

# DIGITAL AFRICA



Technological  
Transformation  
for Jobs

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**OVERVIEW**

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**This booklet contains the overview from *Digital Africa: Technological Transformation for Jobs*, doi:978-1-4648-1737-3. A PDF of the final book is available at <https://openknowledge.worldbank.org/> and <http://documents.worldbank.org/>, and print copies can be ordered at [www.amazon.com](http://www.amazon.com). Please use the final version of the book for citation, reproduction, and adaptation purposes.**

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Cover design: Bill Praglusk, Critical Stages, LLC.

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# Foreword

As Africa's population grows, creating more and better jobs for youth will be essential for poverty reduction and shared prosperity. This report, *Digital Africa: Technological Transformation for Jobs*, makes the case for putting digital technologies at the center of a good-jobs strategy for the continent.

The report's overview of current challenges establishes that, although Africa's mobile internet availability has increased in recent years, its internet infrastructure and the quality of available services still lag behind other regions. Divides in the availability of quality digital services remain an issue in all countries, especially in remote and poorer subregions.

Additionally, Africa lags behind other regions in the use of internet services. Although 84 percent of country populations averaged across Sub-Saharan Africa live in areas where a minimal quality level of 3G or 4G mobile internet services is available, only 22 percent were actually using these services by the end of 2021.

A lack of *affordable* coverage partly explains this significant usage gap. Forty percent of Africans fall below the global extreme poverty line, and even basic mobile data plans alone can represent about one-third of their incomes. African small and medium businesses also face more expensive data plans than their counterparts in other regions.

Addressing these constraints will yield major dividends for development. The report offers robust evidence that internet availability can increase jobs and reduce poverty. Furthermore, new empirical data presented on Nigeria and Tanzania add to the rapidly growing literature about the direct impact of mobile internet availability (3G or 4G coverage) on jobs and welfare outcomes.

The new conceptual framework in this report focuses on policies that prioritize digital tools for *productive use* to generate inclusive, jobs-related spillover effects while expanding coverage of higher-quality broadband internet. These digital tools can create greater demand that, in turn, allows for increased investments in higher-quality digital and complementary technologies. Innovations are essential to attract people with fewer skills and boost their potential to generate higher earnings.

Strategic policies are critical to encourage the use of digital technologies. Interventions can include curbing excessive market power in order to drive down costs, undertaking complementary public investments, and supporting credit and demand-support programs to overcome affordability barriers and enable quality internet connectivity in underserved or remote areas. Specific data policies are also required to enable wider availability of relevant apps and to enhance trust in digital services. This report also recommends a new focus on developing more appropriate and accessible apps that support managers and lower-skilled workers so that they can learn as they work.

Digital technology is a necessary ingredient of economic transformation, and it plays a role in addressing multiple challenges from education to energy. As this report shows, it is imperative that policy makers scale up the availability and use of quality digital services across Africa to improve the lives of its citizens and unlock the potential of the continent to achieve inclusive development.



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# Acknowledgments

*Digital Africa: Technological Transformation for Jobs* is dedicated to Princeton University Professor Emeritus Robert (Bobby) Willig, in memory of his passion and excellence in developing and teaching microeconomics for improved public policies addressing social welfare. This book's focus on innovation-led productivity as a driver of inclusive jobs growth, supported by market competition in the provision of infrastructure services and grass-roots entrepreneurship, was deeply influenced by his work.

This report was prepared in support of the World Bank's Digital Economy for Africa Initiative (DE4A). It is the product of a collaboration across the World Bank's teams in the Africa; Infrastructure; and Equitable Growth, Finance and Institutions Vice Presidencies under the oversight of the Office of the Chief Economist of the Africa Region and the Office of the Chief Economist of the Infrastructure Vice Presidency. The preparation of this report was co-led by Tania Begazo, Moussa P. Blimpo, and Mark A. Dutz.

The main authors are as follows:

- *Chapters 1 and 2:* Mark Dutz, with contributions of original research for Africa from Carlos Rodríguez-Castelán and Takaaki Masaki on the effects of digital connectivity on household welfare; Xavier Cirera and Marcio Cruz on digital technology adoption by firms; İzak Atiyas on mobile internet availability and use as well as digital technology adoption by microenterprises; César Calderón and Catalina Cantú on the effects of digitalization on growth and poverty reduction; Georges Hounghonon, Justice Mensah, and Nouhoum Traoré on the effects of digital infrastructure availability on entrepreneurship and investment; Juni Zhu on digital business analysis; and Clara Stinshoff on Apptopia data analysis
- *Chapter 3:* Moussa Blimpo, with contributions from Ramaele Moshoeshe and support from Henry Aviomoh and Tchapo Gbandi
- *Chapter 4:* Tania Begazo, with contributions from Clara Stinshoff, Estefania Vergara-Cobos, Xavier Decoster, Tim Kelly, Jerome Bezzina, and Aneliya Muller, and original research by Edward Oughton, Genaro Cruz, and Kalvin Bahia on geospatial data and broadband internet in Africa

The authors are especially appreciative of the various background research papers prepared for this report and cited throughout it.

The work commenced with an internal workshop on regional digital infrastructure regulation in Africa held at the World Bank on March 28, 2019, that benefited from the participation of Penny Goldberg, Paul Klemperer, and the late Robert Willig.

The book benefited from useful guidance and advice from Simon Andrews, Haroon Bhorat, Pablo Fajnzylber, Mary Hallward-Driemeier, Daniel Lederman, Aliou Maiga, and Deepak Mishra, among others present at the book's inception and decision meetings.

The team also incorporated feedback from members of the research program advisory committee including Daniel Björkegren, Ibrahim Elbadawi, Avi Goldfarb, Jonas Hjort, Ayhan Kose, Njuguna Ndung'u, Yaw Nyarko, and Davide Strusani. The team remains grateful for their helpful suggestions.

Finally, this flagship report was conducted under the general direction of Albert Zeufack and Vivien Foster, with contributions from Andrew Dabalen. The team is also grateful for the overarching guidance received from Hafez M. H. Ghanem, Riccardo Puliti, Boutheina Guermazi, Christine Qiang, Michel Rogy, and Isabel Neto.

Beatrice Berman, Flore Martinant de Preneuf, Kelly Alderson, and Breen Byrnes provided superb communications support. Justice Mensah helped oversee the finalization of the book from the Office of the Chief Economist of the Africa Region. Nora FitzGerald, Mary Anderson, and Nora Mara provided timely editorial assistance. The World Bank's formal publishing team included production editor Mark McClure, acquisitions editor Jewel McFadden, and print coordinator Orlando Mota.

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# Main Messages

## The promise of technological transformation for a growing African workforce

Digital technologies (DTs) have emerged as an essential element of a good-jobs strategy for African countries. *Digital Africa: Technological Transformation for Jobs* presents the best available evidence on the transformative effects of DTs—showing, for instance, that internet use significantly increases inclusive jobs on the continent, which is poised to have the *largest workforce in the world by 2100* relative to other regions.

The report’s robust analysis provides strategies that can be adopted to capitalize on this growing evidence. For example, when high-quality internet (third- or fourth-generation mobile communications technology, 3G or 4G) was available for at least three years, *labor force participation increased by 3 percentage points in Nigeria and by 8 points in Tanzania*. In addition, poverty rates fell by 7 percentage points in each country. These welfare impacts were higher among poorer and less-educated households.

In highlighting results such as these, the report informs the digitalization and complementary technology adoption policies and programs that African governments can employ for *inclusive* impact—jobs that generate income growth for all, including faster per capita income growth for the bottom 40 percent of each country’s population as well as for women and for lower-skilled workers more generally. It is especially intended for technical advisers who provide input for government policies on economic transformation and growth in Africa, although it should also be of interest to all people in the region. Government beneficiaries include ministries and regulators in charge of information and communications, finance, industry (agriculture, manufacturing, and services), competition, technology and innovation, and jobs and poverty reduction.

## Africa’s digital challenges and divides

The primary challenge for Africa is its low productive use of DTs. Enterprises and households alike need *greater ability to pay for* and *willingness to productively use* these technologies, as the following findings show.

- As a share of country populations averaged across Sub-Saharan Africa, 84 percent live in areas where mobile internet services are available, yet only 22 percent used them by the end of 2021. This usage rate is the lowest in the world.
- Enterprise digitalization is also low, and small and medium businesses in Africa pay more for data plans than those in other regions, while 70 percent of surveyed micro-enterprises do not perceive the need for internet-supported technologies.

- Forty percent of Africans fall below the global extreme poverty line, meaning the cost of even basic mobile data plans would represent about one-third of their incomes. Only about 5 percent of extremely poor households access the internet.
- Africa’s lagging internet infrastructure and service quality constrain potential user willingness to use DTs. Although the region’s mobile internet availability has increased in recent years, it still lags the world’s other regions—especially regarding the quality of digital services, requiring support by reliable and resilient infrastructure.

## **Policies to boost DT use for more, and better, jobs**

Africa needs more activist policies that promote the use of digital and complementary technologies, especially affordable, attractive skill-appropriate technologies that support productive and inclusive jobs. Such policies must target all potential users’ ability to pay for these technologies as well as their willingness to productively use them.

*Policies that ensure the ability to pay* should address internet affordability, additional infrastructure availability, adequate data infrastructure, and availability of affordable complementary technologies. *Policies that support greater willingness to use* should focus on developing more attractive applications and building the awareness and education required for productive DT adoption. These policies include innovation policies, data policies and regulations, capability support programs, and national strategies for productive use of DTs.

- *Internet affordability policies* encompass effective pro-competition regulations to reduce investment costs, including rules on licensing and market dominance, infrastructure access and sharing, and spectrum availability and use, ideally through more integrated continental markets. Regulations to help drive down operational costs include rules on access to essential infrastructure controlled by state-owned enterprises, operation of open-access fiber networks, and progressive elimination of excise taxes.
- *Policies for better internet quality everywhere and for availability in areas that are not commercially viable* after implementing regulatory reforms require targeted interventions. Demand-side incentives and financing (through earmarked funds, obligations on operators, and universal service funds) can boost use, improve service quality, and support climate-resilient infrastructure development.
- *Policies for affordable availability of data infrastructure* include pro-competition rules for upgrading internet exchange points that can grow into regional data centers and cloud computing facilities to help drive down costs. Effective regional integration for cross-border digital connectivity and data markets is critical to gain economies of scale and to expand and upgrade data infrastructure.
- *Policies to support affordable access to complementary analog technologies* require broader interventions. Improvement of electricity, transportation, and agricultural (tractors and irrigation) systems would enhance the income-generation potential of DT use and strengthen potential users’ ability to pay.
- *Innovation policies* can redirect technology development toward generating and scaling up skill-appropriate DTs. To enable enterprises and households to use DTs and learn as they work, Africa must provide sophisticated, inclusive, and attractive apps

through touch-screen pictures, voice, and video in languages that local people speak. Development requires public-private investments in public goods, such as country-wide availability of digital addresses, geotagged land records, and local weather mapping, as well as public goods specific to value chains. More integrated continental markets will allow entrepreneurs to profitably design and scale attractive apps that are affordable and enhance people's earnings.

- *Data policies* are needed as both enablers and safeguards of data use and reuse to ensure the development of new, attractive, data-driven DTs, along with appropriate levels of trust in their use.
- *Capability support programs* to enhance the productive use of available DTs must be institutionalized for micro, small, and medium enterprises as well as for households. These programs include business advisory services, technology information and upgrading services, and manager and worker skills training, together with longer-term investments in high-quality secondary and tertiary education.
- *National strategies* are essential to support familiarity with and use of DTs to support higher earnings. They could include investments in common-access facilities at internet cafés, local schools, or community centers, especially for microentrepreneurs.





# Overview

## **Africa's imperative: Better technology for better jobs**

For Africa's large and growing youthful labor force to thrive, the continent urgently needs good jobs. Countries need business environments conducive to generating the kinds of jobs that enable productive learning as a basis for supporting growth in earnings over time.

Africa's jobs and technology challenges are immense and urgent. Its share of the global workforce is projected to become the largest in the world by the twenty-second century, rising from 16 percent in 2025 to over 41 percent by 2100. More than 22 million Africans between the ages of 15 and 64 join the workforce each year—almost 2 million people per month. This flow of workers is expected to increase to over 33 million per year by 2050 (UN DESA 2022). The imperative is to create good jobs for these millions of young entrants to the workforce and better jobs for today's workers. Greater adoption of improved and adequate technologies is a critical and underemphasized requirement to meet this goal. Moreover, the continent needs better technologies and products that all Africans want and can afford to buy.

Africa has the potential to generate more and better jobs through greater adoption of technologies that enable scaled-up production and hence generate good jobs in expanding medium and large firms, entrepreneurial start-ups, and informal microenterprises. Often, though, productive technologies are designed in higher-income countries for use by workers with higher skill levels or to replace tasks performed by people to reduce the workers required. Adoption of such technologies in Africa can lead larger local firms to become more productive and competitive but generate few additional jobs. Smaller firms rarely use these technologies, remaining at lower productivity and competitiveness, with jobs that pay too little. And these technologies are often not appropriate for more productive use by lower-skilled owners, managers, and workers in Africa's labor-abundant countries.

There are two ways to bridge the gap between technologies designed for use in higher-income economies and those needed in the low- and middle-income world, especially in African countries. The conventional strategy involves investment in longer-term upgrading of skills to match the level for which these technologies have been designed. The alternative is for entrepreneurs to design technologies—often requiring cutting-edge adaptations of existing products—to fit with current skill levels and needs, ensuring that the technologies are attractive and easy to use, labor-augmenting, and supportive of continuous learning and higher worker productivity.

African economies require a technological transformation that generates both productive learning and job growth. The challenge is to produce and promote the expanded use of affordable, attractive, skill-appropriate technologies that support jobs that are more productive and inclusive—that is, jobs that generate income growth for all, including faster income per capita growth for the bottom 40 percent of each country's population. Fortunately, Africa's demographic dynamics can positively affect the use of new technologies. Great potential lies in the continent's large and growing youth

population, including tech-savvy entrepreneurs, managers, and workers likely to generate and use new digital and complementary technologies. By using better technologies, Africans can produce more goods and services for consumption in local markets and for export, thereby generating more good jobs for Africans.

## **Contributions of the *Digital Africa* report**

### **New analyses to support job growth strategies**

This overview and the full report provide new analyses to support improved efforts on the part of governments and the private sector to spur more inclusive job growth with appropriate technologies while narrowing the current digital divides. These findings can inform the implementation of the African Union’s Digital Transformation Strategy for Africa (2020–2030) (AU 2020) and the Digital Economy for Africa initiative.<sup>1</sup>

The overview also summarizes the report’s diagnostic review of current trends and drivers of digital and data infrastructure availability, and the use of digital technologies (DTs) in Africa. Broadly defined, DTs include not only digital and data infrastructure, broadband internet, smartphones, tablets, and computers but also a wide range of more specialized productivity-enhancing digital solutions—ranging from communications, management upgrading, and worker training to procurement, production, marketing, logistics, and financing and insurance.

DTs enable economywide productivity gains and job growth by catalyzing the uptake and use of complementary technologies, including many that are inaccessible without digital and data infrastructure. In general, taking advantage of Internet of Things technologies requires investments in the “internet” as well as the “things.” In the agriculture sector, for example, precision agriculture requires internet coverage. Foremost, however, it requires the prerequisite of tractors and irrigation systems that can then be equipped with sensors, as well as smartphones to access weather forecasts and upload pictures of unusual plant diseases. Appropriate apps with video or voice interfaces enable farmers to integrate into formal value chains, learn from upstream seed providers and downstream buyers, and gain better access to financing and markets.

Complementary technologies also include critical infrastructure for services such as electricity, transportation, and logistics. Therefore, even though the report largely focuses on provision and adoption of broadband internet, it must be viewed as an entry point or gateway to a broader discussion of the role of technology adoption—or lack thereof—in the ability of African economies to meet their job creation challenges.

### **A new conceptual framework for policy directions**

The report answers three primary policy questions:

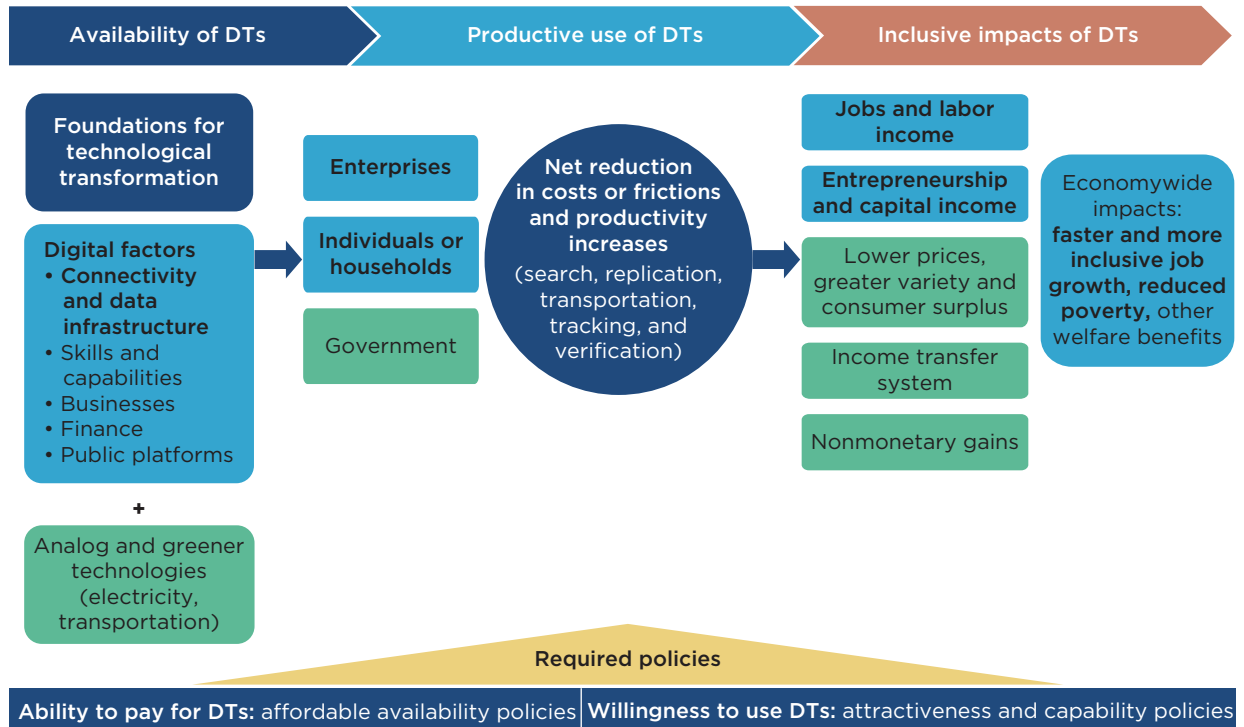
1. What are the effects of digital and data infrastructure, and the use of DTs, on enterprise productivity, jobs, and household welfare?
2. What is the extent of digital and data infrastructure availability and use of DTs and complementary technologies, and what are the main barriers preventing broader and more intensive productive use by enterprises and households?
3. What are key areas where policy and regulatory interventions could be implemented to strengthen consumers’ ability to pay and willingness to use DTs for productive purposes?

The report’s conceptual framework lays the foundation for this policy analysis, emphasizing that the impact of DTs on inclusive job growth depends on two objectives: ensuring potential users’ *ability to pay for* and *willingness to use* DTs (figure O.1). First, the affordable availability of digital and data infrastructure is a prerequisite for inclusive job growth. And the affordable availability of DTs, including broadband internet, depends on the affordable availability of electricity and transportation infrastructure. Second, inclusive job growth from DTs requires a willingness among all enterprises and individuals to *use* these technologies—meaning that these consumers find DTs attractive to use, understand how to use them, and believe that the DTs meet their productivity needs with opportunities to learn. A complementary requirement is that users possess sufficient capabilities to use the DTs productively.

DTs can lead to faster job growth, more inclusive jobs, and improved household welfare, primarily through (a) jobs and labor income, and (b) entrepreneurship and capital income (figure O.1). Through the first of these channels, productive use of DTs enables better, more inclusive jobs as well as higher earnings for more people. Through the second channel, productive use of DTs increases entrepreneurial jobs and capital income, including profits earned not only by entrepreneurs and owners of larger firms but also by owners of smaller formal and informal enterprises.

By focusing on *productive use* and *inclusive impacts*, the conceptual framework highlights the critical distinction between two views of digitalization policy. Traditional digitalization policy prioritizes *universal availability* of digital infrastructure, largely a

**FIGURE O.1 Conceptual framework for policy analysis of DTs’ impacts on job and income growth**



Source: Original figure for this publication.

Note: Bolded text indicates the primary focuses and themes of this report, emphasizing the production side of the economy (enterprises and workers). DTs = digital technologies.

supply-side view. This view underscores the internet’s role as a general-purpose technology, through which widespread availability—and presumably usage—will raise overall economic productivity over time. However, in contexts of limited resources, formidable needs across sectors, low income, and countries that often lack scale, this approach faces daunting challenges on the financial front.

The new conceptual framework in this report focuses instead on a second view of digitalization policy—prioritizing *productive use* that generates large, inclusive, jobs-related spillover effects while also expanding coverage of quality broadband internet. Innovations are essential in technologies that will attract people with fewer digital skills and boost their capabilities to generate higher earnings. This nuanced view of digitalization policy emphasizes the interdependency between demand and supply: greater demand for productive use and the ability to pay for these services will enable increased investments in higher-quality DT services.

## **Technological transformation: A pathway to inclusive productivity growth**

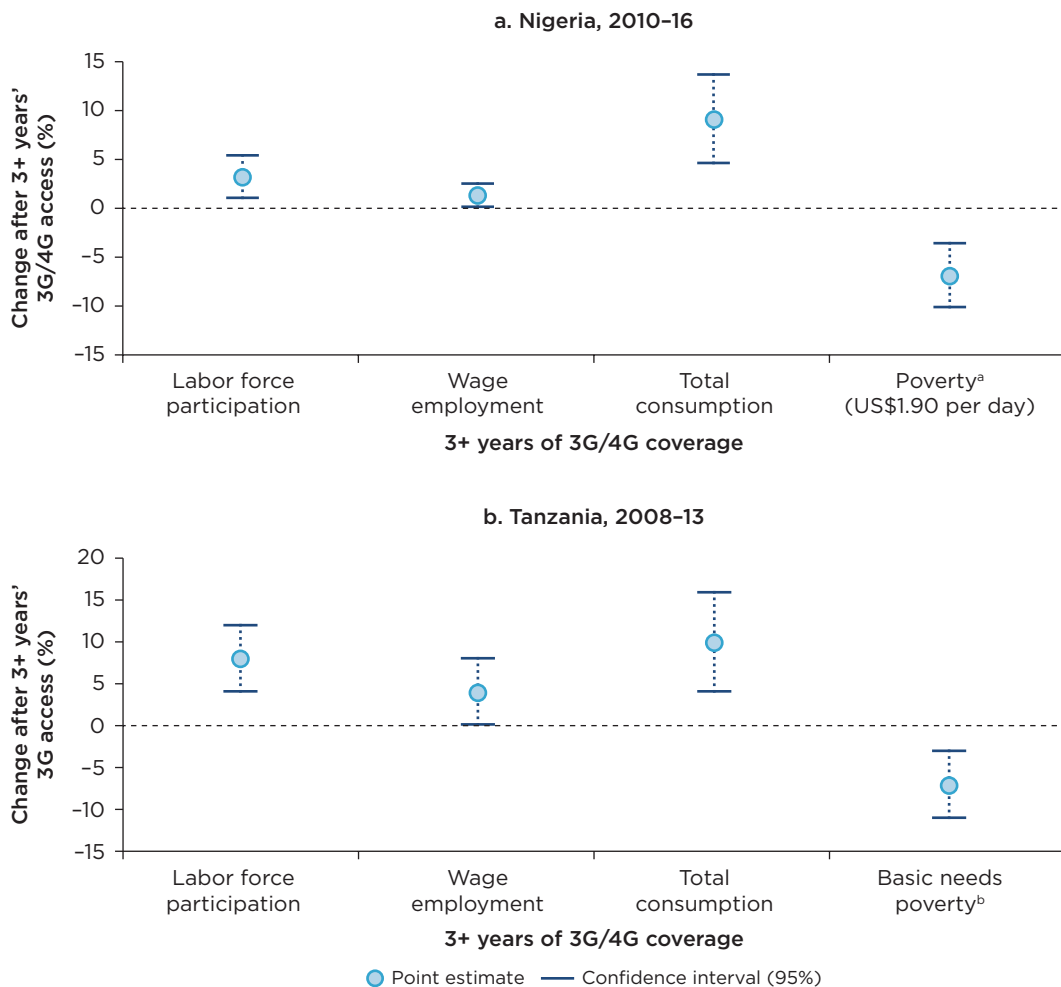
Two new empirical studies undertaken for the report have added to the rapidly growing positive evidence base by exploring the direct impact of mobile internet availability (third-generation [3G] or fourth-generation [4G] mobile communications technology coverage) on jobs and welfare. The studies examine geospatial information on the rollout of mobile internet towers over time, combined with at least two rounds of household data over six to seven years (Bahia et al. 2020; Bahia et al. 2021). Figure O.2 summarizes the main jobs and welfare (consumption and poverty) results for Nigeria and Tanzania.

Internet availability improved jobs and welfare outcomes in both Nigeria and Tanzania. In Nigeria, labor force participation and wage employment increased by 3 percentage points and 1 percentage point, respectively, in areas having three or more years of exposure to internet availability relative to those without coverage, after accounting for potential confounding factors.<sup>2</sup> Total consumption increased by about 9 percent, and the proportion of households below the extreme poverty line (US\$1.90 per person per day) declined by 7 percent after three years. Poorer households and those living in rural areas benefited the most, perhaps reflecting the internet connectivity already available to most urban households over the period of analysis.

The job estimates for Tanzania are similarly significant. Working-age individuals (ages 15–64) living in areas with internet availability witnessed increases of 8 percentage points in labor force participation and 4 percentage points in wage employment after three or more years of exposure. Total consumption per capita among households residing in areas with 3G availability was about 10 percent higher than in areas without coverage. Moreover, the proportion of households falling below the national basic needs poverty line dropped by 7 percentage points.<sup>3</sup> Welfare gains were higher among households headed by women, those with lower incomes, and those with less education (not having completed primary school). Larger relative gains are observed in urban areas, reflecting an earlier rollout from zero to 3G coverage in the early 2010s.

Other empirical studies highlight the indirect impacts of internet availability on access to more and better jobs through effects on improving firm–worker matching and improving firm productivity through entrepreneurship, innovation, and foreign direct investment. A background study for this report has found evidence of internet-induced entrepreneurship in 10 African countries.<sup>4</sup> The probability that a household establishes a

**FIGURE 0.2** Effects of mobile internet availability on job creation and household welfare, Nigeria and Tanzania



Source: Bahia et al. 2020; Bahia et al. 2021.

Note: The studies examine geospatial information on the rollout of mobile internet towers, combined with three rounds of household data over seven years for Nigeria and two rounds over six years for Tanzania. The estimates on poverty and consumption include all individuals or households, whereas labor outcomes include only working-age populations (ages 15-64). The results represent percentage changes in the covered locations after three or more years of high-quality internet exposure relative to those without such coverage after accounting for potential confounding factors. The figure shows difference-in-difference average value point estimates with 95 percent confidence intervals. 3G = third-generation mobile communications technology; 4G = fourth-generation mobile communications technology.

a. Nigeria's poverty status of households is calculated based on the international poverty line of US\$1.90 per day (2011 purchasing power parity) and after applying the Consumer Price Index to adjust for both spatial and temporal inflation.

b. Tanzania's poverty status of households is calculated based on the cost of acquiring enough food to provide adequate daily nutrition per person (food line) plus the cost of some nonfood essentials (nonfood component).

nonfarm business is 17 percentage points higher in areas with internet availability. This increase in entrepreneurial activities is concentrated in the service sector, plausibly because of the low entry cost of establishing many service-related businesses relative to those in agribusiness and manufacturing (Houngbonon, Mensah, and Traore 2022).

The same study also found evidence of a positive impact of internet availability on innovation: internet availability increases the probability of a firm undertaking process

and product innovation by 20 percentage points and 12 percentage points, respectively. The effect on process innovation stems largely from the adoption of DTs for business functions, such as sales, distribution, and marketing, and is boosted by the availability of digital skills within the firm.

Another new study for this report provides evidence that internet availability is associated with increases of 6 percentage points and 3 percentage points, respectively, in the probability of foreign direct investment in the financial and technology services sectors (Mensah and Traore 2022). The number of foreign direct investment projects in financial services increased by almost 20 percent following the arrival of submarine internet cables.

Internet availability also expands the demand side of production and boosts aggregate growth. Evidence from a background study of the rollout of 3G internet networks in Ethiopia (Abreha et al. 2021) suggests that internet availability can boost jobs by closing gaps in information between buyers and sellers. Enterprises operating in areas with 3G availability experienced an average 29 percent decline in markups, an 18 percent rise in firm productivity, and a 28 percent increase in jobs. These improvements are interpreted as resulting from increased competition as consumers become aware of price information and alternatives in nearby markets and as firms respond to increased competition and compressed profit margins by reducing costs—with increased productivity enabling output expansion and more jobs.

Finally, another study undertaken for this report indicates that internet availability boosts aggregate economic growth, with job expansion presumed from the output expansion accompanying faster growth. Aggregate country-level data show that increases in mobile internet subscriptions and the population share of internet users contribute to the growth of output per worker and reductions in poverty and income inequality (Calderón and Cantú 2021). Internet use has a significant effect in reducing poverty, and mobile connections are found to have a significant effect on reducing income inequality.

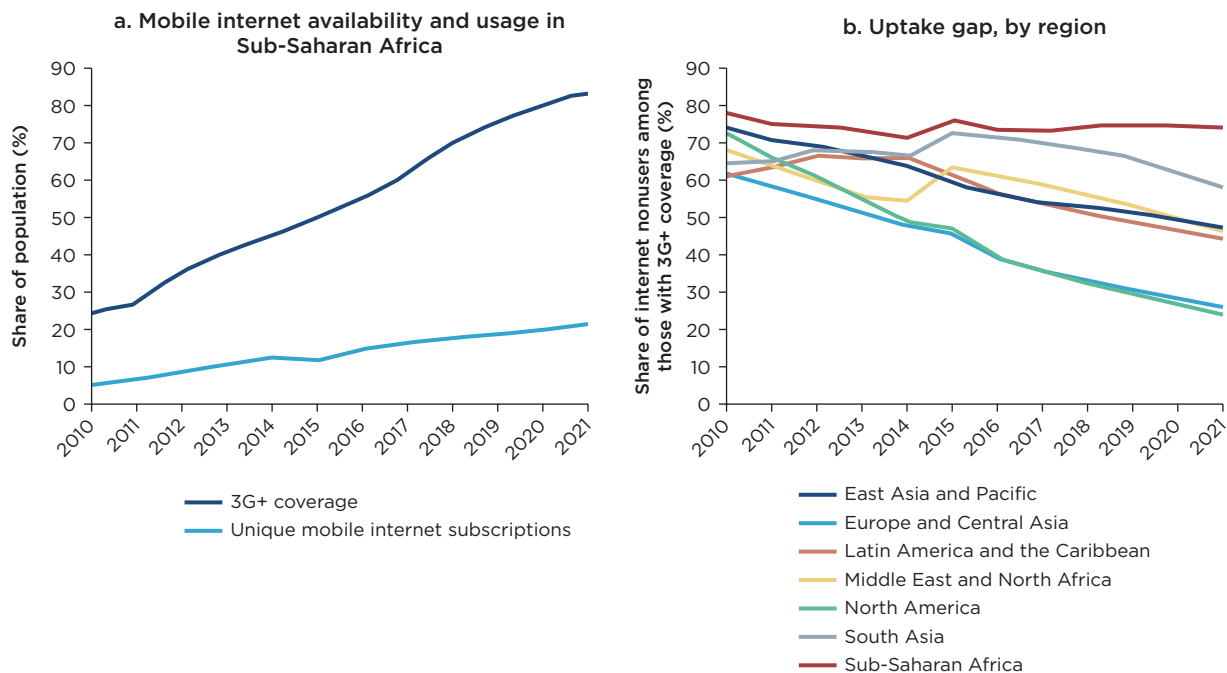
## **Digital transformation in Africa: Challenges and divides**

Despite the good news on the positive causal inclusive impacts of internet availability on jobs and poverty, Africa faces the challenge of insufficient use. Too few people can truly access these benefits. Though mobile internet availability has increased, Africa's internet infrastructure coverage and the quality of available services still lag other regions. Divides in availability of quality digital services remain an issue in all countries, especially in remote and poorer subregions.

This divide is compounded by Africa's large usage gap (Atiyas and Dutz 2022). Although 84 percent of country populations averaged across Sub-Saharan Africa had at least some level of 3G mobile internet availability and 63 percent had some level of 4G mobile internet services, only 22 percent used mobile internet services as of the end of 2021 (figure O.3, panel a). These figures represent a usage gap of 62 percent as a share of total population. Africa's uptake gap, or internet users with internet availability, is 74 percent, almost three-quarters, on average across countries (figure O.3, panel b), the highest in the world.

Recent increases in digital infrastructure investment following the onset of the COVID-19 pandemic have not been accompanied by concomitant increases in use. Instead, there are growing digital divides in use between large formal and micro-size informal enterprises; between enterprises owned by young men and those owned by older women; and between richer, urban, and better educated households and poorer, rural, and less educated households.

**FIGURE O.3** Gap between mobile internet coverage and usage, Sub-Saharan Africa and other regions, 2010–21



Source: Atiyas and Dutz 2022, based on Global System for Mobile Communications Association (GSMA) data.

Note: The figure incorporates updated 2016–21 data based on an improved 2022 methodology for calculating unique subscribers. In panel a, mobile internet availability (3G+ coverage) and use (unique mobile internet subscribers) are expressed as unweighted averages across countries, as a share of total country population. In panel b, the “uptake gap” is the percentage of people who live within the footprint of a mobile broadband network but who do not use mobile internet. “North America” comprises Bermuda, Canada, and the United States. 3G+ = third-generation (or later) mobile communications technology.

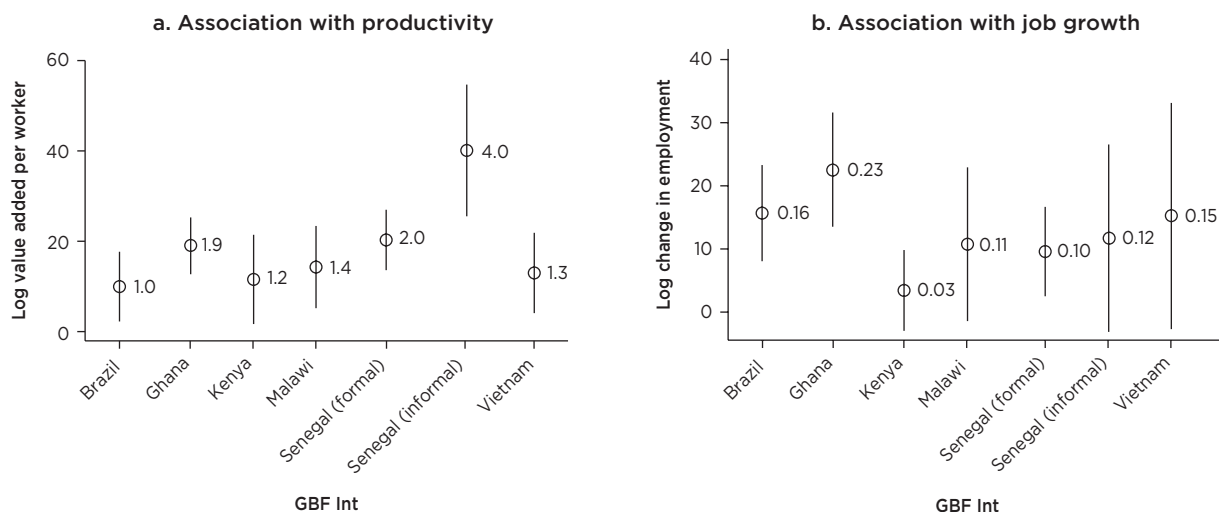
## Enterprises: More jobs for more people

To increase the availability of jobs, African enterprises must invest to expand their technology frontier, which appears to be relatively stagnant. African and global entrepreneurs must also generate more digital and complementary technologies that align with Africa’s current skills profile and production context (such as smaller-scale farms) and that evolve with workers as they increase capabilities. In addition, most enterprises must adopt and use DTs and complementary technologies more intensively. Such skill- and context-appropriate technologies would enable existing and newly entering workers, managers, and entrepreneur-owners to continuously raise productivity and generate higher earnings.

### Productivity and job gains from sophisticated technologies

The use of more sophisticated DTs and related technologies is associated with higher productivity across African countries for enterprises employing five or more full-time employees (Cirera, Comin, and Cruz 2022). Firms with higher average technological sophistication have higher productivity on average, with varying degrees of responsiveness (figure O.4, panel a). Interestingly, the association between technology use and productivity

**FIGURE O.4 Association between firms' use of more sophisticated DTs and productivity and job growth, selected countries, 2019–21**



Source: Cirera, Comin, and Cruz 2022, based on 2019–21 FAT (Firm-level Adoption of Technology) survey data.  
 Note: The figure shows regression coefficients (circles) and 95 percent confidence intervals (vertical lines) from country-level regressions of a new technology sophistication index that averages the most intensively used technologies across general business functions (GBF Int) for each firm on productivity levels (panel a) and changes in full-time workers over the preceding three years (panel b), while controlling for sector, firm size, and region. Country samples are restricted to enterprises with five or more employees. Senegal is the only country that includes a representative subsample of informal as well as formal enterprises.

is stronger for informal than formal Senegalese firms. There is also a positive association between the use of more sophisticated technologies and job growth for Senegal (formal firms) and Ghana (figure O.4, panel b).

Findings for microenterprises show a positive progression in the number of more sophisticated DTs (figure O.5, light blue bars) associated in turn with higher productivity, sales, and job levels. Six internet-enabled and three non-internet-enabled DT uses (figure O.5, dark blue bars) are the only significant conditional correlates of higher job levels. So a greater range of more sophisticated DT uses based on internet-enabled computers or smartphones relative to DT uses based only on second-generation (2G) phones is associated with higher jobs levels.

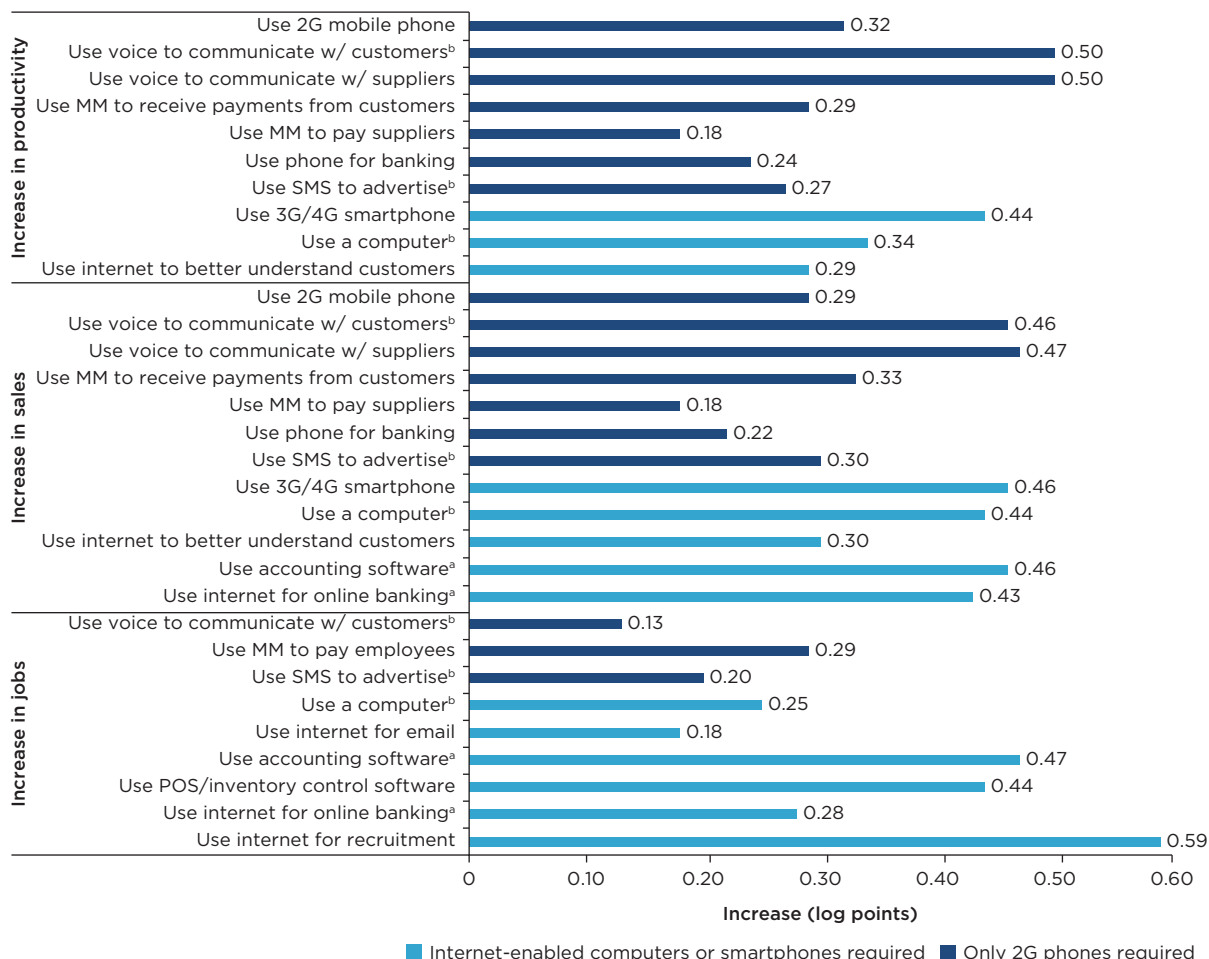
Despite these beneficial associations, the average African enterprise with five or more full-time employees in Ghana, Kenya, Malawi, and Senegal lags in the use of computers relative to Brazil and in the use of smartphones for most enterprise size groupings. Informal enterprises (with Senegal being the only available country with nationally representative data) lag much more (figure O.6). Microenterprises lag even more, with large digital divides: only 7 percent of all microfirms and 3 percent of microfirms owned by older women (over 30 years of age) use a smartphone. The digital divide in computer use is even larger: only 2 percent of microfirms owned by young women (30 years of age or younger) use a computer, but four times as many (8 percent) microfirms owned by young men do (Atiyas and Dutz 2023).

### Factors affecting productive use of DTs

The key DT-related issue for African enterprises is low productive use. The main factors affecting enterprise use of smartphones, computers, and the more-sophisticated DTs that rely on these access technologies are related to the ability to pay for them and the



**FIGURE O.5 Association between microenterprises' use of technologies and higher productivity, sales, and jobs, 2017-18**



Source: Atiyas and Dutz 2023, based on 2017-18 Research ICT Africa (RIA) survey data.

Note: The figure shows the association between average firm use of selected digital technologies (DTs) and the percentage increase in three outcome variables: productivity, sales, and jobs. The included business-related uses of DTs—listed in order from simple-access technologies to more sophisticated uses—are those for which the conditional correlates are significant at least at the 5 percent level based on ordinary least squares with robust standard errors using unweighted data. Controls include whether the enterprise has ever had a loan, has access to electricity, is run by transformational entrepreneurs, and has links with more sophisticated upstream suppliers or downstream buyers, among others, together with country fixed effects. The data cover 3,325 formal and informal microenterprises (the median firm being informal and self-employed with no full-time workers) across seven African countries. Dark blue bars represent non-internet-enabled DTs; light blue bars represent internet-enabled DTs; 2G = second-generation mobile communications technology; 3G = third-generation; 4G = fourth-generation; MM = mobile money; POS = point of sale; SMS = short message service.

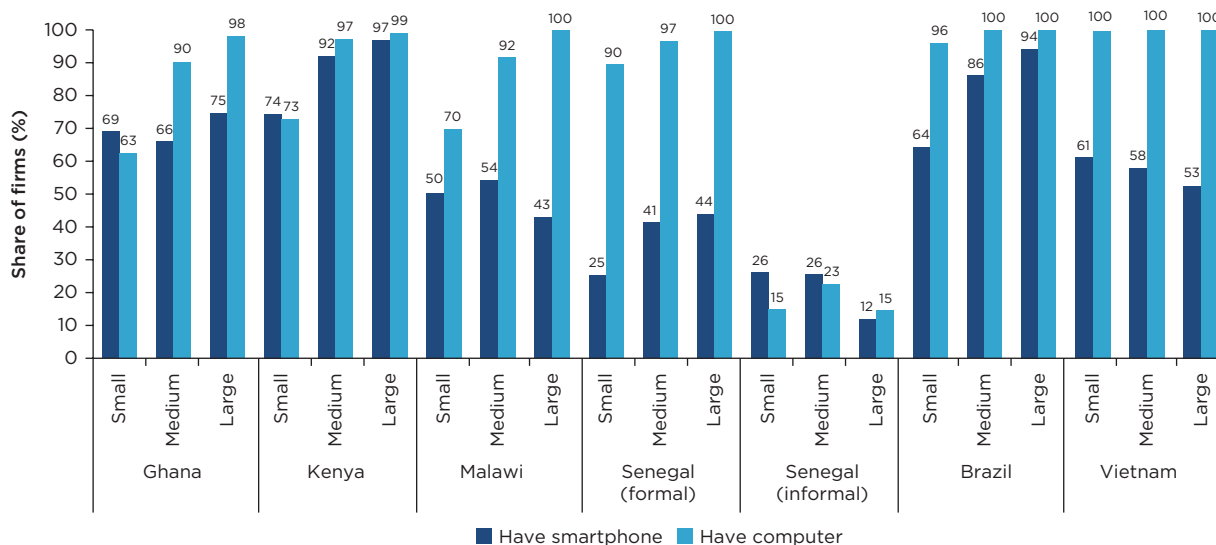
a. Variable is significant across all three performance outcomes: productivity, sales, and jobs.

b. Variable is significant across both sales and jobs.

willingness to use them (figure O.7). These factors are relatively similar across larger enterprises (with five or more workers) and microenterprises.

**Ability to pay.** Affordable availability of DTs is linked to the prices of quality internet services, access technologies, and apps relative to enterprise earnings, as well as access to financing to help pay for DTs. Small and medium enterprises in Africa face high prices and lack adequate business offerings in terms of speed and data allowances. Ability to pay is also linked to the affordable availability of complementary infrastructure, especially that of reliable electricity as well as transportation and logistics services.

**FIGURE 0.6 Smartphone and computer use, by firm size, selected countries, 2019–21**



Source: Cirera, Comin, and Cruz 2022, based on 2019–21 Firm-level Adoption of Technology (FAT) survey data.

Note: Included enterprises are those employing at least five full-time workers. “Large” firms have 100 or more employees; “medium” firms, 20–99 employees; and “small” firms, 5–19 employees.

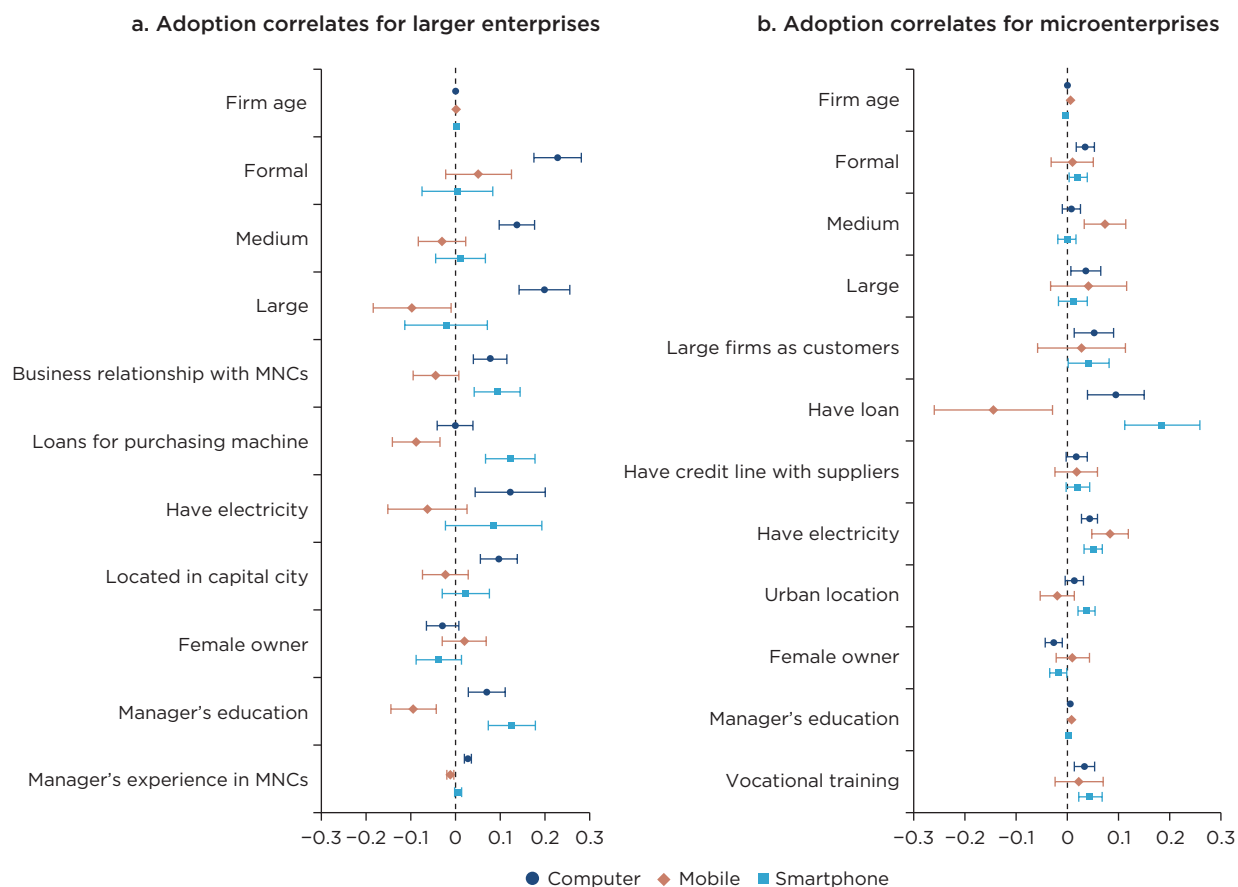
Affordability is influenced by whether enterprises, be they larger firms or microfirms, have loans; information is also available on whether microfirms have a credit line with suppliers, an indicator of their creditworthiness. Access to finance, as reflected by having a loan, is one of the largest correlates of use. Larger firms that have a loan are 12 percent more likely than those without loans to use smartphones and 9 percent less likely to use a 2G phone (Cirera, Comin, and Cruz 2022). Microenterprises that have a loan are 18 percent more likely to use smartphones and nearly 15 percent less likely to use a 2G phone; they are also over 9 percent more likely to use a computer (Atiyas and Dutz 2023). Having electricity and being in an urban location are associated with computer use for larger firms and with smartphone use for microenterprises.

**Willingness to use.** Willingness to use DTs is linked to both the firms’ capabilities and the DTs’ attractiveness—in turn related to both the availability of information about DTs and whether they meet the productive needs of users.

Regarding capabilities, skills (especially at the managerial level in larger firms) and vocational training (in microenterprises) are strongly associated with both smartphone and computer use (Atiyas and Dutz 2023; Cirera, Comin, and Cruz 2022). Enterprise technological capabilities are also affected by the firm’s

- *Size*, with those employing five or more workers and microfirms that are larger (relative to other microfirms) being more likely to use computers;
- *Age*, with those that have been in operation longer being less likely to use a smartphone than younger firms; and
- *Formality status*, with formal firms of any size being more likely than informal firms to use computers.

**FIGURE O.7 Correlates of smartphone and computer adoption by African firms, 2017–21**



Sources: Atiyas and Dutz 2023; Cirera, Comin, and Cruz 2022.

Note: Reported results are marginal effects based on probit regressions on enterprise characteristics, controlling for country fixed effects. Error bars indicate 95 percent confidence intervals. Panel a is based on 2019–21 FAT (Firm-level Adoption of Technology) survey data. “Larger” enterprises are those with at least five full-time employees. Panel b is based on 2017–18 Research ICT Africa (RIA) data. The median “microenterprise” is informal and self-employed with zero full-time employees. MNCs = multinational companies.

The attractiveness of DTs, and the consequent adoption of smartphones and computers, is likely driven by the need to adopt specific DTs when larger firms have business relationships with multinational companies and when microenterprises have large firms as customers.

**Business and socioeconomic factors.** Finally, specific elements of the business environment (linked to market access and competition-related incentives) and socioeconomic factors (whether social norms and rules make ownership of access devices difficult for women) also affect DT use. Among microenterprises, female-owned firms are less likely than male-owned firms to use either a smartphone or a computer (Atiyas and Dutz 2023). Because most microfirms are owned and managed by self-employed individuals with no full-time paid employees, this digital divide may reflect prevailing social norms and rules that make access to finance and ownership of access devices more difficult for women.

## Policy recommendations

Public policies and investments are needed both to incentivize the creation of attractive apps—especially solutions that are simple to use and boost the productivity of enterprises with lower-skilled workers—and to stimulate use by enterprises, including through investments in capabilities. Three broad policy recommendations arise from these findings:

1. *Institutionalize technology upgrading* and worker and management capability support programs.
2. *Support start-up entrepreneurs* in developing more appropriate technologies for Africa's current and future asset base, including through incentives for creating skill-appropriate technologies, intellectual property rights protection, and regulations facilitating a more job-inclusive development of machine learning and other forms of artificial intelligence.
3. *Facilitate enterprise financing* for the generation and use of DTs as well as complementary technologies. Public financing support policies should include (a) targeted partial credit guarantees, matching grants, and vouchers for the adoption of technologies and needed capabilities; and (b) credit infrastructure with a focus on credit bureaus and secured transactions as well as mechanisms to access key data for credit ratings.

## Households: Inclusive impact through productive use

Several factors could explain the low internet use and low intensity of use by African households. The latest evidence from seven West African Economic and Monetary Union (WAEMU) countries finds that three key factors correlate with low adoption (Rodriguez-Castelán et al. 2021):

1. *Affordable availability*, encompassing the ability to pay (influenced by household expenditure, the price of mobile services, and asset ownership); access to electricity; and urban location
2. *Attractiveness* of alternative modalities of internet access
3. *Capabilities*, including tertiary educational attainment, French language proficiency (in francophone countries), and sector of employment, together with socioeconomic factors

## Constraints on the ability to pay and willingness to use

Many Africans do not use DTs because the costs appear to outweigh the benefits. Two main groups of factors underpin the low perceived benefits to costs: ability to pay for DTs and willingness to use them.

Ability to pay involves the availability of quality digital services and the price and affordability of access devices, data plans, and apps relative to purchasing power. A package that covers a few hours of basic daily use—1.5 gigabytes of data over 30 days—amounts to about a third of the income of the 40 percent of Africans who fall below the global extreme poverty line (US\$1.90 per person per day at 2017 purchasing power parity). Low-consumption users face prices per unit of data that are more than double those for high-consumption users, holding back higher intensity of use among low-income users.

Attractiveness of DTs, and hence the willingness to use them, is linked to multiple factors: Do users have information about the existence of DTs and how to use them? Do DTs meet minimum speed and latency requirements for effective use? Do they meet users’ productive (and other) needs? Are they designed for the users’ skills level? Do they raise trust concerns related to data protection, cybercrime, or data surveillance? Do the expected benefits of using DTs outweigh the costs of devices, data plans, and other investments? Ultimately, household members’ capabilities—their skills and technological sophistication—also affect their ability to extract value from DTs.

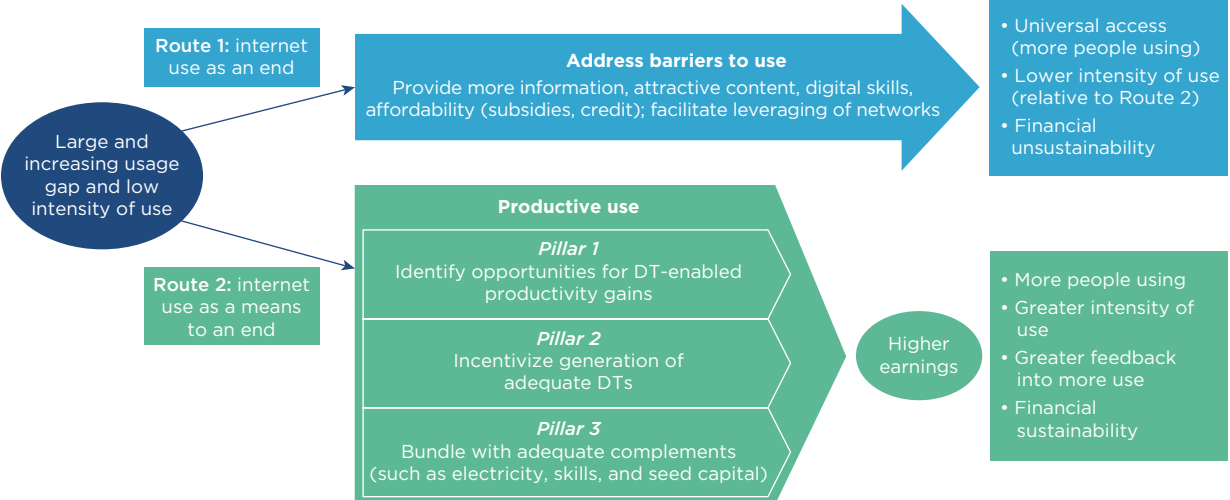
Policies to expand access to credit, better regulations, and market-induced price reductions can help address affordability. Policies that can induce the development of easy-to-use DTs and capability-enhancing content are also needed to meet the productive needs of households, especially among poor people, who face constraints on many fronts including skills gaps and a lack of information on how internet use could benefit them. Providing information to households on the variety of ways DTs can help people—through community-based associations, town hall meetings, religious organizations, and social networks—could help to address some of these constraints.

**Policy routes to productive internet use by households**

Given the low income levels and high inequality across Africa, broader internet adoption among households is financially sustainable only if adoption results in higher earnings. Policy makers can play a role in promoting and enabling productive uses.

Figure O.8 depicts a framework to increase internet use, offering two complementary approaches: Route 1 targets internet adoption as an end goal, while Route 2 views adoption as the means to enhance people’s earnings and livelihood opportunities and achieve greater economic impact. Although Route 2 may close gaps at a slower pace, it would be more financially sustainable in the long term. The goal is to create a positively reinforcing cycle through which productive internet use enhances earnings, feeding back into more DT use.

**FIGURE O.8 Policy routes for increasing households’ inclusive uptake and productive use of DTs**



Source: Adapted from Blimpo and Cosgrove-Davies 2019.  
 Note: DTs = digital technologies.

**Internet use as the end goal.** Under Route 1, policies focus mainly on addressing the symptomatic barriers to use. These interventions will contribute to achieving the universal access goal faster, especially if countries support adoption and use with significant subsidies.

Via this route, increased internet use ideally would lead to increased productivity—which may happen in some households. However, without the presence of analog complements (such as electricity and skills), productive use and the returns that encourage further use are weaker. This strategy may thus be financially unsustainable because it requires sustained provision of credit or subsidies for adoption and use.

**Internet use as a means to an end.** Under Route 2, internet use is seen as the means to increasing household earnings and reducing poverty. The policy goal is to increase the productive use of the internet to increase household earnings, thereby strengthening the ability to pay and stimulating further internet use. This approach views the internet and related DTs as inputs and tools to enable technological transformation and higher earnings.

As with many other types of inputs, DTs are necessary, but insufficient, to generate income. Availability of electricity, adequate education and skills, road access, and attainable financing are all complements with varying degrees of relevance, depending on the context. (This policy alternative requires synergies among at least three types of interventions, shown as the three pillars in figure O.8.)

These policy interventions are expected to increase productive use, which will in turn boost household earnings. With higher earnings, households can afford to buy smartphones and mobile broadband data and increase the intensity of internet use.

## Digital and data infrastructure: Policy reforms to increase availability and use

Two sets of complementary and mutually reinforcing policies are required for DTs to support inclusive job growth in Africa: those that ensure the ability to pay for DTs and those that elicit willingness to use DTs for productive purposes (as illustrated earlier in figure O.1). Downside risks include the potential for increased digital divides affecting low-income people displaced by the adoption of newer technologies and unable to adjust and adapt. The potential for misuse by business (data protection, cybersecurity, and consumer protection) and government (surveillance and misinformation) must also be managed.

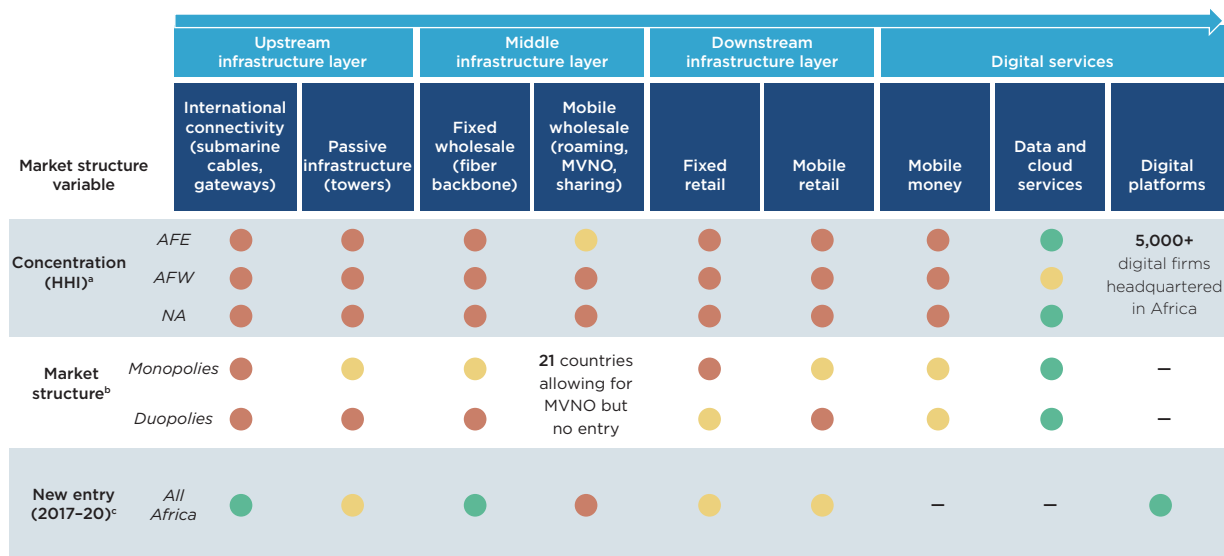
### Policies to ensure ability to pay

Policies to ensure all potential users' ability to pay must address internet affordability, additional infrastructure availability, adequate data infrastructure, and affordable availability of complementary technologies. The big problem in effectively addressing affordability issues is that prevailing market structures do not yet enable enough competition in Africa. Markets are concentrated (figure O.9). Monopolies and duopolies still exist in many African countries, including in key bottleneck markets such as international connectivity. State-owned enterprises remain important in the sector and have the potential to thwart competition.

Moreover, vertical integration of dominant firms in Africa creates risks to competition: 53 firms in 36 countries have at least 40 percent market share in mobile retail or fiber backbone and are vertically integrated into two other segments (World Bank, forthcoming).

Regulation of dominant operators is weak. Internet affordability requires effective pro-competition regulations to reduce investment costs—including rules on licensing and market dominance, infrastructure access and sharing, and radioelectric spectrum

**FIGURE 0.9 Extent of competitive constraints in market structures across the digital value chain in Africa, 2021**



Source: World Bank, Africa Digital Market Players Database (internal), 2021, built on data from numerous sources, including TeleGeography, Global System for Mobile Communications Association (GSMA), Africa Bandwidth Maps, Afterfibre.org, Policytracker, TowerXchange, PeeringDB, and Xalam Analytics.

Note: Red circles represent higher risk to competition, on average; orange circles, medium risk; and green circles, lower risk. The sample covers 54 African countries for mobile retail, 38 for fixed retail, 52 for fiber backbone, 26 for telecommunications towers, 35 for submarine cables, 25 for data centers, and 15 for mobile money. AFE = Eastern and Southern Africa; AFW = Western and Central Africa; HHI = Herfindahl-Hirschman index (market concentration measure); MVNO = mobile virtual network operator; NA = North Africa; SLE = state as minority shareholder; SOE = majority or fully state-owned enterprise; — = not available.

a. A market with HHI of less than 1,500 is considered to have a competitive market structure, HHI of 1,500 to 2,500 is moderately concentrated, and an HHI of 2,500 or greater is highly concentrated.

b. In terms of monopolies and duopolies, less than 5 percent of countries are monopolies/duopolies = green, 5–20 percent of countries = orange, above 20 percent of countries = red.

c. For new entry, new entry in less than 5 percent of countries = red, in 5–20 percent of countries = orange, in more than 20 percent of countries = green.

d. SOE presence in less than 10 percent of countries = green, in 10–50 percent of countries = orange, and in more than 50 percent of countries = red.

availability and use—within the context of more integrated continental markets. Regulations are also required to drive down operational costs, including rules on access to essential infrastructure controlled by state-owned enterprises, operation of open-access fiber networks, and minimization of excise taxes.

An empirical analysis of six countries conducted for this report shows that cost-reducing policy reforms (on spectrum, infrastructure sharing, and taxation) can save 10–20 percent of the cost required to achieve near-universal availability, resulting in over US\$200 million in savings for governments across the countries included in the analysis (World Bank 2022). Increasing market competition can deliver additional benefits and could achieve levels of use similar to those spurred by supply-side subsidies, as simulations for Ghana show.

Infrastructure availability in areas that are not commercially viable after implementing regulatory reforms requires targeted subsidies and financing (through earmarked funds, obligations on operators, universal service funds, or alternative solutions) to incentivize universal access and service and to support climate-resilient development.

If demand-side policies were to increase potential 4G use above the current level in uncovered areas (currently less than 5 percent) to 40 percent for the six studied African countries, expansion would become commercially viable, and 4G availability would reach the same near-universal levels as it would under a pure supply subsidy. This finding highlights the importance of demand-side programs to not only expand use but also boost coverage. Furthermore, affordable availability of data infrastructure requires transparent, pro-competition rules for upgrading internet exchange points and for accessing data centers and cloud computing to help drive down costs.

### **Policies to increase willingness to use**

Policies on attractiveness and capabilities are required to promote DT use for productive purposes. These include national strategies for productive use of DTs, innovation policies, data policies and regulations, and capability support programs. The implementation of these tailored strategies is essential to support familiarity with and use of DTs as well as to ensure productive gains by all enterprises. These strategies could include investments in common-access facilities and demonstrations at internet cafés, local schools, or community centers, especially for microentrepreneurs.

For DT use to be inclusive, Africa must provide sophisticated yet simple-to-use and attractive apps through touch-screen pictures, voice, and video in the languages people speak—enabling enterprises and households to want them, use them, and learn as they work. Africa must redirect technologies to the different contexts across its countries, particularly its differing skill compositions. To that end, entrepreneurs are needed to further develop existing DTs to enable productive use and learning by all people in the region. Development of new DTs by private entrepreneurs may require prior public-private investments in public goods, such as countrywide availability of digital addresses, geotagged land records, and local weather mapping. Data policies are needed as both enablers and safeguards for data use and reuse to ensure the development of new, attractive, data-driven DTs along with appropriate levels of trust in their use.

Finally, capability support programs must be institutionalized for micro, small, and medium enterprises as well as for households, so that they know how to make productive use of available DTs. These programs include business advisory services, technology information and upgrading services, and manager and worker skills training, together with longer-term investments in high-quality secondary and tertiary education.

### **The role of regional cooperation**

Looking ahead, African countries have the potential to benefit further from deeper regional integration and the adoption of environmentally friendly DTs to advance the continent's technological transformation. The African Union has developed and is implementing the Digital Transformation Strategy for Africa (2020–2030) to boost DT use and innovation to promote Africa's integration (AU 2020).

Creating a single continental market for both connectivity and data will require the harmonization and compatibility of national policy and regulatory frameworks. Integrated regional connectivity and data markets, in turn, can facilitate the scalability of DTs across the continent, boosting positive network effects, economies of scale and scope, and competition benefits. The operation of continental data infrastructure and cross-border connectivity infrastructure enabled by domestic and regional regulatory frameworks is fundamental for a single digital market. Table O.1 presents how national



**TABLE O.1 Main policy recommendations for advancing the use of digital technologies to support inclusive job growth**

	Goal	Policy area	Topic	Emerging sector <sup>a</sup>	Evolving between “emerging” and “transitioning”	Transitioning sector <sup>b</sup>
<b>Policies to ensure ability to pay</b>	<b>Affordability of internet</b>	Pro-competition regulation	Licensing and regulation of dominance	Entry liberalization: simpler licensing, no exclusivities, including for cross-border connectivity	Rules to allow ISPs to deploy infrastructure, elimination of voice over internet protocol (VoIP) restrictions	SMP rules: designation and remedies; control of license transfers/mergers
			Access and sharing of essential infrastructure	Interconnection rules for domestic networks	Infrastructure sharing/access to essential infrastructure, regulation of regional roaming and cross-border transportation	Rules for coinvestment and wholesale-only networks
			Management of radio frequencies	Spectrum policy Published national spectrum frequency register	Spectrum rules: allocation, assignment, pricing, sharing/transfer, coordination at regional level	5G spectrum allocation and assignment; unlicensed spectrum and dynamic spectrum access
		Cost-reducing regulation	SOEs	SOEs open to private shareholding Restructuring of SOEs for better governance	Open access to state fiber networks (energy); SOE accountability	PPPs for open-access fiber network, co-investments for uncovered areas
			Sectoral taxes and fees	Elimination of sector-specific (excise) taxes on telecommunications services	Revision of taxes on digital services Cost-oriented regulatory fees	Harmonization of subnational fees for infrastructure deployment
	<b>Availability of internet and complementary technologies (analog infrastructure)</b>	Government interventions to complement markets	Universal access and service	Creation of USF Transparent and more effective USF, focusing on availability of demand-responsive services and use	Redefine USF scope (DTs to pull internet demand) and contribution modality (capital expenditure versus contribution)	Focus on use and upgrading: targeted demand-side support, pricing rules for vulnerable groups
			Climate adaptation and resilience	Mandatory emergency preparedness plans	Policies for resilient and green design, construction, operation of digital infrastructure	E-waste management; incentives for energy-efficient and green digital infrastructure
	<b>Affordable availability of data</b>	Data infrastructure	IXPs, data centers, and cloud computing	Improved governance of IXPs to allow for growth, updated telecommunications rules for regional IXPs	Rules on cross-border data flows that allow for regional data hubs and edge computing	Neutral data centers, rules to facilitate switching between providers, including at regional level

*(continued)*

**TABLE O.1** Main policy recommendations for advancing the use of digital technologies to support inclusive job growth (*continued*)

	Goal	Policy area	Topic	Emerging sectors <sup>a</sup>	Evolving between “emerging” and “transitioning”	Transitioning sector <sup>b</sup>
<b>Policies to ensure willingness to use</b>	<b>Attractiveness of and capabilities to use DTs</b>	Digital entrepreneurship	Reduction of barriers and support of drivers of entry and expansion	Elimination of administrative barriers; access to finance (partial credit guarantees, matching grants), incubators, and accelerators	Access to data and effective data portability, incentives to develop pro-poor DTs, creation of public-good data platforms, elimination of barriers to regional expansion	Appropriate taxation of digital services and effective competition enforcement (entry and exit, mergers, abuse of dominance), including regional approach
		Technology and innovation	DT generation and use by firms	Information to increase attractiveness of DTs, support for basic digitalization, government e-services to pull demand	Support to business advisory and technology extension services and to FDI and joint ventures for tech transfer, for generation and use of DTs	Test beds for generation and adoption of new DTs in specific industries, including low-skill-based DTs that enable learning over time
		Data policies and regulations	Enablers of new DTs and trust; safeguards for data use and reuse	Clear laws on data protection, cybersecurity, cybercrime, open data, e-transactions, and cross-border data flows, aligned at the regional and global levels	Effective enforcement by data protection authorities, cybersecurity agencies, and the like Compliance and awareness for start-ups and SMEs Regional interoperability of national laws	Data spaces, data sharing between government and private sector and across enterprises Regional convergence and harmonization of frameworks
		Social inclusion	DTs for productive use by individuals and households	Exposure to DTs through access in community centers, schools and health clinics, government programs, digital public service delivery	Comprehensive interventions complementing internet availability and affordability; skills and capabilities; attractiveness and information; affordability and access to finance, electricity, and transportation; social norms	Identification of productive DT uses by low-income, vulnerable, and underserved groups; programs to incentivize the generation and use of DTs targeting these segments

*Source:* Original table for this publication.

*Note:* 5G = fifth-generation mobile internet technology; DTs = digital technologies; FDI = foreign direct investment; ISPs = internet service providers; IXPs = internet exchange points; PPPs = public-private partnerships; SMEs = small and medium enterprises; SMP = significant market power; SOE = state-owned enterprise; USF = universal service fund.

a. An “emerging sector” refers to a digital sector where the digital economy is still emerging and internet use is low.

b. A “transitioning sector” refers to a digital sector transitioning toward universal internet use.

and regional policy actions are complements to ensure ability to pay and willingness to use DTs in Africa.

In addition, as African countries expand their data use, the deployment of a greener connectivity and data infrastructure that takes advantage of renewable energy and better e-waste management will become more important to support climate mitigation and adaptation while making DTs more environmentally sustainable.

Africa should embrace the adoption of jobs-enhancing technologies—including cloud computing, artificial intelligence, and robotics—in ways that enhance the learning and earning potential of each country’s workforce. Positive impacts can materialize only if governments, enterprises, and households support bold policy actions to create an enabling environment. This report offers an evidence-based framework to spur action toward an even brighter future for the continent.

## Notes

1. The Digital Economy for Africa (DE4A) flagship initiative is a partnership between the World Bank, African governments, the African Union, and other development partners. For more information, see the DE4A initiative website: <https://www.worldbank.org/en/programs/all-africa-digital-transformation>.
2. Because the regression specifications differ by type of outcome, some are expressed as percentage changes (when variables are in log such as for income) and others as percentage points (when variables are binary such as for poverty and labor outcomes).
3. Tanzania’s household poverty rate is based on the national “basic needs” poverty line: the cost of acquiring enough food to provide adequate daily nutrition per person (food line) plus the cost of some nonfood essentials (nonfood component). The food line is derived from the cost of buying 2,200 calories per adult per day according to the food consumption patterns prevailing in the population whose per adult real consumption is below the median during a period of 28 days valued at prices faced by the reference population. The nonfood component of the basic needs poverty line uses the average nonfood consumption share of the population whose total consumption per adult is in the bottom 25 percent.
4. The countries studied included the Democratic Republic of Congo, Ghana, Kenya, Malawi, Namibia, Nigeria, Sudan, Tanzania, Uganda, and Zambia.

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## ECO-AUDIT

### *Environmental Benefits Statement*

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**A**ll African countries need better and more jobs for their growing populations. *Digital Africa: Technological Transformation for Jobs* shows that broader use of productivity-enhancing digital technologies by enterprises and households is imperative to generate such jobs, including for lower-skilled people. At the same time, broader use can support not only countries' short-term objective of postpandemic economic recovery but also their vision of economic transformation with more inclusive growth.

These outcomes are not automatic, however. Mobile internet availability has increased throughout the continent in recent years, but Africa's uptake gap is the highest in the world. Areas with at least 3G mobile internet service now cover 84 percent of country populations averaged across Sub-Saharan Africa, but only 22 percent use such services. The average African business lags in the use of smartphones and computers, as well as more sophisticated digital technologies that catalyze further productivity gains.

Two issues explain the usage gap: the affordability of these new technologies and the willingness to use them. For the 40 percent of Africans below the extreme poverty line, mobile data plans alone would cost one-third of their incomes—in addition to the price of access devices, apps, and electricity. Data plans for small and medium businesses are also more expensive than in other regions. Moreover, shortcomings in the quality of internet services—and in the supply of attractive, skill-appropriate apps that promote entrepreneurship and raise earnings—dampen people's willingness to use them.

For those countries already using these technologies, the development payoffs are significant. New empirical studies for this report add to the rapidly growing evidence that mobile internet availability directly raises enterprise productivity, increases jobs, and reduces poverty across Africa.

To realize these and other benefits more widely, Africa's countries must implement complementary and mutually reinforcing policies to strengthen both consumers' ability to pay and willingness to use digital technologies. These interventions must prioritize productive use to generate large numbers of inclusive jobs in a region poised to benefit from a massive, youthful workforce—one projected to become the world's largest by the end of this century.