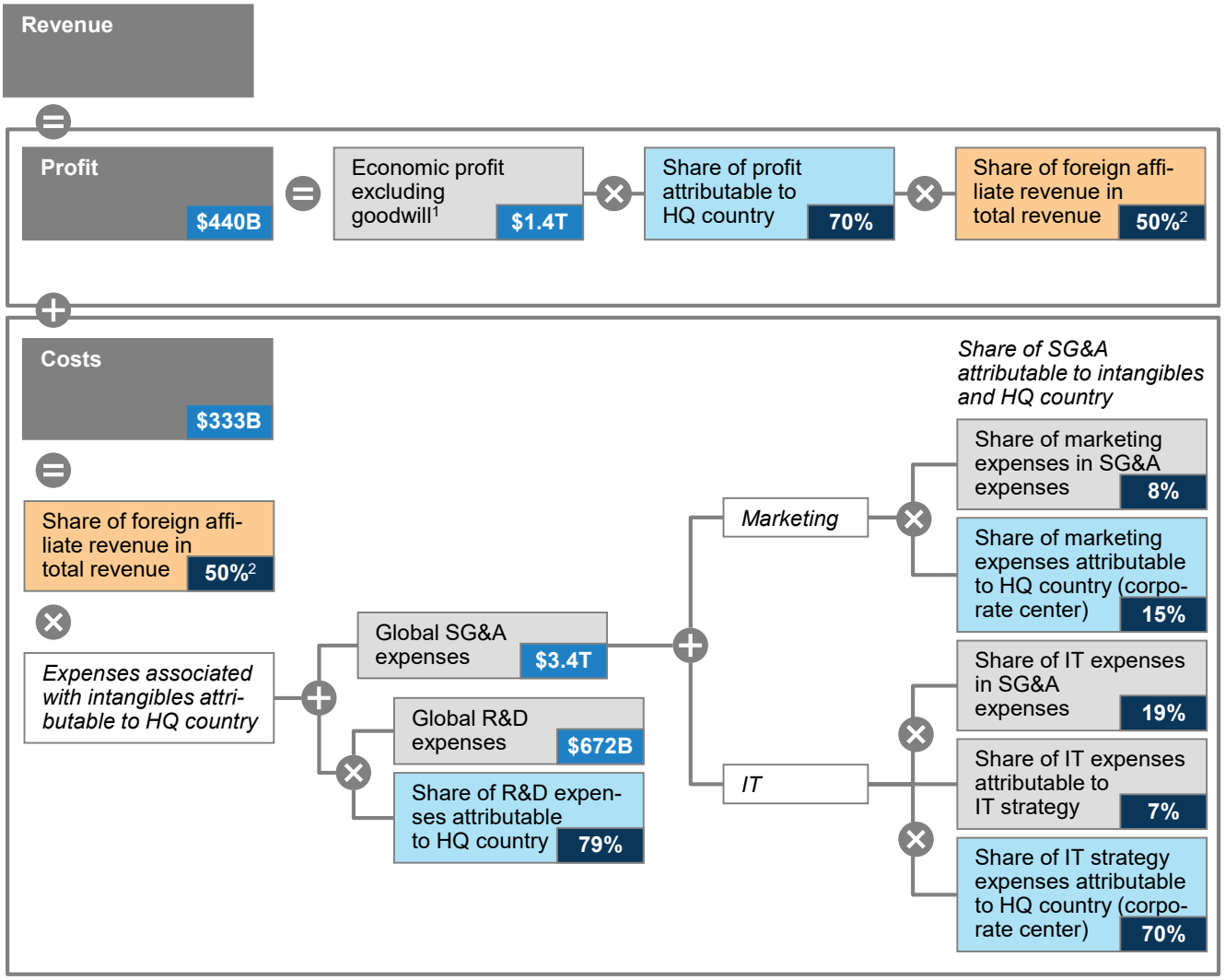
  To reflect that a part of the value of intangibles is created by foreign affiliates locally, we applied the share of spending on IT and marketing in the corporate center as the share of total IT and marketing spending based on McKinsey benchmarks. Some benchmarks have sector-level granularity, while others were applied to all companies in the sample.

Exhibit A2

**Methodology for estimating the value of cross-border flows of intangibles.**

**Based on 2017 data**
Sample of 1,328 companies (based on data availability and profit and costs above zero)

- Step 1: Calculate income and costs associated with intangibles
- Step 2a: Determine income and costs attributable to a country of headquarters
- Step 2b: Determine income and costs generated outside of the country of headquarters
- Global total
- Weighted average share[3]




1 Including companies with negative economic profit, excluding companies with negative estimated gross flows (EP + R&D and SG&A costs). Excluded companies are mainly real estate and financial-sector companies.
2 Share based on a sample of companies with foreign revenues above zero.
3 For illustrative purposes only. Actual calculations based on company-level data.
NOTE: Consistent sample of companies used in both approaches.

SOURCE: CPAT; Capital IQ; McKinsey Corporate and Business functions survey; Moody's; Business R&D and Innovation Survey, 2014; McKinsey Digital 20/20; McKinsey Global Institute analysis

To account for intangibles used by foreign affiliates only and exclude those used domestically in the country of headquarters, we applied the share of foreign affiliate revenue in total company revenue to the value of intangibles based on Capital IQ data. This assumes that the value of intangibles generated at headquarters is proportionally spread according to revenue.

### Cross-border flows of free digital services

Free digital services include search engines, email, messengers, video, social networks, and other online solutions that generate value but do not charge users fees for standard versions of those services. To estimate their value, we multiplied the implied price of free digital services by the number of their foreign users.

The calculations were performed by country and by type of service. We included 30 large economies and the top 1,000 global websites according to Alexa Web Information Service (AWIS), based on the number of users and page views.

We followed two separate approaches to estimate the value of free digital services globally. The first begins with US median willingness-to-accept figures (lower end of 95 percent confidence interval) for free digital services as presented in recent research.[174] We then applied three adjustments to derive the implied prices of free digital services by country. First, we scaled based on disposable income per capita to account for the relative value of free digital services in disposable income. Second, we scaled based on the time spent on the internet in each country in order to account for the relative importance of the service by country. Third, we scaled down the users by half to account for the fact that Brynjolfsson gives the *median* willingness to accept, which implies that half of users would stop using the services at that price.

Given the high values found by Brynjolfsson et al., we also test a second approach by pricing the services based on reasonable proxies. For example, we consider the implied price of video services like YouTube to be equivalent to the price of a standard Netflix subscription ($132 annually). We assume a price for a user to be an implied price of a free digital service.

We use AWIS June–August 2018 data for the top 1,000 global websites to calculate the number of foreign users of free digital services by country and by type of service. The database includes number of users by country. Below are the steps we followed:

- **Step 1.** We categorized users into domestic and foreign based on the location of website headquarters and the location of users. We determined the headquarters location by first assuming that its headquarters is in the country where more than 50 percent of users are located. If this did not hold, we assumed that headquarters is the country where there are at least 50 percent more users than in the country with the second-largest number of users. If neither of these methods held, we consulted details on the website itself.[175] For the number of users by location, we consulted Amazon's Alexa Web Information Service database.
- **Step 2.** We categorized each website into one of 16 categories (adult, advertising, digital services, e-commerce, education, email, games, media, messenger, music, news and information, payments, search engine, social media, video, and Wikipedia).[176]
- **Step 3.** We estimated the number of internet users by country based on total population and the share of internet users by country based on World Bank data.
- **Step 4.** We estimated the total number of users of a given website in a country based on the total number of internet users in a country * reach per million (an AWIS metric reflecting a share of all internet users who visit a given website) * the share of website users in a country * the ratio of a number of users of a website with the highest number of users in a country to total internet users in a country.[177]
- **Step 5.** We split Google users into users of its email, video, social media, search engine, and other services using a US proxy for number of hours spent per day on these five different services.
- **Step 6.** We adjusted for double counting of users (e.g., one person using both Google and Yahoo for search) by conservatively assuming that the highest number of users of a given type of website in a given country is a total number of unique users. We also scaled down the number of website users for each website of a given type in a given country based on this number of unique users.

### 5. METHODOLOGY FOR ESTIMATING THE POTENTIAL IMPACT OF NEW TECHNOLOGIES ON TRADE FLOWS IN 2030

We constructed a 2030 baseline that measures projected bilateral flows at the sector and product level. We first calculated average historical growth rates of trade from 2013 to 2017 (or latest available year) between two countries at a sector and product level. We then applied the average historical growth rates to obtain the compound annual growth rate of each bilateral trade flow from 2017 to 2030, adjusting for extreme growth rates by applying caps.

This model should not be considered a comprehensive projection. It does not take into account other variables that may impact trade in 2030—and any look 11 years into

[174] Erik Brynjolfsson, Felix Eggers, and Avinash Gannamaneni, *Using massive online choice experiments to measure changes in well-being*, April 2018.

[175] A similar approach is used in Georgios Alaveras and Bertin Martens, *International trade in online services*, Institute for Prospective Technological Studies Digital Economy Working Paper, European Commission, 2015.

[176] We assume games and adult to have no implied value, so these categories are not used in the final estimate.

[177] Introduced because a number of users in a country for some websites is slightly above total number of internet users in a country.

the future necessarily involves substantial uncertainty. However, our 2030 baseline is at least representative of historical trends in trade patterns between country pairs for every sector and product. The projection is used only as a baseline from which to estimate deviations and should not be taken as a forecast from MGI of future trade levels.

### Cross-border e-commerce

To estimate cross-border e-commerce in 2030, we estimated the value of cross-border e-commerce today and its projected growth. We first obtained current estimates of cross-border B2C e-commerce using a recent report by AliResearch and the International Trade Centre that includes estimated values at a regional level from 2014 to 2020 (forecast).[178] No comparable estimate is available for cross-border B2B e-commerce. However, the US International Trade Commission estimates that total B2B e-commerce is $23.9 trillion, six times the value of B2C e-commerce.[179] We take a more conservative estimate for the cross-border portion of B2B e-commerce and project that it is almost three times the size of cross-border B2C e-commerce.

We then calculated the impact of cross-border e-commerce at a country and regional level, using Forrester data on historical and forecast growth rates of e-commerce as a proxy for the growth of cross-border e-commerce to 2030. We adjusted these growth rates to account for a potential slowing of e-commerce growth over time.

However, we cannot assume that all of the growth of cross-border e-commerce equates to incremental growth in trade; some of it may simply substitute for offline trade. Our low case assumes that 30 percent of the growth in cross-border e-commerce is incremental trade, while our high case assumes that 50 percent is incremental. We remain conservative in our estimates, since it is likely that domestic sellers on e-commerce platforms will match the offerings and prices of foreign competitors. On aggregate, the estimated increase in trade in 2030 could range from $1.2 trillion to $2.1 trillion, or 4 to 6 percent of total exports in 2030.

### Logistics technologies

We first separated these technologies into two categories based on expert opinions. Category 1 includes the Internet of Things and blockchain, which can help to improve traceability of shipments and provide end-to-end tracking. Category 2 includes technologies such as automated document processing, autonomous vehicles, and automated stacking cranes.

We obtained use cases in which these technologies have been deployed and their impact on reducing trade times has been documented. For example, the Maersk-IBM pilot described in Chapter 4 used the IoT and blockchain to reduce transit times by approximately 40 percent. Based on McKinsey expert estimates, we make a more conservative assumption that the technologies in Category 1 can reduce trade times by 10 percent in a low case and 20 percent in a high case. In another case example described in Chapter 4, full automation at the Port of Rotterdam reduced gate-in and gate-out times by up to 30 percent. We make a more conservative assumption that the automation technologies in Category 2 can reduce transit times in trade by 6 to 8 percent. Summing the effects of both categories of technologies yields a 16 to 28 percent potential reduction in transit times.

We then translate this time savings into trade impact, using Hausman's estimate of a 0.4 percent increase in trade flows for every one percent reduction in trade processing time.[180] We selected estimates from this paper as its coverage of 80 countries leverages data from the World Bank's Trading Across Borders indicator and models the impact based on both total time to import and total time to export. We removed commodities from the analysis as we believe that trade of commodities is relatively inelastic to processing times.

Combining the estimated 16 to 28 percent time savings with the 0.4 percent trade elasticity gives us a potential 6 to 10 percent increase in trade flows, equating to an increased value of $1.5 trillion to $2.6 trillion. We further refined the estimates by taking into consideration the total processing time for each bilateral flow, summing the export processing time of the exporter country with the import processing time of its trading partner.[181] Bilateral flows that have long trade processing times have the potential to benefit more from logistics technologies. In contrast, bilateral flows with already short

[178] AliResearch and International Trade Centre, *E-commerce in China: Opportunities for Asian firms*, 2016.

[179] World Trade Organization, *World trade report 2018: The future of world trade: How digital technologies are transforming global commerce*, October 2018.

[180] Warren H. Hausman, Hau L. Lee, and Uma Subramanian, "The impact of logistics performance on trade," *Production and Operations Management*, March–April 2013, Volume 22, Number 2.

[181] Import and export processing times for each country are obtained from the World Bank's Trading Across Borders 2017 data set.

processing times of a couple of hours have less room for improvement.

### Additive manufacturing

We took three steps to estimate the potential impact of additive manufacturing. First, we removed industries and products where additive manufacturing is not expected to be relevant. Next, for relevant products, we estimated the percentage of production in which additive manufacturing is technically feasible. These estimates are based on a series of interviews with industry experts; they range from 10 percent in electronics to 70 percent in toys. Adding up each individual vehicle part, we see that additive manufacturing has applicability to roughly 40 percent of a car.

After estimating the technical feasibility associated with each product, we estimated the economic viability, or actual expected additive manufacturing adoption. We obtained estimates at a product level for economic viability at a low range and a high range based on expert interviews. Multiplying the technical feasibility with economic viability gives us a range showing the possible reduction in trade that could be caused by adoption of 3-D printing (Exhibit A3). Cumulatively, we expect that additive manufacturing can reduce trade flows by some $350 billion to $790 billion in 2030.

### Automation technologies

Our quantification of the impact of automation technologies (advanced robotics and AI) is based on the assumption that their adoption in advanced economies will reduce offshoring or lead to reshoring of production. To arrive at an estimate, we took three steps. First, we filtered out sectors in which offshoring or reshoring is unlikely to be influenced by automation technologies (commodities, tourism, transportation services, and IP charges). Second, we isolated exports from developing countries to advanced economies as well as from developing countries to China. We included China since

Exhibit A3

**We estimate that 3-D printing will likely supplant only 1 to 2 percent of trade in manufactured goods by 2030.**

Underlying goods for each product category were considered to refine estimates

| | | | Technical feasibility | × | Economic viability | = | Reduction in trade |
|---|---|---|---|---|---|---|---|
| | | | | | % replaceable by 3-D printing | | |
| | Industry | Product | % of 3D-printable parts | | Low estimate | High estimate | Reduction % |
| Labor-intensive goods | Consumer | Toys | 70 | | 10 | 20 | 7–14 |
| | | Footwear | 60 | | 15 | 25 | 9–15 |
| | | Apparel | 40 | | 10 | 20 | 4–8 |
| | | Textiles and textile products | 50 | | 3 | 5 | 1–3 |
| | | Jewelry | 80 | | 5 | 15 | 4–12 |
| | | Furniture and wood products | 90 | | 5 | 10 | 5–9 |
| | | Sports, musical instruments, and others | 50 | | 5 | 10 | 3–5 |
| R&D-intensive goods | Consumer | Plastics and plastic products | 75 | | 5 | 10 | 3–7 |
| | Healthcare | Medical instruments | 20 | | 5 | 25 | 1–5 |
| | Industrial | Electronics | 10 | | 20 | 40 | 2–4 |
| | | Machinery and electrical equipment | 50 | | 5 | 10 | 3–5 |
| | Automotive | Vehicle parts | 40 | | 5 | 15 | 2–6 |
| | | Other transport equipment | 40 | | 5 | 15 | 2–6 |
| | Aerospace | Aircraft transportation | 20 | | 10 | 30 | 2–3 |

**Overall reduction in manufactured goods trade = 1–2%**

SOURCE: McKinsey Global Institute analysis

a large share of developing countries' trade is with China, which is actively adopting automation technologies. Third, we estimated the adoption of these technologies in advanced economies and China by 2030 using McKinsey's Automation Model.

Looking at the exports of each developing country, we multiplied the automation adoption percentage of partner countries (advanced economies and China only) for specific sectors at a bilateral flow level. The assumption here is that companies in those partner countries can decide against offshoring or decide to reshore the proportion of activities that can be automated. The exact point at which this will occur is still to be determined, however, and some production may be nearshored instead. In aggregate, we estimated that automation technologies in production could reduce total trade by 5 to 10 percent ($1.5 trillion to $3.0 trillion) by 2030.

### Electric vehicles (EVs)

We estimated the impact of EVs on the oil trade based on both expected oil consumption and expected penetration of EVs of total car stock by 2030. We used a model developed by McKinsey Global Energy Perspective projecting the share of road transportation out of total oil consumption under various scenarios. On aggregate, we expect that road transportation will account for 40 to 45 percent of oil consumption by 2030. We also used a model developed by McKinsey's automotive practice to estimate the share of EVs out of total car parc (the total stock of cars in use) globally by 2030. This ranges from 9 to 13 percent, although it differs at the country and region levels. In total, EVs could reduce the oil trade by 3 to 6 percent ($39 billion to $69 billion) by 2030.

To calculate the estimated impact of EVs on trade in auto parts, we identified a list of vehicle parts that are not present in EVs, which amount to some 35 percent of total exports of all vehicle parts. For this calculation, the share of EVs in total car sales globally is more relevant than car stock; it is estimated to range from 20 to 30 percent. We estimate that EVs could reduce trade in vehicle parts by 6 to 10 percent ($86 billion to $140 billion) by 2030.

### Renewables

We first obtained the full input-output table for electricity generation from Purdue University's Global Trade Analysis Project database. It includes a detailed breakdown of all the inputs required to generate electricity based on different energy sources.

We used the power model developed by McKinsey's Global Energy Perspective team, which models the amount of electricity generated by various energy sources through 2030 at a country level. The model also contains estimates for the levelized cost of energy to 2030 at a country level.

In 2016, the shares of solar photovoltaic and wind power in electricity generation were 2 percent and 4 percent, respectively. By 2030, the share of solar PV is expected to quadruple to 8 percent, and wind power is expected to almost triple to 11 percent.

To estimate the impact on trade in 2030, we developed a baseline case and a scenario with greater adoption of renewables. The baseline case assumes no change in the electricity generation mix from 2016. As a result, the value of imports for each energy source is expected to grow at a uniform rate, estimated by the total volume of energy generated in 2030. In the scenario of renewables adoption, we assumed that the share of renewable resources changes according to energy projections. As a result, the value of imports for each energy source is expected to change at different proportions, according to the changing energy mix in 2030. The overall impact was derived based on calculating the difference between the value of imports in the baseline case and the renewables case. It results in an approximately $104 billion reduction in trade.

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