Executive summary

A consumer buys a new smartphone. What exactly is she paying for?

The phone consists of many parts and components manufactured all over the world, and the price needs to cover the cost of those. She is also paying for the labor of the people who made the components and assembled the final product, and for services such as transportation and the retailing of the product in a physical store or online. And, very importantly, she is paying for intangible capital – the technology that runs the smartphone, its design and its brand name.

Today, production is global. Companies perform different production stages in different locations around the world. At each stage of the supply chain or global value chain for each product, value is generated by workers, by production machinery and, increasingly, by intangible capital – things one cannot touch, but which are crucial to the look, feel, functionality and general appeal of a product. Intangible capital is crucial in determining success in the marketplace – which companies succeed and which fail.

Is it possible to quantify the importance of intangible capital? What types of intangibles are most valuable at different production stages and for different consumer products? How do companies manage their intangible assets in global value chains, and what role does intellectual property (IP) play in generating a return on these assets?

Although there have been numerous studies on the rise of global value chains, little evidence is available to answer these questions. This report endeavors to help fill that gap. It does so at the macroeconomic level, by presenting original estimates of the income accruing to intangible assets in 19 global manufacturing value chains, and it also explores the role of intangibles in greater detail through case studies of specific value chains for smartphones, coffee and solar cells.

Insight into the role of intangible assets in global value chains matters from a policy perspective. Investments in intangible capital are a key source of economic growth, and better understanding how those assets are generated and exploited in a globalized marketplace may help policymakers refine the enabling environment for such investments.

Similarly, acquiring intangible assets is a key imperative for policymakers in developing economies seeking to support local firms that strive to upgrade their production capabilities in global value chains.

The rise of global value chains

Production processes have been unbundled and spread around the world…

The growth of global value chains is a key distinguishing feature of the so-called second wave of globalization that set in some time in the second half of the 20th century. The invention of the steam engine in the 18th century unleashed the first globalization wave, which peaked early in the 20th century. International commerce during the first wave mostly consisted of trade in commodities and fully assembled manufactured goods. What stands out about international commerce in the second globalization wave is the unbundling of the production process and the spreading of different production stages across different locations around the world. As a result, trade patterns have shifted toward multidirectional trade in intermediate goods within particular industries.

Several forces supported this shift in the organization of global production:

- Falling costs of international trade made it cost-effective to disperse production across a number of locations. Cheaper and faster transportation had already propelled international trade during the first globalization phase. The advent of air transport, the spread of containerization and other innovations lowered transport costs even further.

- Progressively more liberal trade policies after the Second World War – following the proliferation of protectionist policies in the interwar period – also helped to lower the costs of shipping goods from one country to another.

- Modern information and communication technologies (ICTs) were critical in enabling dispersed production. In particular, rapidly falling communication costs and ever more powerful computing technology allowed companies to coordinate complex production processes involving many locations around the world.

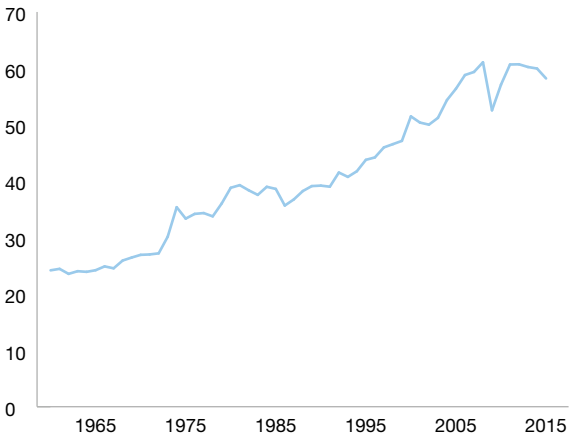
... unleashing rapid growth in world trade, outpacing global output growth

As a result, international commerce boomed. As parts and components cross borders several times before the resulting products are finally assembled – and often exported again – growth in world trade has outpaced global output. The ratio of trade to gross domestic product (GDP) has more than doubled over the last half-century (figure 1).

Figure 1

Growth in world trade outpaces growth in world output

Trade as a percentage share of GDP



See figure 1.2.

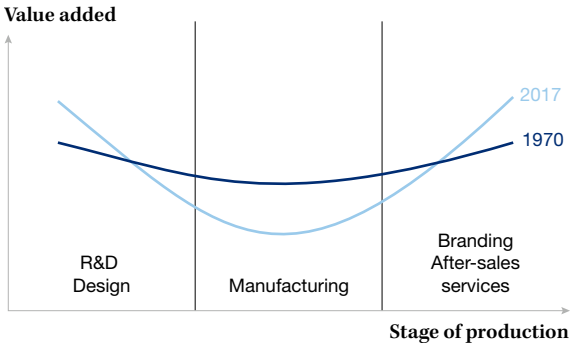
Intangible capital has become more important in global value chain production

Global value chain production in the 21st century is popularly characterized by the so-called smile curve – first proposed in the early 1990s by the chief executive officer of the company Acer, Inc. As illustrated in figure 2, the smile curve recognizes the increased importance of pre- and post-manufacturing stages and posits that those stages account for ever-higher shares of overall production value. The growing smile shown in figure 2 reflects that intangible capital – in the form of technology, design and brand value as well as workers' skills and managerial know-how – has become critically important in dynamically competitive markets. Firms continuously invest in intangible capital to stay ahead of their rivals.

As economies have grown richer, consumers' preferences have shifted toward goods that respond to differentiated tastes and offer a broader "brand experience."

Figure 2

Production in the 21st century – a growing smile



See figure 1.4.

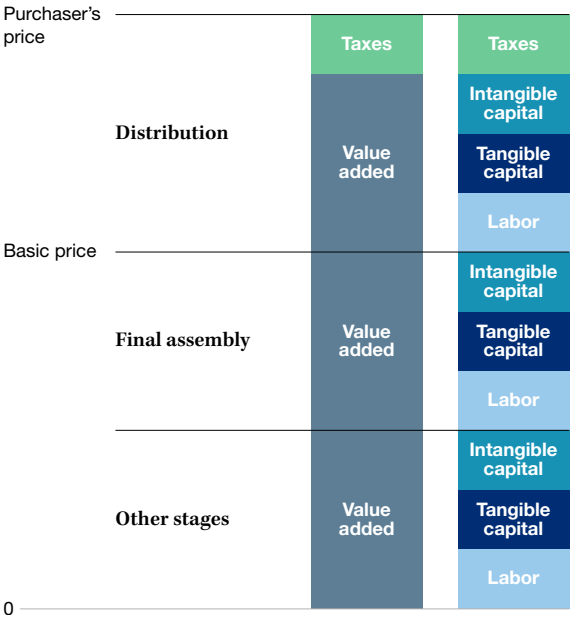
What return accrues to intangible assets?

While appealing and intuitive, the concept of the smile curve has its limitations. It may reasonably portray the distribution of value added for firms performing all production stages. But it is more difficult to apply at the economy-wide level, where firms' value chains intersect and overlap. In addition, it does not provide any insight into what precisely generates value added at different production stages. For example, "higher value added" does not necessarily coincide with underlying activities being more profitable, associated with better paying jobs, or generally "more desirable."

One can gain a better understanding of what generates value in global value chains by quantifying how much income accrues to labor, tangible capital and intangible capital used in global value chain production. In research for this report, economists Wen Chen, Reitze Gouma, Bart Los and Marcel Timmer performed precisely such an analysis (see chapter 1). Their approach consisted of two steps. First, they assembled macroeconomic data on shares of value added in 19 manufacturing product groups spanning 43 economies plus one rest-of-the-world region which together captured around one-quarter of global output. Then they decomposed value added at each stage into the incomes accruing to labor, tangible capital and intangible capital – as illustrated in figure 3.

Figure 3

Decomposing global value chains



See figure 1.6.

Intangible capital accounts for around one-third of production value...

Figure 4 presents the resulting income shares accruing to the three production factors for all products manufactured and sold worldwide from 2000 to 2014. The intangibles share averaged 30.4 percent throughout this period, almost double the share for tangibles. Interestingly, it rose from 27.8 percent in 2000 to 31.9 percent in 2007, but has stagnated since then. Overall income from intangibles in the 19 manufacturing industries increased by 75 percent from 2000 to 2014 in real terms. It amounted to 5.9 trillion United States dollars (USD) in 2014.

... with food products, motor vehicles and textiles accounting for around one-half of income to intangibles

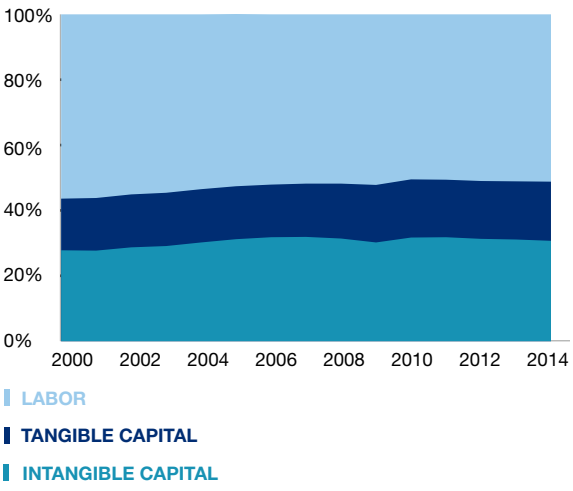
Which product global value chains use intangibles most intensively? Table 1 presents the factor income shares in 2014 for the 19 manufacturing product groups in descending order of their global output size. For all product groups, intangible capital accounts for a higher share of value added than tangible capital.

The intangibles share is especially high – and more than double the tangibles share – for pharmaceutical, chemical and petroleum products. It is also relatively high for food products as well as computer, electronic and optical products. In terms of absolute returns, the three largest product groups – food products, motor vehicles and textiles – account for close to 50 percent of the total income generated by intangible capital in the 19 manufacturing global value chains.

Figure 4

Intangible capital captures more value than tangible capital

Value added as a percentage of the total value of all products manufactured and sold worldwide



See figure 1.7.

These and other figures presented in this report offer for the first time an estimate of the return to intangible asset investments in global value chain production, which has so far largely escaped measurement. Nonetheless, they also leave a number of questions open and come with methodological caveats. For example, which economies harvest the returns from intangible capital? The question is obvious, but the answer is elusive. For one thing, through transfer pricing and related practices, companies can easily shift profits from one location to another. Thus, an intangible asset may originate in one economy, but most of its returns may show up in another. More fundamentally, increasing cross-border ownership and sharing of intangibles is undermining the very notion of location-bound assets and earnings.

Table 1

Income shares by manufacturing product group, 2014

Product group name	Intangible income share (%)	Tangible income share (%)	Labor share (%)	Global output (USD bn)
Food, beverages, and tobacco products	31.0	16.4	52.6	4,926
Motor vehicles and trailers	29.7	19.0	51.3	2,559
Textiles, apparel and leather products	29.9	17.7	52.4	1,974
Other machinery and equipment	27.2	18.8	53.9	1,834
Computer, electronic and optical products	31.3	18.6	50.0	1,452
Furniture and other manufacturing	30.1	16.3	53.7	1,094
Petroleum products	42.1	20.0	37.9	1,024
Other transport equipment	26.3	18.5	55.2	852
Electrical equipment	29.5	20.0	50.6	838
Chemical products	37.5	17.5	44.9	745
Pharmaceutical products	34.7	16.5	48.8	520
Fabricated metal products	24.0	20.8	55.2	435
Rubber and plastics products	29.2	19.7	51.1	244
Basic metals	31.4	25.6	43.0	179
Repair and installation of machinery	23.6	13.2	63.2	150
Paper products	28.0	20.9	51.1	140
Other non-metallic mineral products	29.7	21.5	48.9	136
Wood products	27.5	20.0	52.5	90
Printing products	27.1	21.2	51.7	64

Source: Chen et al. (2017).

The precise nature of intangible capital and how it affects the business models of global value chain participants differs widely across industries. The case studies on coffee, photovoltaics and smartphones in this report offer more concrete perspectives on the nature of intangible capital and prevailing business strategies.

The case of coffee

Coffee is one of the most important traded agricultural commodities. It is the source of income for nearly 26 million farmers in over 50 developing economies, but 70 percent of coffee demand comes from high-income countries. Most of the value added of coffee sold also accrues to high-income countries. This partly reflects the short shelf life of roasted coffee, which implies that most of the roasting is done close to where the coffee is consumed. More importantly, it reflects the economic importance of downstream activities in the global value chain.

Intangible capital in the coffee supply chain mainly consists of downstream technological innovations and branding

The case study on coffee highlights two key forms of intangible capital in the global value chain (see chapter 2):

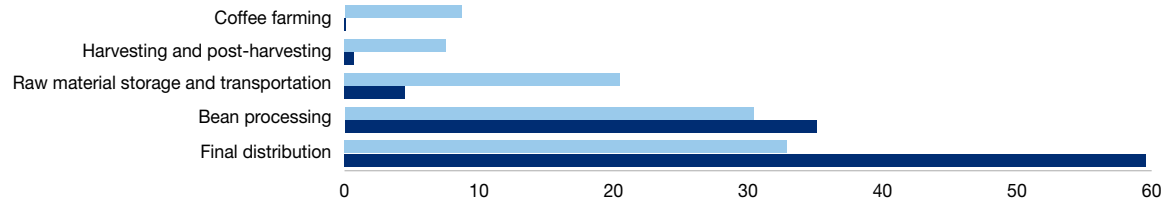
- Technology associated with coffee farming and with turning coffee into a high-quality and appealing consumer product. Patent data suggest that the most innovative value chain stages are those closer to the consumer, including the processing of beans and especially the final distribution of coffee products (figure 5). The latter stage includes the modern espresso machines and coffee capsules found in many homes and offices.

- Brand reputation and image, which allow consumer product firms to differentiate their offering from those of their rivals. Branding plays an important role in all coffee market segments, including soluble and roasted coffee sold in grocery stores, espresso-based coffee products and retail coffeehouses.

Figure 5

Most coffee-related innovation occurs in activities close to the consumer

Share of firms and patent applications related to coffee at each stage of the value chain



See figure 2.5.

In addition to technology and branding assets, the lead firms in the global coffee value chain benefit from long-term relationships with distributors downstream. As a result, the global coffee value chain is largely buyer-driven and dominated by a relatively small number of multinational companies headquartered in the large coffee-consuming countries.

Different waves of coffee consumption…

Shifting consumer preferences have prompted three waves of coffee consumption that have progressively transformed the global value chain:

- The first wave centered on consumers who largely consume their coffee at home. The products – in the form of packaged roasted coffee beans, soluble coffee and, more recently, single-serving capsules – are standardized, with price differences reflecting variation in the quality of coffee blends.

- The second wave emerged with consumers who prefer to consume coffee in a social setting. Products in this market segment range from the typical Italian espresso to more elaborate concoctions of coffee plus foamed milk. In addition to coffee itself, most of the coffee shops in this market segment offer a distinct ambiance to attract their consumers. The quality of the coffee beans used in the second wave tends to be higher than those in the first wave. In addition, the second wave introduced voluntary sustainability standards (VSSs), informing consumers of the coffee's origin and whether farmers receive fair wages.

- The third wave market segment targets consumers with discerning coffee tastes, willing to pay premium prices for their coffee. They are interested in knowing where their coffee beans are sourced, how they have been farmed and how best to brew the beans in order to fully appreciate the flavor, body, aroma, fragrance and mouthfeel of the coffee. The coffee beans tend to be of superior quality to those used in the other two market segments.

… are reshaping the global coffee value chain…

The first wave still accounts for 65 to 80 percent of the total quantity of coffee consumed, but only 45 percent of the global market value. This reflects higher unit prices commanded in the second and third waves (see figure 6). The second and – more recently – third waves are reshaping the governance of the global coffee value chain. In particular, sourcing of coffee in the first wave has traditionally been market-based, with buyers blending different types of coffee from different parts of the world. The introduction of VSSs in the second wave established more direct ties between coffee growers and downstream value chain participants. These ties are of even greater importance in the third wave and have, in fact, shortened the value chain by cutting out intermediaries in the coffee trade.

… with the third wave opening opportunities for upgraded participation by coffee farmers

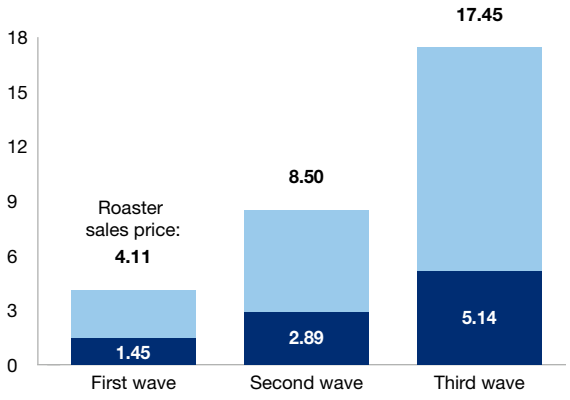
The shift in consumer preferences associated with the second and especially the third wave has opened up opportunities for upgraded participation by coffee farmers in exporting countries. The emphasis in this market segment is akin to the wine industry's flavor profile, which valorizes the *terroir*, grape variety and craftsmanship involved in producing the wine.

Information on the origin and variety of the coffee beans, how they were farmed and processed, and if the farmers are adequately compensated has become an integral part of selling coffee. For coffee farmers, direct communication with buyers can sometimes lead to the sharing of technology and know-how, helping to upgrade the coffee farm and its processing. Figure 6 shows how the higher prices commanded in the third wave are associated with better remuneration of coffee farmers.

Figure 6

Third-wave coffee commands the highest price, and farmers gain better remuneration

Distribution of income by market segments (USD/lb)



See figure 2.3.

Responding to coffee demand in the third wave, more and more coffee growers are investing in efforts to differentiate their offering from generic coffee, adopting their own branding strategies. In addition, some coffee-producing countries are actively pursuing the branding of coffees originating from their countries in overseas markets, while associations of coffee growers and other entities have been seeking IP rights to protect their brand assets in key consumer markets – such as the Juan Valdez brand from Colombia and the Jamaican Blue Mountain Coffee label.

The case of photovoltaics

Thanks in part to supportive public policies, demand for photovoltaic (PV) systems has grown exponentially since the early 2000s. At the same time, rapid technological progress has led to dramatic reductions in the price of solar PV modules – between 2008 and 2015 alone, prices fell by an estimated 80 percent.

Cost-reducing innovations have shaped competitive dynamics in the PV value chain

The case study on the PV value chain describes how crystalline PV systems emerged as the dominant PV technology (see chapter 3). Their production entails five main stages: purification of silicon, the manufacturing of ingots and wafers, production of PV cells, assembly of modules and their integration into PV systems. The intangible assets of value chain participants largely consist of advanced technology, especially in the more upstream stages. This technology often requires specific know-how which companies keep secret, though patenting has grown rapidly, especially since 2005 (figure 7).

Companies in the United States, Germany, Japan and Australia traditionally accounted for the bulk of product innovation in the industry. However, over time PV panels and systems have essentially turned into commodities – the key competitive factor is how much electricity they can produce per dollar invested. As a result, the dynamics of the industry have been profoundly driven by strategies to reduce production costs. Successful market participants were able to lower their cost structures by investing in more powerful production equipment, realizing efficiencies through complementary process innovations and achieving large-scale production.

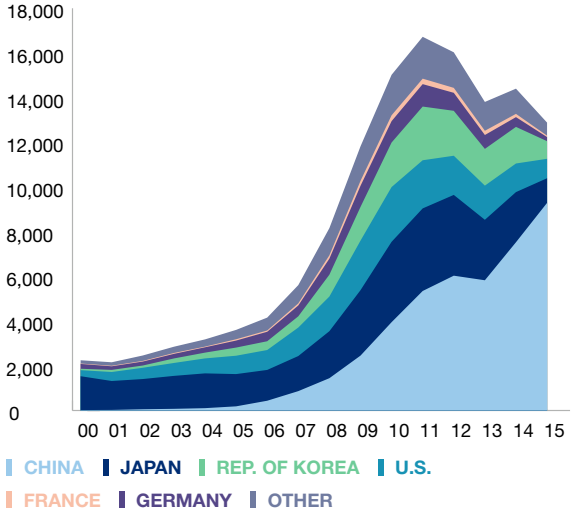
Innovation remains geographically concentrated

Innovation in PV technology remains geographically concentrated. The vast majority of PV patents are filed in China, Germany, Japan, the Republic of Korea and the United States, with Chinese innovators emerging as the largest source of patent filings from 2010 onward (figure 7). Interestingly, the distribution of patenting activity across origins varies markedly by PV-related technology, with Chinese entities, for example, focusing more on solar module technology and less on cell technology than other origins (figure 8).

Figure 7

A few country origins account for most PV patenting activity

First filings of PV-related patents by origin, 2000-2015

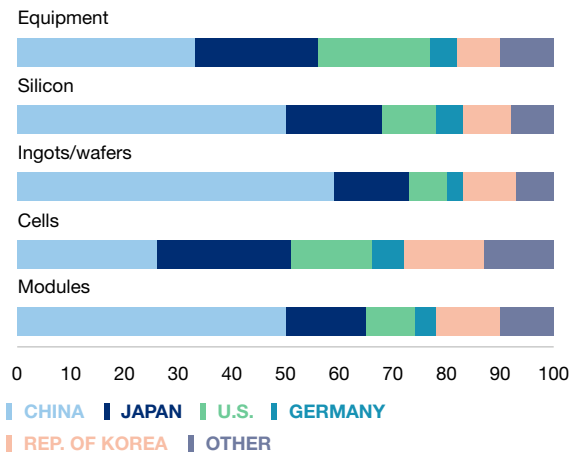


See figure 3.8.

Figure 8

The focus of patenting activity varies by country origin

Percentage distribution of first patent filings by origin and value chain segment, 2011-2015



See figure 3.10.

China has emerged as the dominant force in the PV global value chain...

Participation in the PV global value chain has shifted markedly over the last decade, in particular with the relocation of upstream and midstream production activities to China. PV products initially invented in high-income countries decades ago were no longer protected by patents, and Chinese firms successfully acquired the knowledge to manufacture PV components efficiently along the PV value chain. They did so through two main channels:

- Chinese companies acquired PV technologies by purchasing state-of-the-art production equipment from international suppliers.
- When entering the industry in the 2000s, Chinese PV companies benefited from the arrival of skilled engineers and executives from abroad, bringing technological knowledge, capital and professional networks to China.

... realigning the global PV innovation landscape

The shift in global value chain production – combined with the steep fall in prices – put many traditional PV manufacturers in the United States, Europe and elsewhere under competitive pressure, resulting in bankruptcies and acquisitions. This partly explains the decline in PV patent filings worldwide after 2011, which was driven by the traditional origins of PV innovation (see figure 7). China is the only major patenting origin to have seen continued patenting growth after 2011.

However, the picture is more nuanced. With a saturated solar PV market and low prices that result in tight profit margins, surviving firms have stepped up their investments in research and development (R&D) to develop new cost-competitive PV technology. A closer look at the patent data reveals that patent applications per applicant have continued to grow in the traditional origins since 2011, suggesting an increase in patenting among surviving firms. Indeed, among those firms patent filings have been growing faster than R&D outlays, suggesting that patent rights may well become more important in securing future returns to R&D.

A second response to market saturation and tight profit margins is for PV manufacturers to move downstream by getting involved in project development and building up reputational assets through branding activities. Such a strategy can help companies generate demand for their upstream products and increase profit margins, especially in local and less competitive service markets.

The case of smartphones

Relatively few lead firms dominate the smartphone value chain

Smartphone value chains are dominated by a relatively small number of lead firms that operate under strong brands and invest heavily in technology and product design. The case study looks at three such lead firms – Apple, Samsung and Huawei – and specific smartphone models they offer (see chapter 4). Key features of the smartphone value chain are the following:

- In addition to their own technology, lead firms source components and technology from third parties which can also be innovative. Certain components – such as phone chipsets and batteries – are highly complex and have their own global supply chains behind them.

- Lead firms require access to technology employed in interoperability and connectivity standards, such as the fourth-generation (4G) Long-Term Evolution (LTE) cellular standard. Companies such as Nokia, Ericsson, Qualcomm, InterDigital, Huawei, Samsung, NTT DoCoMo and ZTE contribute patented technologies to the development of such standards, which are defined by standard-setting organizations. Access to these technologies typically entails the payment of licensing fees.

- Smartphones require a mobile operating system and other dedicated mobile software applications, often from third parties. Samsung, Huawei and others use Android developed by Google, whereas Apple produces its own iOS system.

- In the case of Apple, assembly of the final product is performed by large original design or contract manufacturers. Samsung mostly internalizes the assembly in its own factories, while Huawei uses both internal and external assembly.

- Lead firms have their own stores as well as using third-party retailers to distribute their products to consumers, with Apple relying the most on its own stores.

Estimates of value capture show that lead firms generate substantial returns from their intangible capital – especially Apple…

To obtain insight into the return to intangibles in the case of smartphones, the case study estimates so-called value capture shares of the three lead firms. These value capture shares are conceptually similar to the macroeconomic returns to intangible capital discussed above, though there are important methodological differences reflecting the availability of underlying data.

Figure 9 shows the value capture shares for three smartphone models. For every iPhone 7 that Apple sells for around USD 809, it gets to keep 42 percent. While the value capture shares of Huawei and Samsung are comparable, Apple captures more value in absolute terms than its two competitors, reflecting the iPhone's premium price and its substantially higher sales volume. These figures underscore the high returns accruing to intangible capital in this industry, especially for Apple.

… though other firms benefit as well

It would be too simplistic to conclude, however, that only the lead firms generate returns to intangible capital. Certain component suppliers offering proprietary technology in the United States and Asia achieve significant margins, and so do technology providers such as Qualcomm, but contract manufacturers performing final assembly realize relatively low margins, reflecting the minor importance of intangible capital at this production stage. They benefit mainly from high-volume activity.

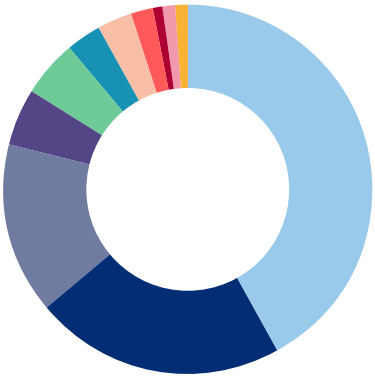
Smartphone value chain participants rely heavily on IP to generate a return on their intangible capital

The case study also sought to map IP filings to smartphone products and technology. This is exceedingly difficult. Existing patent classification schemes do not provide off-the-shelf categories for all smartphone-related inventions. Indeed, many inventions at the heart of a smartphone's functionality may not be found in the classification categories most directly associated with smartphones such as "portable communication terminals" and "telephone sets."

Figure 9

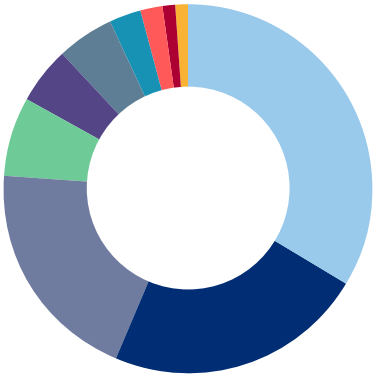
Smartphone lead firms take a large chunk of value

- 42% Apple
- 22% Cost of materials
- 15% Distribution and retail
- 5% IP licenses
- 5% Unidentified material
- 3% Other U.S.
- 3% Taiwan (Province of China)
- 2% Unidentified labor
- 1% Labor (China)
- 1% Rep. of Korea
- 1% Japan



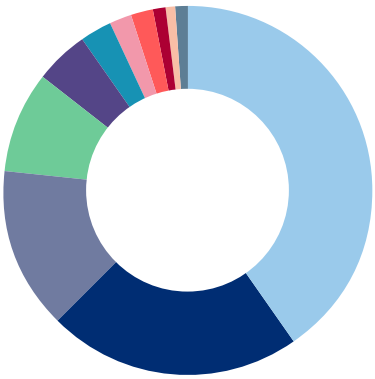
Apple iPhone 7

- 34% Samsung Electronics
- 23% Cost of materials
- 20% Distribution and retail
- 7% Unidentified material
- 5% IP licenses
- 5% U.S.
- 3% Other Rep. of Korea
- 2% Unidentified labor
- 1% Labor (China)
- 1% Japan



Samsung Galaxy S7

- 42% Huawei
- 20% Cost of materials
- 15% Distribution and retail
- 9% Unidentified material
- 5% IP licenses
- 3% Other China
- 2% Rep. of Korea
- 2% Unidentified labor
- 1% Labor (China)
- 1% Taiwan (Province of China)
- 1% U.S.



Huawei P9

See figure 4.4.

In addition, many inventions may not be unique to smartphones or may not even have been thought of as being relevant to smartphones when the patents were filed, for example global positioning system (GPS) technology. The broadest mapping approach suggests that up to 35 percent of all first patent filings worldwide relate to smartphones.

Similar difficulties arise in identifying industrial design and trademark filings associated with smartphone products. Available filing statistics show that Apple, Huawei and Samsung rely heavily on these forms of IP, but not all their filings necessarily relate to their smartphone models. One particularly fast-growing area of industrial design filing activity concerns graphical user interfaces (GUIs). At the European Union Intellectual Property Office, Apple filed 222 industrial design applications on GUIs between 2009 and 2014, while Samsung filed 379.

Value capture is geographically concentrated, but is shifting over time

Only a few country locations, mostly the United States and a few Asian countries, have captured the vast majority of value in smartphone production in recent history (see figure 9). However, the smartphone value chain is evolving dynamically, with new technology and changing consumer tastes benefiting some players and challenging others:

- Chinese market participants have rapidly upgraded their technological capabilities. Huawei, for example, has evolved from a supplier of telecommunications equipment and low-end mobile phones to a lead supplier of high-end smartphones, investing heavily in R&D and building up a global brand. Other Chinese smartphone suppliers – such as Xiaomi, Oppo and Vivo – have entered the top 10 in terms of global sales.

- Firms traditionally associated with assembly operations such as Foxconn have created their own technological edge, having spent considerable sums on R&D and building up large patent portfolios.

- Even the assembly of smartphones is undergoing constant shifts, with lead firms at times struggling to meet high demand, leading to experiments with new manufacturers or assembly locations such as India in the case of Apple and Viet Nam for Samsung.

- Participation in patent pools for newer technological standards such as LTE see relatively strong participation by Internet firms such as Google and companies from China and the Republic of Korea, notably Huawei, ZTE and Samsung.

The future of global value chains

Global value chains have emerged as the 21st-century face of international commerce. They have tied together national economies as never before and have helped integrate numerous developing countries into the global economy. How will they evolve further, and what role is there for policy to ensure that they support economic growth and rising living standards around the world?

As shown in figure 1, the world's trade-to-GDP ratio has more than doubled over the past 50 years, but it has not seen any increase since the global financial crisis unfolded in 2008. Research suggests that the stagnating trade-to-GDP ratio may well reflect diminished opportunities for global value chains to spread any further (see chapter 1). This development may suggest that greater global production sharing will not provide the same growth impetus in the future that it did in the decades prior to the financial crisis. At the same time, technological and business innovations as well as shifting consumer preferences will continue to transform global production. Most prominently, developments in 3D printing, robotics and automated manufacturing have already reconfigured supply chains in a number of industries, and further progress in these areas may well unleash more profound change. These developments may lead to the "re-shoring" of certain production tasks, implying less trade. But the deployment of such technologies could still help spur economic growth.

Whatever their causes, shifts in global value chains disrupt prevailing patterns of production – and this should be the chief concern for policymakers. Production tasks offshored abroad may lead affected workers to lose their jobs or experience declining wages. Trade protection is not the answer to such disruption. Reversing open markets could be highly disruptive in and of itself. Instead, policymakers should aim to provide a social safety net that cushions the adverse effects of unemployment and to institute measures to facilitate the retraining of affected workers.

Indeed, policies aimed at addressing disruption arising from global value chain shifts are, in principle, no different from policies that seek to address disruption naturally arising in any economy that undergoes structural transformation as part of the economic growth process.

For policymakers in low- and middle-income economies, a key question is how they can support the upgrading of global value chain production capabilities by local firms. Experience from successful upgrading in East Asia suggests that establishing a mix of policies conducive for investments in intangible assets – including through balanced IP policies – should be a key priority. In addition, governments can play a constructive role in identifying pre-existing industrial capabilities – often at the level of sub-regions – and leveraging them by removing constraints on entrepreneurial activity. In doing so, it is important to adopt a global value chain perspective as the opportunities and challenges of local entrepreneurs evolve with global market trends.

Successful global value chain upgrading in all likelihood does not entail a zero-sum game among national economies. While it may lead to the displacement of some global value chain participants, it is an inherently dynamic phenomenon. Technological change and new product cycles invariably prompt continuous reconfigurations of global value chains that create entry opportunities for some firms and may force the exit of others. In addition, successful global value chain upgrading generates economic growth that enlarges the market for global value chain outputs as a whole.