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Increasing Access to Technology for Inclusion

[1]Clara Aranda-Jan & [2]Qursum Qasim
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Abstract

Digital technology has introduced innovative business models and changed how society operates. Through digital technology, access to services can be increased and more people can be reached, particularly those from underserved groups, such as women, people in rural communities and persons with disabilities. Yet, gaps in access to digital technology deepen inequalities and have social costs and economic implications. Countries have lost out on $1 trillion in GDP due to the digital exclusion of women (Alliance for Affordable Internet, 2021). Grounded in examples extracted from research and World Bank Group operations with client countries and clients in the private sector, this policy note presents interventions that aim to close the gaps in digital inclusion. These examples demonstrate that the public and private sectors have significant roles to play in ensuring digital technology reaches women, aligns with their needs, and strengthens their economic empowerment. This policy note provides impetus for the World Bank Group to continue strengthening its work on the digital inclusion of women and underserved groups.

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Corresponding Author: *Clara Aranda-Jan*

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Background to the Study

Digital technologies are the building blocks of a new, rapidly changing world. Over the past few decades, progress in basic internet services, automation, digital financial services and social media have changed fundamentally human interaction, including how women participate in the global economy. The sharp increase in the uptake of digital technology during the COVID-19 pandemic provided a clear example of technology's potential and risks. With restrictions on movement and social interactions, governments and organizations accelerated technology adoption (Amankwah-Amoah, Khan, Wood, & Knight, 2021). Digitalization allowed for continuity in providing people access to work, education, and health care services. In some sectors, the acceleration in digitalization brought great benefits. E-commerce's share of global retail trade rose from 9.5 percent in 2019 to about 12.4 percent in 2020 and revenues increased by 50 percent in some regions, such as the Middle East and North Africa (Katz & Jung, 2021).

Connectivity and access to the internet became indispensable during the pandemic. The UN's International Telecommunication Union (ITU) estimates that internet traffic worldwide increased by approximately 30 percent during the pandemic and the global penetration of broadband increased by 10 percent, with a significant increase in households adopting fixed broadband in all regions of the world (Katz & Jung, 2021). Still, many had poor or no access to the internet, meaning digitalization excluded them further (Beaunoyer, Dupéré, & Guitton, 2020; ITU, 2022). Digital technology has introduced innovative business models and changed how society operates. Digital technology has expanded access to economic opportunities and new ways to provide access to services such as education, healthcare, and information, particularly to those from underserved groups and who are harder to reach, such as women, people in rural communities, and persons with disabilities. As digital technology restructures the labor market and consumption patterns, technology helps break existing social norms and gender stereotypes that often prevent women from entering the labor market (Lechman & Paradowki, 2021; Anwar, 2022). Many women join the digital economy as it provides opportunities to generate income, often in the formal economy, and to gain new productive skills, including digital and professional skills. Digital technology can also enable access to financial services, such as mobile money. In some emerging markets, where paid work is a critical solution to eliminate gender disparities, many women use digital platforms as a primary source of income (Anwar, 2022). There are barriers to the digital inclusion of women that limit their participation in the digital economy, as discussed later in this paper; yet, increasing women's participation in the labor market through digital technology contributes to more inclusive and equitable societies and to economic growth. Women's economic empowerment translates into their capacity to make their own choices and contributes the redistribution of economic power between genders (Lechman & Paradowki, 2021).

Digital technology is also generating large amounts of data. Digitally enabled forms of identification, for instance, can help those who lack an official identification to access services offered by governments and the private sector. It can also help service providers to access

customer or user data to improve the delivery of services (Dahan & Sudan, 2015). Women in emerging markets are using digital IDs to open digital financial account and accessing government services. As the lack of sex-disaggregated data is a critical barrier to achieve progress towards gender equality, digital technology creates new avenues to generating data that can help identify where the gender gaps exist for public and private service providers. By generating better and more accurate data, policy and decision-makers can take informed actions to address gender inequalities. Yet, as much as it can act as an equalizer, digital technology can exacerbate existing inequalities due to prevailing gaps in access and availability. Furthermore, it can also pose risks to the population, such as gender-based online violence and harassment1 (Hinson, Mueller, O'Brien-Milne, & Wandera, 2018). The risks can undermine the expected positive effects of digitalization, particularly for underserved groups. Women are disproportionally and increasingly affected by online abuse, and those who experience online harassment may be pushed to leave their digital jobs or digital spaces (Hammond, Robinson, & Munoz, 2022; Wang & Affoun, 2021). In addition, accessing digital technologies can expose people to fraud and cybersecurity threats, and data breaches while also codifying existing biases through ostensibly 'neutral' algorithms (Noble, 2018). This is concerning as people's protected characteristics may be exposed and suffer discrimination as result. There is an urgent need for policy action to ensure that the future of digitalization does not continue to exclude underserved groups and that it does not cause more harm than good to society.

Defining Digital Inclusion and Equity

The UN Office of the Secretary-General's Envoy on Technology defines digital inclusion as "equitable, meaningful, and safe access to use, lead, and design of digital technologies, services, and associated opportunities for everyone, everywhere" (United Nations, n.d.). Digital equity refers to the context in which all people have the capacity and opportunity for full participation in the digital economy. Digital equity is an equally important aspect of inclusion, and some of its key dimensions include the following (Digital Future Society, 2019):

i. Access to quality and affordable infrastructure (i.e., electricity and internet) and digital devices
ii. Awareness and digital skills (basic and advanced), as well as literacy and entrepreneurship
iii. Availability of digital services, products, and relevant content provided by private and public organizations for work, social, and civic engagement
iv. Supportive ecosystems, including legal and policy frameworks, to address gaps in affordability, identification, and financial inclusion
v. Trustworthy and safe digital environment that is free of harassment

Digital inclusion and equity vary greatly across regions and countries. In Africa, for instance, the average cost of 1 gigabyte (GB) of mobile internet is 8.8 percent of income while in Latin America and the Caribbean this is 3.6 percent of income (Alliance for Affordable Internet, 2021)

The Need for Gender-Responsive Digital Policy and Legal Frameworks

In many regions, information and communications technology (ICT) and digital policies have not been developed to include the perspectives of women and underserved groups. These policies are meant to speed up digitalization as a value neutral concept, but they may exacerbate further digital exclusion (World Wide Web Foundation, 2022). Examples include limited investments in digital infrastructure that tend to be concentrated in urban areas, the lack of competitive digital services' markets, taxes on enabling digital services, and duties on the import of devices. These all constrain market development of the digital economy which disproportionately affects underserved groups and, in particular, women (Clifford, 2020).

In many countries in Sub-Saharan Africa, for example, taxes on mobile money withdrawals or digital services prohibit uptake of digital services, particularly for low-income women. In a situation where devices or services are expensive, women are often last in line for access and must rely on the men in the household to access services. These policy decisions on taxing mobile money withdrawals (where withdrawals from banks are not taxed) actively disincentivize the use of digital financial services. Achieving equal access to digital technology for men and women requires gender-responsive policies and frameworks for ICT and digital technologies that consider the needs of women and underserved groups (World Wide Web Foundation, 2022).

Data protection legislation is increasingly an area where additional policy support is needed to protect vulnerable populations. According to UNCTAD (2021), 71 percent of countries worldwide have some data protection legislation in place, although implementation and enforcement vary greatly. Uneven implementation, combined with gaps in cross-border alignment of legislation, reduces efficacy. Even in jurisdictions where legislation is being implemented, overall gender gaps in access to the justice system and gaps in its efficacy mean that ostensibly equitable legislation is not implemented equitably. For women, issues like reproductive privacy may be compromised by participation in the digital space. Even the Global Privacy Assembly, which first met as the International Conference of Data Protection and Privacy Commissioners (ICDPPC) and comprises representatives from 122 jurisdictions, does not have any dedicated research or resolutions relating to women (Coombs & McKee, 2019). More dedicated research is needed to understand the impact of existing legislation on women's digital safety and resolve issues.

The Business Value of Addressing the Digital Inclusion Gaps

It is imperative to close digital divides to deliver on the Sustainable Development Goals (SDGs) by 2030. Leaving no one behind means that everyone should be able to enjoy connectivity (ITU, 2022). The gaps in access deepen inequalities and have social costs and economic implications. Countries have lost out on $1 trillion in GDP due to the digital exclusion of women (Alliance for Affordable Internet, 2021). There are also benefits of addressing the gaps in access for specific economic sectors. Closing the mobile gender gap could add $700 billion in GDP growth by 2023 (Rowntree, 2019). The International Finance Corporation (IFC) estimates that between 2025 and 2030, the market for e-commerce could

increase by nearly $300 billion if the gaps in sales between men and women vendors are closed in Southeast Asia and Sub-Saharan Africa (IFC, 2021).

IFC research also suggests that if participation gaps in online learning between women and men learners in emerging markets were closed, the global value of the online learning market could grow up to an additional $14 billion by 2026. This research also indicates that one job is created for every 30 people trained online in the four focus countries studied: Egypt, India, Mexico, and Nigeria.

Emerging evidence and operational experience point to several challenges and opportunities in closing the digital gender gap. They lay in improving digital infrastructure and users' digital skills, enhancing digital business, public platforms and finance mechanisms, and strengthening online safety. It is also important to address overarching social norms, algorithmic biases in AI, and the lack of sex-disaggregated data. To follow is a brief description of these areas.

Digital Infrastructure

Around the world, while 95 percent of the global population lives in areas covered by mobile broadband networks, nearly 400 million people have yet to be connected (Delaporte & Bahia, 2022). In 2021, 86 percent of the global population in rural areas had access to 4G or 3G coverage while in rural Africa almost 30 percent or people cannot access mobile internet (18 percent are not covered by mobile broadband and 11 percent only have 2G coverage. The lack of awareness and access to devices and the prohibitive costs of devices and services remain challenging. Tackling the barriers to internet adoption and usage can close the digital gender gaps, while bringing greater equality for women. It can increase economic opportunities for women and reduce the prevalence of gender-biased social norms, early marriage, and fertility (Viollaz & Winkler, 2020). For instance, mHealth use can improve women's health knowledge, attitudes, and practices (Meherali, Rahim, Campbell, & Lassi, 2021). Several interventions exist to facilitate the enabling ecosystem for digitalization, including expanding and increasing the resilience of connectivity infrastructure, and to address the barriers to internet usage, such as access to and affordability of digital technology.

Expanding connectivity can reduce poverty and increase consumer welfare and women's labor force participation. Evidence shows that increasing mobile broadband connectivity can help reduce poverty in the long term. Women, in particular, stand to benefit with greater economic opportunities. For instance, a study conducted in Nigeria shows that after a year or more of mobile broadband coverage the total consumption in households increased by more 6 percent and that two or three years of 3G/4G coverage increased labor force participation for women (Bahia, et al., 2020). Women's use of mobile phones and the internet can increase their participation in the labor market (Ngoaab & Song, 2021). Fixed broadband costs are often high and out of reach for many people and, while cheaper, mobile broadband can be prohibitively expensive for mobile operators (Alliance for Affordable Internet, 2020). To expand connectivity, policies can be implemented to make infrastructure-sharing options

available, with benefits clear to all players. Operators that rely on wholesale infrastructure can be given specific advantages. Through the Universal Service and Access Funds (USAFs), policymakers can also support the expansion of broadband networks and ensure reach to rural areas, with a priority focus on serving public institutions and complementary providers, such as community network operators, and subsidizing the costs of individual devices (Alliance for Affordable Internet, 2020).

Affordability of devices is still a critical barrier to adoption, only worsened by the reduction in income during the COVID-19 pandemic which affected people's capacity to buy a mobile phone (Delaporte A., 2022). In most regions of the world, affordability of devices such as smartphones represents a significant cost in relation to an individual's monthly income. Several, interventions have proven effective in ensuring that women and underserved groups can access and use the internet and internet-enabled devices. For example, offering women and underserved groups adequate financing mechanisms can help them access digital technology, such as smartphones (Delaporte A., 2022). Outreach is important to ensure customers are aware and can take advantage of financing options. Partnerships for last-mile delivery of devices can also help get to those who are harder to reach in remote or rural areas. Device providers also need to ensure that devices available in the market meet people's needs and their willingness to pay. Public spaces, such as telecentres, community centers, libraries, and post offices, can also provide people with free or affordable access to computers, tablets, and other internet-enabled devices.

Digital technology and services need to integrate inclusive design principles to make sure that digital environments are accessible to all and no one is left behind. Inclusive design is a methodology that places at its core the understanding of the diversity of human experience around environments and use of technology (Microsoft, n.d.). Inclusive design recognizes those individuals who have been excluded, focusing on user-centered design to build better digital tools that address expectations from those who will use the technology. Inclusive design approaches help ensure that digital solutions meet the needs of women from underrepresented groups, persons with disabilities, and people in fragile and conflict settings. Involving these groups in the design and implementation of digital projects is fundamental to ensuring that their voices are heard and included, and operations deliver results according to their needs.

Digital Skills

In addition to increasing access to connectivity and devices, closing gender gap in internet usage requires improving women's digital skills and literacy so they can better use and benefit from the internet and digital technologies. Digital skills range from the competences to use a mobile phone and navigate the internet, to more complex skills and knowledge for coding and software programming. At the high end, the digital skills continuum encompasses people's ability to deploy and develop digital technologies and innovations. Digital literacy involves competences to access, use, manage and create digital information and tools (World Bank, 2021). Closing the gaps in digital skills, literacy, and awareness is important for gender

equality. With challenges around access to literacy and education, women are limited by their digital skills knowledge. Worldwide, 35 percent of men can provide correct answers to financial literacy questions, compared with 30 percent of women (Klapper & Lusardi, 2020). In emerging markets, literacy and digital skills are the second most reported barrier to owning a mobile phone by women and the topmost reported barrier by women mobile users who are aware of the mobile internet but are not using it (Shanahan, 2022).

Understanding the quality and level of skills required to enable women to adopt and use digital technology is a challenge. This is due to a lack of evidence and frameworks to allow countries to classify and evaluate these skills (World Bank, 2020). In addition, poor literacy and numeracy skills can prevent people from learning digital skills, thus reinforcing the need for universal access to education. To ensure they have the required digital competencies for a sustainable and resilient future, countries need to identify shortages in digital skills and set goals on capacity building for its citizenry (World Bank, 2021). This will require actions to identify and address digital skills gaps facing women and underserved groups and actively implement solutions. This may include the provision of training for digital competencies in formal education or non-formal training programs or the creation of ICT labs or community centers where people can gain digital skills (UNICEF, 2019).

Digital Businesses

Digitalization has led to the development of digital platforms by governments and the private sector, changing fundamentally the way in which services are provided and how platform users and service providers interact. Emerging economic sectors enabled by digital platforms, such as e-commerce and ride-hailing, are increasingly providing opportunities for women to generate income. The digitalization of government services is also helping to break down access barriers that women face in health care, education, and other types of government support, including cash transfers. The growth in digital platforms in the private sector has increased income opportunities for women. The COVID-19 pandemic highlighted some of these opportunities. During the pandemic, women-led small and micro-enterprises were more likely to increase the use of digital platforms compared to men-led businesses (Iacovone, et al., 2021). However, women still benefit less than men when using digital platforms for income generation, even if they are active users.

Research by IFC has generated evidence on how women can gain access to employment in the digital economy. E-commerce offers pathway for women's economic inclusion driven by digital technologies. Women-led businesses represent between 35–51 percent of all businesses on e-commerce platforms across five countries studied, and women are entering e-commerce at higher rates than the offline market (IFC, 2021). However, they are more likely than men to run micro-enterprises and less likely to participate in high-value sectors. Closing gender gaps on e-commerce platforms could bring $300 billion to the market in Africa and Southeast Asia (IFC, 2021). Increasingly, private sector companies are moving their procurement online through the use of portals as the benefits of digitalization are becoming evident. In the coffee value chain for example, increased transparency offered by

digitalization leads to higher premiums for value chain actors as traceability increases the prices consumers are willing to pay (ICO, 2018). This is a sector where 20–30 percent of farms are operated by women. In the trade of fast-moving consumer goods, the concentration of women-led firms varies depending on the market context, but it can also be high. In the Philippines, for example, women own 88 percent of the country's micro, small, and medium enterprises (MSMEs) in the retail and wholesale industry (Asia Pacific Foundation of Canada, 2018). Yet, many of them face barriers in accessing corporate procurement contracts.

Digital Public Platforms

Digital public platforms provide another important pathway toward women's financial inclusion. Government-to-person payments (G2P) are used to distribute cash assistance to vulnerable and low-income populations. To respond to economic and social impacts of COVID-19, many governments digitalized payments (Rutkowski, Garcia Mora, Bull, Guermazi, & Brown, 2020). Using existing digital public infrastructure, including identification, payments, and trusted data-sharing processes, governments were able to implement response programs and reach more beneficiaries (World Economic Forum, 2022). While governments have been able to reach many people through digital payments, gender gaps persist in financial inclusion. In developing economies, men with an account are, on average, 6 percentage points more likely than women with an account to use digital payments (Demirguc-Kunt, Klapper, Singer, & Ansar, 2022). This gender gap in the use of digital payments among account owners has remained virtually unchanged since 2014, despite the overall increase in digital payments. Furthermore, about one-third of mobile money account holders in Sub-Saharan Africa say they could not use their mobile money account without help from a family member or an agent. Women are 5 percentage points more likely than men to need help using their mobile accounts (Demirguc-Kunt, Klapper, Singer, & Ansar, 2022).

The digitalization of government payments can encourage people to set up digital accounts and increase digital inclusion. For instance, in emerging markets, 39 percent of adults—or 57 percent of those with a financial institution account (excluding mobile money)—opened their first account (excluding mobile money) at a financial institution, specifically to receive a wage payment or receive money from the government (Demirguc-Kunt, Klapper, Singer, & Ansar, 2022). Among adults in developing economies with an account at a financial institution, roughly 865 million opened their first account to receive money from the government, including 423 million women (Demirguc-Kunt, Klapper, Singer, & Ansar, 2022). Digital payments can improve women's economic empowerment and financial inclusion. Women can access money more conveniently, they can get paid directly into their accounts, and their access to government program's benefits is improved (Rutkowski, Garcia Mora, Bull, Guermazi, & Brown, 2020). Evidence on digital payments for women's economic empowerment points to some key actions to ensure benefits reach women, including opening accounts in women's own names, governments depositing payments to women, and providing digital financial literacy and information (Hammond A., n.d.).

Digital Finance

Digital financial services can boost the financial inclusion of women, offering them greater privacy, security, and control over their money. While the COVID-19 pandemic had huge implications on economic development, the rapid adoption of technology for financial transactions, in response to mobility and social distancing restrictions, led to greater access to and use of formal financial services. For example, the digitalization of government transfer payments led many people to open an account for the first time to receive subsidies, pension funds, or public sector wage payments (World Bank, 2022). Global Findex data finds that 71 percent of people in developing countries have a financial account. This includes about 865 million account owners in developing countries (18 percent of adults), including 423 million women, who opened their first financial institution account for the purpose of receiving money from the government (Demirguc-Kunt, Klapper, Singer, & Ansar, 2022).

Expanding access to digital financial services for women requires addressing underlying causes of financial inequality. For example, mobile money has been a game changer in offering financial services to many people who lack access to traditional banking systems in Sub-Saharan African and other countries. This includes many women who benefit from the convenience and lower costs of transacting with local mobile money agents, rather than traveling to the nearest bank branch. In some countries, however, financial and social gender biases leave women behind in mobile phone ownership. One barrier women face is a lack of national identification, which is necessary to register an account or purchase a SIM card in one's name (World Bank, 2022). Digital identification, such as biometric identification, can facilitate customer on-boarding by local agents and customer due diligence for transactions. Women also lag men in basic numeracy and literacy skills. As illustrated in, addressing the gender gap in financial literacy could help women use formal financial services more responsibly and effectively and improve their use of digital platforms, such as ride-hailing, e-commerce, and e-health applications (World Bank, 2022).

Online Safety and Security

As more women get online, safety and security concerns are increasingly an issue. In many cases, women are experiencing the same type of harassment they face offline but now magnified by technology. These risks limit women's participation online. For women who do not own a mobile phone and for those who are still not online, safety and security is the third-most reported barrier to mobile internet use (Shanahan, 2022). Many of these women may face fears of intimidation, harassment, violence, fraud, surveillance, identity theft, misuse of personal images and data, and privacy challenges. In some cases, male gatekeepers limit women's use of digital technology, citing safety concerns as a reason for women to not go online.

Abusive language or comments and sexist or misogynist comments directed at women are commonly reported as types of online aggression experienced by women (Amnesty International, 2017). These were intensified during the pandemic (Wang & Affoun, 2021). A few countries have established legal frameworks to protect individuals from online

harassment and bullying, such as in the Marshall Islands, but implementation varies significantly across and within regions (Wang & Affoun, 2021). Without adequate protection, women may limit their access and participation in digital services and environments, contributing to their digital exclusion. Combating online gender-based violence (GBV) and creating safe online environments are essential for gender equality. Countries can take actions to define and penalize cyber aggressions and use these definitions to collect data that can inform the development of programs and policies to counter digitally-enabled GBV. Similarly, tech companies can play an important role by adapting solutions, or creating new tools, to address the pervasiveness of GVB online and provide better support to users (Hinson, Mueller, O'Brien-Milne, & Wandera, 2018). Digital skills training can also help women learn how to keep themselves safe while online.

Social Norms

Closing the digital gaps means going beyond the technical components required to build digital infrastructure and connectivity. Equally important is addressing restrictive gender norms, role expectations, stereotypes, and patriarchal systems that can limit women's and girls' access to digital technology, as well as their participation and contribution in the tech sector. Gender norms can determine women's digital inclusion, as they are often embedded in formal and informal institutions. In some countries, the historically patriarchal norms mean that women can have restricted access, ownership, and use of digital technology. For mobile phone and internet usage, for instance, lack of family approval is a major reason preventing women from using mobile internet. It ranks as one of the top three barriers for women in Nigeria, Bangladesh, and Pakistan (Shanahan, 2022). In Pakistan, over 30 percent of women (compared to only 3 percent of men) who do not own a phone cite family disapproval as the main reason for the lack of ownership.

Gender stereotypes may also limit women's participation in the tech sector. Gender disparities in STEM education perpetuate existing gender disparities in income and employment (UNESCO, 2017). Socialization processes and stereotyped ideas of gender roles heavily contribute to girls' self-selection bias, leading them to opt out of STEM. Interventions to get more girls and women in STEM include creating awareness to counter misconceptions about STEM, promoting safe and inclusive learning environments, removing biases in learning materials, recruiting more women STEM educators, strengthening teaching capabilities and STEM curricula, and creating mentorship opportunities for girls in STEM (UNESCO, 2017; Hammond, Rubiano Matulevich, Beegle, & Kumaraswamy, 2020). Digital tools can be used to implement several of these interventions, as long as the gender gaps to digital and online education are also tackled.

Additionally, women are underrepresented in tech sector leadership. As of 2022, only 24 percent of leadership in the technology industry are held by women (World Economic Forum, 2022). With fewer women in tech and management roles, it is less likely that solutions generated in the tech sector are inclusive. IFC's research shows that companies with more than 30 percent women on their boards demonstrated better financial performance than

those with less than 30 percent (IFC, 2019). Women make up only around 11 percent of senior investment professionals in private equity and venture capital in emerging markets, and only 7 percent of the total funding in emerging markets goes to women-led business (IFC, 2019).

Access to finance for women-led tech firms also continues to be a challenge. According to a 2021 World Bank report, only 3 percent of the USD 1.7 billion in startup funding in Africa went to all-women teams while 76 percent of funding went to all-men teams (World Bank, 2021). Globally, only 11 percent of seed funding capital in emerging markets is given to women-founded companies, and the proportion of funding reduces significantly for later stages (IFC, 2020). The lack of funding to women-led companies has spillover effects for women's employment in tech, as women-founded firms employ more women as staff and in management. Gender-lens investing solutions and more diversity in investment decision making can help address some of these gaps.

Algorithmic biases amid the rise of AI

There is a risk of frontier technologies exacerbating digital gender gaps. The acceleration in the development and adoption of digital technologies and platforms, as well as the increasing computing power, have brought an unprecedented opportunity for large sets of digital data and complex analysis to inform solutions embedded with big data, AI, and machine learning (ML). These frontier technologies can bring great benefits to people and are increasingly being used to address complex development challenges, from health care to agriculture, weather and climate, and education (United Nations, 2018). AI/ML, software as a service (SaaS) application, and robotics, digital manufacturing, and other automation have improved efficiency and transparency and have shorten the time for organizations to make informed decisions (United Nations, 2018). Yet, these technologies are still in their infancy and their long-term impact is not known. Some risks have started to emerge.

Unintended consequences of AI/ML can exacerbate inequalities and discrimination against certain groups. For example, advancing AI/ML may shift the demand for labor and skills, benefitting those who have these skills and reducing opportunities for those who do not (often women and underserved groups). Automated decision making will also displace people by replacing jobs (often done by women) and, consequently, will increase inequalities between people, within countries, and may even widen gaps between high-income countries and emerging markets (Strusani & Vivien Houngbonon, 2019; Huttson, 2017).

Furthermore, AI/ML pose significant social challenges, including issues with data privacy and security, algorithmic biases around gender and race, and the ethical use of AI. Reasons for these challenges include the lack of policy and regulatory frameworks for data privacy and protection, as well as the lack of diversity in the technology sector and AI fields. For instance, most AI pilot studies in health care have been conducted in higher economies by men researchers (Leo Anthony Celi, et al., 2022). Addressing the risks of AI and frontier technologies will require interventions at different levels. Actions are needed to recruit more

women and underrepresented groups in AI and other tech sectors, to ensure that technologies are inclusive throughout their lifecycle (Khan, 2021). This will require that more women and underserved groups have the skills needed for AI. This points to interventions that increase the participation of women and underrepresented groups in STEM and training programs to learn to code and other skills needed for AI (Khan, 2021).

Lack of Sex-Disaggregated Data

Understanding the gaps in digital inclusion requires data to capture their character and magnitude, including why these gaps exist and how different people experience the use of digital technologies. In the private and public sectors, sex-disaggregated data is often not available and, when available, is rarely updated. At a minimum, data should allow the measure of access and use of digital technologies for men and women (World Bank, 2018). Possible data sources include sex-disaggregated nationally representative consumer surveys, national labor force surveys, nationally representative demand size survey on ICT access, and use data from digital platform providers. To understand women's experiences around digital technologies, it would also be valuable to conduct qualitative studies on barriers and inequalities and how they impact women's use of digital technologies.

Digitalization is part of everyday life, so any strategy to reduce gender inequalities must address disparities in access, affordability, and usage of digital technologies. The public and private sector have a significant role to play in ensuring digital technology reaches women, aligns to their needs, and strengthen their economic empowerment. This thematic policy note has gathered evidence of operational implementation and investments in the area of digital development where projects address one or more barriers to the digital and financial inclusion of women. While many projects are in early stages and impact evaluations are not yet available, this review provides impetus for the World Bank Group to continue strengthening work on the digital inclusion of women and underserved groups. Specific recommendations for the World Bank Group and its partners include the following.

Include Gender Gaps in Digital Inclusion in New and Existing Analytics

Given the cross-cutting nature of digital inclusion, there is an opportunity to integrate digital inclusion analysis into the World Bank Group's core analytics, like Country Economic Memorandum, Country Economic Update, poverty assessments, and job diagnostics. Analytics like the Public Expenditure Review and the Program Expenditure Review offer a platform to analyze how much of public funding goes to a specific area of interest. It would be important to analyze existing ICT and digital investments through a gender lens to ascertain the impact on digital inclusion. With the support from the Gender Innovation Labs and the Development Economics Vice-presidency, research can help generate much needed sex-disaggregated data to inform digital interventions.

The Financial Sector Assessment Program (FSAP) could focus on more targeted policy recommendations to reduce gender gaps in digital financial services (DFS). While DFS gender gap analysis is part of the program, the menu of gender-specific actions is limited.

Most recommended actions are broadly targeted with the expectation that an overall increase in DFS adoption would also extend to women. The World Bank supports national financial inclusion strategies (NFIS) across the globe, and this would be a strong platform to further invest in reducing digital inclusion gaps through the development of more targeted activities. The Digital Economy for Africa program undertook country-level diagnostics to generate insights into five key themes: digital infrastructure, digital businesses, digital skills, digital financial services, and digital public platforms. These analytics offer a starting point to develop a more holistic approach toward women's digital inclusion through projects spanning multiple Global Practices.

Instruments like the Enterprise Survey also offer an opportunity to integrate digital inclusion at the firm level, thereby engaging the private sector as a major player to reduce gender digital gaps. Currently the framework of the survey incudes questions on the usage of basic digital technologies, like internet and email. There may be opportunities to include questions on whether the firms engage in online sales, marketing, e-commerce platforms, and the like. Digital platforms are in a particularly advantageous place as they can capture sex-disaggregated data and use it to improve women's user experiences and, at the same, design solutions tailored to them. New analytics are needed to focus on the multidimensional factors that influence digital inclusion for women. For example, in advocating for broader digitalization of public services, there is a need to take a more nuanced approach toward the implications for women's privacy and security. While national IDs yield tremendous benefits for citizens, legal protections are necessary to protect against discriminatory legislations based on identity, especially for women. Important building blocks for a more inclusive digital economy include transparency in how data provided to governments is used and built-in measures for citizens to control who has access to their data and how it is used.

Similarly, more policy work is needed to support governments in regulating how private platforms and digital services use data. One of the main reasons why women may also opt out of the digital economy is the lack of effective regulation of how data is used by private platforms and digital services (Keck, Gillani, Dermish, Grossman, 2021). The World Bank Group has a role in providing technical assistance on the regulation of the private tech sector and public data safety to facilitate competitive markets and ensure consumer protection, similar to support provided for regulation of other sectors. Emerging new analytics like the Country Climate and Development Reports (CCDRs) offer an additional pathway to bring in digital inclusion for women and understand the intersectional vulnerabilities that women face across the spectrum of development challenges. Mainly the focus should be on enriching existing analytical tools to more concretely and explicitly and developing new approaches towards identifying, quantifying and analyzing gender gaps in digital inclusion, the applicability of these gaps across WBG operations and investments, and dedicated, measurable actions to reduce these gaps.

Strengthen the Holistic Nature of Projects to Reduce Gender Gaps in Digital Inclusion

The primary requirement for women's participation in the digital and digitalized economy is ownership and affordability of digital devices and services. In addition to directing investments toward digital networks and backbone infrastructure, there is opportunity to prioritize investments in initiatives that facilitate access to low-cost devices, like smartphones, tablets, and laptops, as well as digital skills training programs for women. Many governments levy import duties on basic digital devices and, in the absence of locally manufactured, affordable devices, these taxes make it difficult for low-income women and other segments to access devices. There may be opportunities to develop a set of policy recommendations around tiered duties that subsidize import of devices. A combination of analytics, technical assistance, and operational support offers a viable path for World Bank Group activities to broaden and deepen support for an inclusive digital economy.

There is also a need to expand beyond physical infrastructure and address affordability and wider provision of services. High prices of internet and data services lead to reduced uptake among low-income populations. Within countries, there tend to be regional differences in access, and providers of digital services can be incentivized to reduce connectivity gaps for women consumers and other underserved segments. Even in countries where prices may not come down in the short term, there may be opportunities to invest in public access to the internet. In Uganda, for example, the government offers subsidized internet access to business incubators (although these tend to be located in larger urban areas and available only to startups). The expansion of such a network across underserved regions may offer a viable path for underserved populations, including women, to gain access to digital technologies.

In designing new projects, it is important to go beyond the framework of gender tagging and support task teams in undertaking more creative approaches to addressing digital inclusion across sectors. It is also important to take into account the data protection and privacy implications of the growing portfolio of projects focused on digital infrastructure and services. This would require working across Global Practices within the World Bank and developing projects that address the multidimensional constraints of digital equity and inclusion for women. As the IFC portfolio of investments in the tech sector grows, there is an opportunity to support investees in identifying gender gaps in their operations and offerings. Finally, it is important that inclusive design approaches are integrated into operations and investments to ensure that the voices of women and underserved group are heard, and the outcomes of the project address their need for technology and digital inclusion. Inclusive approaches increase the likelihood that outputs of the implementation are adopted by women.

Address Social Norms That Restrict Women's Digital Inclusion

Dedicated activities that focus on addressing social norms around women's access to and usage of digital services need to be better integrated into World Bank Group operations that focus on the digital economy. Important social norms to consider include economic mobility,

physical mobility, interactions between people of different sexes, perceived need for identification, social constraints against women's use of digital technologies, gender biases in STEM education and employment, and discriminatory laws and procedures (World Bank, 2018). Where operations support expanded digital infrastructure and access, there is a need to add activities that identify local dynamics around gender gaps in digital inclusion and work with local communities to develop customized programs that can scale up women's usage of digital technologies. Activities focused on enhancing women's voice and agency would also benefit from leveraging digital technologies.

Support Women's Participation and Leadership in the Tech Sector

It is also essential that women are recognized as more than passive recipients of technology. Their full participation in designing and implementing tech solutions for pressing global problems must be supported through World Bank Group activities. Gender discrimination and harassment in the workplace are also persistent in the tech sector. While data from emerging markets is limited, nearly 50 percent of women working in STEM jobs report gender-related discrimination at work, compared to 19 percent of men working in the sector (Funk & Parker, 2018). This in turn constrains women's entry into and success in the tech sector. More needs to be done to ensure that respectful workplace policies are set in place in the tech sector so that more women can be active participants in the development of technologies.

To increase women in the tech sector, more girls and women need to enroll in STEM education, complete educational programs and be gainfully employed in the tech sector. Addressing the gender norms in learning requires engagement with parents and educators to reshape attitudes toward the participation of girls in STEM, and encouraging the participation of girls and women in extracurricular activities related to STEM, such as coding and robotics camps, to increase their interest in the field (World Bank, 2020). Women role models as examples of what success means for women in the sector and mentorship programs can encourage more women to pursue STEM-related careers. The private sector can also play a role by providing financial support to STEM initiatives for women, facilitating exposure of women role models and providing opportunities for women and girls, such as internships programs (World Bank, 2020). At the same time, broader inclusive workplace policies that provide access to childcare, maternity leave, anti-harassment initiatives would also benefit women in tech.

In many countries, government-led support programs for the private sector include financial incentives, like risk sharing facilities, credit lines, and guarantees, and are enhanced by World Bank operational investments. To support more women-led firms, these instruments can be better targeted to support women-founded and managed firms. For example, credit guarantee schemes can be designed to offer dedicated windows for women-led firms and include women-led tech firms and/or digitalization of women-dominated sectors as specific segments of focus. IFC works with venture capital funds to increase the percentage of capital that funds allocate to women-led companies. Programs focused on diversifying boardrooms

could also focus on diversifying tech company boards which remain primarily male dominated.

Invest in Digitalization of Women-Dominated Value Chains and Sectors

Digital platforms need to consider the needs of women-owned small and medium enterprises, as well as other women users. In sectors such as e-commerce, evidence shows that women can leverage technology to enter more profitable sectors and pursue great value-added opportunities as the platforms can address challenges of market access and in some cases logistics handling. To better support all women, digital platforms need to collect sex-disaggregated data to inform solutions. These may include leveraging platform financing, helping women to take advantage of paid promotions to boost their sales, increasing training offerings for women, and encouraging women entrepreneurs to enter high-value sectors (IFC, 2021).

Investing in the digitalization in value chains where women have an increased presence—agribusiness, hospitality, trading, and services, for example—offers a pathway to leverage digital technologies for women's greater economic and digital inclusion. Digital technology can provide greater visibility for companies and help them to identify gender inequalities in distribution networks, such as gaps in the participation of women distributors and retailers and differences in sales performance. Working to build firm capacity to access these platforms and addressing the logistical challenges of cross-border e-commerce through World Bank operations offers an opportunity to realize the potential economic benefits of an inclusive digital economy. In countries like Uganda, where women farmers in the coffee sector face significant income gaps, digitalization of the coffee value chain offers an avenue to increase transparency and link women farmers directly to processors and buyers thereby increasing the likelihood of higher income generation.

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