A $2 Trillion Plan to Bring Two Billion More People into the Digital Age

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By Vaishali Rastogi, Wolfgang Bock, Maikel Wilms, Justine Tasiaux, and Kar Min Lim

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This report grew out of Boston Consulting Group's work with the World Economic Forum on accelerating digital inclusion in the new normal. It builds on a WEF playbook developed in collaboration with BCG, *Accelerating Digital Inclusion in the New Normal* (July 2020), (https://www.weforum.org/reports/accelerating-digital-inclusion-in-the-new-normal), which presents the framework for a multiyear, cross-industry program to shape policymaking and accelerate action to close the digital divide.

A $2 Trillion Plan to Bring Two Billion More People into the Digital Age

The critical importance of digital connectivity to the quality of daily life has become starkly apparent during the COVID-19 crisis. Internet access, enabled by decades of investments by telecommunications companies, has played a major role in enabling work, education, and life to continue during the recent global lockdown. Telcos' efforts to ensure that connectivity remains largely uninterrupted have generated praise from governments, business, and society.

Unfortunately, as the world increasingly moves online, the digital divide between people who don't have access to high-speed internet connectivity and those who do has also become more apparent. Telecom infrastructure limitations aren't the sole cause of this worsening problem; affordability and insufficient digital literacy add to it. Moreover, the divide isn't confined to developing nations. Its importance in the developed world has also become more visible. Joining individuals and households on the dark side of the divide are an increasing number of small and medium enterprises that lack high-speed internet connectivity.

Moreover, telcos have been facing additional financial pressure since the pandemic broke out, and they can't carry the weight of connecting the unconnected alone. A multi-stakeholder approach is essential. In this regard, the current crisis is also an opportunity. As the pandemic keeps the spotlight on the critical role of connectivity, we see unprecedented momentum to accelerate efforts to bridge the digital divide. Governments, business—including telecommunications companies—and society must seize this watershed moment to close the gap between the digital haves and have-nots, once and for all.

Reducing the digital divide by half over the next five years will require a $2.1 trillion investment, according to our research. That goal may seem dauntingly ambitious, but it can be achieved through a combination of actions driving high-speed internet adoption and revenue growth, promoting cross-sector partnerships, and optimizing technologies. If the public and private sectors collaborate and act quickly, they can provide high-speed internet access to around 80% of the world's population by 2025, compared to just 53% today. That accomplishment will be critical for economic development because high-speed internet access is no longer a luxury, but an essential need—and fundamental to work and play.

Telcos Have Made the World Go Around During the COVID-19 Crisis

Imagine, for a moment, that the COVID-19 pandemic had erupted across the world not in 2020, but at the dawn of the millennium. In 2020, as countries locked down their economies and imposed quarantine restrictions—multiple times in some cities and regions—internet usage shot up by 70%, the use of virtual communication tools rose by 10 times, and online streaming increased by more than 50%, according to several estimates.[1] How would the world have coped in 2000, with the telecommunications infrastructure and technology available then?

Our analysis suggests that 20 years ago, the world's connectivity levels would have been able to help, at most, 0.2% of the labor force to work remotely compared to the 10% of people in the global workforce who have been able to work from home in 2020.[2] Today's connectivity levels have saved from 150 million to 300 million jobs, safeguarding $8 trillion in global GDP—around twice the size of Germany's economy in 2019.[3] In the US, current connectivity levels have enabled online retailing to grow by 15% to 30%, food deliveries to rise

1. Forbes; ZDNet; Microsoft.
2. Ovum; World Bank; International Labor Organization.
3. Estimate based on Okun's law that a 1% fall in employment leads to a 2% fall in output.

by 90%, and online grocery shopping to skyrocket by 140% during the crisis—none of which would have been possible in 2000.[4] Those sectors alone have contributed $4 trillion to global GDP so far, in addition to providing an indirect boost to adjacent businesses. (See Exhibit 1.)

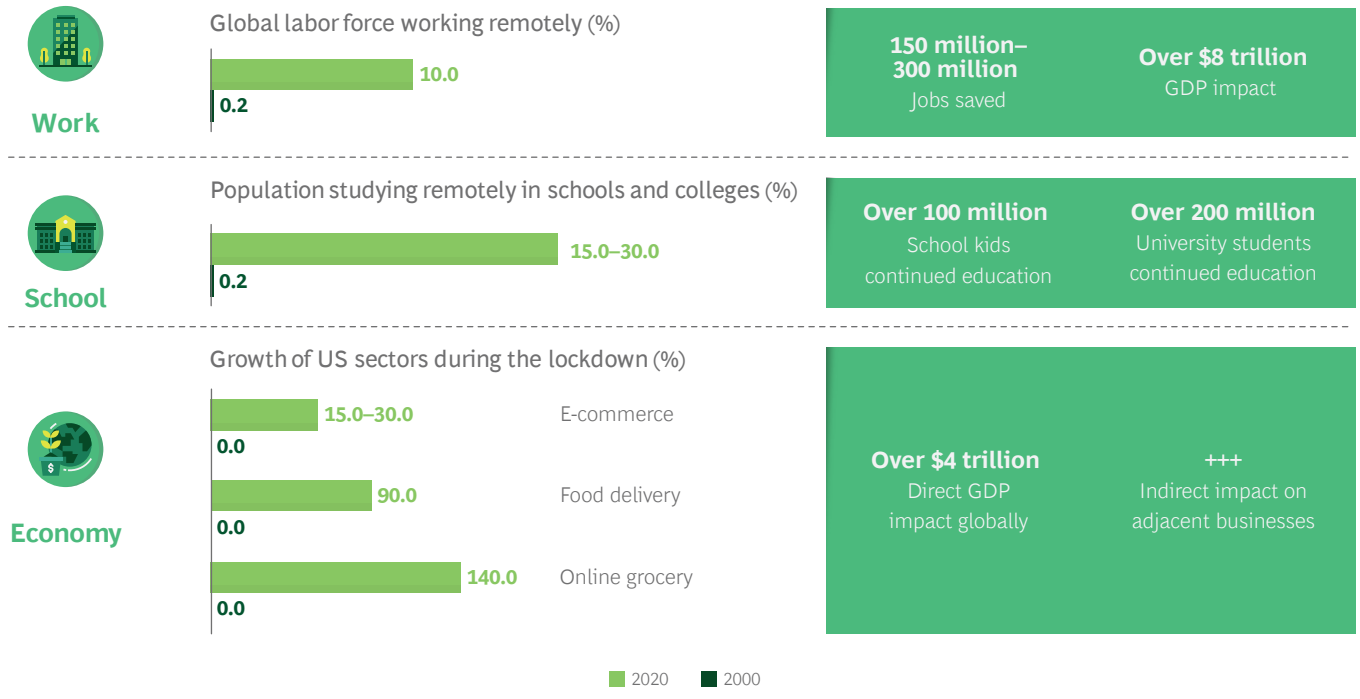
Crucially, because of connectivity, at least 100 million schoolchildren and 200 million university students worldwide were able to continue their education online despite the pandemic—more than 75 times as many as would have been possible in 2000.[5] Telcos have also provided a semblance of business as usual in several other aspects of life by enabling e-finance, e-health, and e-citizenship transactions, along with e-entertainment and socializing. Their key role in making social distancing guidelines bearable should not be underestimated. In sum, telcos have played a heroic role in the fight for normalcy amidst the economic and social paralysis caused by the COVID-19 virus.

If telcos have ensured that the world can operate in the teeth of a global lockdown, it's because of the enormous investments in infrastructure that they have made over the past two decades. Since 2000, telcos have invested more than $5 trillion to increase global connectivity. [6]

The numbers capture the impact. In 2000, less than 1% of households had access to fixed broadband, at speeds of at most 512 Kbps; but today, just over 50% of households enjoy fixed broadband, and close to half of those users access it through fiber. Similarly, whereas only 12% of the global population could access the internet over mobile devices 20 years ago—and at low speeds of 40 Kbps—now 97% can, and 85% of them do so over 4G networks that offer speeds of up to 150 Mbps under optimal conditions.[7]

Thanks to the investments that they have been making over the past two decades, telcos were able to respond swiftly and decisively to the current crisis. When demand for voice and data communications exploded, they ensured that their networks would perform at maximum capacity, reallocating capital to free up infrastructure, launching emergency rollouts, and sharing infrastructure with each other. They launched new offerings, such as free data packages for customers in the most affected areas, and supported suppliers and distributors by offering payment extensions. Forward-thinking regulators assisted in this process by facilitating access to emergency spectrum, providing consumer subsidies, and granting telcos some tax relief. Telcos worked closely with governments to en-

Exhibit 1 - Telcos Made the World Go Around During the COVID-19 Crisis



Sources: Ovum; World Bank; ILO; Statista; IMF; BCG GAMMA; Earnest Research; BCG analysis.

Note: +++ = unmeasurable additional positive impact.

4. Earnest Research; BCG GAMMA.
5. Ovum; UNESCO Institute for Statistics; Edtech Hub.
6. Capital IQ.
7. Ovum; GSMA.

able contact tracing and to broadcast public health information, and they proved to be a dependable lifeline of support during the crisis.

Telcos' quick, effective response has drawn widespread media attention. That's evident from a BCG Quid analysis (Quid is a software firm that specializes in text-based data analysis) covering over 3,000 news stories relating to telecommunications as well as public sentiment about service providers before and after the pandemic began. (See the sidebar "Understanding the Responses to Telcos' Actions During the COVID-19 Crisis.") The most-discussed topics, we found, shifted quickly from 5G-related content (40% of the number of stories before the crisis) to actions taken by telcos to tackle the pandemic—and to public approval of them.

The Crisis Revealed the Pervasiveness of the Digital Divide

Despite telcos' creditable short-term crisis response, the connectivity needs of a large underserved population remain unaddressed. The COVID-19 crisis has exposed the multifaceted nature of this challenge. The digital divide doesn't exist solely because of a lack of access to connectivity infrastructure, but also because of constraints on speed, affordability, and usage. It isn't just a developing-economy problem, but also a developed-economy issue. And the deficit isn't limited to individual access, but also affects small and medium enterprise (SME) connectivity.

Beyond Infrastructure: Gauging the Real Connectivity Gap

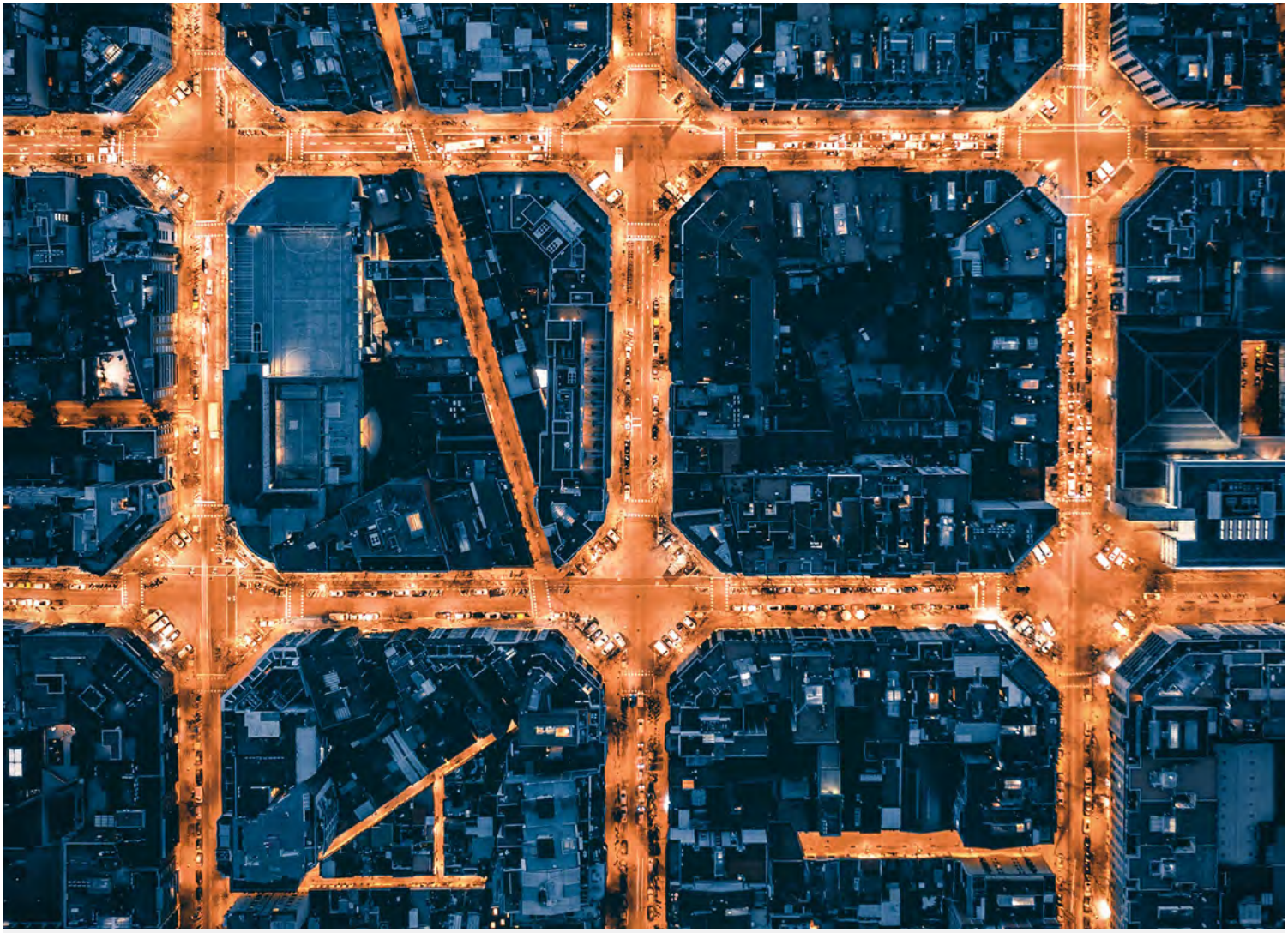
The average household requires speeds of 30 Mbps at a bare minimum, and speeds as high as 100 Mbps to support greater connectivity, better simultaneous virtual communications for work and school, and a better user experience. The population that doesn't have access to high-speed internet at or above 30 Mbps, regardless of the technology, must count as part of what we call the "real connectivity gap." Although a quarter of the world's households connect to the internet at sufficiently fast speeds through fixed broadband, and another quarter can do so via mobile, that still leaves a gap of 47% of households unconnected. The gap has three elements:

- **The Coverage Gap.** In some countries, lack of infrastructure coverage poses a challenge for a substantial part of the population. In low-income countries (LICs), 70% of households aren't yet covered by fixed broadband networks—and despite the enormous progress in coverage that has occurred in recent years, 33% are still out of reach of a 4G mobile network. In middle-income countries (MICs), the corresponding numbers can be as high as 24% and 9%, respectively, and even in high-income countries (HICs), 2% to 3% of households have no fixed-line or 4G network coverage.[8]

- **The Speed Gap.** Being connected to a fixed or mobile network is necessary for connectivity, but it isn't enough. While 51% of households worldwide have fixed broadband connections to the internet, half of them can connect only at speeds below 30 Mbps.[9] (See Exhibit 2.) These households can support, at most, one or two people on videoconferences at the same time, and in most countries the speed of the service wouldn't qualify as high-speed broadband. Mobile networks can provide high-speed connectivity in some places, raising the percentage of households connected to high-speed internet to just over 50%.[10] Mobile frequencies become congested when data consumption rises, however, and slow connections hinder people's participation in virtual activities. The speed gap forces households to make compromises about who gets to use the available bandwidth—parents who must attend virtual meetings for work, or children who need to participate in online classes.

- **The Usage Gap.** Even when broadband infrastructure is available, many people don't connect to the internet. In HICs, 8% of households covered by fixed broadband are not connected; and in LICs, the figure is 67%. Cellular 4G connectivity is more widely accessed, but a usage gap exists there too. For instance, 10% of households in LICs are covered by 4G and yet not connected.[11]

8. Income level classifications are based on gross national income per capita. High-income countries (HICs) have a per capita income of $12,376 or more; middle-income countries (MICs) have a per capita income of $3,996 to $12,375; and low-income countries (LICs) have a per capita income of $3,995 or lower. This classification reflects the 2018 World Bank income group classification and combines the two lowest income categories into a single one. The coverage gap estimate is based on data from these sources: the Study on National Broadband Plans in the EU; the Nigerian National Broadband Plan; Ovum; GSMA.
9. Ovum.
10. GSMA; Ookla Speed Tests.
11. The usage gap estimate is based on data from these sources: the Study on National Broadband Plans in the EU; the Nigerian National Broadband Plan; Ovum; GSMA.

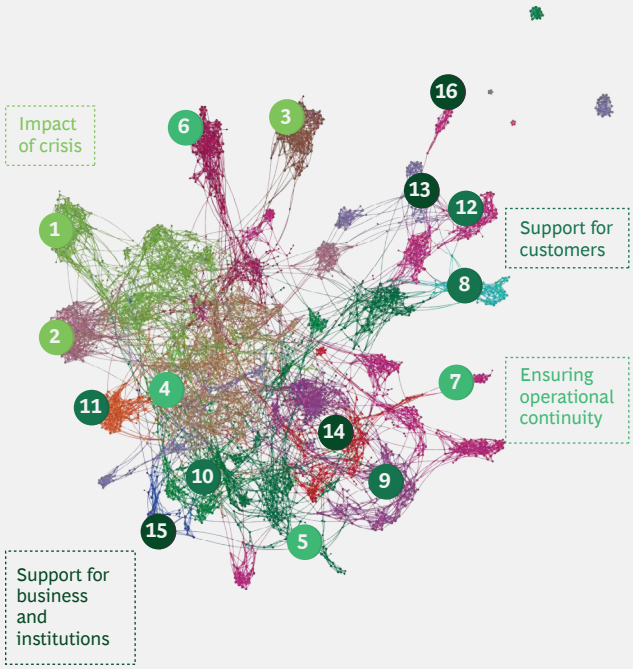


Understanding the Responses to Telcos' Actions During the COVID-19 Crisis

To understand the actions that the world's telecommunications companies took during the COVID-19 crisis and the global response to them, BCG partnered with Quid, a data analytics and visualization firm that uses artificial intelligence to map the connections in large text data sets. We used Quid to analyze over 3,000 articles relating to telecom operators globally from February to May 2020, identify the key topics and key words used in the publications, and represent them on a map. (See the exhibit.)

In this exhibit, each node on the map represents a publication, and its size is a function of the number of connections it has with other connections. Nodes that share common key words and text are linked. Multiple linked nodes form clusters, which represent publications connected by unique keywords. Clusters that appear in close proximity (such as 10 and 15) suggest a high level of integration between their themes, while clusters that appear in relative isolation (such as 16) have few connections with other clusters.

Telcos Garnered Kudos for Their Quick Actions During the COVID-19 Crisis

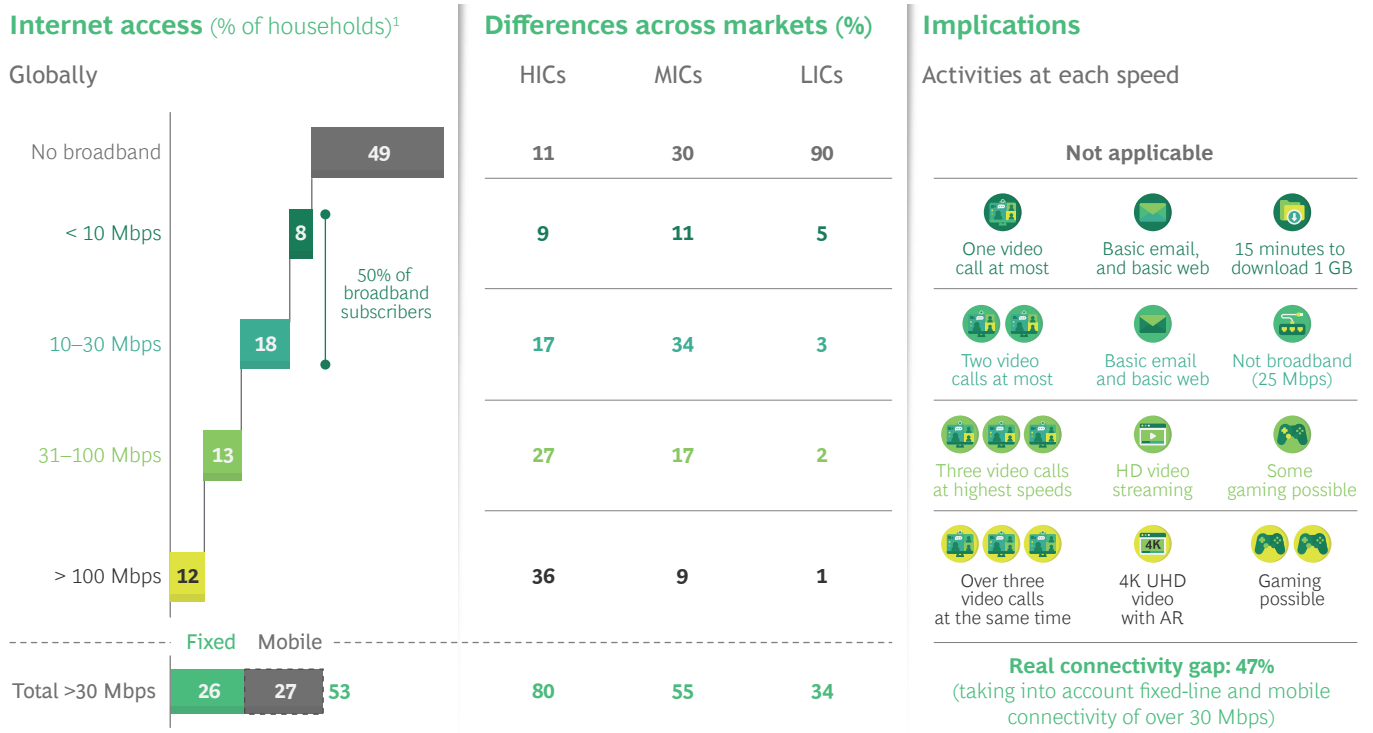


	ID	Categorization	Share (%)	Media sentiment
Impact of crisis	1	Financial impact	14.0	Neutral
	2	Stock exchange impact	5.5	Very negative
	3	Impact on telecom events and conferences	3.6	Very negative
Ensuring operational continuity	4	Packages and/or free data for employees	13.0	Positive
	5	Surge in network traffic	11.0	Positive
	6	5G	6.8	Neutral to negative
	7	Closure of retail stores and move to online	0.5	Positive
Support for customers	8	Packages and/or free data for customers	10.0	Very positive
	9	Transaction/late fees waiver	9.6	Positive
	10	Telecom relief funds/donations	5.0	Very positive
	11	Data protection and privacy concerns	2.4	Neutral
	12	Extension of bill payments/validity	1.9	Very positive
Support for business and institutions	13	New digital tools for COVID-19	6.9	Positive
	14	Tools and/or free data for education	4.7	Very positive
	15	Health care: free data, digital solutions	1.7	Very positive
	16	Partnerships with insurance providers	0.2	Very positive

Source: BCG Quid analysis.

Note: Nodes are colored and labeled by cluster (publications bound by unique keywords) and sized by degree. The data comes 3,094 stories about telecom operators, including Airtel, AIS, América Móvil, AT&T, Axiata, China Mobile, China Telecommunications, Deutsche Telekom, Etisalat, Globe Telecom, Mobile TeleSystems, MTN, NTT, Ooredoo, Orange, Reliance Jio, Safaricom, SingTel, Softbank, STC, Swisscom, Telefónica S.A., Telenor, Telkomsel, Telstra, TIM, VEON, Verizon, Viettel, and Vodafone.

Exhibit 2 - Low Connectivity Speeds Have Made for a Larger Digital Divide



Sources: FCC; Frontier; WBIS; BCG analysis.

Note: Because of rounding, the percentages shown may not add up to 100. Calculations assume one subscription per household. AR = augmented reality; HIC = High-income country; LIC = low-income country; MIC = middle-income country; UHD = ultra-high definition.

One key reason for the usage gap is affordability. Although the prices of offerings have continuously declined in the telecom industry over the past decade, affordability remains an issue for a substantial part of the population, particularly when gaining effective access to services entails using prohibitively expensive devices. For example, an average person in an LIC would have to spend more than a month's wages to buy a cheap smartphone and five months' wages to buy a laptop. (See Exhibit 3.)

Income inequality within a country only amplifies the problem: The bottom 20% of the population in HICs would have to spend more than a month's wages for a basic laptop—rendering it unaffordable to them—and the corresponding numbers are six months' wages for the bottom 20% in MICs and eight months' wages for the bottom 20% in LICs.[12] In addition, meeting minimum performance and device standards to support remote working and education may require more-expensive devices or additional investments in platforms and software, driving prices further out of reach.

Lack of digital skills and literacy is another factor underlying the usage gap. Over 60% of people in MICs and LICs don't have basic computer skills—such as knowing how to use the copy-and-paste function in a document to copy and move a file, how to send email messages with attachments, or how to transfer files between a computer and other devices. Meanwhile, in HICs, almost 60% of young people and adults don't possess the next level of standard skills, such as knowing how to use a basic formula in a spreadsheet, how to connect new devices, how to create electronic presentations, or how to find, download, and install new software.[13]

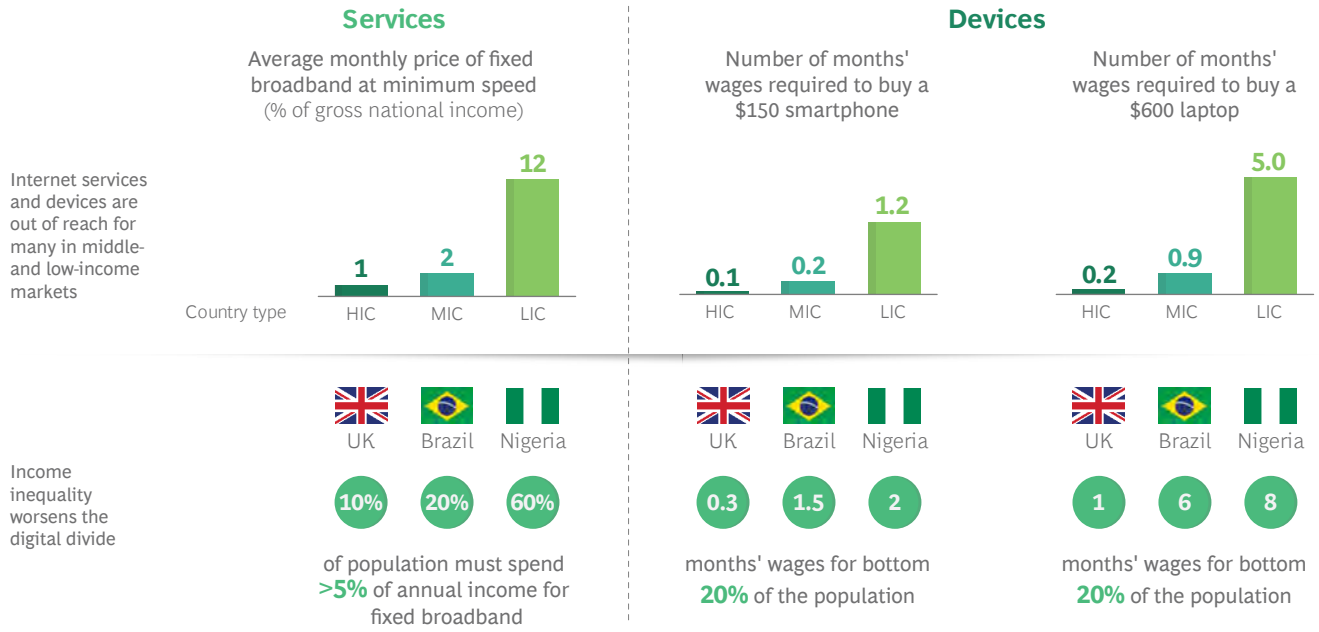
Experts began to realize the seriousness of this challenge during the recent COVID-19 crisis when many teachers seemed to lack the digital skills needed to conduct online classes. In a recent BCG survey, close to 40% of parents in HICs cited that shortcoming as an important barrier to online schooling, ranking it second behind the insufficient availability of digital infrastructure. The lack of digitally skilled teachers has major ramifications in all countries but especially in LICs, where students are at risk of losing 30% of their reading skills and 50% of their math skills if they have to forgo access to classrooms for a sustained period.[14]

12. World Inequality Database.

13. International Telecommunication Union ; UN Sustainable Development Goals.

14. CNBC.

Exhibit 3 - Affordability Poses a Major Challenge Even in High-Income Countries



Sources: Facebook EIU; World Bank; World Inequality Database; BCG analysis.

Note: Income level classifications based on GNI per capita. HIC = High-income country ($12,376 or more); LIC = Low-income country ($3,995 or lower); MIC = Middle-income country ($3,996–$12,375).

Digital literacy lags disproportionately in areas where people don't see the benefits of using the internet or the need to use it. In the absence of applications that can help them with their day-to-day lives—such as for financial services, education, or health care—people have little incentive to learn digital skills and to connect to the internet.

Beyond the Developing World: The Divide in the Developed World

The digital divide isn't just a challenge for people in LICs and MICs. It's also a problem in HICs, where 20% of households aren't connected to the internet at sufficient speeds. The COVID-19 crisis has exposed some limitations of networks in HICs, too. Because of sudden surges in traffic, from 15% to 25% of broadband users in a BCG survey of around 15,000 customers in 13 developed countries said that they had experienced at least daily disruptions to fixed broadband during the lockdown, hindering their ability to access remote work and education services. Reliance on legacy fixed broadband technologies in many HICs, in tandem with the sharp increase in remote activities in recent times, has probably overloaded several networks. In addition, the difference between urban and rural connectivity quality is notorious. Download speeds average 150 Mbps in New York City but can slow to far less usable speeds in rural areas of the country.[15]

The COVID-19 crisis has also brought to the fore the skills gaps in HICs, where only 62% of youth and adults have basic information and communications technology (ICT) skills.[16] One US teacher recently described learning how to teach remotely as being like "attempting to drive on a road that I am simultaneously paving while following a paper map"; another observed that many students struggled with technology because they didn't have desktop computers at home.[17]

15. The New York Times; BroadbandNow; BroadbandSearch.
16. International Telecommunication Union; UN Sustainable Development Goals.
17. The New York Times.

The Digital Divide is an issue for both developing and developed economies. It affects individual access and SME connectivity.

Beyond Individuals: SMEs' Connectivity Constraints

The digital divide has become tangible in business, too, with SMEs trailing far behind larger companies in digital connectivity. Less than half of SMEs have access to fixed broadband services, and only 25% offer customer service online, while almost 100% of large companies do.[18]

Only a few SMEs have managed to operate remotely during the COVID-19 crisis. As a result, the coronavirus has had a disproportionately negative impact on SMEs overall. In Japan, for instance, just 10% to 20% of employees in SMEs have been able to work virtually during the pandemic compared to more than 50% of those who work for large companies.[19] Early evidence from Hubei province in China suggests that SMEs have also been slower than large companies to reopen after the lockdown; and in France, SMEs are about 2.5 times more vulnerable to job losses and closure than their larger counterparts.[20]

SMEs play a critical role in the global economy, accounting for over 90% of businesses worldwide and half of global employment. The latter proportion is even higher in emerging markets, where they are the source of over 70% of jobs and generate more than half of national GDP.[21] Unfortunately, the gap in digital capabilities between large companies and SMEs is likely to widen. A survey of businesses in Singapore revealed that only 50% of SMEs had plans for digital transformation, compared to over 98% of larger companies.[22]

SMEs face the same connectivity barriers—including lack of infrastructure, low speeds, affordability issues, and limited digital skills—that individuals do. In many countries, cost is the top barrier to SME digitization, and a good-quality business broadband subscription can be substantially more expensive than a residential broadband subscription. Insufficient digital skills are another issue; more than a third of SMEs haven't developed the capability to create websites, use social media, or market products and services over the internet.[23]

Why the Connectivity Gap Will Worsen

Left alone, the digital divide will only worsen in the future, when digitization becomes all-pervasive. Remote working, learning, and shopping are all likely to become routine as consumers become more accustomed to conducting key activities online and as institutions prepare for future pandemics.

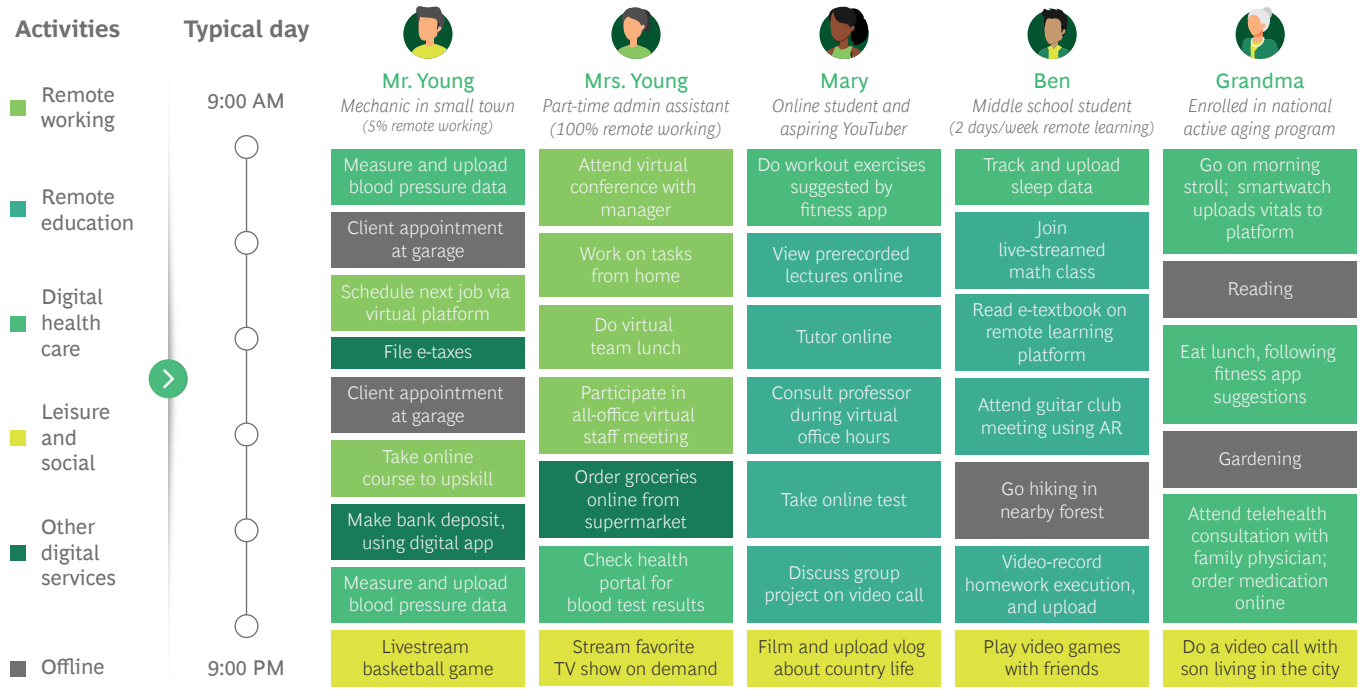
In the new normal, a typical day will see digitization embedded in every aspect of daily life. (See Exhibit 4.) Working remotely may involve attending videoconferences and virtual meetings with colleagues, as well as participating in virtual town halls that bring together employees from across the world. For children, going to school virtually—at least in part—could entail streaming prerecorded lectures, attending classes via the internet, and conducting extracurricular activities remotely with the help of augmented reality. Using a digital health care system will mean using smart devices that track your vital statistics, and pursuing online leisure activities may include watching movies on demand, live-streaming concerts, and playing video games. A host of other digital services, such as online tax return filing and electronic voting, are likely to become common.

Almost every household will need more connectivity, which will consume a larger share of home budgets and family incomes. Our calculations, which factor in the use of several applications and connectivity standards for households in different countries, indicate that families will require—in addition to sufficient devices such as smartphones and laptops—a significant increase in connectivity speeds, from 30 Mbps for households in LICs to 100 Mbps for urban households in HICs. Assuming an average household size of four, that translates into a need for bigger budgets for devices and services: from $750 to $1,000 per year in LIC households to $2,500 to $3,000 per year in urban HIC households. (See Exhibit 5.) Those numbers represent a share of from 7% to 100% of average household incomes in LICs and from 4% to 8% of average household incomes in HICs, according to our projections. The numbers thus exceed most families' affordability thresholds for internet connectivity by an order of magnitude.

Similarly, SMEs will require more infrastructure, larger budgets, and better digital skills training to adapt to the demands of the post-COVID-19 world. SMEs will need greater digital literacy and more digital resources to understand, select, and adopt software for digitization. Although infrastructure requirements will vary by size, a typical SME with 20 employees may require speeds of up to 200 Mbps with unlimited data usage. It will also need to budget for business broadband plans and, possibly, dozens of devices, additional software, and other services to support effective digital processes. That adds up to a significant expense for a small, liquidity-starved business, especially in the developing world.

18. UN Conference on Trade and Development.
19. Nikkei; The Straits Times.
20. Organization for Economic Cooperation and Development.
21. World Bank; Organization for Economic Cooperation and Development.
22. ASME-Microsoft SME Digital Transformation Study.
23. UN Conference on Trade and Development.

Exhibit 4 - Connectivity Needs Will Rise in the New Reality...



Source: BCG analysis.

Note: Some of the activities listed may take place only in the long run in the low-income countries. AR = augmented reality.

Worryingly, even as the requirements for telecom infrastructure rise, telcos' operating economics are deteriorating, and they face severe financial pressure. On the one hand, although traffic has increased, intense competition has driven down the average revenues per user from fixed-line and mobile services. On the other hand, telcos have had to maintain high levels of investment in order to deploy new technologies and offer new services. In just the past three years, telcos' free cash flows have fallen from 17% of revenues to 6%, and at the current rate of decline they could hit zero by 2025.[24] That trend will obviously limit telcos' ability to sustain investments, especially in areas where financial returns are likely to be low.

Many governments have supported the short-run provision of connectivity in their COVID-19-related relief measures, but most haven't earmarked funds for digitization in their long-term recovery plans. Fewer than half of the 18 HICs and MICs we've studied plan to invest in expanding or improving the connectivity infrastructure for rural users; just five have designated funding for SME digitization; and only two nations have announced measures to upgrade people's digital skills.[25] Only a quarter of them have set aside funds to digitize industries such as health care, education, and government. In the face of such limited government support, telcos won't be able to bridge the digital divide by themselves.

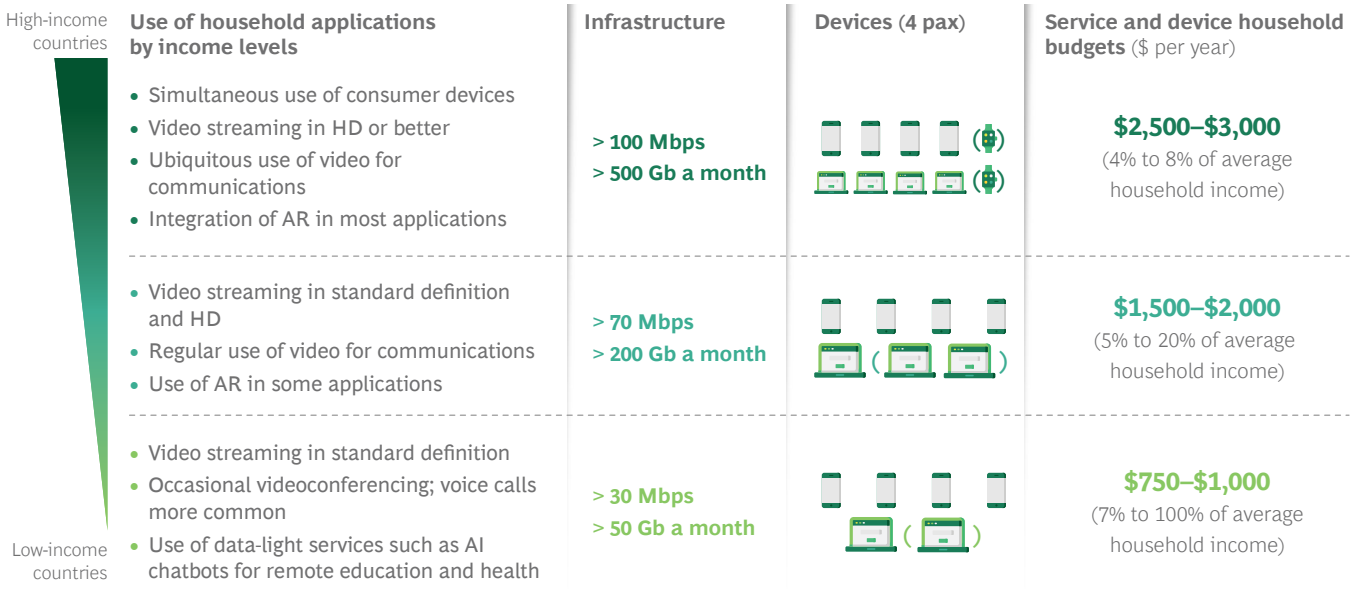
There's a crying need for a new social contract between telcos and society to ensure that providing connectivity is financially sustainable. On the one hand, investments in connectivity take a long time to generate paybacks for telcos, especially in remote and economically unrewarding areas—often more than ten years in the case of high-speed fixed or mobile coverage. On the other hand, the fillip that a country's GDP receives from investments in the connectivity infrastructure yields a much faster payback: less than two years in almost all of the countries we studied.[26] That's why a more collaborative approach across the private and public sectors is essential to ensure that bridging the digital divide doesn't exert unsustainable financial pressure on telcos.

24. Capital IQ.

25. IMF; government websites.

26. WEF-BCG report, *Financing a Forward-Looking Internet for All*, 2018.

Exhibit 5 - … And Household Digital Budgets Will Have to Rise as Well



Sources: US Census; Allianz; Eurostat; Malaysia Department of Statistics; BBVA; UNDP; ISA; WEF White Paper 2018, "Financing a Forward-Looking Internet for All"; BCG estimates.

Note: AR = augmented reality; HD = high definition; pax = per household.

Halving the Digital Divide Demands No Half Measures

Clearly, it is time for everyone to come together, identify priorities for accelerating high-speed internet penetration, and take action to reduce the digital divide. According to our calculations, around $2.1 trillion will be required to shrink the current connectivity gap by half, which will increase the percentage of high-speed internet users from 53% to 80% by 2025. That will translate into nearly 100% use in HICs, 80% use in MICs, and around 70% use in LICs. (See Exhibit 6.) It won't mark the end of the journey to universal internet access, but it will represent significant progress toward that goal.

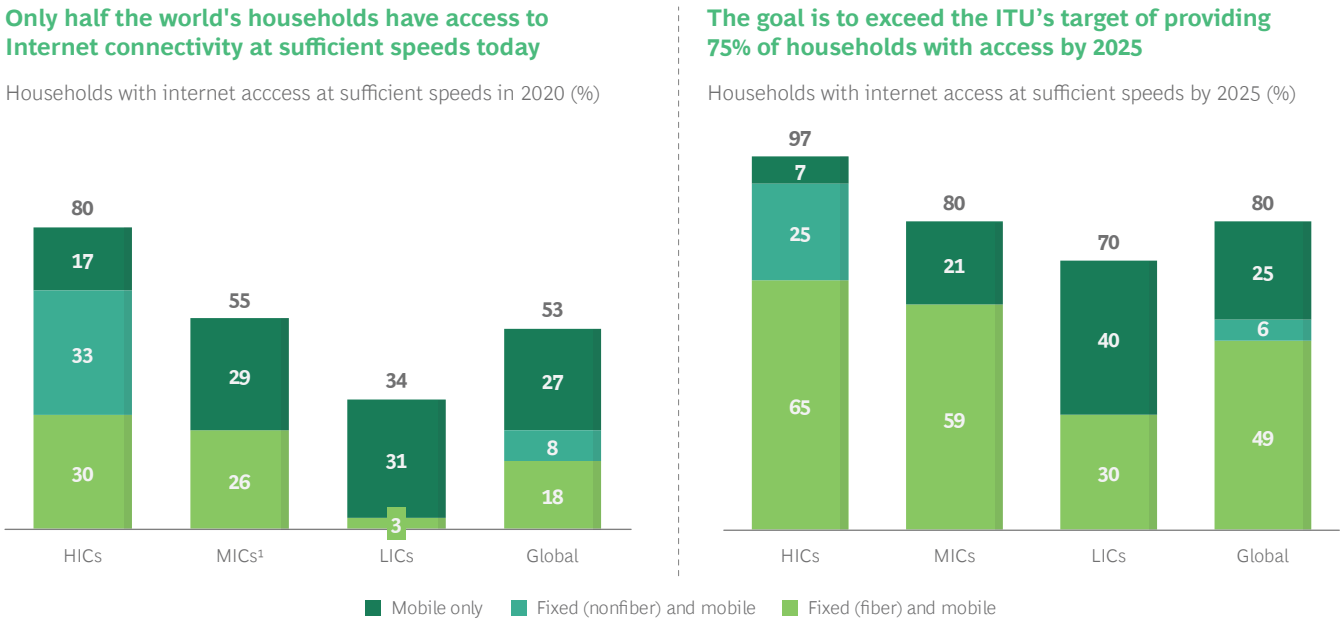
Two kinds of concurrent investments are necessary: investments in deploying and operating the infrastructure, and investments to support internet adoption. Both are critical because, as the current usage gap suggests, merely building the infrastructure won't ensure usage.

Infrastructure investments must encompass building new fiber networks and upgrading existing infrastructure, as well as increasing wireless network capacity wherever mobile networks can provide sufficient speeds more efficiently than fixed-line networks can. Around $1.5 trillion will be required to roll out and operate infrastructure in the next five years; the initial capital expenditure will account for a third of that figure, according to our estimates.[27]

In the absence of additional measures, however, only a handful of newly connected households—just 20% in LICs, for example—will adopt and pay for services. Adoption investments will ensure that all those who are covered can connect to and use the internet. These investments will increase the affordability of services and devices through direct subsidies or financing plans; build skills through digital curricula and workforce upskilling programs; and incentivize the development of key digital applications. Driving adoption and usage will require an investment of $0.6 trillion over a five-year period, and it will enable close to 600 million households worldwide to adopt and use the internet, including existing subscribers who currently lack necessary skills or suitable devices to do so.

27. Estimated from Cartesian-FTTH Study 2019; expert interviews.

Exhibit 6 - Increasing the Number of People with High-Speed Internet from 50% Today to 80% by 2025 Is Feasible



Sources: Ovum WBIS; GSMA; Ookla; World Bank; BCG analysis.

[1] If China is excluded, only 53% of people in MICs are connected at sufficient speeds—18% by fiber, and 35% by mobile.

Three Pillars Will Help Bridge the Divide

Daunting though the digital divide may seem, a combination of actions across three key pillars can get us halfway across during the next five years, reducing the number of households that lack high-speed internet access from 47% to 20%. (See Exhibit 7.) These pillars consist of driving adoption and revenue growth, fostering collaboration, and leveraging technology.

Imagine that it's 2025 and that 80% of the world's population now enjoys high-speed internet access. What actions, coupled with public- and private-sector collaboration, taken at scale during the previous five years, helped halve the digital divide? (See Exhibit 8.)

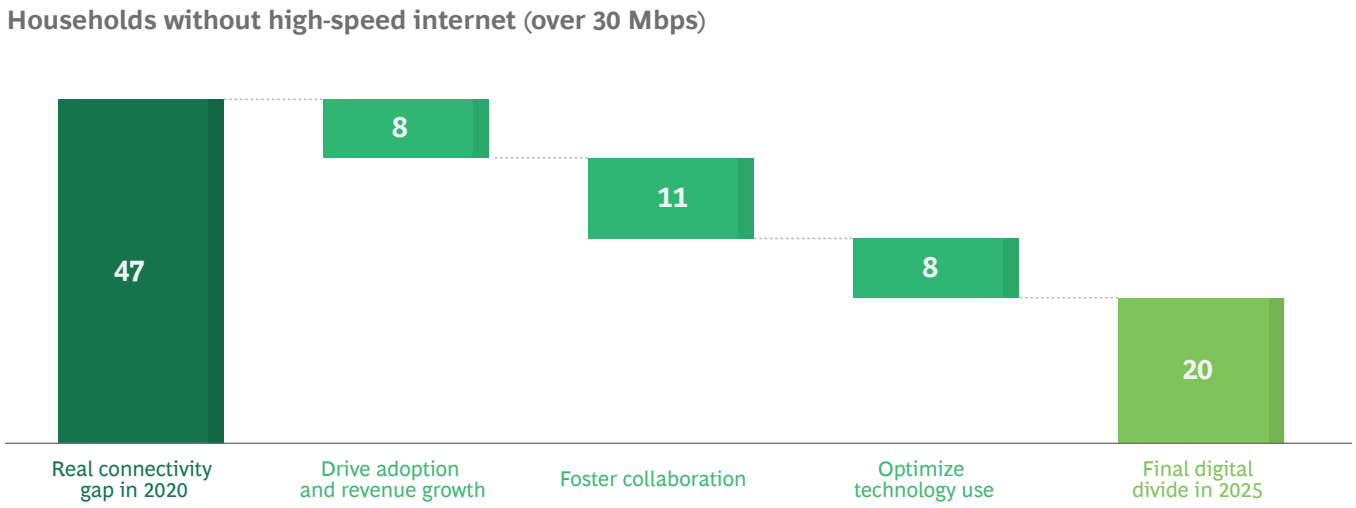
Drive Adoption and Revenue Growth

To unlock funds for infrastructure investments in underserved areas—especially areas that were not commercially viable—stakeholders had to reverse the trend of declining revenues in the telco industry and stimulate revenue growth across every channel.

Key industries digitized. The digitization of sectors that underpin basic needs—such as finance, health care, and education—generated a 30% increase in connectivity revenues from these sectors by 2025. That change had a double impact. In addition to generating additional revenues for telcos, it helped accelerate the adoption of connectivity by new users by making new applications and use cases available.

Governments played a key role in the process by incentivizing digital transformation through loans, grants, and funds, and by creating clear regulatory regimes and standards. They drove national digital strategies across sectors, and many of them appointed a minister for digital affairs to coordinate the digital transformation efforts of government agencies and industries. Governments also took the opportunity to earmark funds for cross-sector digitization in post-COVID stimulus packages in 2020.

Exhibit 7 - Three Pillars Can Reduce the Digital Divide by More Than Half by 2025



Sources: GSMA; BEREC; Deloitte; BCG analysis.

Many countries kick-started digitization in the financial services sector because of the ubiquity of financial transactions in daily lives and their potential impact on other sectors. Industry players quickly developed use cases to address target groups' biggest pain points, such as e-wallets for the unbanked and real-time price information for small farmers. To facilitate mass adoption, players worked with regulators to ensure that digital platforms were interoperable. Governments supported the creation of a conducive ecosystem by allowing companies to use digital payment systems to pay salaries and by creating digital identities to facilitate tax filing and loan applications.

SMEs went online. SME digitization increased significantly from the relatively low levels of 2020, generating a 50% increase in connectivity revenue for telcos around the world. Telcos, tech companies, and financial services players collaborated to create end-to-end offerings that simplified and facilitated digitization for smaller businesses. The offerings, described as "digital SME in a box," covered everything from connectivity, devices, and related infrastructure (such as cloud and virtual private networks) to turnkey software solutions, large-scale training, and financing mechanisms. (See the sidebar "Digital SME in a Box.") In parallel, governments catalyzed ecosystems by setting up suitable regulation standards, supporting financing and training solutions, and developing platforms to facilitate SMEs' searches for digital vendors.

Usage and adoption proliferated. As much as $600 billion was invested globally by 2025, enabling almost 600 million households to obtain devices and digital skills and to thrive in the new normal. Governments and industry players helped make devices and services more affordable by accelerating the availability of subsidies; financing microfinance, interest-free loans, and installment plans; and providing incentives to develop inexpensive devices such as the $40 smartphones offered by MTN, Safaricom, and Vodacom, among others, in Africa.[28] ICT curricula and teacher training in schools, such as India's ICT Academy, became the norm. And large-scale programs designed to retrain and upskill workers, such as the Microsoft Global Skills Initiative—which was launched in 2020—flourished.

Telcos' monetization improved. Telcos' average revenue per user increased by 1.5% over 2020, returning to previous years' levels. That was a significant first step in generating the cash needed to invest in closing the digital divide. To support a healthy telecom industry structure, governments allowed consolidation that benefited both customers and telcos. This policy followed the trend of "four-to-three" telco mergers that started in many countries in the 2010s. Telcos were able to pursue healthy pricing strategies and increase their offerings of value-added products and services to improve price realization.

28. GSMA report "Accelerating affordable smartphone ownership in emerging markets," 2017.

Exhibit 8 - The BCG 2020 Playbook to Accelerate Digital Inclusion

Drive adoption and revenue growth

Digitalize key sectors	• Incentivize digital transformation through loans, grants, and funds • Develop national digital strategies, appointing ministers for digital affairs who coordinate with agencies and business • Earmark COVID-19 crisis recovery and economic stimulus funds for digitization • Develop clear regulatory regimes, and set simple data governance, privacy, and security standards
Digitalize SMEs	• Create end-to-end offerings to help SMEs digitize without requiring significant IT expertise • Set up a conducive digital ecosystem in the form of regulations, financing, digital education, and sovereignty
Drive adoption through affordability and digital literacy	• Drive affordability through subsidies, and direct provision of service and devices • Offer creative financing models such as installment plans, payment schemes for the unbanked, and inexpensive device rentals • Promote digital literacy through ICT curricula, teacher training, and upskilling of workforce, schools, and health care institutions • Invest in developing localized applications and content as well as training local ICT talent while addressing digital gender divide
Reverse ARPU declines	• Devise and implement price optimization strategies • Offer more value-added products and services • Foster a healthy industry structure with optimal levels of competition

Foster collaboration

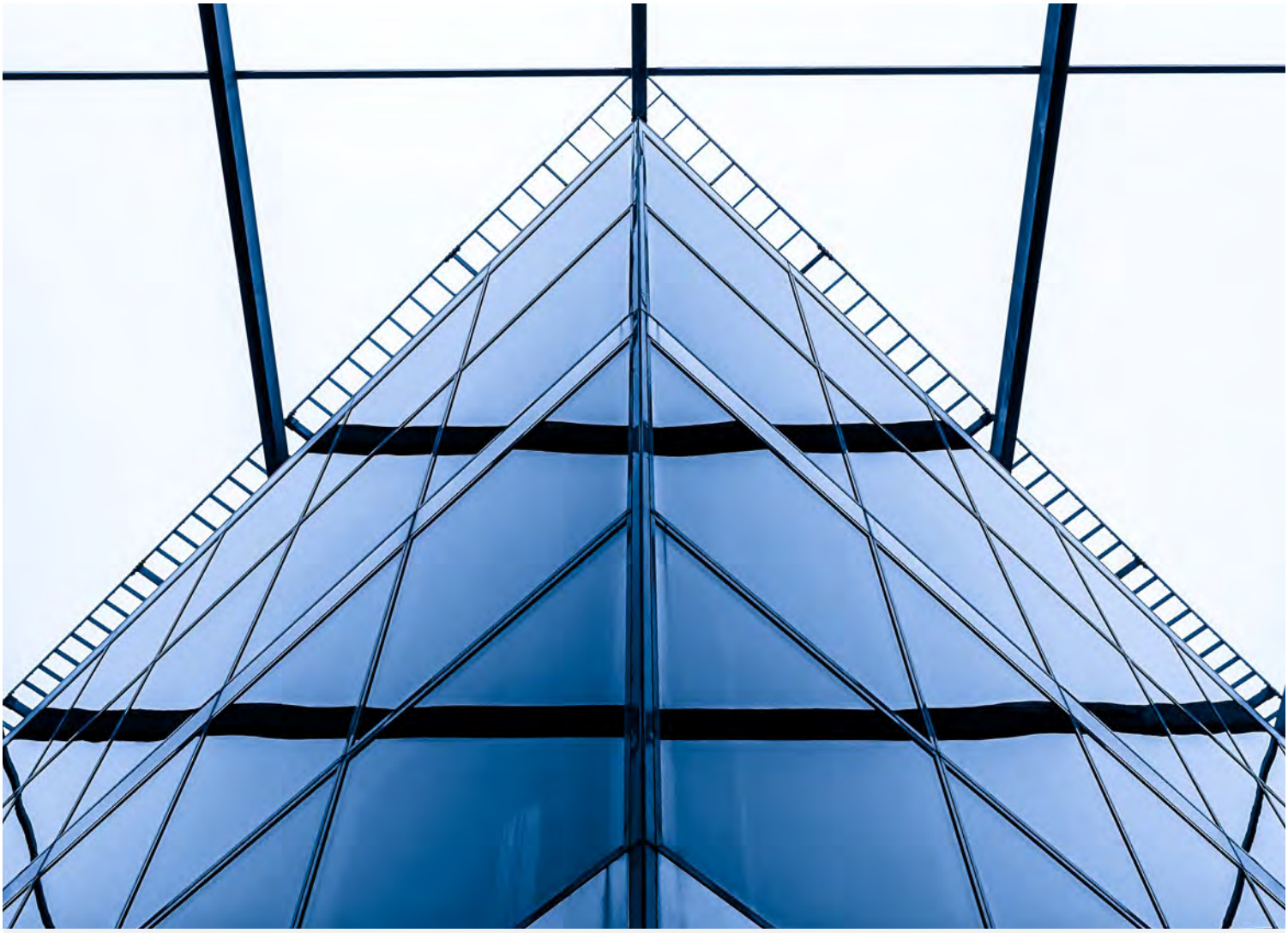
Expand Infrastructure sharing	• Promote passive sharing, such as mast sharing, and explore active sharing partnerships such as RAN or core network sharing • Test sharing models with nontraditional partners such as infrastructure or utility companies • Implement policies to facilitate sharing, such as promoting establishment of internet exchange points and small cell-sharing agreements
Develop creative financing mechanisms	• Facilitate cross-sector financing, particularly with nontraditional players eager to invest in connectivity companies such as tower companies • Devote funds from economic recovery stimulus packages to investments in connectivity and infrastructure • Explore ways to prioritize and fund essential digital services, and provide universal access in specific use cases such as schools • Review taxation policies on spectrum sharing, spectrum repurposing, small cell access, and ICT equipment to reduce spectrum costs
Reduce bureaucratic hurdles	• Simplify and streamline regulatory approval and permit processes • Incentivize stakeholders such as landlords and municipalities to agree to rollouts through subsidies and brokered agreements • Launch information campaigns to educate stakeholders, and promote benefits of infrastructure rollout

Optimize technology use

Leverage the right mix of access technologies	• Use existing terrestrial technologies such as fixed-wireless broadband access, 4G, and 5G networks • Explore nonterrestrial technologies such as satellites, drones, and high-altitude balloons as part of hybrid solutions, where relevant • Set clear, technology-agnostic performance standards
Digitalize telcos' operations	• Implement smart planning strategies and processes • Integrate automation and AI into different stages of network deployment and operations • Explore and implement new network architectures • Adopt agile ways of working to improve efficiency, productivity, and teamwork • Pursue network virtualization and centralization

Source: BCG analysis.

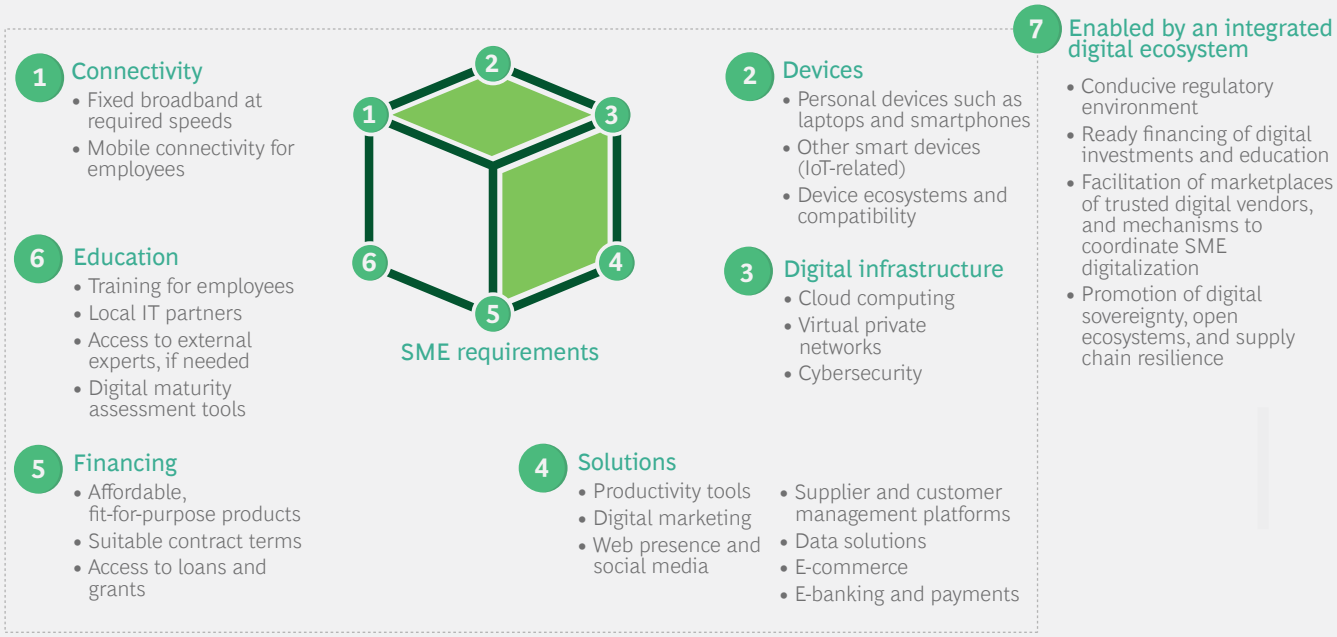
Note: ARPU = average revenue per user; ICT = information and communications technology; RAN = radio access network; SME = small and medium enterprise.



Digital SME in a Box

Most SMEs lack digital resources and knowledge. Industry players must collaborate and create holistic, end-to-end solutions that meet an SME's digital needs and are easy to implement. (See the exhibit.) As the exhibit indicates, the concept of a digital SME in a box must encompass connectivity, devices, other critical infrastructure, turnkey software solutions, financing mechanisms, and ICT education—and it should be enabled by the digital ecosystem.

A Digital SME in a Box Can Help Small Businesses Go Online



Source: BCG analysis.

Foster Collaboration

Telcos stepped up collaboration within the industry, with governments, and with other sectors, such as utilities and finance, to facilitate the deployment and financing of connectivity infrastructure.

Infrastructure sharing expanded beyond telcos. To utilize infrastructure more efficiently, especially in remote and low-density areas, telcos shared half of their fresh infrastructure building over the past five years. That strategy yielded savings of 30% to 40% in capital expenditure and operating expenses on those projects.[29] Telcos also entered into more passive partnerships, such as site and mast sharing, in settings where multiple networks weren't financially viable—as well as active sharing (of radio access networks, for example) and revenue-sharing agreements, such as those offered by Africa Mobile Networks. To supplement these traditional arrangements, telcos accelerated cross-sector partnerships. For instance, they shared fiber networks with electricity providers, following the examples set by the Relined Fiber Network in the Netherlands and the Balkans Digital Highway Initiative. Governments played a key role in catalyzing these arrangements by fostering a supportive regulatory environment and driving optimal competitive structures for the industry infrastructure.

Creative financing flowered. The telecom industry took advantage of the rising interest among infrastructure investors and private equity firms in tower companies, fiber companies, and others in the sector. In addition to promoting such investments, many governments facilitated co-investment by bundling projects into infrastructure funds; encouraging the use of infrastructure marketplaces to connect investors and players; and issuing grants and loans to reduce project risk. By tapping cheaper sources of funding, telcos reduced their capital expenditures by 2%, contributing significantly to their efforts to bridge the funds gap.

Moreover, governments set up creative ways to provide universal internet access in places where commercial ventures couldn't. They did so for specific use cases such as connecting schools in certain regions within specific time frames. Governments worked with industry players to package internet service and devices in order to provide bundles to every public school, essentially mandating access for education. To finance such projects, governments redirected funds, including some from the COVID-19 stimulus packages; disbursed unspent universal access funds; and encouraged partnerships between government and industry.

Governments reduced bureaucratic hurdles. With governments helping to resolve bureaucratic hurdles—such as objections by landlords and municipalities to installing underground cable or rooftop masts, and high right-of-way fees—the standard rollout time required for telecom infrastructure was cut in half. Governments streamlined their approval processes, incentivized consensus through subsidies and brokered agreements, and launched campaigns to educate key stakeholders. An early example of this occurred in Germany in 2020, when the federal government set up a new entity to accelerate wireless infrastructure rollout by granting permits faster and mounting a public information campaign. Collectively, those measures reduced capital expenditure by 10%.

Optimize Technology Use

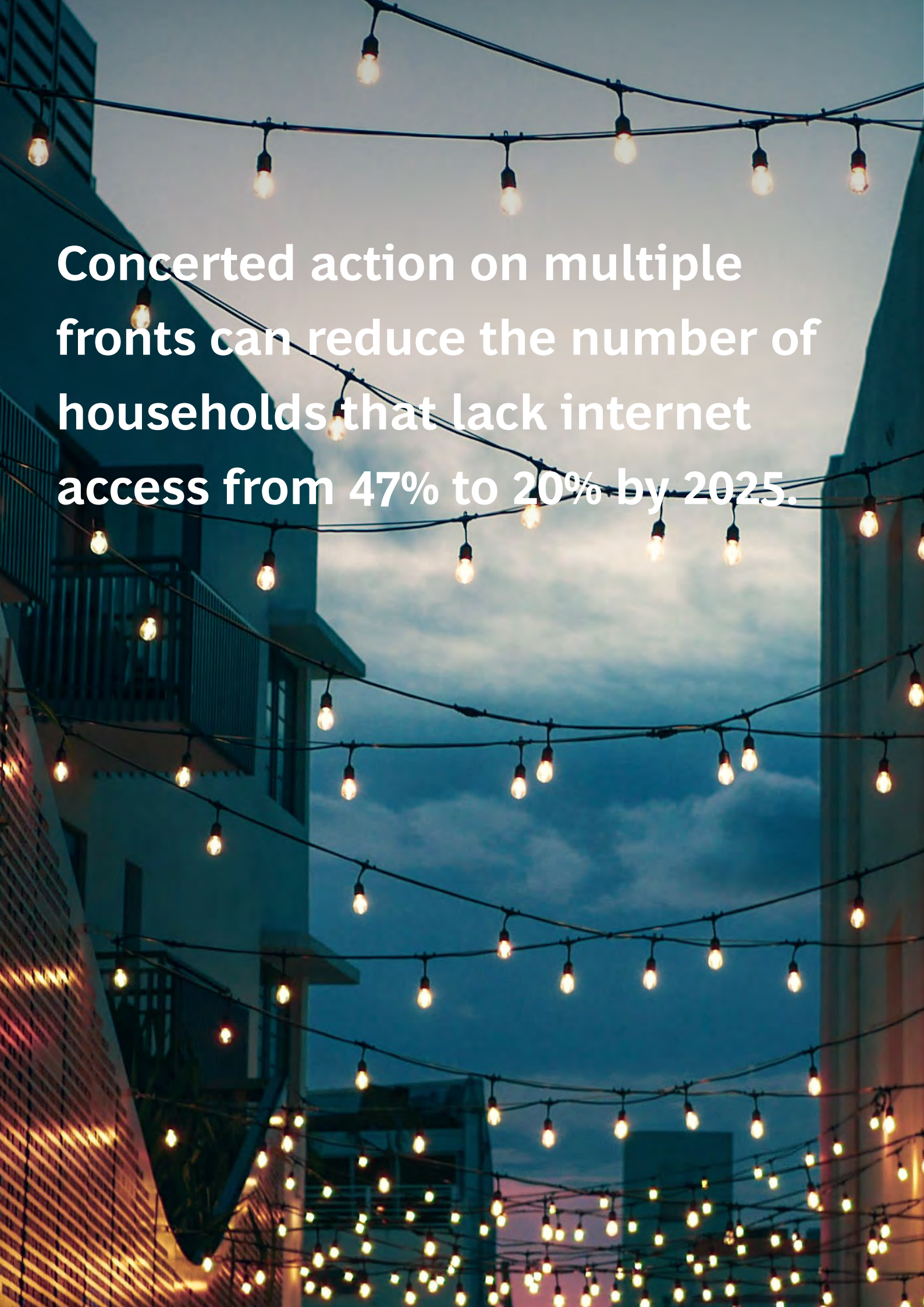
Connecting underserved areas required a mix of new technologies and existing ones, so industry players adopted a more collaborative and technology-agnostic approach to delivering global connectivity. They worked on two fronts.

Companies optimized the access technologies mix. Existing terrestrial technologies continued to roll out at scale to provide the required speeds in unserved areas, with telcos optimizing the mix of fixed-fiber, fiber-wireless access, and 4G or 5G networks, depending on geographic, demographic, and economic context. As novel, nonterrestrial solutions (such as satellites, drones, and high-altitude balloons) became more widely available, industry players incorporated them into hybrid solutions (such as Huawei's Rural Star and SES Networks' satellite backhaul) to provide access in difficult-to-reach areas. Both traditional players and newcomers collaboratively developed solutions, while governments adopted technology-agnostic standards for performance and regulatory approval.

Telcos digitized their operations. Telcos around the world switched to digital technologies in their operations to improve the economics of rollouts in underserved areas. By doing this in 50% of the new infrastructure rollouts, they reduced capital expenditures by as much as 15% and operating expenses by 10%. Specifically, telcos used smart network planning, automation and artificial intelligence (AI), new network architectures, and agile ways of working—each of which contributed to a 4% to 6% overall reduction in ownership costs.

For example, Finland's Elisa used automation to optimize the configuration, management, and operation of its networks, leveraging machine learning and AI to learn from data and build self-organizing networks. In addition, some telcos pursued network virtualization and centralization—Rakuten's network built on cloud architecture with Open-RAN, for instance—to reduce spending and broaden the ecosystem.

29. GSMA; BEREC.



Concerted action on multiple fronts can reduce the number of households that lack internet access from 47% to 20% by 2025.

As we have just shown, bringing 2 billion more people into the Digital Age will entail taking a number of discrete steps within each of the three primary pillars. Our experience suggests that several of these steps will require significant changes in companies, processes, and regulations, and may necessitate new forms of collaboration. However, each step will have tremendous impact, spurring growth and increasing efficiency to help close at least half the digital divide over the next five years.

During the recent pandemic, telcos emerged as unlikely heroes for their swift responses to the crisis as well as for the investments they had made since 2000, which enabled key activities such as work and school to continue despite lockdowns. However, the crisis has also exposed the stark digital divide that exists today. Overcoming that divide is a multifaceted challenge, spanning connectivity coverage, speeds, and usage; the developed and developing worlds; and individuals and businesses. Unfortunately, the divide will only worsen as the globe emerges from the COVID-19 crisis, so urgent action is necessary now. As the crisis drove home, there is no alternative to extending internet access and catalyzing its use by everyone.

We estimate that around $2.1 trillion will be required to halve the connectivity gap through investments in infrastructure and increasing adoption. That is a large number and suggests the need for a huge effort, but a combination of levers across three key pillars—driving adoption and revenue growth, fostering partnerships, and optimizing the use of technology—can help us get significantly closer to the objective. With strong, timely collaboration between public and private sectors, we can accelerate digital inclusion for all.

About the Authors

Vaishali Rastogi is a managing director and senior partner in the Singapore office of Boston Consulting Group and is the global leader of the Technology, Media & Telecommunications practice. You may contact her by email at rastogi.vaishali@bcg.com.

Justine Tasiaux is a principal in BCG's Singapore office. You may contact her by email at tasiaux.justine@bcg.com.

Wolfgang Bock is a managing director and senior partner in the firm's Munich office. You may contact him by email at bock.wolfgang@bcg.com.

Kar Min Lim is a project leader in the firm's Singapore office. You may contact her by email at Lim.KarMin@bcg.com.

Maikel Wilms is a partner and director in BCG's Amsterdam office. You may contact him by email at wilms.maikel@bcg.com.

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For Further Contact

If you would like to discuss this report, please contact the authors.

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