Financing for Sustainable Development Report 2021

Inter-agency Task Force on Financing for Development

United Nations

This report is a joint product of the members of the Inter-agency Task Force on Financing for Development. The Financing for Sustainable Development Office of the United Nations Department of Economic and Social Affairs serves as the coordinator and substantive editor of the Financing for Sustainable Development Report.

The online annex of the Task Force (http://developmentfinance.un.org) provides additional data and analysis on progress in implementation of the Financing for Development outcomes, including the Addis Ababa Action Agenda and relevant means of implementation targets of the Sustainable Development Goals.

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for Economic Cooperation
and Development

The production of this report and the online annex of the Inter-agency Task Force are generously supported by the Federal Ministry for Economic Cooperation and Development of Germany.

How to cite this report:

United Nations, Inter-agency Task Force on Financing for Development, *Financing for Sustainable Development Report 2021*. (New York: United Nations, 2021), available from: https://developmentfinance.un.org/fsdr2021.

United Nations publication

Sales No. E.21.I.6
ISBN: 978-92-1-101442-6

Science, technology, innovation and capacity-building

Chapter III.G

Science, technology, innovation and capacity-building

1. Key messages and recommendations

Science, technology and innovation (STI) has been instrumental in the global response to the COVID-19 crisis, and can help build more resilient societies. STI has long been recognized for its contributions to sustainable development. In an increasingly complex and interrelated risk landscape, it can help identify and manage risks, and build more resilient societies. From the onset of the pandemic, policymakers have relied on scientific knowledge for guidance. Medical innovations are helping societies cope with the emergency and pave a way towards recovery. New digital technologies are supporting economic activity—including through remote work, education, e-commerce and finance—and accelerating digital trends with potentially lasting consequences for all areas of social and economic life.

At the same time, the acceleration of digitalization has deepened the digital divide and exacerbated other risks of unintended consequences of digital technologies. As more activities are shifting to the digital realm, the digital divide is rapidly becoming a development divide by perpetuating or worsening existing inequalities, including gender inequality. The rapid scaling up of digital services has also aggravated other risks, including new forms of exclusion, the spread of misinformation, and market dominance by large digital platforms.

- *Policymakers should make every effort to build an inclusive digital economy, including by ensuring affordable Internet access for all and increasing digital literacy;*
- *Public and private cooperation can help mobilize the estimated $428 billion needed to achieve universal broadband Internet access by 2030;*
- *National financial inclusion strategies should build on the potential of financial technology (fintech), while addressing inequalities and financial stability risks;*
- *More transparent algorithms, guidelines for the ethical use of artificial intelligence (AI), and the inclusion of more diverse views in the innovation process can help overcome new forms of exclusion;*
- *Content regulation is a complex issue and requires careful consideration of the rights and obligations of platform providers, users, other private and civil society organizations and government institutions;*
- *Regulatory frameworks, including enhanced antitrust regulation, are needed to reduce the market power of large digital platforms—including in fintech—and create a more level playing field.*

Beyond the immediate COVID-19 pandemic, STI can support and advance strategies to reduce the likelihood of shocks and build more resilient societies. Despite progress, including through public-private research cooperation, there is still insufficient understanding of the systemic nature of risk and interdependencies between sectors. Least developed countries (LDCs) and many other developing countries lack the necessary information and resources to manage shocks and build resilience.

- *Enhanced development cooperation, investment and knowledge-sharing are needed, particularly for LDCs, to strengthen their knowledge of risk and help address complex hazards. The recent decline in official development assistance for STI must be reversed;*
- *Mission-oriented innovation can contribute to reducing risk and building resilience, by setting incentives that direct innovation towards specific technological, environmental or social goals;*
- *Policymakers, telecommunications providers, and other stakeholders need to ensure resilient telecommunications infrastructure, to ensure that communications are available during disaster response and recovery.*

Numerous United Nations entities contribute to the strengthening of Member States' STI capacity; they have joined forces to tackle the COVID-19 crisis. Both the Technology Facilitation Mechanism (TFM) and the United Nations Technology Bank for the Least Developed Countries (Technology Bank) are cooperating with the World Health Organization (WHO) and other United Nations entities to strengthen developing countries' response to and recovery from the pandemic, and the United Nations Commission on Science, Technology and Innovation has provided a platform for member countries to discuss how to use STI to close the gap on Sustainable Development Goal (SDG) 3 on good health and well-being.

- *Member States are called upon to step up their contributions to the Access to COVID-19 Tools (ACT) Accelerator to close the remaining funding gap of over $20 billion for 2021;*
- *Continued efforts by Member States are also needed to help the TFM and Technology Bank deliver on their mandates to support developing countries' adaptation of new technologies for sustainable development.*

The next section of this chapter reviews the role of digital technologies in the COVID-19 response and makes recommendations for building an inclusive digital economy; section three lays out how STI can help address complex risks and build resilience; section four highlights how STI is interacting with other action areas of the Addis Ababa Action Agenda; and section five takes stock of the progress on STI for the SDGs—including in combatting COVID-19—across the United Nations system.

2. New and emerging digital technologies in times of COVID-19 and beyond

Digital technologies helped societies respond to COVID-19. Their adoption expanded dramatically, driving lasting changes in all sectors of the economy. Digital trends have accelerated in all areas, including health, labour markets, consumer behaviour, e-commerce and financial services. While throwing a lifeline to many companies and communities, this has also exacerbated existing risks. Digital divides create new challenges and threaten sustainable and inclusive development. Significant efforts are needed from all stakeholders to create inclusive digital economies.

2.1 Acceleration of digital trends

Digital technologies have been critical for both medical and non-medical responses to COVID-19, with lasting consequences around the world. Digital and data science tools have been essential for epidemiological monitoring, maintaining physical distancing and tele-health. Digital technologies have also impacted social and economic behaviours during the crisis, in response to lockdowns and the need for social distancing. Digital tools for remote work have become widespread and are now part of the "new normal". More consumers are shopping online, and more people rely on the Internet for education, interaction with government services, news, information and entertainment. There has also been a big push for digitalization in e-commerce, logistics, and customs systems (see section 4.4). Many changes in the use of digital technologies and online activities are likely to continue after the crisis.

Impacts on labour markets

For many people, digital technologies have made work more mobile, task-based, ever-present and virtually non-stop. These trends are expected to accelerate as a result of the COVID-19 pandemic. The increased availability of smartphones, tablets, laptops and desktop computers has facilitated work outside the employer's premises. The sectors in which the workforce deals primarily with information and data—the so-called knowledge sectors of technology, finance, engineering and media—have felt this most. However, as noted in the *Financing for Sustainable Development Report (FSDR) 2020*, traditional sectors in agriculture, manufacturing and services have also benefited from cheaper, instantaneous, and global data flows.[1]

Before the pandemic, only a fraction of the global workforce was occasionally working from home. For instance, within the European Union (EU), the incidence of regular or occasional teleworking (home-based telework and mobile telework combined) varied from 30 per cent or more in Denmark, the Netherlands and Sweden to 10 per cent or less in the Czech Republic, Greece, Italy and Poland. Depending on the studies, up to 20 per cent of the workforce in the United States of America were regularly or occasionally working from home or another alternative location, 16 per cent in Japan, and just 1.6 per cent in Argentina.[2] At the global level, the International Labour Organization estimates that 7.9 per cent of the world's workforce (approximately 260 million workers) worked from home on a permanent basis before the COVID-19 pandemic.[3]

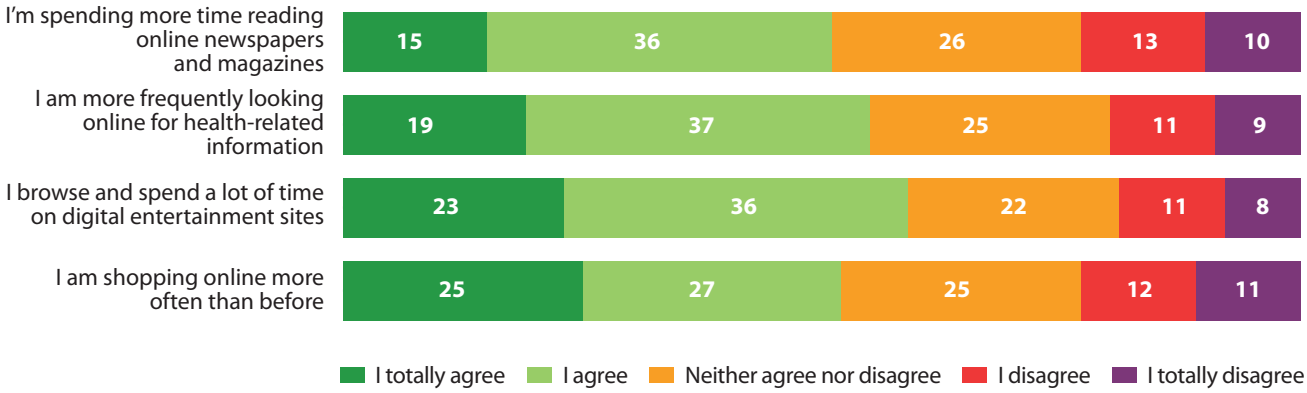
With the COVID-19 pandemic, the share of teleworking has sharply increased, as companies have taken steps to facilitate the practice. A survey of 250 large firms carried out in Argentina in March 2020 found that 93 per cent had adopted a teleworking policy in response to the COVID-19 pandemic.[4] Other studies have estimated the home-based work potential to be from 24 to 31 per cent for different European countries and 34 per cent for the United States.[5]

However, this shift to teleworking has not yet reached most people in low- and lower-middle-income developing countries. Big surges of technological change follow a wave pattern. They start in one or two of the most technologically advanced countries and then begin spreading around the world—first to other advanced economies, then to more complex sectors of emerging economies. Over time, they move towards the more peripheral economies. The spread of new digital technologies in the workplace takes time, as it usually starts in more complex industries in which fewer developing countries are engaged. For example, the finance and manufacturing sectors are early adopters of AI, Internet of Things (IoT), big data, and blockchain. Thus, these sectors will be the first to experience workplace changes.[6] It also requires a digital infrastructure, but only 29 per cent of people in Africa and 19 per cent in the LDCs were using the Internet in 2019, compared with over 80 per cent of people in Europe.[7]

Changing consumer behaviour

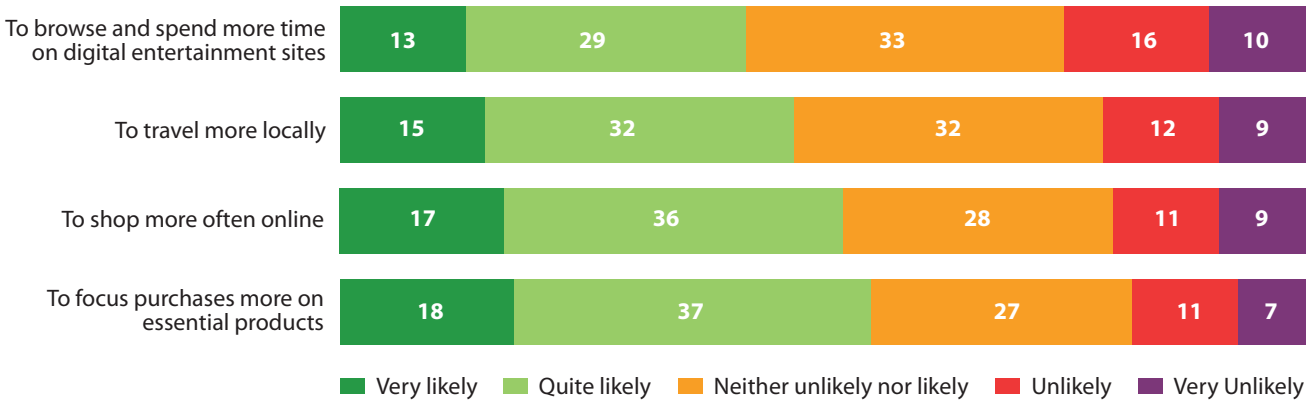
Consumer behaviour has shifted online in multiple ways. A recent survey conducted by the United Nations Conference on Trade and Development (UNCTAD) in collaboration with NetComm Suisse eCommerce

Figure III.G.1
Effects of COVID-19 on the use of digital technologies
(Percentages)



Source: UNCTAD and NetComm Suisse eCommerce Association.
Note: Respondents were asked to indicate how strongly they agreed with the above statements.

Figure III.G.2
Likelihood of continuing newly adopted behaviours beyond the COVID-19 pandemic
(Percentages)



Source: UNCTAD and NetComm Suisse eCommerce Association.
Note: Respondents were asked how likely they were to continue their online habits adopted during the COVID-19 pandemic.

Association examines the effects of COVID-19 on consumer behaviour in the use of digital technologies and e-commerce in nine countries, representing both emerging and developed economies.[8] The results suggest that, for the first time, digital technologies offered an alternative channel for maintaining business activities, social interactions and consumption in times of strict preventive measures such as lockdowns (figure III.G.1). Many consumers expect a continuation of the digital habits adopted during the COVID-19 outbreak, most notably, in terms of online shopping (figure III.G.2).

Rising inequalities and risk of misinformation

The trend to faster digitalization also creates challenges, as many people still lack Internet access and/or digital skills. With half of the world's population still not connected to the Internet, the development divide has translated into a digital divide and vice versa. Existing income, gender, age, education, health and other inequalities affect access to the benefits of new technologies and risk further exacerbating social divides. For instance, in the education sector, 188 countries imposed countrywide school closures during the pandemic, affecting more than 1.6 billion children and youth. The pandemic has increased existing inequalities in children's learning, particularly affecting schoolchildren in poorer countries. Globally, many schools lack the resources to invest in digital learning, and many children from poorer households do not have Internet access. According to the International Children's Emergency Fund (UNICEF), at least one third of the world's schoolchildren—463 million children globally—were unable to access remote learning when COVID-19 shuttered their schools, with large differences between and within countries.[9]

Another challenge is the risk of online mis- and disinformation. COVID-19 is the first pandemic in history in which technology and social media are being used on a massive scale to keep people safe, informed,

productive and connected. At the same time, digital technology is enabling an infodemic[10] that undermines the global response and jeopardizes measures to control the pandemic. This includes the unintentional spread of misinformation and deliberate attempts to disseminate wrong information or to advance alternative agendas of groups or individuals. Mis- and disinformation can be harmful to people's physical and mental health; increase stigmatization; threaten health gains; and undermine compliance with public health measures, thus endangering countries' ability to stop the pandemic.[11]

Voluntary codes of conduct for large digital platform providers have helped combat misinformation. In 2018, Facebook, Google, Twitter and others signed the EU self-regulatory code of practice on disinformation (Microsoft and TikTok joined later). In June 2020, the European Commission asked these platforms to provide monthly reports on their actions to limit disinformation and advertising related to COVID-19. According to these reports, Google blocked or removed over 82.5 million COVID-19 related ads between January and August 2020, suspended more than 1,300 accounts from EU-based advertisers, and took action on over 1,700 URLs with COVID-19 related content. Microsoft Advertising rejected 3,871,425 advertiser submissions related to COVID-19 globally in August 2020. Twitter removed 4,000 tweets and challenged 2.5 million accounts in August. Facebook displayed misinformation warning screens and fact-checks on over 4.1 million pieces of content in the EU in July and 4.6 million in August. In July and August, TikTok applied a COVID-19 sticker to more than 86,000 videos across its four major European markets (Germany, France, Italy and Spain), while removing more than one thousand COVID-19 related videos, owing to medical misinformation and policy violations.[12] Despite their efforts, platform providers have struggled to keep pace with the growth of misinformation. Faced with difficult ethical choices as to what constitutes misinformation, some providers have called for new regulations to help define norms.

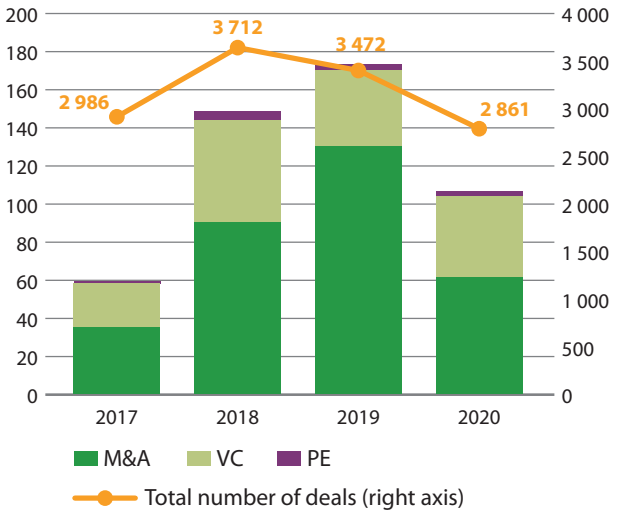
Additional action is needed to combat misinformation and increase big tech companies' responsibilities for content on their platforms. A recent European Commission report found shortcomings in the voluntary code of practice related to: (i) inconsistent and incomplete application across platforms and countries; (ii) a lack of uniform definitions; (iii) coverage gaps; and (iv) limitations of self-regulation.[13] In December 2020, the European Commission announced that it would update the code of practice and propose new legislation on political advertising transparency in 2021.[14]

2.2 Digital financial services during COVID-19 and beyond

Lockdowns and social distancing have boosted the usage of digital financial services, allowing many households and micro, small and medium-sized enterprises to access financial resources and maintain some level of economic activity. A recent joint survey by the Cambridge Centre for Alternative Finance, the World Bank and the World Economic Forum found that, during the first half of 2020, transaction volumes had increased in almost all areas of fintech, compared to the first half of 2019. Digital payment volumes grew by 21 per cent, as consumers and businesses increasingly used digital channels for sending and receiving payments and remittances. Transaction volumes also increased in digital capital raising, digital savings, WealthTech[15] and InsurTech,[16] among others. The only category that witnessed declines was digital lending, reflecting the economic slowdown. Fintech providers in developing countries saw higher growth in transaction volumes and the number of deals than those in developed economies.[17]

Overall, fintech investment fell in 2020, despite a strong recovery during the second half of the year. But venture capital fintech investment recorded positive growth. Total investment in fintech through venture capital (VC), private equity, and mergers and acquisitions fell 39 per cent in 2020, to $105 billion, owing to a steep year-on-year decline in the first half of the year (figure III.G.3). Deal activity picked up during the second half of the year, driven mainly by VC investment—in particular from the corporate VC sector as more financial sector incumbents have made acquisitions and entered partnerships with specialized fintech companies. The decline was steepest in the combined Europe, Western Asia and Africa region, where fintech investment collapsed by 77 per cent. It contracted by 31 per cent in Asia and the Pacific, while the Americas witnessed a more muted decline of 11 per cent. The number of deals focused on the payments sector held up better than in other sectors, reflecting increased investor interest amid the expansion of digital payments during the pandemic.[18]

Figure III.G.3
Global fintech investment activity, 2017–2020
(Billions of United States dollars)



Source: KPMG, The pulse of fintech 2020.
Note: Mergers and Acquisitions (M&A), Venture Capital (VC), and Private Equity (PE).

Government policies contributed to the increased usage of digital financial services, as part of their COVID-19 mitigation strategies. Regulators in many countries reacted quickly to support digital payments, for example, by reducing or waiving transaction fees for remittances, mobile money or other forms of digital payments, and by increasing limits on transactions. Other measures included the temporary weakening of compliance rules related to know-your-customer (KYC) and anti-money laundering (AML) regulations through electronic KYC processes and digital on-boarding.[19] Some of these outcomes could become permanent, although related risks should be carefully monitored and considered in

future regulatory innovation (see chapter III.F). Many Governments also stepped up government-to-person (G2P) transfers through digital channels to provide social assistance in a secure and socially distanced manner.

Countries that had invested in financial inclusion programmes and digital delivery channels during "good times" were able to quickly deploy large-scale digital transfers. For example, India built on its Jan Dhan Yojana programme for financial inclusion to make emergency transfers to over 300 million account holders.[20] Countries without established systems also mobilized digital channels to provide payments, including through the creation of e-wallets or unique-code based payments, although implementation was slower.[21]

The rapid expansion of digital finance can strengthen financial inclusion but may also exacerbate risks. The increased use of digital financial services and rapid onboarding of new customers during the pandemic, and the accompanying changes in policies and regulations, are likely to have lasting effects on the acceptance and usage of digital financial transactions (see chapter III.B). However, the rapid scaling up may also exacerbate existing risks, including in consumer protection and digital exclusion; financial stability and integrity; and competition.[22]

The increasing reliance on digital technologies for financial services can perpetuate gaps in the financial inclusion of women, rural residents and the poor, particularly in LDCs. Where digital technologies become the primary access point for financial inclusion, they risk leaving behind the most vulnerable groups who lack affordable access and the necessary digital and financial skills, and those who are excluded from official identity systems. The increasing use of AI and machine learning—for credit risk assessments, for example—may also create new forms of exclusion, owing to intransparent algorithms and biases in historical data. National financial inclusion strategies, as called for in the Addis Ababa Action Agenda, should address these risks. They can build on the G20 High-level Policy Guidelines on Digital Financial Inclusion for Youth, Women and SMEs .[23]

The rapid scaling up may also increase the susceptibility to cyber-attacks and digital fraud, and pose a threat to financial integrity and financial stability (see chapter III.F).[24] For example, the temporary relaxation of KYC rules to facilitate digital onboarding could increase the risk of money laundering, especially if there is no universal official digital identity system. In the short-term, regulators can instruct financial providers to physically verify the identity of new customers after the immediate health crisis.[25] Going forward, financial regulators will need to cooperate closely with national identity providers and other regulatory entities, to increase the availability and safety of digital onboarding procedures.

There is also a risk of increased market concentration, as big tech companies continue to expand into digital financial services, and some smaller providers may not survive the COVID-19 crisis. As discussed in the *FSDR 2020*, big tech companies could become dominant players in financial markets, owing to their large number of established users, wealth of data, analytical and innovative capacity, and network effects. [26] Their growth has been faster in developing than in developed countries, driven in part by demand from previously underserved customers, and supported by the increased availability of mobile phones.[27] Some smaller providers had difficulty raising funding in 2020. They may also be disproportionately affected by imposed cuts in transaction fees, especially those servicing more remote areas. Meanwhile, big tech companies are continuing to build partnerships and cross-invest in fintech and platform companies, to extend their market reach and service offerings.[28] This rapid expansion, together with their dominant roles in other markets, has raised concerns about competition and financial stability risks (see chapter III.F).

2.3 Towards inclusive digital economies

COVID-19 has highlighted the importance of building inclusive digital economies that can increase resilience while ensuring that no one is left behind. Those without access to the Internet or digital skills have fallen behind, and businesses that had not gone digital have struggled more than those that had. Looking ahead, public and private stakeholders need to work together to build a more equitable and inclusive digital economy (box III.G.1 discusses a measure of digital inclusiveness).

Box III.G.1
Inclusive digital economy scorecard

The inclusive digital economy scorecard (IDES), developed by the United Nations Capital Development Fund, measures the development of a digital economy and its inclusiveness and identifies key market constraints hindering the development of an inclusive digital economy. Governments can use IDES as a tool to help set priorities and work with public and private stakeholders to foster a digital economy that leaves no one behind.

The scorecard has two main components:

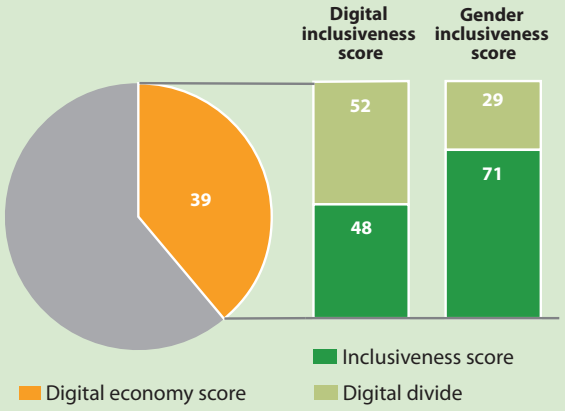
i The digital economy score indicates the status of the overall digital economy and its components (enabling policy environment, digital infrastructure and payments, innovation ecosystem, and digital skills);

ii The digital inclusiveness score measures the level of inclusion in the digital economy for marginalized segments, such as women; youth; elders; refugees and migrants; micro, small and medium-sized enterprises; people with disabilities; and rural inhabitants. The gender inclusiveness score is a subindicator measuring the level of inclusion of women.

The inclusiveness of the digital economy is primarily measured through qualitative assessment of the efforts made by the public and the private sector to include specific segments in the expansion of the digital economy. The digital divide is calculated as the difference between 100 and the digital inclusiveness score, at the aggregate level and for each marginalized segment.

In August 2020, IDES was implemented in Burkina Faso, Nepal, Solomon Islands and Uganda . In the last quarter of 2020, implementation was initiated in 13 additional countries: Democratic Republic of the Congo, Fiji, Guinea, Malaysia, Myanmar, Namibia, Rwanda, Samoa, Senegal, Sierra Leone, Timor-Leste, United Republic of Tanzania and Zambia. In 2021, IDES will be implemented in 30 countries in Africa and Asia and the Pacific.

Figure III.G.1.1
IDES Scores for Solomon Islands, 2020
(Percentages)



Source: United Nations Capital Development Fund.
Note: (i) A 39 per cent digital economy score implies that the digital economy is still in a start-up stage; (ii) the overall level of inclusion of key customer segments is 48 per cent, with a corresponding digital divide of 52 per cent; (iii) the level of inclusion of women is higher than that of other marginalized segments, at 71 per cent, but there is still a gender digital divide of 29 per cent.

Inclusive digital connectivity

"Last mile" connectivity should be a policy priority for Governments, to create inclusive digital economies. Developed countries have seen rapid fixed broadband connectivity increases since 2005, while developing countries on average saw an acceleration after 2014. However, fixed broadband connectivity growth in LDCs was from a very low starting point, causing a new digital divide. In 2020, the average number of subscriptions per 100 inhabitants in LDCs was only 1.3, compared to an average of 11.5 per 100 in developing countries and 33.6 per 100 in developed countries (figure III.G.4). While mobile broadband network coverage now reaches over 95 per cent of the global population, around one quarter of the population in LDCs still does not have access to mobile broadband.[29]

The cost of Internet access remains another source of inequality, which could be addressed through public-private cooperation. According to a recent World Bank report, the monthly price of 1 GB of data—measured as the lowest price for at least 1 GB per month of mobile data usage—represents, on average, over 20 per cent of the gross domestic product per capita per month (or $14.59) in low-income countries, while it accounts for 1.1 per cent (or $23.63) in high-income countries.[30] Where high costs result from difficulties in reaching remote customers, Governments could offer incentives to private service providers, for instance, via subsidies, instalment plans and targeted policies. Combining grants with equity financing for infrastructure deployment could enable Governments to recoup investment once services become profitable. Governments can also help reduce connectivity costs by facilitating the sharing of infrastructure among operators and across sectors. For example, mobile network operators could share antenna sites, and the cost of broadband network deployment could be reduced by coordinating with road construction. This could generate up to 40 per cent savings for capital expenditures that could be passed on to customers.[31]

Digital skills for all

Digital skills are a prerequisite for participation in the digital economy. Targeted government policies are required to ensure inclusivity. For instance, the Government of Bangladesh, which has made digitalization a priority, is prioritizing digital skills development among youth. The Government of Singapore aims to promote lifelong learning and reskilling for adults by offering personal training accounts and through tax incentives that encourage firms to invest more in lower-paid workers.[32] Recognizing the digital gender divide, policies and investments are needed to strengthen women's and girls' digital skills, through education, training and mentorship, in support of their equitable participation and leadership in the creation, development and use of digital technologies.[33]

Inclusive e-commerce

The COVID-19 pandemic has highlighted the role of e-commerce—especially business-to-consumer (B2C)—for providing people with daily necessities. When lockdowns or measures for social distancing were introduced in many countries, e-commerce provided a possible solution. For instance, in Thailand, the rapid adoption of e-money and e-wallets since the beginning of the pandemic, mainly driven by non-bank transactions, suggests a substantial growth of e-commerce.[34] In Lao Peoples Democratic Republic, e-commerce enabled street vendors to sell products through social media platforms during the pandemic.[35] Uganda saw a triple-digit increase in business e-commerce, which amplified the growth of e-payments and local fintech solutions.[36] However, due to a lack of digital access, skills and digital finance, small business owners and street vendors in many countries and regions have not been able to take advantage of these opportunities. And in many countries, the COVID-19 crisis has exacerbated persistent bottlenecks in e-commerce ecosystems (figure III.G.5).

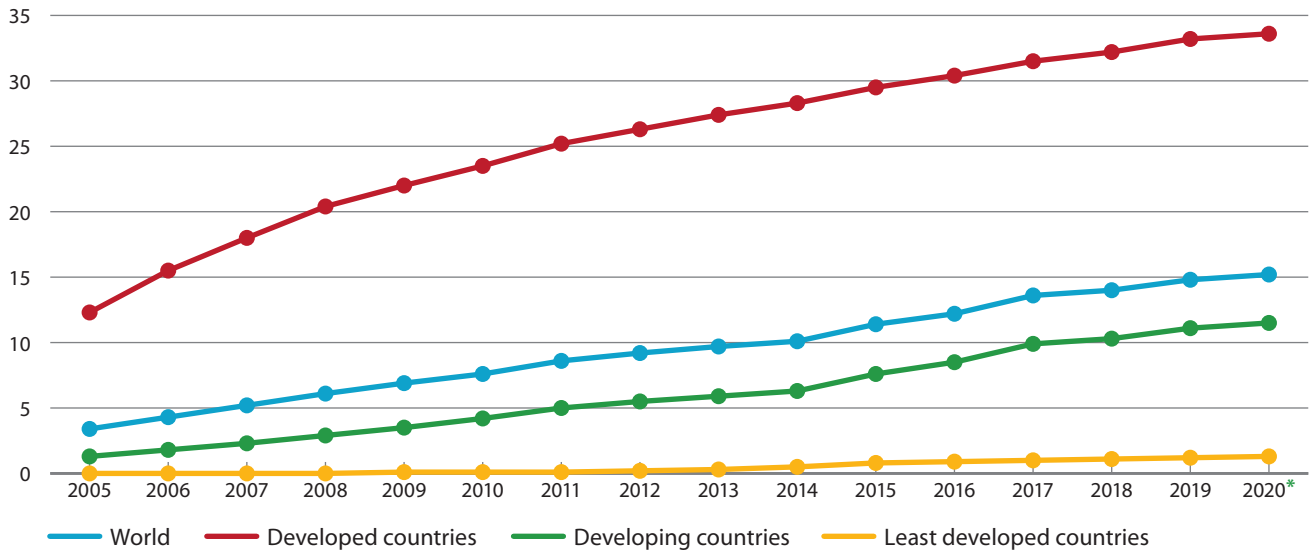
Building on innovative solutions and collaborations that began during the pandemic can help further strengthen e-commerce and ensure that it leaves no one behind. Governments can bolster the momentum of e-commerce by providing supporting frameworks and infrastructure. For example, China is treating e-commerce as an important driver of poverty alleviation amid COVID-19.[37] A recent UNCTAD survey found that the development of a national e-commerce strategy was the most important measure to support e-commerce during the pandemic (23 per cent of respondents). Other important measures include skills training programmes and reduced e-payment costs (20 per cent of respondents each).[38] Facilitating the exchange of experiences and providing access to learning materials for e-commerce entrepreneurs in developing countries—for example through the ecomConnect platform—can also provide valuable support.[39]

2.4 Investing in inclusive science, technology and innovation

Investment in technology

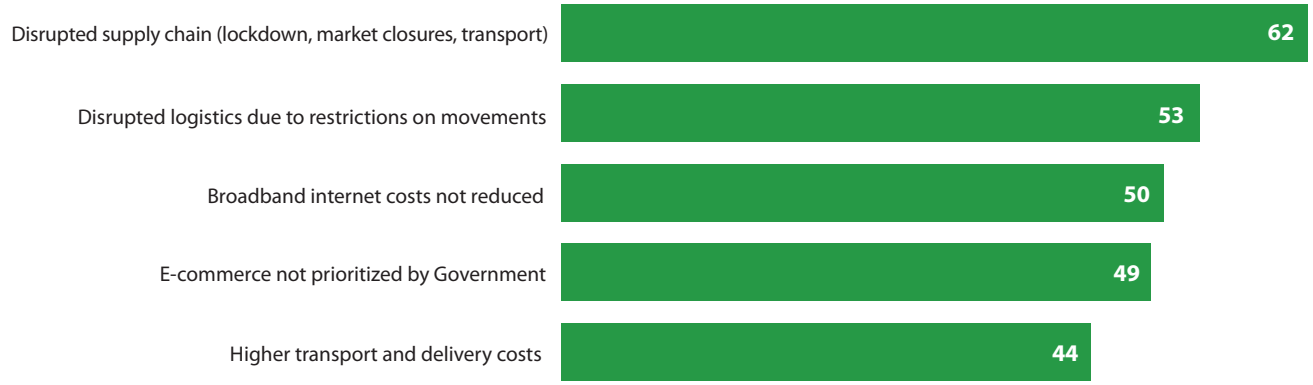
Technology investment has shown some resilience despite the global investment decline in 2020. There are indications that investment in technology, including in research and development (R&D), held up better than overall investment, at least in major developed

Figure III.G.4
Fixed broadband subscriptions by country groups, 2005–2020
(Subscriptions per 100 inhabitants)



Source: ITU World Telecommunication/ICT Indicators database.
Note: *Data for 2020 are estimates.

Figure III.G.5
Key COVID-19 challenges faced by e-commerce businesses in developing countries
(Percentages)



Source: UNCTAD. 2020. COVID-19 and e-commerce impact on businesses and policy responses.
Note: Respondents were asked which challenges most impacted their business since the outbreak of COVID-19. A maximum of 10 choices was allowed (232 responses).

economies (see chapter I). In the United States, investment in intellectual property recorded positive growth, likely owing to increased business opportunities for digital companies during the pandemic. VC investments appear to have been particularly strong: VC investment in European technology start-ups may have grown by over six per cent in 2020,[40] while VC investment in the United States surpassed 2019 levels, with a focus on start-ups aiming for a further digitization of sectors like banking, retail and health care.[41] Global VC investment in fintech has also grown (see section 3.2).

Yet, significant additional resources will need to be mobilized to overcome the digital divide. A recent International Telecommunication Union (ITU) study estimates that achieving universal access to broadband Internet by 2030 will require bringing over three billion people online in the next ten years, at an estimated cost of $428 billion (including $135 billion for South Asia and $97 billion for sub-Saharan Africa). This includes investment needs in infrastructure; the design and implementation of appropriate policy and regulatory frameworks; investments in basic digital

skills; and the creation of locally relevant digital content. Reaching this goal will require both public and private financing. While information and communications technology (ICT) infrastructure investments are often provided mostly by private sources (see section 2.3), public leadership and investments will be needed, including to adjust policy and regulatory frameworks and ensure that people acquire the necessary digital skills.[42]

Financing for innovation

The COVID-19 crisis presents large risks for innovation outside of innovation hotspots and in developing countries. While the pandemic might only have a short- or medium-term impact on innovation in the leading innovation nations or by top corporate innovators, the effect might be more pernicious in developing countries and outside of global innovation and venture capital hotpots. As outlined in the *Global Innovation Index 2020*—co-published by the World Intellectual Property Organization (WIPO)—before the crisis, countries of all world regions had started to embrace innovation expenditure and policies as a new tool for economic and social development. The pandemic risks bringing this process to a halt, owing to the severe negative impact on public finances, particularly in developing countries. Companies in sectors that have seen large falls in revenue—such as travel and leisure (including restaurants), professional services and household goods—will also have a temptation to cut R&D and other innovation expenditures.[43]

Governments need to maintain investment in innovation throughout the COVID-19 crisis and beyond. With the exception of the health sector, many Governments have, so far, not made innovation and R&D a priority in their emergency relief and fiscal stimulus packages. As countries move from containment to recovery, it will be important to reprioritize innovation—for example, by supporting innovation in global public goods (such as climate change mitigation), and by revitalizing international cooperation and knowledge flows.[44] Effective innovation policies—those that facilitate technology absorption and encourage private investment in innovation, for instance—can help developing countries, in particular, to efficiently use scarce public resources.[45]

3. STI for resilient societies

STI development and implementation play an essential role in addressing increasingly complex and unpredictable threats in a globally interdependent world – beyond the immediate COVID-19 pandemic. As highlighted in chapter II, investment in risk management and resilience is critical for achieving the SDGs. STI is needed to better understand and advance strategies to reduce the probability of shocks and build more resilient societies, including by mitigating and adapting to increasing climate risks. It can help policymakers address cascading shocks in a comprehensive and systematic manner, rather than handling one crisis at a time without understanding interlinkages and underlying risk drivers.

3.1 Understanding risk and resilience

Scientific knowledge

Diverse fields of scientific knowledge contribute directly and indirectly to building resilient societies, from scientific discoveries in biology and medicine that uncover new mechanisms of transmission of diseases, to advances in weather forecasting and climate prediction models that increase the reliability of early warning systems.

There is an increasing trend of public-private research cooperation to support resilience building at global, national and local levels. The adoption of open risk modelling principles and frameworks can help countries and cities integrate local knowledge and global research to develop their own view of risk for strategic risk management and operational risk finance.[46] Policymakers also need to cooperate with the financial sector to strengthen disaster risk assessment tools and methodologies. For instance, intelligence on systemic risk can facilitate the inclusion of disaster risk in decisions taken by credit rating agencies and investors.

Since 2015, regional scientific and technical advisory groups for disaster risk reduction have been established or strengthened in Africa, the Asia-Pacific region, Western Asia, Europe, and Latin America and the Caribbean. Guided by the multi-stakeholder Science and Technology Roadmap to Support the Sendai Framework for Disaster Risk Reduction 2015-2030, these advisory groups aim to boost national science and technology capacities to understand disaster risk and improve the dialogue between scientific and technological communities and policymakers. For example, Malaysia has established a Scientific and Technical Panel on Disaster Risk Reduction to support the operational activities of the National Platform for Disaster Risk Reduction. In the Philippines, the National Resilience Council has accelerated science and technology-based public-private partnerships, following a thematic focus of "prepare-adapt-transform" to enhance resiliency leadership and strengthen localization of the Sendai Framework.

However, the COVID-19 pandemic has laid bare the still insufficient understanding of the systemic nature of risk and interdependencies between sectors, and the need for stronger and more comprehensive science-policy coordination. Scientists need to investigate further the direct and indirect linkages between natural, biological, technological and other human-induced hazards to identify and better understand cascading and complex hazards and risks. The International Science Council and United Nations Office for Disaster Risk Reduction (UNDRR) produced a Hazard Definition and Classification, which can support the science-policy interface to strengthen risk-informed policymaking and investment decisions.[47]

LDCs will depend on enhanced development cooperation, investment and partnerships for data and technology to strengthen the generation, management and accessibility of risk knowledge. In these countries, vulnerability and risk levels are often high, while the capacity to respond and recover is limited. Support is needed to collect and analyse disaster loss data, conduct risk assessments, and establish transboundary early warning systems, among others.

Monitoring environmental risks

STI can facilitate the assessment, monitoring and understanding of risks. For instance, low-cost open-source hardware has made it possible to develop ad hoc sensors of environmental risks [48] that can complement existing, but often sparse, monitoring networks in developing countries.[49] Citizens operating these sensors can provide additional

information via smartphones, using time-stamped and geolocated photographs,[50] social media updates,[51] or interviews and feedback to ad hoc hazard mitigation websites.[52]

Environmental monitoring is also conducted via remote sensing using satellites or drones. Satellites transmit images of the Earth's surface in real time, which can populate land-use databases as well as assessments of disasters such as flood or earthquake damage. They can also be used for rapid mapping in case of emergencies, for example, in combination with crowdsourcing platforms that tag live footage from aerial vehicles during disasters.[53] Drones offer another, low-cost, approach to remote sensing.

Identifying hotspots of systemic risk and cascading hazards

Combining scientific information from different sources and sectors can improve the understanding of the systemic nature of risk and the potential for cascading impacts of hazards. For example, the combination of seasonal rain forecasts and confirmed COVID-19 cases has allowed identification of systemic risk hotspots in South Asia (figure III.G.6).

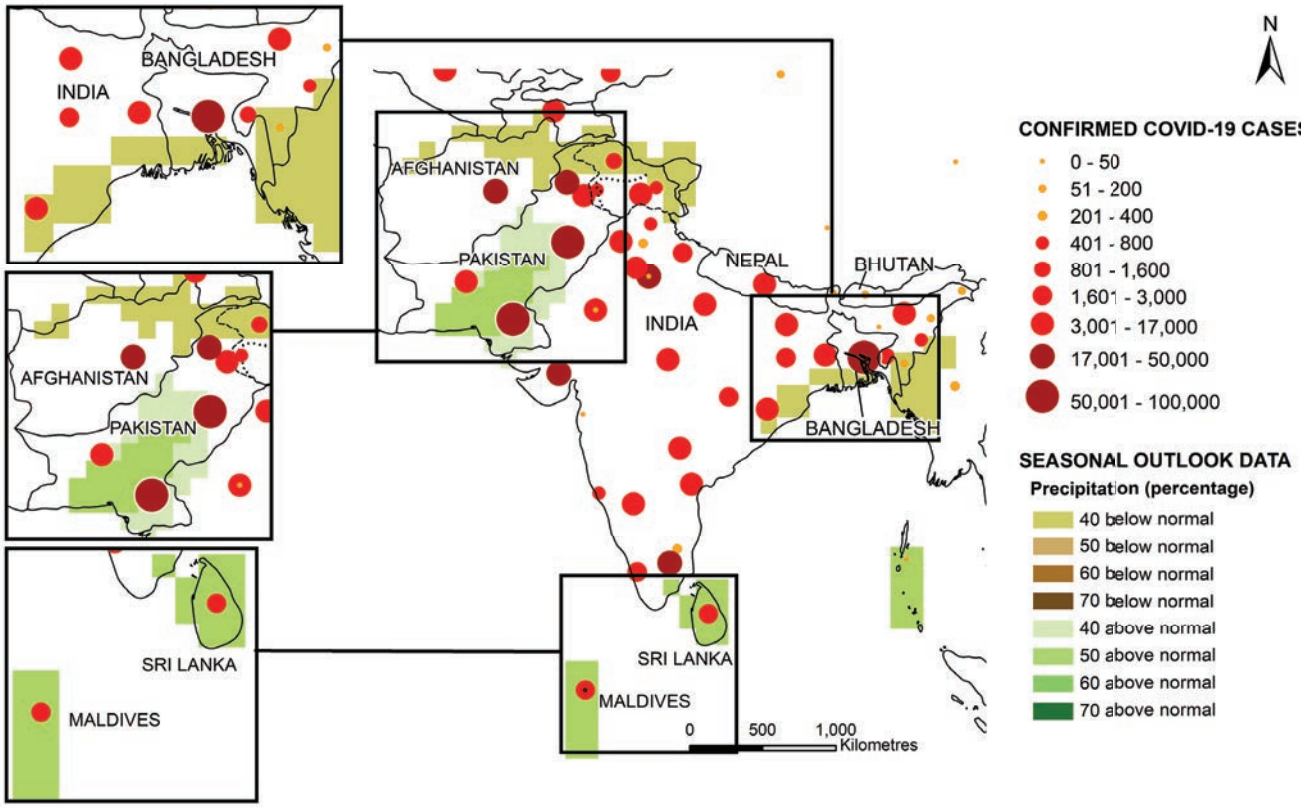
3.2 Risk prevention and reduction

Community empowerment

Communities are at the frontier of disaster impacts, and must be empowered to understand and utilize complex risk and hazard information. Localized interventions should build on community knowledge. Technological advances cannot be operationalized in a meaningful way without the support of communities at all levels. An important challenge is to overcome the digital divide and to harness new technologies for empowering communities (see section 2.3).

For example, the cyclone evacuation programme in Bangladesh takes advantage of the ubiquitous use of mobile phones to empower vulnerable communities to track and prepare for cyclones. People are using real-time cyclone tracker apps to help them understand how long a cyclone would take to reach their villages so that they can evacuate on time. The programme has been developed through iterative feedback loops, helping the Government establish evacuation shelters that meet communities' needs.[54]

Figure III.G.6
Hotspots of high probability of climate-related disasters amid COVID-19, June–September 2020
(Percentage deviation from normal precipitation, number of COVID-19 cases)



Source: ESCAP (2020). *Protecting the most vulnerable to cascading risks from climate extremes and the COVID-19 in South Asia.*
Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Economic diversification and innovation

For communities to be resilient, they must generate enough and diverse occupations, reduce risk across supply chains, and better adapt to shocks that impact employment and livelihoods. Economic diversification is a commonly pursued strategy for coping and adapting to risks and seasonal cycles of economic activity, particularly in rural, tourism-based, and coastal fishing communities (see chapter II).[55]

Improving health

Modern ICTs can reduce individuals' vulnerability and exposure to shocks and hazards by improving their access to health services, through telemedicine or e-health.[56] These services allow physicians to access, monitor and diagnose patients remotely. For instance, satellite technology has been used to improve care for patients in rural areas,[57] not only in developed regions but also in developing countries in Asia and sub-Saharan Africa.[58] Mobile phone diffusion is facilitating the exchange of texts, photos and videos between local health workers and specialized clinics. COVID-19 has greatly accelerated the global uptake of telemedicine worldwide.[59] Going forward, e-health can be an affordable way to increase the access of vulnerable and remote communities to public health services, by leveraging existing communications technology. However, increased ICT investment will be needed in many developing countries to enhance coverage and affordability (see section 2.3).

Access to information

Educational videos made available through the Internet facilitate e-learning and access to relevant and timely knowledge and information at the community level, improving the capacity to cope with shocks. Mobile phones with video recording capabilities have been used to engage the community in producing mini-documentaries disseminated via social media, showcasing how people can build their capacities and increase their sense of agency.[60] Mobile apps and digital games can also support education efforts for building capacities to prepare, cope and recover from disasters.[61] As in the case of e-health and other digital services, this highlights the urgency of building inclusive digital economies.

Resilient technology infrastructure

Effective disaster management depends on resilient telecommunications infrastructure as well as national strategies, plans and processes that can support and enable the use of telecommunications and ICTs during a disaster and in the recovery phase. Conducting a risk analysis of critical communications infrastructure, reducing vulnerabilities of telecommunication networks, and improving their resilience are key to ensuring that communications will be available in the response phase. In the recovery phase, the rebuilding of more resilient ICT network infrastructure, including digital communication networks, should include potential redundant network deployments—wherever possible—to prepare for future disasters.[62]

3.3 Risk transfer

Satellite imagery can support disaster risk financing tools such as parametric insurance and catastrophe bonds. Parametric insurance makes payments based on an objective index, such as rainfall measures, that can serve as a proxy for losses to crops. In the absence of easily verifiable observations, insurance companies can use satellite imagery and computer models to estimate precipitation, vegetation, or satellite-derived multi-sensor soil moisture.[63] Despite some risks—for instance, that parametric insurance mechanisms may not trigger payouts if the strength of disaster is measured in a different location from its main impact, or because modelled losses are lower than actual losses—well-designed parametric insurances, with parameters relevant to national and subnational contexts, can be an important tool among others for strengthening financial resilience (see chapter III.C). Catastrophe bonds (or catbonds) also typically rely on parametric payout triggers, but they tap into capital markets rather than traditional insurance markets. While they have been used in developed countries, uptake in developing countries has been limited so far.[64]

Improved risk modelling, based on enhanced capacities for the generation and analysis of large amounts of data, can strengthen insurance mechanisms, but may risk excluding the most vulnerable. As more granular information about risks becomes available, insurance providers can better differentiate risk premiums, making them more affordable for lower risks, but, at the same time, less affordable or unavailable for individuals or communities with higher risk scores.[65] This could, for example, affect access to health insurance at the individual level, or crop or property insurance in disaster-prone areas at the community level. Policymakers will need to find solutions to ensure fair and inclusive risk protection, ranging from regulation for private insurers, to public insurance, or construction and land-use regulation for disaster-prone areas.

3.4 Emergency response, adaptation and recovery: rebuilding better

Even as societies and individual actors improve their understanding of existing risks, implement strategies for risk reduction and the prevention of new risks, and build more resilient societies, they will continue to experience economic and non-economic shocks. STI can help communities react to shocks in real time and mobilize emergency responses. During recovery, they can build on the lessons learned to adapt better and recover.

From emergency response to lessons learned

Emergency telecommunications and other ICTs are critical for monitoring developing emergencies and delivering vital information to all stakeholders, including the most vulnerable. Mobile technology offers new possibilities for passing on information during an emergency. Examples include the use of smartphones by rescue and relief workers to form a disjoint peer-to-peer communication network during emergencies,[66] or a mobile wireless local area network through a series of "wearable routers" when pre-existing communication infrastructure is not available.[67] Local agencies also use social media in emergency management to involve community members as first-line informants and as first responders.[68]

Drones can ensure the delivery of emergency supplies in the case of collapsed infrastructure or dangerous situations. Small airborne drones are already being employed for an increasing number of tasks,

including the delivery of high-value items such as vaccines to rural areas in developing countries. For example, in Rwanda, the Government partnered with a robotics company, Zipline, to address maternal mortality by using drones to deliver blood to medical facilities, reducing the time to procure blood from four hours to fifteen minutes.[69] Building on these experiences and on lessons learned from the current pandemic, the use of drones going forward could be enhanced to include the regular delivery of supplies in remote areas.

Beyond the immediate crisis response, innovative technologies can support recovery and strengthen future preparedness. Faced with the unprecedented collision of pandemic and weather events, South Asia has successfully utilized several new technologies to address the impacts of cascading disasters (see section 2.1), which will continue to support recovery and preparedness processes in the future. As biological hazards and concurrent disaster risks continue to intersect, more complex and integrated solutions will be needed, building on these experiences and driven by new technological innovations.

Adapting production and businesses

STI is critical for economies to adapt in times of crises and beyond. Innovation is not limited to new technologies and products, but also includes changes in the way that people organize and carry out their work. One example was the quick move to remote forms of working in many knowledge-intensive sectors during the COVID-19 pandemic. Other examples of COVID-19-induced innovation include the shift of production lines to make protective and health equipment, including ventilators. For instance, the vehicle manufacturer General Motors mobilized hundreds of suppliers worldwide to source 700 parts to help a company that produces ventilators increase its production from about 100 devices per month to over 6,000.[70] Similar efforts have taken place in developing countries. For example, biomedical engineers from the Integrated Polytechnic Regional Centre in Kigali, Rwanda, have worked on the first locally produced ventilators at affordable prices to respond to COVID-19.[71]

3.5 Mission-oriented innovation for building resilience

Mission-oriented innovation can contribute to reducing risk and building resilience. This approach to innovation involves organizing networked research programmes at the national level, as part of national innovation systems,[72] or at the international level. It includes setting incentive structures that direct innovation towards the achievement of specific technological, environmental or social goals, for example, through innovation prizes and advance market commitments.

The recent drive to address and mitigate the impact of COVID-19 is an example of mission-oriented innovation. For instance, XPRIZE has launched two challenges: the Pandemic Response Challenge, a $500,000 four-month challenge, for the development of data-driven AI systems to predict COVID-19 infection rates and prescribe intervention plans that can minimize harm when communities reopen their economies, and the Next-Gen Mask Challenge ($1 million) to reimagine protective face masks.[73] The Joint European Disruptive Initiative (JEDI) has launched the JEDI GrandChallenge to identify molecules, peptides and proteins that can block the spread of the SARS-CoV-2 virus and prevent COVID-19.[74] In the United States, Operation Warp Speed has provided coordinated government support to the most promising treatment and vaccine candidates.[75]

3.6 Unintended consequences of new technologies

STI, especially new technologies – while having the potential to mitigate risks and strengthen resilience – can also be new sources of risk. The externalities of innovation on the environment are a well-known case. For example, blockchain technology can be applied in solutions that contribute to the achievement of the SDGs, thus increasing resilience. At the same time, this technology (particularly in its application to bitcoin) is estimated to use more energy than Argentina, which competes with more essential energy services and also generates CO_2 emissions.[76] The socioeconomic impact of innovation can be even more complex, with some solutions increasing the resilience of some people while also increasing the vulnerability of others. For instance, e-government can ensure the continuity of public services in times of crisis, but if other forms of access are not made available, then people without Internet access are excluded. Big data and AI can also worsen new forms of social exclusion (e.g., through intransparent algorithms and biased historical data); and the platform economy, with its winner-takes-all dynamics, is becoming a threat to competitive markets.

A way to minimize the risks of unintended consequences is to consider diverse views in the process of innovation. This can be achieved, for example, by strengthening the diversity among researchers and by involving end users in the innovation. There is also a clear role for intermediaries—people and institutions that can translate needs and values between producers and users. Examples include community health workers who are at the frontline and who have a close understanding of the community they serve; extension workers helping farmers adopt relevant seed, irrigation, and fertilization techniques; industry-level institutes that help firms find appropriate technologies and assist in technological learning and building innovation capacities; and civil society organizations that can identify and translate communities' needs to the providers of technologies and help direct technological solutions to development problems. Such intermediaries are critical, but they are too often overlooked. Governments and all stakeholders need to engage with such intermediaries and build their capacities.[77]

Appropriate regulations can incentivize increased transparency of new digital tools and innovations. They will also be key in addressing antitrust issues. More transparent algorithms and peer reviews—supported, for example, by guidance on the ethical use of AI—can foster independent assessments of digital tools and innovations (e.g., to address equity implications). Antitrust regulation can help reduce the market power of large digital platforms and create a more level playing field.

4. Opportunities and risks of STI for other action areas of the Addis Ababa Action Agenda

STI cuts across all other action areas of the Addis Agenda. It hassupported rapid crisis responses during the COVID-19 pandemic. In the longer run, it is enhancing the efficiency, effectiveness and resilience of financing, resource mobilization, trade and development cooperation, among others. But it is also creating new risks that policymakers need to address.

4.1 The financial sector

Digital technologies have increased the efficiency and accessibility of financial services, supporting financial inclusion and reducing costs, but have also created new risks. There is increased recognition that policymakers need to carefully balance opportunities and risks—by putting in place basic building blocks for an inclusive digital economy, providing an enabling environment for innovation, and setting an appropriate regulatory framework (see FSDR 2020 and chapter III.F).[78]

Digital finance has also demonstrated its potential to mobilize private financing for the SDGs. The United Nations Secretary-General's Task Force on Digital Financing of the SDGs recently published its final report, highlighting how digital financial innovations can help finance the SDGs. Examples include: (i) the incorporation of SDG-related risks in private lending and investment decisions (see below); and (ii) better opportunities for retail investors to apply such SDG considerations—for example, through the use of specialized AI-based robo-advisors that offer reduced commissions and lower capital thresholds. Digital finance can also help low-income populations access capital-intensive infrastructure services through financing mechanisms, such as product-as-a-service and pay-as-you-go models (e.g., for electricity, water or other utilities).[79] For instance, in Kenya and Nigeria, M-Kopa Solar and Lumos, respectively, are using fintech and mobile technologies for decentralized renewable energy investments (see chapter III.B).

Big data can help incorporate SDG-related risks, or environmental, social and governance factors into lending and investment decisions. Big data and AI can help gather and analyse comprehensive environmental, social and governance (ESG) data from different sources. For example, heat maps of local economic and financial impacts of climate-related risk can help investors and lenders take risk-informed financing decisions (see chapter III.B).[80]

Digitally enabled financial innovation is also driving change in the cross-border payments market. Fintech solutions have been instrumental in reducing the cost of cross-border payments, notably in the case of remittances (see chapter III.B). So-called global "stablecoins" have the potential to greatly increase the speed, transparency and inclusiveness of cross-border payment services, while reducing transaction costs. However, regulators and international standard-setting bodies have voiced concerns about the potential risks they pose to financial stability and integrity, among others (see chapter III.F).

Financial regulatory and supervisory authorities can harness technology for regulatory compliance. The use of new technologies by authorities for their regulatory, supervisory and oversight tasks ("SupTech") and by financial institutions for meeting their regulatory requirements ("RegTech") can strengthen financial stability and efficiency. However, they also create new challenges and risks, for example, by increasing cyber-vulnerabilities, decreasing transparency, and creating potential competition barriers (see chapter III.F).[81]

4.2 Domestic public finance

Technology can strengthen the efficiency and effectiveness of public resource management and service delivery, while improving transparency and government accountability.[82] For instance, the digitalization of G2P transfers helped authorities to quickly scale up social assistance programmes to counter the social and economic impacts of the COVID-19 pandemic (see section 2.2). More broadly, STI can help improve public financial management systems by increasing fiscal transparency and accountability (see chapter III.A).

Digital technologies helped tax administrations provide continuing services during the pandemic, but many countries still lack the necessary capacities. Shifting operations and processes to digital service delivery was easier for tax administrations in developed countries, as many of them could build on more advanced systems and capacities, in comparison to countries with less capacity, particularly LDCs (see chapter III.A).

The accelerated digital transformation of the economy has raised the stakes in the discussions over international taxation standards. Amid increasing concerns about the allocation of taxing rights, both developed and developing countries recognize that, without a consensus-based global solution, proliferation of unilateral tax measures is expected. Multilateral negotiations are currently ongoing at the OECD-housed Inclusive Framework and at the United Nations Committee of Experts on International Cooperation in Tax Matters (see chapter III.A).

4.3 International development cooperation

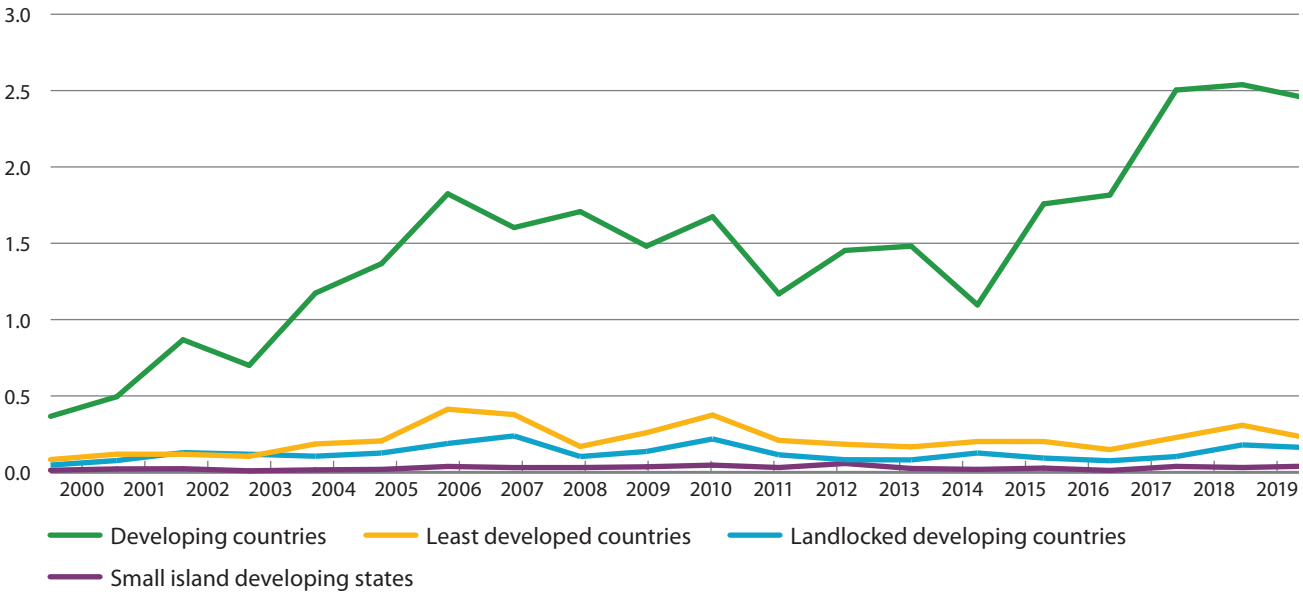
Official Development Assistance (ODA) for STI has outpaced overall ODA trends in recent years, but contracted in 2019. In the Addis Agenda, Member States committed to enhancing international cooperation, including ODA for STI. While there is no internationally agreed measure of ODA for STI, estimates show a sharp increase in such funds, outpacing total ODA growth since 2014 (figure III.G.7).[83] This trend was interrupted in 2019, when ODA for STI fell by 3.6 per cent year on year—more than the 0.5 per cent decrease of total ODA on a cash flow basis (see chapter III.C). Most worryingly, ODA for STI directed to LDCs fell by 27.5 per cent. While disaggregated data for 2020 are not yet available, there may be a revival in ODA for STI in response to COVID-19, as funding for medical research has been one of its main growth drivers in the past.

Sendai Framework monitoring indicates that most donors do not yet effectively track the transfer of technology to reduce disaster risk, and do not adequately integrate disaster risk reduction into technology transfer initiatives. It also finds that ODA in areas such as infrastructure, ICT, and agriculture is often provided without adequate investment in science, technology and knowledge-sharing for disaster risk reduction. UNDRR has developed technical guidance to improve the tracking of technology transfer and ensure that SDG actions are risk-informed and resilient to future shocks.[84] The online platform of the Technology Facilitation Mechanism could also support information on STI solutions for disaster risk reduction and related initiatives (see box III.G.2).

4.4 International trade

Beyond the overall rise in e-commerce, COVID-19 has accelerated the digitalization of supporting services, such as logistics and customs systems. For instance, the UNCTAD Automated System for Customs Data (ASYCUDA) provided the necessary flexibility to reduce face-to-face interactions and facilitate the implementation of COVID-19-related trade policies. In Afghanistan, national experts configured the

Figure III.G.7
ODA flows to developing countries targeting science, technology and innovation activities, 2000–2019
(Billions of United States dollars, 2018 constant prices)



Source: UN DESA, based on OECD/DAC.

system to reflect new customs rules to facilitate the importation of medical supplies and necessary food items. In the Democratic Republic of the Congo, ASYCUDA also helped implement a suspension of delay penalties and tailor the risk management mechanism to expedite shipments and perform fewer inspections.[85]

Anti-competitive cross-border commercial practices by globally dominant digital platforms warrant increased international co-operation. Increased international and regional cooperation between competition and consumer protection authorities will be key to ensuring fairer and more inclusive international trade practices. For instance, many regional economic communities in Africa already have regional competition rules (see chapter III.D).

AI and blockchain have great potential to boost trade, but the impact on sustainable development is not clear. AI and blockchain technologies can improve trade and transport efficiency; reduce trade costs; and improve transparency, traceability and reliability throughout value chains. However, the sustainable development benefits will depend on many other factors, including the productive structure of countries and public policies to harness trade for development. For many LDCs and other low-income countries— where a majority of the population depends on subsistence agriculture, few cash crops, and low-wage, low-tech manufacturing—productivity gains from digitalization are likely to be passed on to foreign clients in the form of lower prices.

5. Overview of United Nations system actions on STI in the areas of the Addis Ababa Action Agenda

There are numerous United Nations entities that contribute to ongoing efforts to enhance Member States' capacity in STI to achieve the SDGs. During the COVID-19 crisis, they have joined forces to tackle the spread of the pandemic and mitigate the impact on economies and societies, and to harness STI to strengthen resilience and rebuild better.

5.1 Progress on STI for the SDGs across the United Nations system

The Addis Ababa Action Agenda and the 2030 Agenda for Sustainable Development help coordinate STI actions across the United Nations system and beyond. Both agendas identify key STI policies and actions for meeting the SDGs. They established the United Nations Technology Facilitation Mechanism (TFM) (box III.G.2), which was later complemented by the establishment of the United Nations Technology Bank for the Least Developed Countries (Technology Bank).

Since 2015, Member States have strengthened the science, technology and innovation pillars of the United Nations, bringing it closer to stakeholders at the centre of technological progress. Several new mechanisms—most notably the TFM, the Technology Bank, the Global Sustainable Development Report, and the High-level Political Forum on Sustainable Development—were created as multi-stakeholder complements to the existing United Nations Commission on Science and

Box III.G.2
United Nations Technology Facilitation Mechanism in support of the Sustainable Development Goals

The Technology Facilitation Mechanism (TFM) comprises four components:

i A United Nations inter-agency task team (IATT) that brings together 43 United Nations entities and their external partners;

ii A 10-Member-Group of High-level Representatives of the Scientific Community, Private Sector and Civil Society (10-Member-Group);

iii An online platform (TFM 2030 Connect) for sharing technology solutions and knowledge resources; and

iv The annual Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals (STI Forum).

IATT comprises 10 work streams, including gender and STI; STI policy frameworks, action plans and road maps; capacity-building on STI for the sustainable development goals (SDGs); and analytical work on emerging science and technologies for the SDGs. In 2019, IATT prepared a guidebook and launched a Global Pilot Programme on STI for SDGs roadmaps. Efforts are underway to facilitate a second phase, through the new joint initiative "Partnership in Action". New IATT work has focused on improving the science-policy-society interface and various responses to and recovery from COVID-19.

TFM 2030 Connect[a] brings together an increasing range of resources, from publications to training opportunities to technology offers and requests, including on specific technology solutions for the SDGs.

The annual STI Forum collects views and ideas from science, engineering, the private sector and government, and reports to the High-level Political Forum on Sustainable Development. It has led to various STI partnerships within and beyond the United Nations system, and fostered key initiatives and conferences, for example, the Global Sustainable Technology and Innovation Community, the Global Solution Summit, and the Global Innovation Exchange.

Source: United Nations Technology Facilitation Mechanism.
a TFM 2030 Connect (https://tfm2030connect.un.org).

Technology for Development (CSTD), which has brought together Ministries of Science and Technology since 1992. The multi-stakeholder TFM and the CSTD discussions on STI for development have proven mutually beneficial, particularly related to the CSTD analysis of critical STI trends, and the work of CSTD on new and emerging technologies. In 2020–2021, CSTD focused on two priority themes: "Using science, technology and innovation to close the gap on Sustainable Development Goal 3, on good health and well-being"; and "Harnessing blockchain for sustainable development: prospects and challenges".

The extent and visibility of work on STI for the SDGs has expanded across the United Nations system. The most recent inter-agency task team (IATT) comprehensive mapping of STI activities in the United Nations system identified 1,600 STI activities across 20 system entities (including the World Bank), encompassing $1 billion annual budget and $120 billion for recipients ($50 billion as grants and $70 billion as loans). Half of these activities were associated with one or more SDGs. The other half had a broader STI focus. Entities with the largest STI budgets were the World Bank, Food and Agriculture Organization (FAO), ITU, WIPO, United Nations Environment Programme, United Nations Educational, Scientific and Cultural Organization, and United Nations Industrial Development Organization (UNIDO), accounting for 15 per cent of budgets and 30 per cent of resources for recipients. Other entities, such as UNCTAD, UNICEF, the World Food Programme (WFP), WHO, the Regional Commissions and the United Nations Office for South-South Cooperation (UNOSSC), have more narrowly focused STI activities.[86]

The Technology Bank is emerging as an important hub for STI capacity-building for LDCs. Based on a call to action in the 2011 Istanbul Programme of Action, which was confirmed in the Addis Ababa Action Agenda and in the 2030 Agenda for Sustainable Development (SDG target 17.8), it was operationalized in 2018 (box III.G.3 presents an update). The Bank is also an active member of IATT.

5.2 United Nations Actions on new and emerging technologies in times of COVID-19

WHO and Member States, with the support of other United Nations entities, have taken coordinated action to tackle the spread of COVID-19, mitigate its impacts on the poorest and most vulnerable, and support vaccine development and delivery.

COVID-19 technology solutions

In early 2020, several United Nations entities issued calls for technology solutions to respond to COVID-19 and its immediate impacts. For example, the United Nations Department of Economic and Social Affairs (DESA) and its IATT partners organized a joint call for such solutions. About 180 technology solutions were accepted and featured on the TFM 2030 Connect online technology sharing platform.[87]

The Technology Bank, WHO, UNCTAD and UNDP launched the United Nations Technology Access Partnership as part of the United Nations coordinated technology approach to COVID-19. [88] Innovations can be submitted to an online platform and are vetted by WHO or an appropriate regulatory authority. Another example for United Nations calls to action was the UNIDO global call to identify and promote innovative ideas for addressing the impacts of COVID-19 in developing countries. Among 1,100 applications from 108 countries, 5 initiatives were selected and awarded with advisory and mentorship services.[89] **TFM partners have set up online portals with technology solutions.** The World Federation of Engineering Organizations set up an online portal on new

Box III.G.3
United Nations Technology Bank for Least Developed Countries (Technology Bank)

Since its operationalization, the Technology Bank has conducted comprehensive technology needs assessments in Bhutan, Guinea, the Gambia, Timor Leste and Uganda, to support demand-driven formulation of national science, technology and information (STI) priorities for national development strategies.

In 2020, the Technology Bank supported Angola, the Central African Republic, the Democratic Republic of the Congo, Chad, Lesotho and Malawi towards establishing academies of science as important sources of STI advice for government and industry.

It provided training on research and data management to over 3,490 participants from 88 countries in 2020, together with the Food and Agriculture Organization and in collaboration with Research4Life. During 2019 and 2020, training workshops were delivered in collaboration with UNITAR-UNOSAT in the Gambia, Uganda and Mozambique with a focus on using satellite data to support decision-making for climate change adaptation, risk management, and natural resources management. As part of a joint programme with United Nations Development Programme (UNDP) Turkey and the Ministry of Foreign Affairs of Turkey, a global call was launched under the SDG Impact Accelerator[a] for enhancing innovation capacity through entrepreneurship promotion. Most recently, the Technology Bank has partnered with the International Centre for Genetic Engineering and Biotechnology to offer fellowships to young researchers from least developed countries (LDCs).

In May 2020, the Technology Bank, jointly with UNDP, the United Nations Conference on Trade and Development and the World Health Organization (WHO), launched the Tech Access Partnership (TAP),[b] to strengthen developing and LDC manufacturing capacities of essential COVID-19-related equipment, medical diagnostic kits, and medical devices. The Partnership is also an implementing partner of the COVID-19 Technology Access Pool (C-TAP), an initiative led by WHO aimed at making vaccines, tests, treatments and health technologies to fight COVID-19 accessible to all.

Resource mobilization from other sources—both public and private—remains a key priority for the Technology Bank, to support LDC STI capacities towards the achievement of the SDGs.

Source: United Nations Technology Bank for Least Developed Countries.
a SDG Impact Accelerator, available at https://www.sdgia.org/.
b Tech Access Partnership, available at https://techaccesspartnership.net/.

engineering solutions for rapid adaptation of industrial production lines, while supporting medical responses. Various United Nations entities, such as the UNOSSC South-South Galaxy Platform and others, posted calls and opportunities encouraging joint projects by experts worldwide. These technology solutions are expected to become available through the TFM online platform as a one-stop-shop to support partners' work and extend its reach.

Various IATT members have used new and emerging technologies in their COVID-19 responses. The Economic and Social Commission for Western Asia, the United Nations High Commissioner for Refugees and the Data Pop Alliance used big data to estimate the impacts of public policies in response to COVID-19 in Lebanon and Jordan. The UNIDO Investment and Technology Promotion Offices (ITPO) organized unmanned vehicles to transport medical supplies, deliver meals for doctors and patients, and complete other emergency tasks in a hospital in Wuhan,[90] and supported technology transfer from Japan and the Republic of Korea. [91] WFP supported Governments in scaling up e-payments and digital registries to extend the coverage of social safety nets.[92]

IATT members have worked together on regulatory responses to strengthen ICT networks. The ITU Global Network Resiliency Platform collected 400 regulatory, policy and industry measures taken by countries and other stakeholders to ensure continued digital network services.[93] The Partnership Dialogue for Connectivity sets out recommendations on "Accelerating Digital Connectivity in the Wake of COVID-19". [94] The "Agenda for Action for Faster and Better Recovery" of the Broadband Commission for Sustainable Development outlines immediate measures to strengthen digital networks, capacity and connectivity of hospitals and transport hubs.[95] ITU, the World Bank, the World Economic Forum and the GSM Association (GSMA) devised a COVID-19 crisis response digital development joint action plan and call for action.[96]

COVID-19 testing, treatments and vaccines

The WHO has led the United Nations system work on COVID-19 tests, treatments and vaccines, with its Access to COVID-19 Tools Accelerator (ACT-Accelerator), but funding gaps remain a key constraint. COVAX, the Vaccines Pillar of the ACT-Accelerator (box III.G.4), has the world's largest and most diverse portfolio of vaccines. Despite new commitments of $4.3 billion from Group of Seven nations in February 2021, the ACT-Accelerator still faces a funding gap of over $20 billion for 2021.[97] If this shortfall is not met, it would delay vaccine access for low- and lower-middle-income countries—resulting in a protracted pandemic with severe economic consequences, not just for these countries but for the global community. More support is also needed for tests, treatments and health systems.

5.3 United Nations system support for harnessing STI for resilience

UNDRR leads the coordination of STI actions for disaster risk reduction. It supports countries in the implementation of the Sendai Framework for Disaster Risk Reduction. Its Scientific and Technical Advisory Group (STAG) provides technical support and facilitates the engagement of scientists, researchers and experts. UNDRR is an active member of IATT and

works closely with the Regional Commissions and other United Nations entities active in STI for disaster risk reduction.

IATT and TFM partners undertake a wide range of activities to mobilize STI for resilience. The United Nations Office for Outer Space Affairs promotes satellite technologies and applications, including for disaster management, telemedicine, precision farming, waste management, efficient transport, agriculture and supply chains, climate change mitigation and adaptation. The WIPO public-private Re:Search consortium addresses neglected tropical diseases, malaria and tuberculosis, which affect over one billion people worldwide. The International Atomic Energy Agency and FAO promote nuclear techniques to improve the resilience of crop varieties to climate change and ensure sustainable food production. They also build capacity for small island developing States on technologies for measuring sea water intrusion and salinity and for the use of crop mutation breeding techniques. ITU resilience-building ICT activities include the joint Policy and Regulation Initiative for Digital Africa (with the African Union and the European Union); [98] guidelines for national emergency telecommunication plans; and reporting on technologies such as AI, IoT, big data, robotics and drones, and their use in disaster risk reduction and management.[99] UN-Habitat and others have identified high-impact technologies for resilient homes and infrastructures and promoted the ethical and transparent uses of AI and big data solutions to improve sanitary and disaster risks management.

Box III.G.4
World Health Organization Access to COVID-19 Tools Accelerator and COVAX.

The Access to COVID-19 Tools Accelerator (ACT-Accelerator) is the only global solution that aims for equitable access to COVID-19 tests, treatments and vaccines. It uses vaccine risk pooling; provides an end-to-end solution across tests, treatments, and vaccines; and focuses on equitable access for all participants.

The ACT-Accelerator works through partnerships with lead agencies, including the Coalition for Epidemic Preparedness Innovations (CEPI), Gavi The Vaccine Alliance, the Global Fund, the Foundation for Innovative New Diagnostics, Unitaid, Wellcome Trust, the World Bank, the World Health Organization (WHO), UNICEF, and the Bill & Melinda Gates Foundation. Its integrated approach to catalyse research and development (e.g., by funding for vaccines, tests and therapeutics), scale up access capacities, and pool procurement is already benefiting people around the world.

Between April 2020 and February 2021, the ACT-Accelerator has transformed the approach to fighting COVID-19 on a global scale: vaccines are rolling out worldwide; low-cost, high-performing antigen rapid diagnostic tests can detect transmission anywhere; affordable therapy for severe disease can save lives in any setting; and health systems are being prepared for the roll-out of tools.

In January 2021, the **Diagnostics pillar** announced that technology transfer, scale up and automation of manufacturing capacity enabled over 250 million high-quality tests to be made available for low- and middle-income-countries, effectively halving the price of tests.

A total of 191 countries have signed up to the **COVAX** Facility to benefit from pooled procurement of vaccines. COVAX has secured hundreds of millions of doses of three promising candidates, including at least 200 million doses for low-income countries. On 24 February 2021, Ghana became the first country outside of India—where the licensed vaccine doses are produced—to receive their vaccine allocation as a participant of the COVAX Facility. By the end of 2021, COVAX aims to secure and deliver at least 2 billion doses of COVID-19 vaccines in what will be the largest global health-care-related supply chain operation in history.

Source: WHO.

Endnotes

1 United Nations. 2020. *Financing for Sustainable Development Report 2020.* New York: United Nations.

2 Eurofound and ILO. 2017. *Working Anytime, Anywhere: The Effects on the World of Work*. Geneva: ILO.

3 ILO. 2020. "Working from Home: Estimating the Worldwide potential." *Policy Brief.* May 7, 2020. https://www.ilo.org/global/topics/non-standard-employment/publications/WCMS_743447/lang--en/index.htm.

4 Ibid.

5 Dingel, J.; B. Neiman. 2020. "How Many Jobs Can be Done at Home?," *Working Paper No. 26948.* April 16, 2020. University of Chicago, Booth School of Business, NBER, and CEPR.

6 UNCTAD. 2021. *Technology and Innovation Report 2021.* Geneva: UNCTAD.

7 ITU. 2020a. *Measuring digital development: Facts and figures 2020.* Geneva: International Telecommunication Union.

8 The nine surveyed countries were: Brazil, China, Germany, Italy, the Republic of Korea, Russian Federation, South Africa, Switzerland and Turkey. See, UNCTAD & NetComm Suisse eCommerce Association. October 2020. *COVID-19 and E-commerce.*

9 UNICEF. October 2020. For more information: https://data.unicef.org/covid-19-and-children/.

10 The World Health Organization defines an infodemic as an overabundance of information, both online and offline.

11 WHO. 2020. "Managing the COVID-19 infodemic: Promoting healthy behaviours and mitigating the harm from misinformation and disinformation." September 23, 2020. https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation.

12 Europan Commission. 2020. "Second set of reports – Fighting COVID-19 disinformation Monitoring Programme." October 7, 2020. https://ec.europa.eu/digital-single-market/en/news/second-set-reports-fighting-covid-19-disinformation-monitoring-programme.

13 Foo Yun Chee. 2020. "Facebook, Google, Twitter urged by EU to do more against fake news." Reuters Technology News. September 10, 2020. https://www.reuters.com/article/us-eu-tech-disinformation/facebook-google-twitter-urged-by-eu-to-do-more-against-fake-news-idUSKBN2610GU.

14 Drozdiak, Natalia, and Stephanie Bodoni. 2020. "EU Seeks to Punish Online Lies in Disinformation Crackdown." Bloomberg Technology. September 3, 2020. https://www.bloomberg.com/news/articles/2020-12-03/eu-seeks-to-punish-online-lies-in-disinformation-crackdown.

15 WealthTech services include: digital wealth management, social trading, robo-advisors, robo retirement/pension planning, personal financial management/planning, financial comparison sites.

16 InsurTech services include: usage-based, parametric-based, on-demand insurance, peer-to-peer insurance, technical service provider, digital brokers or agents, comparison portal, customer management, claims and risk management solutions, IoT (including telematics).

17 CCAF, World Bank, and World Economic Forum. 2020. *The Global Covid-19 FinTech Market Rapid Assessment Report.* University of Cambridge, World Bank Group and the World Economic Forum.

18 KPMG. 2020. *Pulse of fintech H2 2020.* KPMG International.

19 See, for example, World Bank and CCAF. 2020. *The Global Covid-19 FinTech Regulatory Rapid Assessment Report.* World Bank Group and the University of Cambridge, p. 34 and p. 38.

20 Gentilini, Ugo, Mohamed Almenfi, Ian Orton, and Pamela Dale. September 2020. "Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures." Washington, D.C.: World Bank. Last modified December 11, 2020. https://openknowledge.worldbank.org/handle/10986/33635.

21 Gentilini et al. found that on average, countries which completed a first social protection payment in response to COVID-19 by June 2020, had coverage rates of 58 per cent and 90 per cent of financial inclusion and identification systems, respectively. Those with delayed implementation had coverage rates of 34 per cent and 58 per cent, on average.

22 See, for example, United Nations 2020.

23 G20 and GPFI. 2020. *G20 High-Level Policy Guidelines on Digital Financial Inclusion for Youth, Women and SMEs.*

24 See, for example, Agur, Itai, Soledad Martinez Peria, and Celine Rochon. "Digital Financial Services and the Pandemic: Opportunities and Risks for Emerging and Developing Economies." *IMF, Special Series on COVID-19.* July 1, 2020.

25 World Bank and CCAF 2000, p. 34.

26 United Nations 2020.

27 FSB. 2020a. *BigTech Firms in Finance in Emerging Market and Developing Economies: Market developments and potential financial stability implications.* Basel: FSB.

28 For example, in the first semester of 2020, Google, Tencent and Facebook were among investors who injected a total of $3 billion in Indonesia-based ride-hailing platform Gojek, which also has a digital payments service (see KPMG. 2020. *Pulse of fintech H1 2020.* KPMG International).

29 ITU 2020a.

30 World Bank. 2018. *Information and Communications for Development 2018: Data-Driven Development.* Washington, D.C.: World Bank.

31 Strusani, Davide, and Georges V. Houngbonon. 2020. "Accelerating digital connectivity through infrastructure sharing." IFC EMCompass, Note 79. https://www.ifc.org/wps/wcm/connect/2d3c4eff-12a8-4b0b-b55d-9113a950ed33/EMCompass-Note-79-Digital-Infrastructure-Sharing.pdf?MOD=AJPERES&CVID=n2dwWtn.

32 Wong, Johnathan. "Commentary: The rise of the digital economy and tech-driven inequality." Channel News Asia. February 10, 2020. https://www.channelnewsasia.com/news/commentary/inequality-technology-automation-work-workers-asia-singapore-12309370.

33 UN Women and Plan International. 2020. "Op-ed: We cannot allow COVID-19 to reinforce the digital gender divide." May 6, 2020. https://www.unwomen.org/en/news/stories/2020/5/op-ed-ed-phumzile-covid-19-and-the-digital-gender-divide.

34 Aunchithttps, Rattanasorn. "What's Next For E-Commerce Post COVID-19?" July 23, 2020. www.most2414.com/what-next-for-e-commerce-post-covid-19/.

35 Howe, James. "Blog: The e-commerce response to COVID-19". International Trade Centre. April 28, 2020. https://etradeforall.org/itc-the-e-commerce-response-to-covid-19/.

36 UNCTAD. 2020a. "Ugandan e-commerce platforms power recovery from COVID-19 crisis." July 28, 2020. https://unctad.org/news/ugandan-e-commerce-platforms-power-recovery-covid-19-crisis.

37 Xinhua. 2020. "E-commerce still a propeller of China's poverty alleviation amid COVID-19". April 30, 2020. http://www.xinhuanet.com/english/2020-04/30/c_139021893.htm.

38 UNCTAD. 2020b. Fast-tracking Implementation of eTrade Readiness Assessments. December 1, 2020. https://unctad.org/webflyer/fast-tracking-implementation-etrade-readiness-assessments.

39 ITC. ecomConnect. https://ecomconnect.org/.

40 Kahn, Jeremy. 2020. "2020 was a banner year for European tech investment. Not even a pandemic could slow it down". Fortune. December 8, 2020. https://fortune.com/2020/12/08/2020-banner-year-europe-tech-investment-covid/.

41 Reuters. 2020. "U.S. venture capital investments exceed 2019 despite pandemic gloom." December 2, 2020. https://www.reuters.com/article/idUSL4N2II2V0.

42 ITU. 2020b. Connecting Humanity: *Assessing Investment Needs of Connecting Humanity to the Internet by 2030.* Geneva: ITU.

43 Cornell University, INSEAD, and WIPO. 2020. *The Global Innovation Index 2020: Who Will Finance Innovation?* 13th ed. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and WIPO.

44 Ibid.

45 See, for example, UNECE. *2020. Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus.* Geneva: UNECE.

46 IDF. 2020. *The Development Impact of Risk Analytics: A call to action for public and private collaboration.* New York: IDF.

47 UNDRR, ISC. 2020. *Technical Report - Hazard Definition & Classification Review.* https://council.science/wp-content/uploads/2020/06/UNDRR_Hazard-Report_DIGITAL.pdf.

48 Rieger, C. 2016. "Demonstrating the capacity of online citizen science mapping software to communicate natural hazards and engage community participation." *PhD dissertation*, University of Lethbridge.

49 Malakar, Yuwan. 2014. "Community-based rainfall observation for landslide monitoring in western Nepal." In *Landslide Science for a Safer Geoenvironment: Volume 2*. Cham, edited by Sassa K et al. Switzerland: Springer International Publishing. 757-763. https://doi.org/10.1007/978-3-319-05050-8_117.

50 Robson, C. "Using mobile technology and social networking to crowdsource citizen science." *PhD dissertation*, Technical Report No. UCB/EECS-2012-195, University of California, Berkeley. September 11, 2012.

51 Baum, RL, LM Highland, PT Lyttle, JM Fee, EM Martinez and LA Wald. 2014. "Report-a-landslide: A website to engage the public in identifying geologic hazards." In *Landslide Science for a Safer Geoenvironment: Volume 2*. Cham, edited by Sassa K et al. Switzerland: Springer International Publishing.

52 Lane SN, N Odoni, C Landström, SJ Whatmore, N Ward, S and Bradley. 2011. "Doing flood risk science differently: An experiment in radical scientific method." *Transactions of the Institute of British Geographers,* 36(1): 15–36.

53 Salisbury E, S Stein, and S Ramchurn. 2016. "CrowdAR: a live video annotation tool for rapid mapping." *Procedia Engineering* 159: 89–93.

54 ESCAP. 2020. "Investing in innovative solutions to manage cascading disaster risks in South Asia: Key takeaways for stakeholders." *Asia Pacific Disaster Resilience Network Policy Study.*

55 Adger WN, PM Kelly, A Winkels, QH Luong, and C Locke. 2002. "Migration, remittances, livelihood trajectories, and social resilience." *Ambio* 31(4), 358-366; and Marschke MJ and F Berkes. 2006. "Exploring strategies that build livelihood resilience: A case from Cambodia." *Ecology and Society,* 11(1): 42.

56 Graschew G, TA Roelofs, S Rakowsky, and PM Schlag. 2008. "Satellite-based networks for u-health and u-learning." *European Space Agency, Special Publication 660.*

57 Turnin, M.-C., S. Schirr-Bonnans, M.-C. Chauchard, et al. 2017. "DIABSAT Telemedicine Itinerant Screening of Chronic Complications of Diabetes Using a Satellite." *Telemedicine and eHealth* 23(5): 397-403.

58 Martín-de-Mercado, G, A Horsch, G Parentela, P Mancini, and A Ginati. 2011. "Satellite-enhanced telemedicine and eHealth for sub-Saharan Africa: A Development Opportunity." *Sixty-second International Astronautical Congress 2011*, 5, 4320-4327.

59 See, for example, Mrazek, Monique, and Ruchira Shukla. "After coronavirus, telemedicine is here to stay." July 7, 2020. https://blogs.worldbank.org/digital-development/after-coronavirus-telemedicine-here-stay.

60 Ziervogel G, A Cowen, and J Ziniades. 2016. "Moving from adaptive to transformative capacity: building foundations for inclusive, thriving, and regenerative urban settlements." *Sustainability* 2016, 8, 955.

61 For example, the *Extreme Event* is an interactive role-playing game in which participants must build community resilience in the face of disasters, by working together to make decisions and solve problems during an engaging, fast-paced disaster simulation. For more information, see: https://www.koshland-science-museum.org/extreme-event/.

62 ITU. 2020c. *ITU Guidelines for national emergency telecommunication plans*. Geneva: ITU.

63 Enenkel M, C Farah, C Hain, A White, M Anderson, L You, W Wagner, and D Osgood. 2018. "What rainfall does not tell us - Enhancing financial instruments with satellite-derived soil moisture and evaporative stress." *Remote Sensing* 10(11): 1819.

64 Cebotari, A., and K Youssef. 2020. "Natural disaster insurance for sovereigns: issues, challenges and optimality." *IMF Working Paper*, 20/3. January 17, 2020.

65 See, for example, United Nations 2020.

66 Bandyopadhyaya, S., and A Mukherjeeb. 2016. "Tracking user-movement in opportunistic networks to support distributed query-response during disaster management." *Procedia Engineering* 159: 82–88.

67 Hacketta, T.M., and SG Bilén. 2016. "Implementation of a rapidly deployable, mobile communications system prototype for disadvantaged environments." *Procedia Engineering* 159: 158–166.

68 Díaz, P., JM Carroll, and I Aedo. 2016. "Coproduction as an Approach to Technology-Mediated Citizen Participation in Emergency Management." *Future Internet* 8: 41.

69 Rosen, W.J.. 2017. "Zipline's Ambitious Medical Drone Delivery in Africa." *MIT Technology Review.* June 8, 2017.

70 Malone, K., and K Duffin. 2020. "The Race to Make Ventilators." NPR Planet Money. March 31, 2020. https://www.npr.org/2020/03/31/824886286/episode-987-the-race-to-make-ventilators?t=1587727802232.

71 Nkurunziza, M. 2020. "Rwandan biomedical engineers to produce ventilators." The New Times. Last modified April 22, 2020. https://www.newtimes.co.rw/covid-19/rwandan-biomedical-engineers-produce-ventilators.

72 See, for example, United Nations. 2019. *Financing for Sustainable Development Report 2019*. New York: United Nations.

73 XPRIZE Challenges. 2021. XPRIZE Foundation. https://www.xprize.org/challenges.

74 Joint European Disruptive Initiative - JEDI. https://www.covid19.jedi.group/.

75 U.S. Department of Health and Human Serivces, Assistant Secretary for Public Affairs (ASPA). Last modified February 27, 2021. https://www.hhs.gov/coronavirus/explaining-operation-warp-speed/index.html.

76 Cambridge Centre for Alternative Finance. University of Cambridge Judge Business School. 2021. Bitcoin Electricity Consumption Index. https://cbeci.org/.

77 Some examples and discussion on how to activate intermediaries to achieve such inclusive design and business model in the case of robotics are presented in REELER. 2019. *Perspectives on Robots: A Reality Check on Imagined Futures.* REELER.

78 United Nations 2020.

79 United Nations Secretary General's Task Force on Digital financing of the Sustainable Development Goals. August 2020. *People's Money: Harnessing Digitalization to Finance a Sustainable Future.* New York: United Nations.

80 See, for example, Sabine Mauderer. 2020. "The role of fintechs in green finance." *Keynote speech at the 4th German-Singaporean Financial Forum.* November 25, 2020. https://www.marketscreener.com/news/latest/The-Role-of-Fintechs-in-Green-Finance-Keynote-Speech-at-the-4th-German-Singaporean-Financial-Forum---31862424/; and United Nations 2020, p. 75.

81 See, for example: FSB. 2020b. *The Use of Supervisory and Regulatory Technology by Authorities and Regulated Institutions: Market developments and financial stability implications.* Basel: FSB.

82 United Nations 2020, pp. 27-28.

83 For a discussion of measurement challenges and a suggested methodology, see for example OECD. 2019. "Connecting ODA and STI for inclusive development: measurement challenges from a DAC perspective." *DCD/DAC38*.

84 UNISDR. 2017. *Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction: Collection of Technical Notes on Data and Methodology.* Geneva: UNISDR.

85 UNCTAD. 2020c. *ASYCUDA Newsletter.* April 23, 2020. Geneva: UNCTAD.

86 IATT-STI. 2017. "Landscape of Science, Technology and Innovation initiatives for the SDGs." May 2017. https://sustainabledevelopment.un.org/content/documents/147462017.05.05_IATT-STI-Mapping.pdf.

87 Technology Facilitation Mechanism. "2030 Connect – a United Nations online technology plaform for the SDGs." United Nations Department of Economic and Social Affairs and the United Nations Office of Information and Communications Technology. https://tfm2030connect.un.org/.

88 UN Technology - Tech Access Partnership. www.techaccesspartnership.net.

89 UNIDO. 2020a. "Over 1,100 applications submitted to the UNIDO Global Call 'Innovative Ideas and Technologies vs. COVID-19 and beyond.'" News. July 1, 2020. https://www.unido.org/news/over-1100-applications-submitted-unido-global-call-innovative-ideas-and-technologies-vs-covid-19-and-beyond.

90 UNIDO. 2020b. "In China, robot delivery vehicles deployed to help with COVID-19 emergency." Stories. April 1, 2020. https://www.unido.org/stories/china-robot-delivery-vehicles-deployed-help-covid-19-emergency.

91 UNIDO Open Data Platform. "Strengthening the capacity of developing countries to mitigate the impacts of the COVID-19 pandemic through appropriate technology transfer from Japan"Project ID: 200108. https://open.unido.org/projects/M0/projects/200108, UNIDO and Investment and Technology Promotion Office, Tokyo. Sustainable Technology Promotion Platform. Human Health Technologies. http://www.unido.or.jp/en/activities/technology_transfer/technology_db/human-health-technologies/.

92 WFP. 2020. "WFP Global Response to COVID-19: September 2020". September 30, 2020. https://docs.wfp.org/api/documents/WFP-0000119380/download/.

93 ITU. 2020c. REG4COVID. https://reg4covid.itu.int/. Please also see a report summarizing such responses: ITU. 2020d. "Pandemic in the Internet Age: communications industry responses." June 2020. https://reg4covid.itu.int/wp-content/uploads/2020/06/ITU_COVID-19_and_Telecom-ICT.pdf.

94 ITU. 2020e. REG4COVID. Partnership Dialogue for Connectivity. "Accelerating Digital Connectivity in the Wake of COVID-19." Joint Statement. September 17, 2020. https://reg4covid.itu.int/wp-content/uploads/2020/09/UN75_Partnership_Statement_PD_final.pdf.

95 ITU and UNESCO. 2020. Broadband Commission for Sustainable Development. "COVID-19 Crisis: Broadband Commission Agenda for Action for Faster and Better Recovery." https://broadbandcommission.org/COVID19/Pages/default.aspx.

96 World Bank, IBRD, and IDA. 2020. "The World Bank, WEF, GSMA and ITU Mobilized in the Fight Against COVID-19." *Statement*. April 21, 2020. https://www.worldbank.org/en/news/statement/2020/04/21/the-world-bank-wef-gsma-and-itu-mobilized-in-the-fight-against-covid-19.

97 WHO. 2021. "COVID-19 vaccine doses shipped by the COVAX Facility head to Ghana, marking beginning of global rollout." Joint News Release. February 24, 2021. https://www.who.int/news/item/24-02-2021-covid-19-vaccine-doses-shipped-by-the-covax-facility-head-to-ghana-marking-beginning-of-global-rollout.

98 PRIDA, ITU, African Union, and EU. 2021. "Policy and Regulation Initiative for Digital Africa (PRIDA)." Addis Ababa, Ethiopia. https://oneprida.africa/.

99 ITU. 2019. "Disruptive technologies and their use in disaster risk reduction and management 2019." ITUGET 2019 Background document. Emergency telecommunications. https://www.itu.int/en/ITU-D/Emergency-Telecommunications/Documents/2019/GET_2019/Disruptive-Technologies.pdf.

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9 789211 014426