Mobile technology and economic growth

Lessons to accelerate economic growth and recovery

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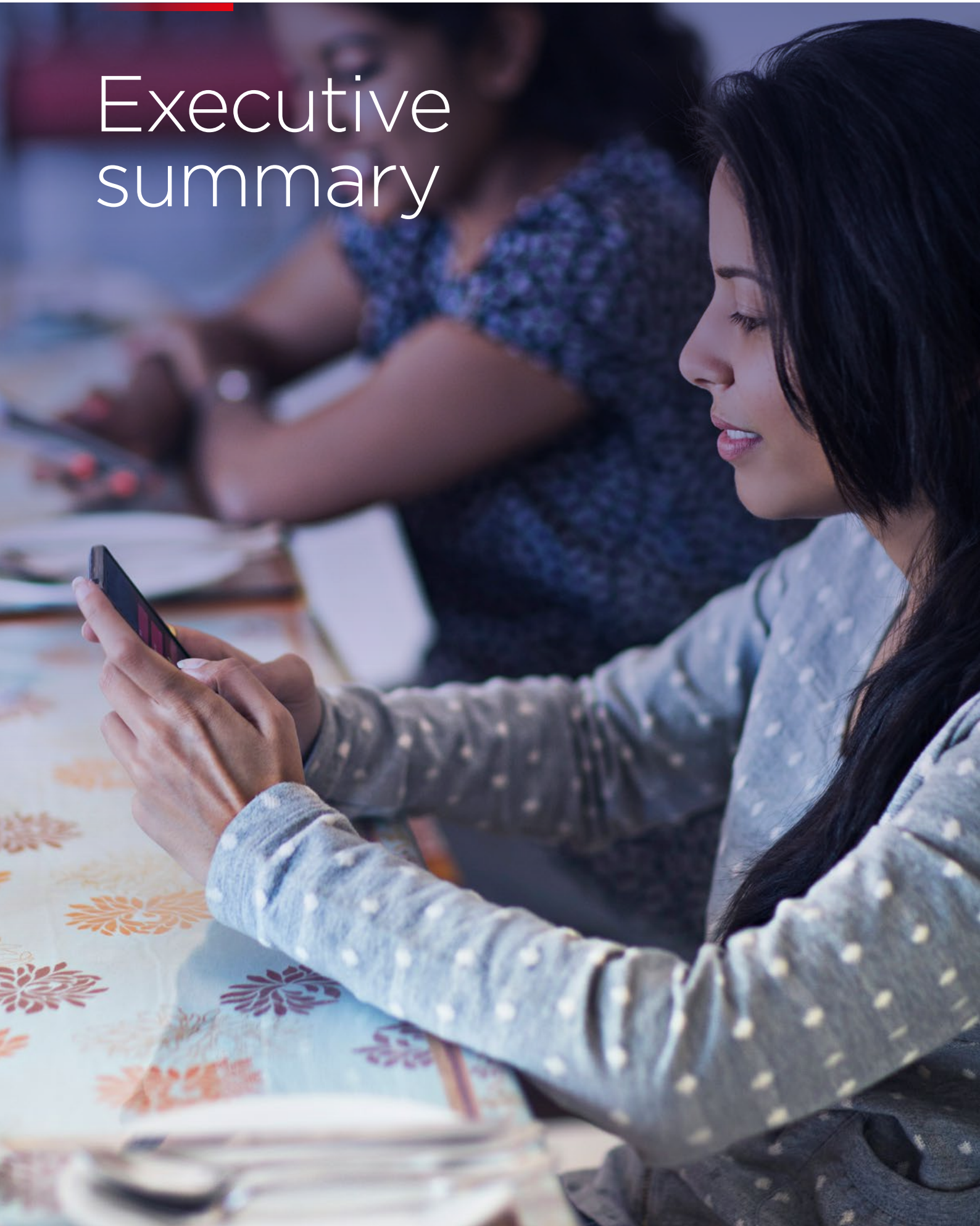
Contents

Executive summary



The COVID-19 pandemic has highlighted the world's dependency on digital technology

There has never been a greater dependency on digital technology. During the COVID-19 pandemic, digital technologies have allowed economic activity to continue, enabling new ways to deliver education and healthcare, and allowing workers and firms to maintain productivity. With half of the world's population using mobile internet, mobile technology has played a critical role in this. As such, governments across the globe are increasingly relying on mobile and digital technologies as a vital tool for short-term recovery, as well as for longer-term economic growth and job creation.

In this context, it is timely to consider what role mobile and digital technologies can have on economic growth as 5G begins to enable a new wave of economic transformation and as efforts to achieve universal internet access gather pace, especially with the full rollout of 4G in developing markets. This report provides novel evidence of the impact of mobile during the last two decades, a period which covers most of the rollout of three generations of mobile technology in both developed and developing countries.

In the last two decades, mobile technology accounted for approximately $10 of every $100 increase in income per capita

- **During 2000–2019, global income per capita increased by $3,000,[1] with mobile accounting for $300 (or 10%) of this gain.** The resulting economic stimulus expanded the global economy by over $2.4 trillion. Importantly, we find that the additional services and functionalities enabled by upgrades from 2G to 3G networks, and further innovation from 3G to 4G, generated significant increases in the benefits that economies reap from mobile technology. This has important implications for the potential benefits of 5G.

- **In relative terms, the economic impacts of mobile technology were more intense in developing countries, where they account for 4.3% of GDP (or $1.4 trillion in economic value).** In the last two decades, mobile adoption in developing countries increased from 10% to more than 100%.[2] Mobile technology had the largest impacts in Sub-Saharan Africa and Latin America, where it accounted for over 20% of the income per capita growth of the last two decades. Despite these gains, developing regions, particularly Africa, still have some way to go to reach universal connectivity. We estimate that achieving universal connectivity in Africa by 2030 would increase projected income growth this decade by 5.5%.

- **Developed countries have seen the greatest impacts of mobile in absolute terms.** Overall, benefits driven by mobile technology in developed markets equalled $1.5 trillion of economic value (2.8% of their GDP) over the last two decades. In North America and Europe, income per capita rose by $1,200 and $550 respectively, due to the expansion of mobile technology. This is 11% and 8%, respectively, of their income per capita growth throughout the last 20 years.

In the next 10 years, 5G could enable 2.1% of global income growth – playing an important role in economic recovery and future productivity growth

- **The world has now entered the 5G era.** Compared to the previous generation of mobile technology, 5G will deliver up to 100× faster data speeds, with a 10× reduction in signal response delays. This will enable a range of new and transformative use applications such as AI, virtual reality and big data. Based on current forecasts, we estimate that 5G technology could enable 2.1% of global income growth in the next decade (or $600 billion), which will initially materialise in advanced economies.

- **Driving productivity growth and economic recovery.** Such a technological change, along with the services and applications that 5G will enable, represents a significant opportunity for countries facing a structural slowdown in productivity growth. At the same time, and more immediately, mobile and digital technologies will be at the forefront of post-COVID-19 economic recovery – helping to alleviate the impacts of social distancing measures on consumers, workers and firms, as well as stimulating opportunities for job creation and activity in sectors interlinked with mobile and digital technology.

1. USD is in real terms as per 2019 throughout the analysis in this report.
2. Mobile adoption (or mobile penetration) is calculated by dividing the total number of 3G/4G connections by total population. A mobile connection is a unique SIM card (or phone number, where SIM cards are not used) that has been registered on a mobile network. A user of mobile can have multiple connections.

1. The story so far

Mobile has expanded rapidly over three technology waves, with more mobile connections than people in the world since 2019

Following two decades of mobile infrastructure deployment, the reach of mobile services today is vast. In 2019, the number of mobile connections surpassed the number of people in the world and almost half of the world used mobile internet services. Three waves of mobile technology have enabled, and improved, voice, SMS and data services (see Table 1).

Table 1. Mobile technology cycles
Source: GSMA Intelligence

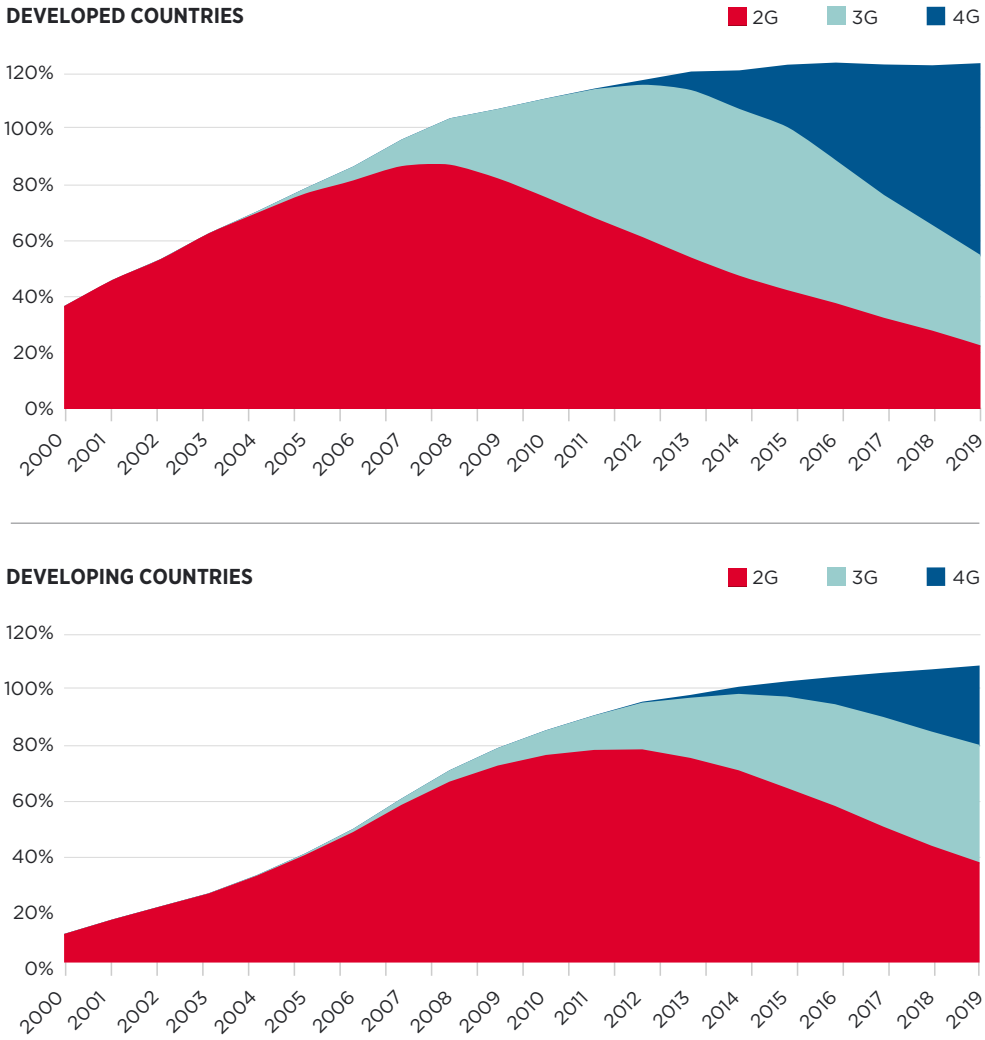
	2G	3G	4G	5G
Commercialisation period	1990s	2000s	2010s	2020s
Applications enabled	Voice calls, SMS, MMS, browsing (limited)	High-speed browsing, applications	Video conferencing, mobile TV	Multipurpose (IoT, AR/VR etc.)
Typical speed	56–115 Kbps	5.8–14.4 Mbps	100–300 Mbps	100–5,000 Mbps

At the start of the century, mobile connections represented around 35% of the population (or 35% penetration) of developed economies; this figure surpassed 120% by 2019.[3] 2G networks, which provide basic voice and SMS connectivity, rapidly expanded to reach just over 80% penetration for developed markets in the second half of the 2000s. The 3G technology cycle, which enabled the first generation of broadband internet, then took over in popularity, reaching approximately 50% penetration in the beginning of the 2010s. Broadband internet was then enhanced with the rollout of 4G networks – 4G penetration today has reached almost 70% in developed markets.

Most developing countries, meanwhile, experienced the full expansion of mobile networks during the last two decades, from very low adoption in 2000 to almost 100% penetration by 2019. Today, mobile connections from these countries represent nine out of every 10 mobile connections in the world. 2G connections in these markets reached over 70% penetration after the first decade of rollout. Since 2010, 3G and 4G technology deployments have accelerated. The adoption of these technologies, although lower than that of developed markets, is still rising. Today, 3G and 4G penetration rates in developing markets have reached 40% and 30%, respectively.

3. Mobile adoption (or mobile penetration) is calculated by dividing the total number of 3G/4G connections by total population. A mobile connection is a unique SIM card (or phone number, where SIM cards are not used) that has been registered on a mobile network. A user of mobile can have multiple connections.

Figure 1. Mobile connections penetration by technology
Source: GSMA Intelligence



Penetration is calculated by dividing the total number of 3G/4G connections by total population. A mobile connection is a unique SIM card (or phone number, where SIM cards are not used) that has been registered on a mobile network.[4] Developed countries include those classified as "High income", as per World Bank classifications in 2019, while the other categories constitute the developing countries group.

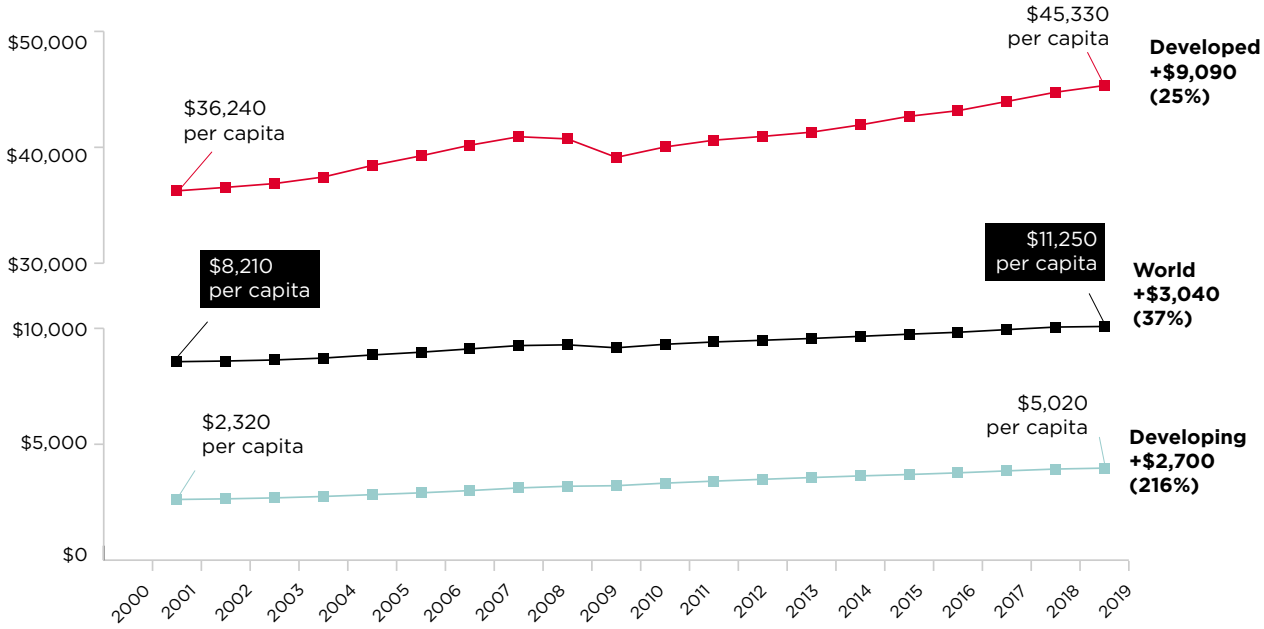
In the last two decades, the global economy has expanded by $37 trillion and income per capita has increased by more than $3,000

The addition of $37 trillion to the world's GDP since the start of the century brought it to a total of over $87 trillion by 2019, with the growth of over $3,000 per person raising GDP per capita to almost $11,250 (an increase of around 33%).

Growth in the global economy in the last two decades has been catalysed by a number of drivers. Globalisation has eliminated frictions to the global economy, with the removal of barriers to trade, fuelling an explosion of exports and a boost in investments, as well as in migration flows.[5] At the same time, ICT expansion, beginning with the rise of computers and the internet in the late 1990s, has been another key factor for economic growth, especially in developed economies, where ICT has been responsible for most of the growth in productivity.[6]

4. Connections differ from subscribers as a unique subscriber can have multiple connections.
5. The role of trade in ending poverty, World Bank, 2015
6. For instance, ICT was responsible for two thirds of total factor productivity growth in the US from 1995 to 2002, and virtually all of the growth in labour productivity (The Economic Impact of ICT: Measurement, Evidence and Implications, OECD, 2004). ICT continued to be an important source of growth afterwards: IT-using and IT-producing industries were the only source of value-added growth between 2005 and 2010 (A prototype industry-level production account for the US, Jorgenson et al., 2013 and How ICT Can Restore Lagging European Productivity Growth, ITIF, 2018).

Figure 2. Income per capita[7]
Source: International Monetary Fund, GSMA Intelligence



Income per capita has been calculated considering the entire world, or a given country classification, as a single unit (e.g. income divided by population of the world or the country category). Developed countries include those classified as "High income", as per World Bank classifications in 2019, while the other categories constitute the developing countries group.

Growth in the last two decades has been particularly strong in developing countries, where income per capita has more than doubled, from around $2,300 to $5,000. This has happened because many of these countries have intensified trade, benefited from foreign investment and imported technology, and turned their economies towards services and manufacturing.[8] For developed countries, growth in income per capita has been more modest. This has been attributed to limited increases in productivity, despite technological progress, and the stronger (and persistent) effects of the 2008 global financial crisis.[9] Still, developed economies have increased their income per capita by over $9,000, bringing it to more than $45,000 on average (a 25% increase).

As a general-purpose technology, mobile is key for long-term economic growth

The COVID-19 pandemic has highlighted how important information and communication technologies are to economies everywhere. Digital technologies have enabled more people to use or access teleworking, remote education, telemedicine and e-commerce, allowing societies continued access to work, education, healthcarex and goods and services. With more than 5 billion unique subscribers globally and almost half of the world's population using mobile internet, mobile communications has been central to this. It often serves as the main platform of access to all of these applications – especially in developing countries, where mobile accounted for 87% of broadband connections in 2019.[10]

Mobile and digital technologies are widely regarded as a general-purpose technology: an innovation that reshapes the economy, redefining the goods and services that are made, the ways used to produce them, and the functioning of the markets that serve them. Notably, mobile and digital technologies drive economic gains because they enable tools and processes for quicker, cheaper and more convenient production, which improves the productivity of firms and workers. They also lower search and information costs of consumers and producers, enabling new transactions and improving existing ones, thereby stimulating more trade and competition.[11]

7. USD is in real terms as per 2019 throughout the analysis in this report.
8. For instance, trade and foreign direct investment have driven significant growth in Asian economies (Liu et al. 2005, "Trade, foreign direct investment and economic growth in Asian economies").
9. Why productivity growth is declining, CaixaBank Research, 2018
10. ITU
11. See How ICT Can Restore Lagging European Productivity Growth (ITIF, 2018) for a more developed discussion of the economic mechanisms linking mobile and digital technologies to economic growth.

2. Economic impacts from existing deployments of 2G, 3G and 4G

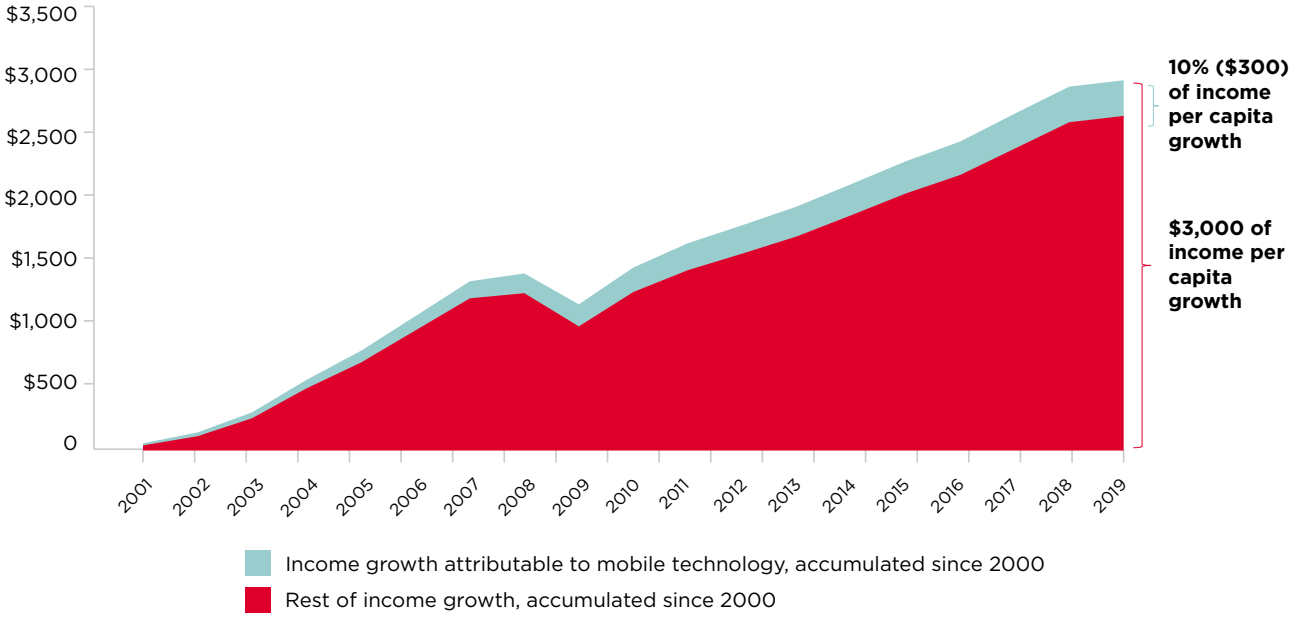
The estimates of economic benefits presented in this section are based on a recent statistical analysis carried out by GSMA Intelligence, which finds that on average a 10% increase in mobile adoption increases GDP by 1%, and the effect increases by approximately 15% when connections upgrade from one mobile network technology to another.[12]

12. See Appendix 1 for a detailed discussion

Mobile technology accounted for about $10 out of every $100 of income per capita growth from 2000 to 2019

From 2000 to 2019, approximately $300 of the $3,000 income per capita improvement was attributable to mobile technology – representing approximately 10% of overall growth. As a result, in aggregate terms, the economic stimulus from mobile technology caused the global economy to expand by over $2.4 trillion, compared to a scenario if there had been no growth in mobile adoption. This represents 6.5% of the aggregate income growth seen in this period. We note that mobile technology accounted for a larger portion of growth in income per capita because, in this period, the benefits attributable to mobile technology grew faster than income and population.[13]

Figure 3. Income per capita growth, accumulated since 2000, globally
Source: GSMA Intelligence



Income per capita has been calculated considering the entire world, or a given country classification, as a single unit (e.g. income divided by population of the world or the country category).

The benefits reaped from the additional services and functionalities enabled by 3G and 4G upgrades contributed almost $280 billion (0.7% of income growth) and $390 billion (1% of income growth) respectively to the $2.4 trillion of economic activity enabled by mobile technology. Greater economic impacts have been realised by 4G upgrades in part because the technology has had a higher level of adoption in key markets of the global economy, particularly China, when compared to the maximum adoption level reached by 3G. This shows that there have been significant economic returns from technology upgrades, and that economic impacts are not simply driven by 'first-time' connectivity.

13. This is because GDP per capita changed less in relative terms, compared to overall GDP, over the period.

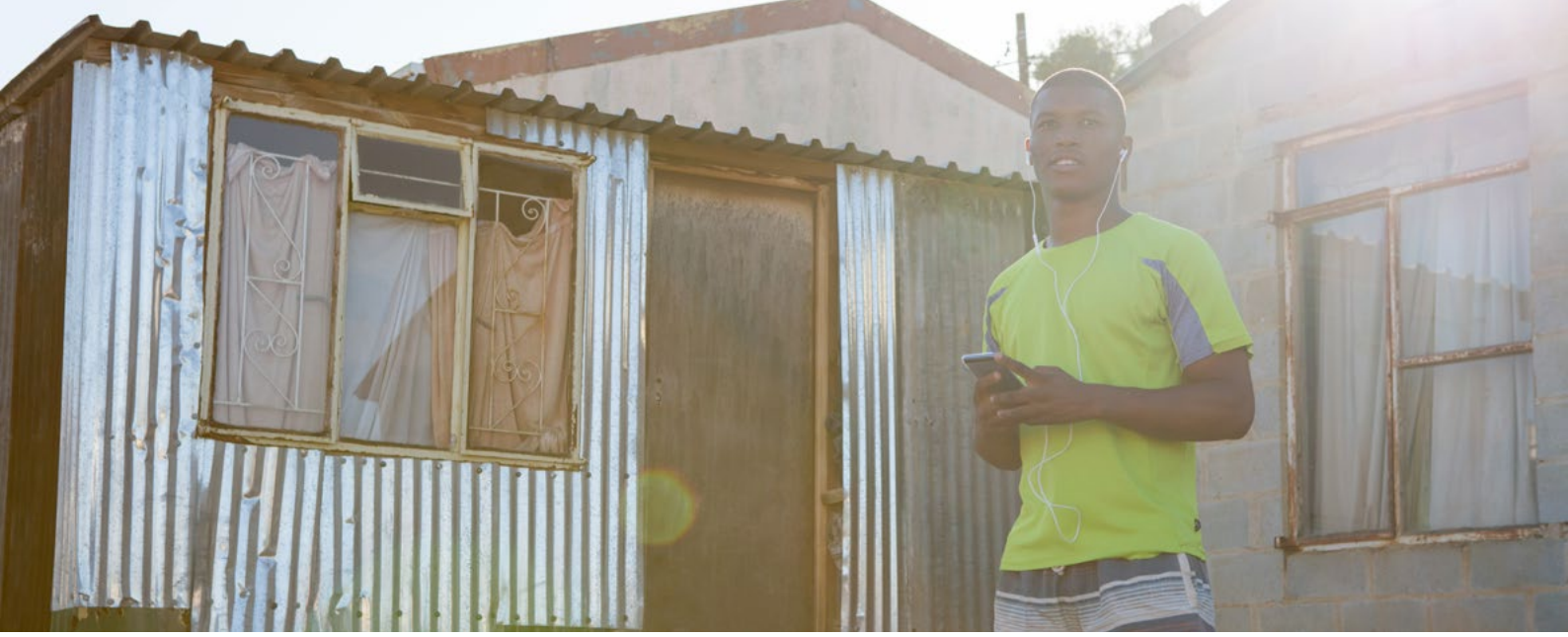
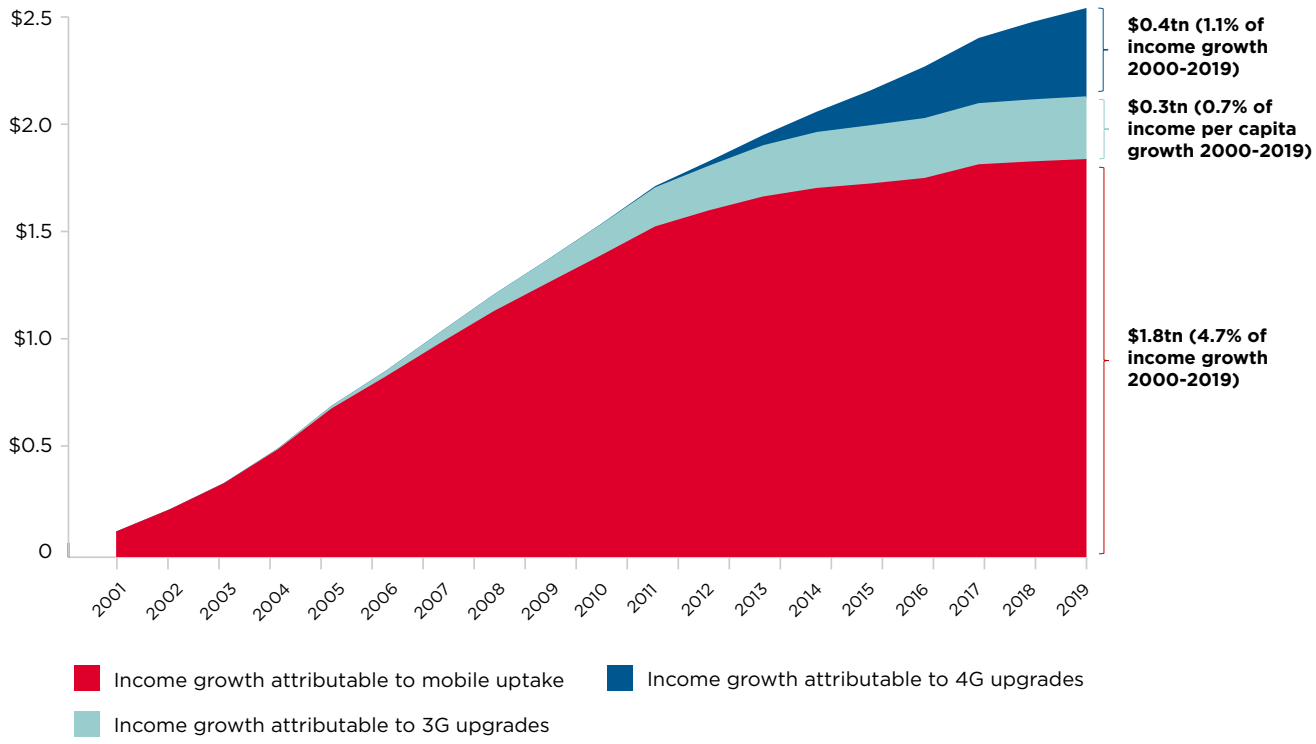


Figure 4. Income growth, accumulated since 2000, driven by mobile technology (trillion)
Source: GSMA Intelligence

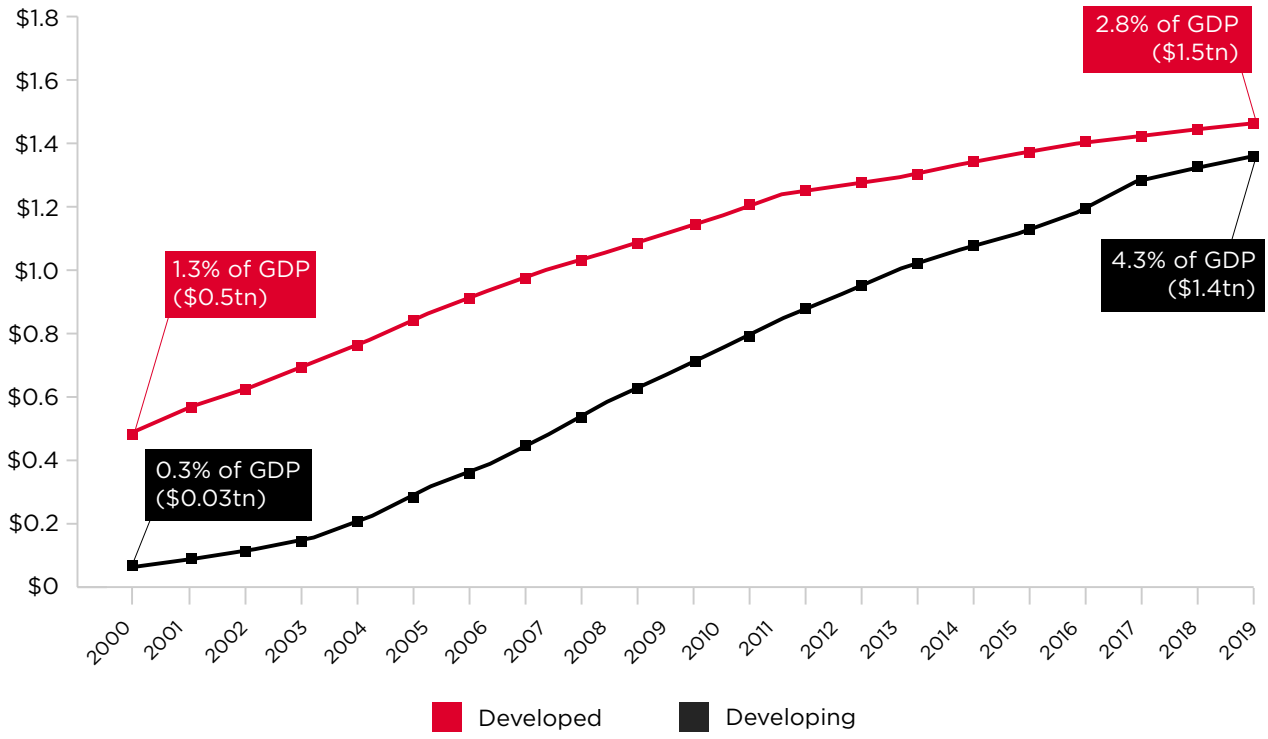


Benefits from mobile technology have been greater in developing countries in relative terms, but more substantial in developed countries in absolute terms

While it is informative to know the extent to which income grew from 2000 to 2019 as a result of mobile technology expansion, it is also important to assess how much the benefits of mobile technology weigh in the entire economy. In the last two decades, developing countries have seen benefits from mobile technology grow substantially to represent over 4.3% of their GDP – above the 2.8% in developed countries. As Figure 5 shows, however, the absolute gains of mobile technology (that is, in dollar terms) in developed markets are higher.[14]

14. This is primarily related to these economies being larger in absolute terms.

Figure 5. Overall income driven by mobile technology (trillion)
Source: GSMA Intelligence



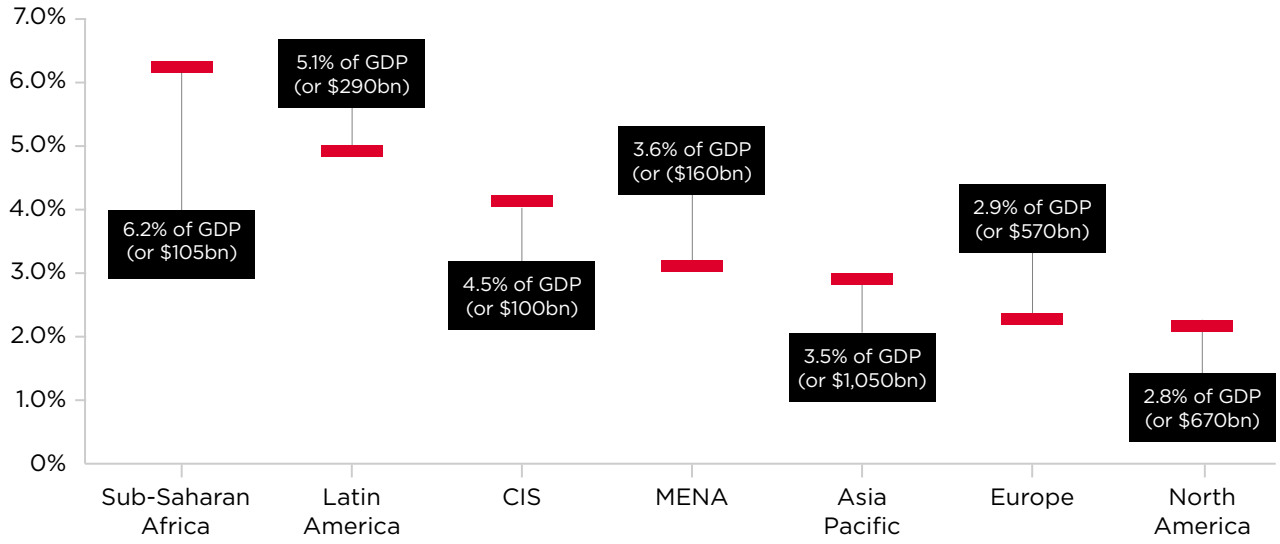
Developed countries include those classified as "High income", as per World Bank classifications in 2019, while the other categories constitute the developing countries group.

The higher relative impacts in developing markets are primarily due to the greater change in mobile adoption rates. Additionally, developing countries have deployed less fixed infrastructure, which allows mobile to drive larger impacts. They have also seen higher rates of economic growth in this period (starting from a lower base), meaning mobile was able to generate more profound effects.

Mobile technology has driven the largest benefits in Sub-Saharan Africa and Latin America in relative terms, and in Asia Pacific, North America and Europe in absolute terms

The overall economic gains of mobile technology represent, on average, 2.8% and 4.3% of GDP of developed and developing countries, respectively – but these vary by region. As seen in Figure 6, the economic impact of mobile represents the highest share of GDP in Sub-Saharan Africa (6.2%) and Latin America (5.1%). For the other regions, the overall weight of the benefits of mobile on GDP varies from 2.8% to 4.5%. Asia Pacific, North America and Europe have experienced the greatest absolute impacts, ranging from $570 billion to just over $1 trillion.

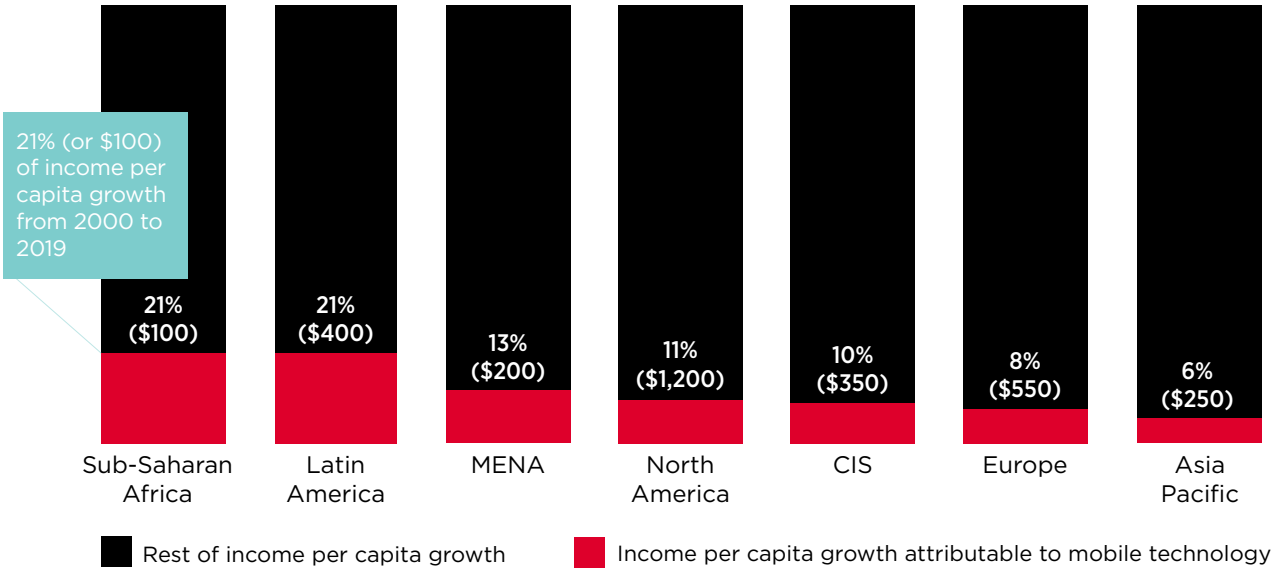
Figure 6. Overall income driven by mobile technology in 2019, by region
Source: GSMA Intelligence



Turning to income growth, mobile technology has driven the largest improvements in Sub-Saharan Africa and Latin America. From 2000 to 2019, the income per capita of these regions improved by almost a quarter, in total.[15] Over the same period, mobile adoption grew strongly, with penetration starting at low levels and increasing by 80–100 percentage points by 2019. As a result, we estimate that mobile technology accounted for around 21% of the gains in income per capita in Sub-Saharan Africa and Latin America ($100 and $400 respectively). MENA also experienced substantial improvements in income per capita due to mobile technology (13% of the income per capita improvement in the region, or $200).

15. From 2000 to 2019, income per capita in Sub-Saharan Africa increased from approximately $1,150 to $1,600 (an increase of $450). Income per capita in Latin America increased from around $7,000 to $9,000 (an increase of $2,000).

Figure 7. Income per capita growth, accumulated since 2000, by region
Source: GSMA Intelligence



Income per capita has been calculated considering the entire world, or a given country classification, as a single unit (e.g. income divided by population of the world or the country category).

Advanced economies in North America and Europe, where adoption had already begun accelerating before 2000, still saw mobile technology adoption drive 8–11% of income per capita growth. In fact, these two regions experienced the largest growth in income per capita in absolute terms – mobile technology generated an increase of $1,200 of income per capita in North America and $550 in Europe.

In the case of Asia Pacific, we estimate that the adoption of mobile technology drove 6% of income growth, which equates to an improvement of $250 in income per capita of the region. Although there was strong growth in mobile technology adoption in Asia Pacific, the gains from mobile technology have less weight on overall income growth because of China's strong economic growth.

3. The economic benefits of further mobile expansion

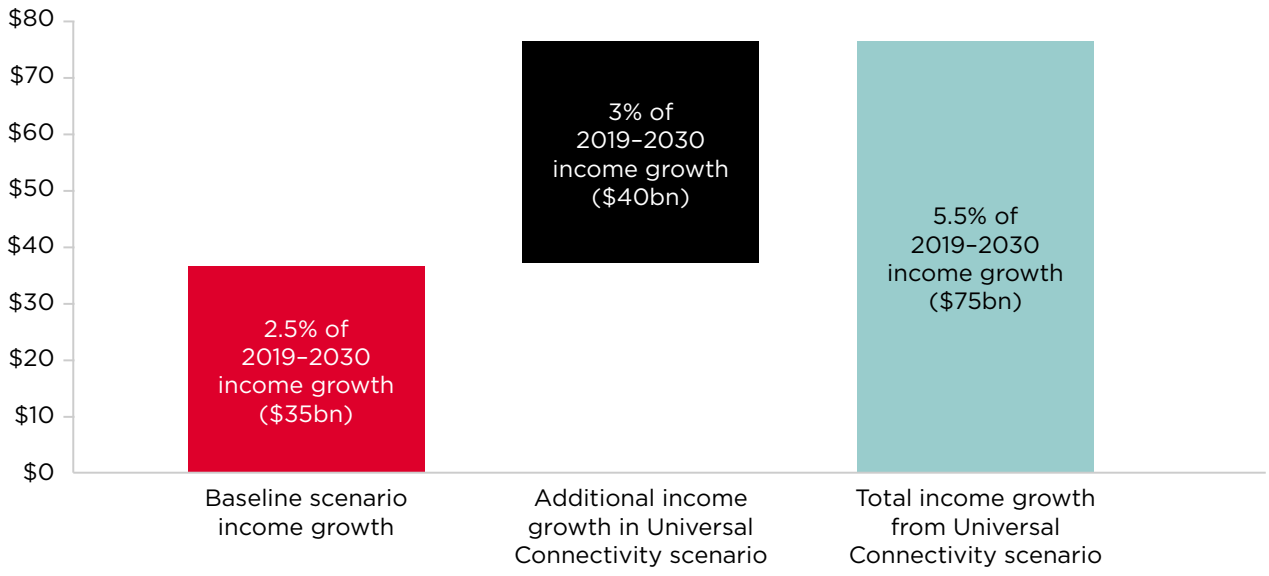
Connecting all of Africa to mobile internet by 2030 would add $75 billion in economic value, adding 5.5% to projected growth in the next decade

Africa is currently the region that lags most behind in adoption of mobile broadband connectivity, with mobile broadband penetration at less than 50% (and unique mobile internet penetration being just over 25%). This presents an opportunity to improve digital inclusion, as well as to drive economic growth, as acknowledged by World Bank's Digital Economy for Africa initiative, which aims to digitally connect every individual, business and government by 2030.[16]

If 4G penetration were to reach 100% by 2030, we estimate that this could add a total of $75 billion to the economy of the region.[17] The magnitude of this impact would represent a significant source of income growth for the next decade – around 5.5% of projected income growth.

Achieving universal mobile connectivity would double the benefits reaped from mobile technology under a business-as-usual scenario. With current deployment expectations, mobile technology is forecast to drive 2.5% of income growth during the next decade – but this could more than double to 5.5% with additional efforts geared towards achieving universal connectivity (see Figure 8).

Figure 8. Income growth in the baseline and universal connectivity scenarios, accumulated since 2019 (billion)
Source: GSMA Intelligence



The universal connectivity scenario assumes 100% of penetration of mobile broadband by 2030. The baseline scenario assumes mobile technology evolves as per current forecasts by GSMA Intelligence.

16. See **https://www.worldbank.org/en/programs/all-africa-digital-transformation**
17. This presumes that the effects of mobile technology realised in the future are similar to the effects observed in the last two decades.

In the next decade, 5G technology will enable 2.1% of income growth

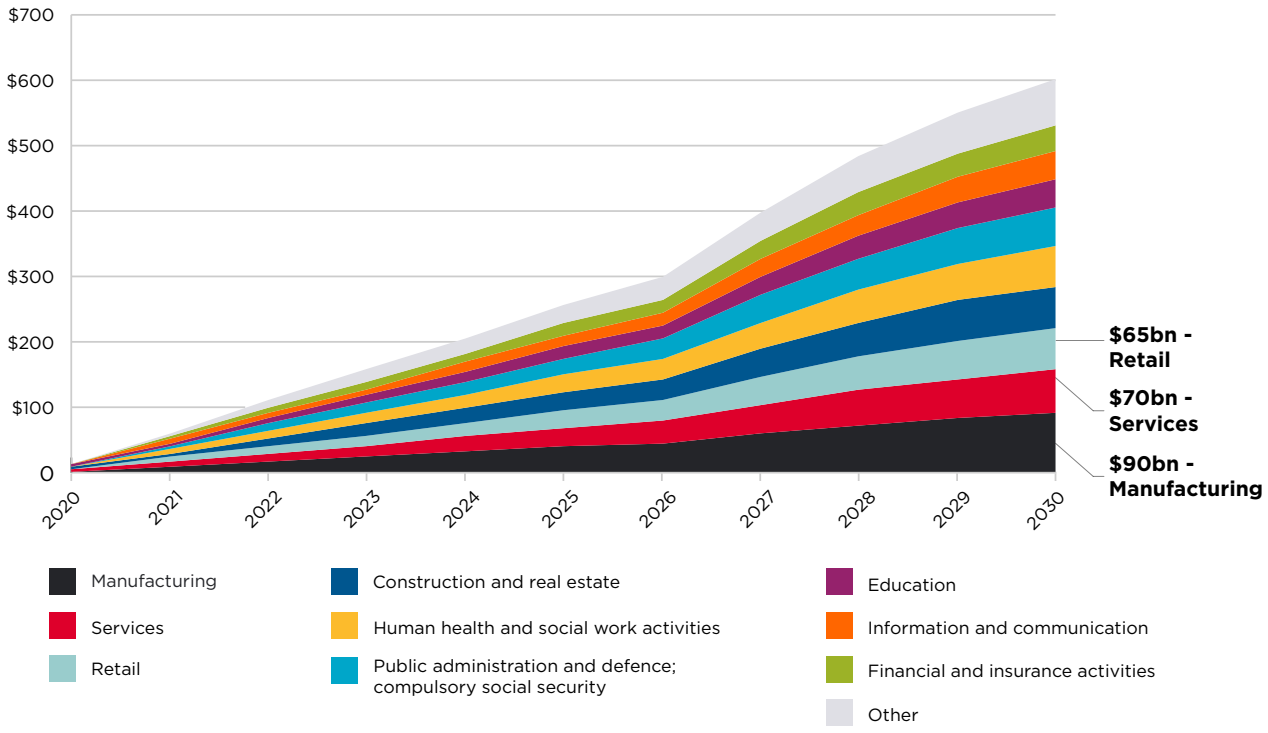
5G will provide significant improvements to current mobile services. Compared to 4G, it will provide upload and download data speeds up to 100× faster, reduce signal response delays by 10× and enable massive communications. This will create a range of new use cases in almost all sectors of the economy. Primary use cases include enhanced mobile broadband, fixed wireless access, ultra-reliable low-latency communications and massive IoT – which will in turn enable a range of transformative applications.

By 2030, we expect the upgrades of 5G and the new services enabled by 5G to add over $600 billion annually to the global economy. This will represent approximately 2.1% of the income growth expected in the coming decade, across all industries and sectors.

We estimate that the benefits of 5G in the next decade will be especially concentrated in manufacturing, services and retail. These industries will drive almost a third of the $600 billion of economic activity that will be added to the global economy.

We expect benefits to be mostly driven by these sectors because they are the primary beneficiaries of the applications that derive from the 5G use cases discussed above and are hence the most ready to adopt 5G. Moreover, the 5G applications they will adopt will be the most transformative in terms of creating additional economic value. Some examples of relevant applications enabled by 5G use cases include edge computing, augmented and virtual reality, industrial automation, connected vehicles and predictive maintenance.

Figure 9. Income growth, accumulated since 2019, driven by 5G, by sector (billion)
Source: GSMA Intelligence



4. Policy implications

Mobile and digital technology at the forefront of post-COVID-19 economic recovery

Mobile and digital technologies provide essential infrastructure that has helped to mitigate the social and economic impacts of lockdowns resulting from the COVID-19 outbreak. In this context, and as social distancing measures remain in place, mobile can continue to help boost economic activity, allowing firms and workers in key sectors (including health, professional services, the public sector, retail and education) to continue their activities. Mobile and digital technologies can also stimulate activity and job creation in sectors that are experiencing increased demand (such as IT, digital services and entertainment) and more generally in sectors interlinked with digital technology.

Facilitating conditions for 5G investments can power future productivity

- **Boosting productivity growth is critical for future economic growth.** While ICT and mobile technology have generated significant impacts, aggregate productivity growth has slowed in advanced economies over the last 20 years, including in Europe and the US.[18] 5G has the potential to help address this challenge by enabling a range of transformative applications, including AI, virtual reality and autonomous cars.

- **5G investments require a supportive regulatory and policy framework.** The speed of network rollout, as well as the adoption, reach and quality of 5G services, will be heavily dependent on an appropriate regulatory and policy environment being in place. This must include effective competition in the market and conditions that incentivise the large investments required. These conditions include access to site locations, facilitation of deployment of small cells and backhaul, and early, affordable and predictable spectrum assignments.[19]

Promoting universal connectivity, including the full rollout of 4G, will drive income and welfare growth in developing countries

- **Complementary policies to develop skills and modernise economic structures can help maximise the benefits of mobile and digital technologies.** The analysis conducted for this report found that countries with a more educated workforce and with relatively larger services and manufacturing sectors reap greater economic gains from adopting mobile. This highlights the importance of complementary policies to maximise the benefits of mobile, such as government investment in initiatives enhancing digital skills for children and adults and policies that enable enterprises (especially SMEs in services and manufacturing) to accelerate digitalisation.

- **Policymakers should identify sectors of the economy that are lagging in the use of digital and mobile technology, as these could drive significant benefits.** In both developing and developed economies, one of the causes of stagnation in productivity growth is that firms and consumers are still not equally and fully realising the benefits of new technologies and applications.[20] This suggests that policymakers should therefore focus on the economic sectors that still do not realise the full benefits from ICT and mobile technology and consider the digitalisation of the economy as a cross-governmental effort.

- **Universal connectivity requires coverage and usage gaps to be addressed, including the full rollout of 4G in developing countries.** Governments can incentivise coverage expansion with pro-investment and pro-innovation policies that reduce rollout costs. This includes removing obstacles to network deployment (at national, regional and municipal levels), ensuring access to sufficient and affordable spectrum, and providing non-discriminatory and timely access to public infrastructure. Policymakers also have an important role to play in addressing the wider usage gap by improving the affordability of mobile services and devices. This can be achieved by adopting international best practices on tax policy, investing in public initiatives that increase mobile digital literacy, and encouraging the development of a digital ecosystem of services.[21]

18. According to Syverson (Challenges to Mismeasurement Explanations for the U.S. Productivity Slowdown, 2016), the average US citizen would have earned an extra $8,400 if productivity had grown at the same rate between 2005 and 2015 as between 1995 and 2004.
19. See **The 5G Guide – A Reference For Operators (GSMA, 2019)** for a discussion of policy enablers for 5G.
20. Some analyses have found a duality between firms with high-productivity growth from new technologies, and laggard firms (e.g. The global productivity slowdown, technology divergence and public policy: a firm level perspective, Andrews et al., 2016).
21. **The State of Mobile Internet Connectivity, GSMA, 2020**

Appendix

Appendix 1 – Estimates of economic impact of mobile technology

In the study *Mobile technology: two decades driving economic growth*, we find that, on average, a 10% growth in mobile uptake increases GDP by 0.5% to 1.2%. These effects have been found to remain broadly stable in the period 2000–2017, and materialise over and above fixed infrastructure. They are also of a similar magnitude to those found in other studies.[22] We also find that 3G and 4G upgrades have driven increasing impacts. For the purposes of the calculations in this study, we have used the following:

- A central impact estimate of a 10% growth in mobile increasing income by 1%. Growth in 3G and 4G connections have been assumed to equally drive an increase in the impact of mobile of 15%.[23]

- A large body of the literature on the impacts of mobile and ICT has documented larger impacts in developing economies, relative to developed markets. In particular, several studies have found gains to be twice as large in developing countries.[24] Consistent with this, the central impact estimate of a 10% increase in mobile uptake increasing income by 1% has been implemented as an increase in income of 0.67% for developed economies, and of 1.34% for developing.

For each country, we have calculated economic benefits by applying the assumptions above to the adoption profiles of mobile uptake, 3G and 4G upgrades. Gains have been accumulated historically, year on year. Income data has been sourced fromthe International Monetary Fund (IMF), and population has been sourced from the UN. Profiles of mobile technology adoption have been taken from GSMA Intelligence.

22. Studies finding broadly aligned effects of mobile technology include Waverman et al. (2009), Gruber et al. (2011), Edquist et al. (2018) and ITU (2012, 2018 and 2019).
23. The study referenced finds that economic impact of mobile increases by approximately 15% when connections upgrade from 2G to 3G; and benefits increase by 25% when connections transition from 2G to 4G. However, these effects are found to be not statistically different. Therefore, for the purposes of the calculations in this report, we have assumed a 15% increase in benefits in both cases.
24. Studies finding gains twice as large in developing countries include Ward & Zheng (2016), Lee et al. (2012) and Waverman (2005). Other studies having found higher impacts in developing countries (or only significant in the latter) include ITU (2018), Thompson & Garbacz (2007), Chakraborty & Nandi (2011) or Dutta (2001).

Appendix 2 – Estimates of forward-looking scenarios

Economic impact of achieving universal connectivity in Africa

In the universal connectivity scenario, the penetration of mobile and of mobile broadband (4G technology) have been assumed to reach 100% by 2030, in all countries of Africa. The amount of growth in mobile technology adoption required to reach this level has been equally divided, yearly, from 2020 to 2030. On this basis, we have run the calculations explained in Appendix 1. Income data has been sourced from the IMF until 2025. This forecast has been extended to 2030 using OECD long-term income growth projections. Forecasts in mobile adoption have been sourced from GSMA Intelligence.

Economic impact of the rollout of 5G technology

5G impact assumption and GDP

We assume that growth in 5G connections generate an increase in the impact of mobile technology of 15%, in line with the assumptions used for 3G and 4G. The adoption of 5G technology has been informed by GSMA Intelligence forecasts until 2025. From 2025 to 2030, we have extended this forecast using stylised trends, on the basis of historical long-term trends in mobile network technology adoption.

The 5G productivity impact assumption is applied to a long-term GDP forecast. Between 2020 and 2024, we use GDP forecasts by the IMF. For the years 2025–2030, GDP forecasts are based on the OECD long-term GDP forecast, which is available for a number of major economies.

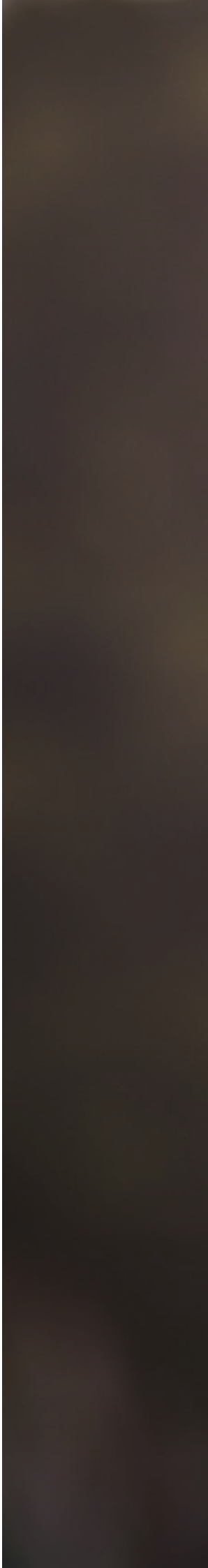
Impacts by sector

For each economic sector, we have evaluated readiness to adopt technology 5G. This has been sourced from combining benchmarking from OECD Technology and Industry Scoreboard studies[25] with desk-based research. In particular, we have evaluated how relevant 5G-enabled services and applications are for each sector. The primary use cases for 5G that we have evaluated include enhanced mobile broadband, fixed wireless access, ultra-reliable low-latency communications, and massive IoT. For each of these, we have analysed the relevance of a range of specific examples of applications.[26]

As a result of the exercise above, technology-intensive sectors, such as financial and information and communications, are characterised by a higher readiness score. Meanwhile, the agricultural sector has the lowest score, indicating that the sector is generally not well-placed to adopt new technology. The 5G readiness by sector is established globally and with country-specific analyses for major economies.

For each country, we have then analysed the weight of each economic sector and used 5G readiness to distribute the overall 5G impact that we obtained after implementing the productivity assumption discussed above. The weight of each sector on the economy has been sourced from the UN, OECD and Eurostat.

25. In particular, the paper A taxonomy of digital intensive sectors (OECD, 2018)
26. For example, for the enhanced mobile broadband use case, we have evaluated relevance of applications of data-intensive mobile connectivity, augmented and virtual reality, and broadband to public transport. Similarly, for the fixed wireless access use case, example applications include ultra-low-cost networks in rural areas, dynamic hotspots, and stationary or near-stationary monitoring networks.



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