How can digital public technologies accelerate progress on the Sustainable Development Goals?

George Ingram
John W. McArthur
Priya Vora

BROOKINGS GLOBAL WORKING PAPER #174
MAY 2022

Center for Sustainable Development at BROOKINGS

How can digital public technologies accelerate progress on the Sustainable Development Goals?

George Ingram
Senior Fellow, Center for Sustainable Development | Global Economy and Development
Brookings Institution

John W. McArthur
Senior Fellow and Director, Center for Sustainable Development | Global Economy and Development
Brookings Institution

Priya Vora
Nonresident Fellow, Center for Sustainable Development | Global Economy and Development
Brookings Institution

MAY 2022
Brookings Global Working Paper #174
Brookings Center for Sustainable Development
www.brookings.edu/SustainableDevelopment

Acknowledgements
The authors thank Odera Onyechi for excellent research assistance. We also thank Jonathan Dolan, Homi Kharas, CV Madhukar, Anit Mukherjee, Jordan Sandman, Merrick Schaefer, Jed Sundwall, Jake Watson, and Kate Wilson, for helpful discussions and comments during the drafting process.

About the Center for Sustainable Development
Launched in 2020, the Center for Sustainable Development at Brookings generates leading research and insights to advance global sustainable development and implement the Sustainable Development Goals within and across all countries. To learn more visit: www.brookings.edu/SustainableDevelopment.

Executive Summary

Rapid shifts in digital technologies are changing the context for pursuing the Sustainable Development Goals (SDGs). In the best cases, these technologies have contributed to massive improvements in access to public services and economic opportunities for millions of people. In the worst cases, they have opened the door to new forms of government surveillance, exacerbated inequalities, and encouraged social divisions. Many private firms also have enormous influence in shaping the interface between digital technology and societal well-being. Against this backdrop, a growing movement is emphasizing the need for digital public goods and digital public infrastructure.

This paper focuses on "digital public technology" (DPT), meaning digital assets that create a level playing field for broad access or use—by virtue of being publicly owned, publicly regulated, or open source. We consider how they could support greater progress toward the SDGs' overarching 2030 deadline, with an emphasis on issues of extreme deprivation and basic needs. None of the relevant SDG indicators are fully on course for success by 2030, although some—like child mortality, access to electricity, access to sanitation, and access to drinking water—are on track to achieve gains for more than half the relevant populations in need. Some indicators are on a path to less than half the needed gains, including stunting, extreme income poverty, maternal mortality, access to family planning, primary school completion, and non-communicable disease mortality. Other issues like undernourishment and children overweight are moving backwards.

The human scale of the SDG shortfall is substantial. For example, over the period 2016-2030, the gap adds up to more than 15 million children under-5 dying and more than 40 million people dying early from non-communicable diseases. In 2030, more than 1.1 billion people are on course to lack access to sanitation, nearly 780 million people will likely be undernourished, and around 570 million people will still live in extreme poverty. Many of these challenges are highly concentrated in a small number of populous countries, including the Democratic Republic of the Congo, Nigeria, India, and Pakistan. Many other smaller countries, such as South Sudan, Chad, and Central African Republic, are also severely off-track on many SDG targets.

There is no singular relationship between access to digital technologies and SDG outcomes. Country- and issue-specific assessments are essential. Sound approaches will frequently depend on the underlying physical infrastructure and economic systems. Rwanda, for instance, has made tremendous progress on SDG health indicators despite high rates of income poverty and internet poverty. This contrasts with Burkina Faso, which has lower income poverty and internet poverty but higher child mortality.

We draw from an OECD typology to identify three layers of a digital ecosystem: Physical infrastructure, platform infrastructure, and apps-level products. Physical and platform layers of digital infrastructure provide the rules, standards, and security guarantees so that local market innovators and governments can develop new ideas more rapidly to meet ever-changing circumstances. We emphasize five forms of DPT platform infrastructure that can play important roles in supporting SDG acceleration:

- Personal identification and registration infrastructure allows citizens and organizations to have equal access to basic rights and services;
- Payments infrastructure enables efficient resource transfer with low transaction costs;
- Knowledge infrastructure links educational resources and data sets in an open or permissioned way;
- Data exchange infrastructure enables interoperability of independent databases; and
- Mapping infrastructure intersects with data exchange platforms to empower geospatially enabled diagnostics and service delivery opportunities.

Each of these platform types can contribute directly or indirectly to a range of SDG outcomes. For example, a person's ability to register their identity with public sector entities is fundamental to everything from a birth certificate (SDG target 16.9) to a land title (SDG 1.4), bank account (SDG 8.10), driver's license, or government-sponsored social protection (SDG 1.3). It can also ensure access to publicly available basic services, such as access to public schools (SDG 4.1) and health clinics (SDG 3.8).

At least three levers can help "level the playing field" such that a wide array of service providers can use the physical and platform layers of digital infrastructure equally: (1) public ownership and governance; (2) public regulation; and (3) open code, standards, and protocols. In practice, DPTs are typically built and deployed through a mix of levers, enabling different public and private actors to extract benefits through unique pathways.

The design and deployment of DPTs often raise considerable challenges. At an operational level, these might include a lack of financial sustainability, limited capabilities within government to oversee a platform, and government procurement obstacles. DPTs can also undermine SDG outcomes if they compound inequities in digital access, contribute to concentrations of power in any public or private entities, or lead to misuse and abuse of individuals' data.

Amid the rapidly evolving context for DPTs to make potential contributions to the SDGs, few official donor organizations have so far made digital development a strategic priority. Robust official statistics are not available, but one estimate suggests relevant funding rose to $6.8 billion in 2019, with multilateral institutions providing more than bilateral donors. A few large private philanthropies appear to be placing greater relative priority on digital technology within their own resources, with estimated funding adding up to $491 million in 2019.

As fast-changing digital technologies penetrate more dimensions of all societies, successful DPT strategies will require multi-pronged approaches that promote benefits while mitigating risks. Governments can establish participatory design processes and citizen-centric data governance regimes while ensuring accountability and redressal systems. Civil society can represent diverse voices in policy making, while spreading digital literacy and holding governments accountable. Funders can finance risk-based support frameworks while prioritizing the sustainability of interoperable, well-governed DPTs and investing in ecosystem players. A holistic approach to DPTs could help accelerate progress on many SDGs as the world approaches its 2030 deadline.

Introduction

Nearly seven years after their adoption in September 2015, the Sustainable Development Goals (SDGs) are approaching the midway point to an overarching 2030 deadline. All 193 U.N. member states launched the economic, social, and environmental objectives of the SDGs under a headline ambition of "transforming our world." But in many ways, the world has already transformed itself, independent of the goals, and often not for the better. Rapid technological changes, divisive politics, and a global pandemic have all altered the context for the pursuit of global sustainable development. Some SDG trend lines have jumped forward, some have stagnated, and many have continued in the wrong direction.

Rapid shifts in digital technologies represent one of the most fundamental changes in the global context. These technologies are advancing much faster than those in other sectors. One recent study estimates the rate of underlying progress in digital-focused industries at more than 200 percent per year.[1] This quick pace of change contrasts with common perceptions of stagnation on the SDGs. In turn, it naturally prompts questions about how advances in digital technology could accelerate gains on the SDGs. One analyst has argued, for example, that "Open-source digital payment networks could [...] provide a foundation for whole-of-society digital transformation."[2]

At one level, digital technology is formally included within multiple SDG targets, especially under Goal 9 for infrastructure and innovation. Target SDG 9.1 is to "Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all." Target 9.c is to "Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020." And Target 9.a is to "Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States."

But digital technology also plays a potentially big role in affecting a much broader range of other SDG outcomes. On the most positive side, new digital technologies have contributed to rapid and massive improvements in access to public services, the provision of social protection, and new economic opportunities for millions of people. For example, India's Aadhaar system now provides digital identification for more than a billion people, quickly enabling a dramatic expansion in access to government programs in the world's second most populous country. In 2020, during the early weeks of a global pandemic, the Government of Togo's Novissi program brought public, private, and non-profit actors together to deploy hyper-targeted digital cash transfers to more than 500 thousand extremely poor people. The same year, Bangladesh delivered digital cash

—

[1] Singh, Triulzi and Magee (2021).
[2] Tillemann (2021).

payments to 23,000 households a week prior to a major flood, as part of an anticipatory humanitarian assistance strategy.[3] Such examples illustrate direct positive links between digital technology and SDGs related to poverty (SDG 1), hunger (SDG 2), and other goals.

On the negative side, evolving digital technologies have opened the door to new forms of government surveillance, empowered autocrats with repressive digital tools, exacerbated many forms of pre-existing inequality, and encouraged social divisions through the spread of misinformation. The latter has, for example, hindered responses to the COVID-19 pandemic—which has in turn adversely affected most SDG trajectories. The same digital technology that can empower hundreds of millions of people to get rapid access to government services can also lead to rapid weakening of fundamental freedoms and inhibit participatory decision-making—some of the fundamental objectives embedded in SDG 16 for peace, justice, and strong institutions.

Concurrently, digital technologies have spurred profound questions regarding the governance of private companies driving so many fundamental changes across societies. Large private firms own and manage many of the world's underlying digital systems, with enormous influence over users of the technologies and potentially also the governments with a mandate to regulate them. When the SDGs were being finalized in mid-2015, only three of the world's ten largest companies (by market capitalization) were focused on digital technology. In March 2022, only two of the world's ten largest companies were *not* centrally focused on digital technology.[4] These private companies provide enormous benefits to customers and users around the world, while also representing a tremendous concentration of economic and political power.

Against this backdrop, a growing international movement has taken shape to highlight the public dimensions of digital technologies, with an emphasis on open-source/open-protocol platforms for developing digital tools, public infrastructure for hosting digital tools, and public regulation of private actors that are creating or managing digital tools and assets. One variant of this is embedded in the Digital Public Goods Alliance (DGPA), which describes itself as a "multi-stakeholder initiative with a mission to accelerate the attainment of the sustainable development goals in low- and middle-income countries by facilitating the discovery, development, use of, and investment in digital public goods."[5] The DPGA defines digital public goods as "open-source software, open data, open AI models, open standards and open content that adhere to privacy and other applicable laws and best practices, do no harm by design, and help attain the SDGs."[6]

The term "public good" is a technical one in the field of economics. It refers to goods that are both non-excludable, meaning that everyone has equal access, and non-rivalrous, meaning that one user consuming them does not limit the availability for other users. Classic examples range from a national defense system that protects all citizens equally to a public health system that keeps all citizens equally protected from a dangerous pathogen. Public goods prompt unique responsibilities for the public sector

—

[3] Pople and others (2021).
[4] Johnston (2021).
[5] DPGA (2021)
[6] Ibid.

since market actors do not face adequate economic incentives to provide them on their own, and "free riders" are able to benefit without paying for access. As discussed in Kharas and McArthur (2021), the operative mix of public and private actors hinges on the extent of public "good-ness" embedded in an issue.

In the digital policy spheres, there are ongoing debates regarding what exactly should count as a digital public good (DPG) and what should count as digital public infrastructure (DPI). The DPGA has created a process whereby third parties can apply for vetting against key criteria and ensuing registration as formally-recognized DPGs. There are also ongoing debates regarding the extent to which DPGs and DPI will serve "the public good"—or social welfare in economics jargon—compared to private digital technologies and platforms. These are complex and technical issues since both public and private goods can contribute to societal well-being.

This paper steers clear of terminology debates regarding what exactly should count as DPGs or DPIs. Instead, we focus more broadly on issues of the "D" (digital) and "P" (public) in the context of fast-shifting technological frontiers and the global need to make better progress toward the SDGs. To this end, we focus on what we dub "digital public technologies" (DPTs)—meaning digital assets that create a level playing field for broad access or use by virtue of being publicly owned, publicly regulated, or open source—to consider how they could support progress toward the SDGs, as the world's agreed objectives for promoting public well-being. We also consider both the limits of DPT in a market-driven global economy and the need for guardrails to ensure that DPTs support basic principles of public well-being.

The remainder of the paper proceeds in four sections. Section 1 provides a snapshot assessment of SDG progress and links to internet poverty as a proxy for lack of access to digital technology. Section 2 considers the role of digital platforms in accelerating SDG success, with attention to the layers of a technology ecosystem, the diverse forms of platform infrastructure, diverse approaches to promoting public well-being, and challenges and risks embedded in the pursuit of platforms. Section 3 then briefly assesses current global development-related policies and funding levels with emphasis on multilateral, bilateral, and philanthropic funders. Section 4 presents factors for DPT success, describing key considerations for governments, civil society, and funders, respectively.

Diagnosing SDG trends

To frame the DPT challenge, we start with an empirical benchmarking of SDG-relevant trajectories, with emphasis on indicators related to extreme poverty and basic needs. Results presented below offer preliminary findings from a separate forthcoming study by Kharas, McArthur, and Onyechi. The methods build upon previous analyses published in 2018 and 2019 and incorporate more recent updates in underlying public data sources.[7] In some instances, such as for extreme income poverty, the underlying data source (e.g., World Data Lab 2022) incorporates effects of the COVID-19 pandemic. In other cases, the relevant source does not yet provide enough information to identify the consequences of the pandemic or other country-specific shocks, such as the change of regime in Afghanistan in 2021. These results should be interpreted as indicative and subject to refinement.

Below we focus on four questions: (i) How is the world doing on poverty-related SDGs? (ii) What is the human scale of the shortfalls? (iii) Where are the problems most concentrated? (iv) How do SDG gaps and digital access gaps interconnect?

How is the world doing on poverty-related SDGs?

The first thing to note is that there is no single answer to how the world is doing on the SDGs. Some issues are making progress, others are facing too much stagnation, and still others are moving in the wrong direction. Kharas and colleagues (forthcoming) conduct an analysis of overall "success ratios" across 12 key SDG indicators based on an extrapolation of how many people are on course to benefit from progress by 2030. For each indicator, a score of 100 represents full achievement of the SDG for all relevant populations across all countries and a score of zero represents no change between 2015 and 2030. A negative score highlights a worsening situation since 2015.

As shown in Figure A1 of the Appendix, none of the indicators are yet fully on track for the SDG targets but there is considerable variation. Access to electricity, access to sanitation, child mortality, and access to drinking water are all on track to register overall gains more than halfway to the respective goals. Targets for stunting, extreme income poverty, maternal mortality, and access to family planning are all on a path to register gains from 25 to 50 percent of the way to the goals. Non-communicable disease mortality is on a path to achieve only 13 percent of the gains required, measured by premature deaths averted, and primary school completion is on track to register a gain of only 12 percent. Meanwhile, indicators for undernourishment and children overweight have been moving in a worse direction since 2015.

What is the human scale of the shortfalls?

To convert these summary statistics into human terms, we estimate the absolute consequences of continuing recent trajectories as of around 2020, when compared to

[7] Kharas, McArthur and Rasmussen (2018); Kharas, McArthur, and Ohno (2019).

the required rates of progress between 2015 and 2030. Figure 1 shows the cumulative number of lives lost from 2016 to 2030 due to SDG shortfalls. For non-communicable diseases, it adds up to 40.1 million excess premature deaths. For under-5 child mortality, this adds up to 15.3 million excess deaths. For maternal mortality, it adds up to 1.8 million additional mothers dying.

Figure 1: Estimated lives lost due to SDG shortfalls worldwide, current trend, cumulative 2016-2030

Source: Kharas, McArthur and Onyechi (forthcoming).

Figure 2: Estimated number of people lacking basic needs in 2030 due to SDG shortfalls

Source: Kharas, McArthur and Onyechi (forthcoming).

Figure 2 then shows the number of people, on current trajectory, lacking a variety of basic needs in 2030. Estimates range from more than 1.1 billion people lacking access to sanitation to nearly 780 million people being undernourished, nearly 600 million people lacking access to electricity, and 570 million people still living in extreme poverty. If recent trends persist, nearly 540 million people will still lack access to basic drinking water and 470 million women are slated to be without access to family planning. In considering estimates for indicators specifically relevant to children (see Appendix Figure A3), nearly 130 million children under-5 will suffer from stunting, on current trajectory, caused by chronic undernutrition. More than 80 million children aged 2-4 will be overweight and more than 10 million 12-year-olds will not have completed primary school.

Where are the problems most concentrated?

We consider the geographic concentration of SDG challenges in two ways: First, as a share of the world's challenge, and second, as the country-specific depth of the challenge. For the first, Figure 3 shows the countries on track to have the world's largest share of excess premature deaths from 2016-2030 and unmet basic needs as of 2030. Cells highlighted in red denote a country with a top five global share for the indicator. The human scale of each issue tends to be concentrated in a small number of countries. For example, 63 percent of the excess child mortality between 2016 and 2030 is slated to occur in only five countries: Nigeria, the Democratic Republic of the Congo (DRC), Pakistan, Somalia, and Chad. A slightly different mix of five countries is on course to account for 43 percent of the world's people living in extreme income poverty in 2030: Nigeria, DRC, Madagascar, Angola, and Tanzania. Around 46 percent of child stunting in 2030 is estimated to be found in India, Pakistan, DRC, Indonesia, and Ethiopia.

Importantly, countries at all levels of economic development face their own unique mix of SDG challenges. DRC and Nigeria both face extensive problems of human deprivation, registering among the top 5 for nine and eight indicators, respectively. Meanwhile, India is on track to meet the child mortality target but also on trajectory for the highest concentrations of undernourished, overweight, and stunted children in 2030, in addition to having the most 12-year-olds out of school. Upper middle-income countries like Brazil and China register high concentrations of overweight children. Excess non-communicable disease mortality is concentrated in a range of populous countries, including the United States, Indonesia, and Philippines.

Table 1 then charts the 20 most severely off-track countries, independent of population size, on 11 indicators for absolute SDG targets in Figure 3 (i.e., excluding the relative target for non-communicable disease). These countries are all hotspots of concern for global challenges of deprivation. All are in sub-Saharan Africa, highlighting the extent of the SDG challenge across the region. South Sudan shows up at the top of the list, meaning it is the country on course to be furthest off track on relevant SDG indicators by 2030, followed closely by Chad and Central African Republic. DRC and Nigeria topped the previous chart and notably show up again in Table 1, highlighting both the absolute and relative scale of the SDG challenge in those two countries.

Figure 3: Top 5 concentrations of aggregate lives affected for 12 key SDG indicators

	Extreme poverty	Undernourishment	Children overweight	Stunting	Maternal mortality	Child mortality	NCD mortality	Family planning	Primary school	Water	Sanitation	Electricity
Congo, Dem. Rep.	12%	7%	3%	5%	7%	9%	<1%	4%	4%	11%	9%	14%
Nigeria	18%	9%	5%	2%	39%	39%	1%	6%		2%	11%	19%
India	-	31%	15%	22%	1%	-	21%	21%	17%	13%	-	-
Pakistan	-	4%	<1%	9%	<1%	9%	3%	6%	8%	4%	3%	9%
Ethiopia	-	2%	2%	5%	3%	1%	1%	1%	5%	10%	11%	1%
Tanzania	4%	3%	2%	2%	4%	2%	<1%	2%	12%	4%	4%	4%
Indonesia	-	1%	3%	5%	1%	-	6%	3%	-	-	-	-
China	-	-	13%	4%	-	-	15%	1%		2%	-	-
Uganda	3%		1%	2%	2%	<1%	<1%	1%	8%	3%	4%	1%
Chad	2%	<1%	<1%	1%	5%	3%	<1%	<1%	2%	2%	2%	3%
United States	-	-	4%	<1%	-	-	8%	3%	-	-	<1%	-
Mozambique	3%	2%	1%	1%	<1%	2%	<1%	<1%	5%	<1%	2%	4%
South Sudan	2%		<1%	<1%	3%	2%	<1%	<1%		2%	<1%	2%
Venezuela, RB	2%	3%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	-
Angola	4%	1%	1%	2%	<1%	2%	<1%	1%		3%	2%	2%
Niger	1%		<1%	2%	2%	3%	<1%	<1%	1%	3%	3%	4%
Madagascar	5%	3%	<1%	2%	<1%	<1%	<1%	1%	3%	2%	3%	3%
Kenya	2%	3%	<1%	2%	2%	<1%	<1%	<1%	-	4%	4%	-
Brazil	1%	-	4%	<1%	-	-	3%	1%		-	<1%	-
Bangladesh	-	-	<1%	3%	<1%	-	3%	1%		<1%	5%	-
Somalia	2%	1%	<1%	<1%	3%	3%	<1%	<1%		1%	<1%	2%
Philippines	-	-	1%	2%	<1%	-	4%	2%	-	<1%	<1%	-
Other countries	38%	28%	40%	25%	21%	21%	30%	40%	28%	30%	33%	30%

Source: Kharas, McArthur and Onyechi (forthcoming).

Table 1: Countries furthest off track on for mix of absolute SDG targets by 2030

1. South Sudan	8. Burundi	15. Niger
2. Chad	9. Liberia	16. Nigeria
3. Central African Rep.	10. Sierra Leone	17. Equatorial Guinea
4. DR Congo	11. Benin	18. Burkina Faso
5. Somalia	12. Guinea	19. Angola
6. Madagascar	13. Mozambique	20. Rep of Congo
7. Eritrea	14. Guinea-Bissau	

Source: Kharas, McArthur and Onyechi (forthcoming).

How do SDG gaps and digital access gaps interconnect?

Country-level analysis is essential for diagnosing SDG challenges and how DPTs might fit into faster progress. If a country enjoys widespread internet infrastructure with affordable access, then DPT policies can reasonably focus on adding high-value platforms. If, however, a country has limited physical infrastructure or generally unaffordable access, then a first order concern is to build the infrastructure itself and to make it available at an affordable price.

There is no single way to measure digital access. One estimate from the International Telecommunications Union (ITU) suggests that, as of 2021, there were approximately 2.9 billion people without connection to the internet.[8] Meanwhile, Cuaresma and colleagues emphasize cost barriers to estimate that 1.4 billion people currently live in "internet poverty."[9] This is based on the number of people who lack access to a minimum quantity (1 GB) and quality (10 Mbps download speed) of internet usage at a minimum level of affordability (no more than 10 percent of disposable income).

Internet poverty is estimated to be more extensive than extreme income poverty. Figure 4 plots country-level data for the two indicators. The chart shows a clear positive correlation, with most countries registering higher levels of internet poverty than extreme income poverty. The figure also indicates a considerable degree of variation across income levels. Ethiopia, for example, is a low-income country, but registers less income poverty (below 20 percent) and internet poverty (around 20 percent). This compares with Rwanda, which is estimated to have more than half its population living in income poverty and nearly 90 percent living in internet poverty.

Cross-country variations in context are further amplified in Figure 5, which plots recent child mortality rates against internet poverty rates. Returning to the example of Rwanda, as of 2020, it was already nearing the SDG target of 25 deaths per 1000 live births despite its high level of internet poverty. Malawi has a similar mix of low child mortality and high internet poverty. Meanwhile, countries like Nigeria, Burkina Faso, and Pakistan register much lower levels of internet poverty with considerably higher levels of child mortality. There is no singular relationship between digital technologies and SDG outcomes.

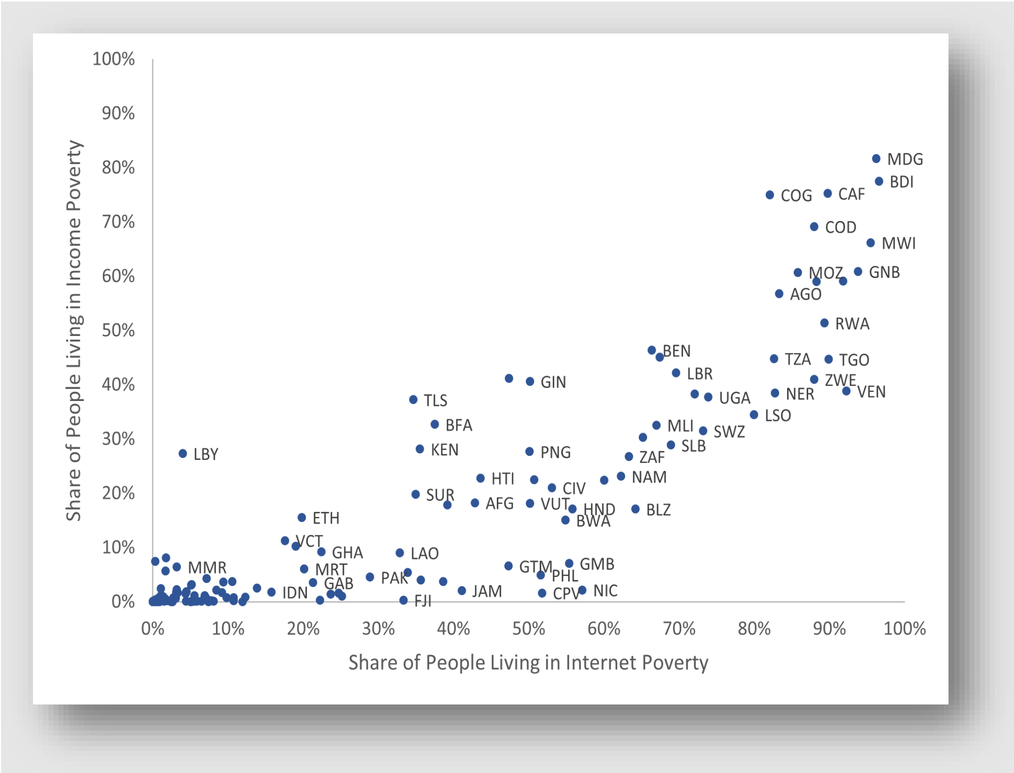
For the purposes of this paper, we treat internet poverty as a proxy measure for lack of access to digital technology. Table 2 offers one way to consider how this relates to the diversity of SDG challenges. It lists the same 20 most off-track countries as in Table 1, but now ranked by share of the population in internet poverty. More than half the countries with data are estimated to have more than 80 percent of their population living in internet poverty. Many of these countries have relatively small total populations, but not all. DRC is estimated to have 88 percent of its population living in internet poverty, amounting to 82 million people. Nigeria is estimated to have 47 percent of its population in internet poverty, adding up to more than 100 million people.

—

[8] ITU (2021).

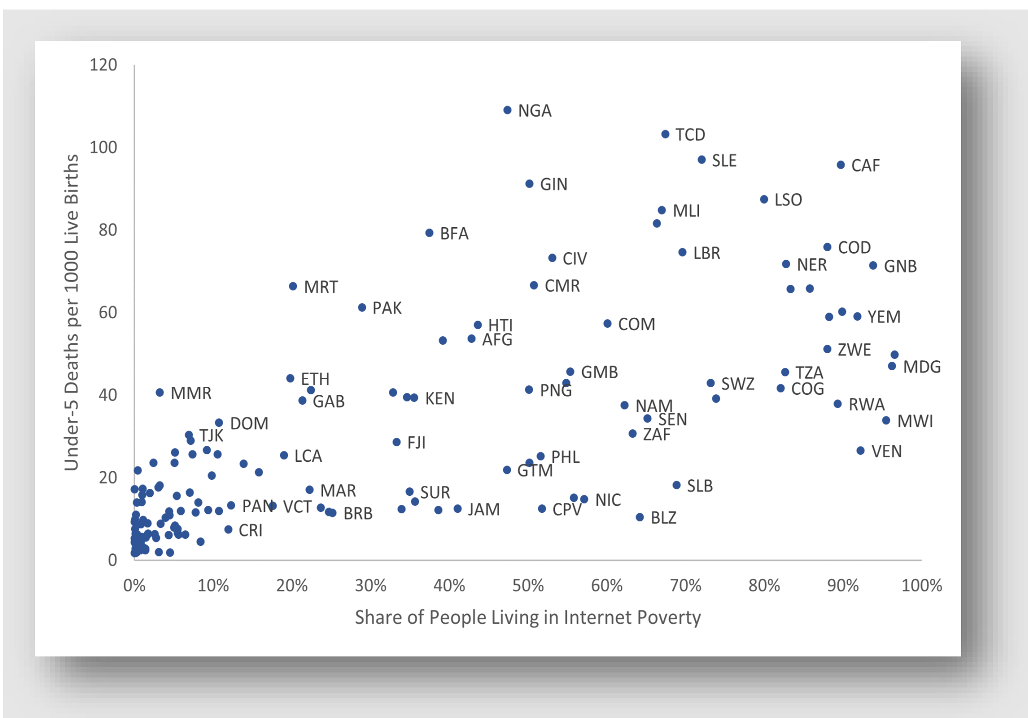
[9] Cuaresma and others (2022).

Figure 4: Estimated internet poverty rate vs extreme income poverty rate in 2022



Source: Cuaresma and others (2022); World Data Lab (2021).

Figure 5: Estimated internet poverty rate vs under-5 child mortality rate in 2022



Source: Cuaresma and others (2022); authors' calculations based on UN-IGME (2021).

Table 2: Internet poverty in 20 countries severely off-track for SDGs

	Internet-poor people (millions)	Share of population		Internet-poor people (millions)	Share of population
Burundi	12	97%	Liberia	4	70%
Madagascar	28	96%	Chad	12	67%
Guinea-Bissau	2	94%	Benin	8	66%
Central African Republic	5	90%	Guinea	7	50%
DR Congo	82	88%	Nigeria	103	47%
Mozambique	29	86%	Burkina Faso	8	37%
Angola	28	83%	South Sudan	-	n.a.
Niger	21	83%	Somalia	-	n.a.
Congo, Rep.	5	82%	Eritrea	-	n.a.
Sierra Leone	6	72%	Equatorial Guinea	-	n.a.

n.a. = not available

Source: Authors' calculations based on Cuaresma and others (2022) and World Bank (2022b).

If one considers some of the larger countries included in Figure 3, representing large global shares of specific SDG challenges, estimates from Cuaresma and colleagues suggest internet access gaps that are often large in absolute terms, and sometimes also proportionate terms. India, for example, is estimated to have 101 million people living in internet poverty, even if this represents only 7 percent of its population. Other countries with more than 50 million people estimated to be in internet poverty include China, at 93 million people (7 percent of the population); Brazil, at 79 million people (36 percent); and Pakistan, at 63 million people (29 percent); Philippines, at 58 million people (52 percent); and Tanzania, at 55 million people (83 percent). Notably, Bangladesh is estimated to have a relatively low rate of internet poverty, at 9 million people (5 percent of population).

None of the above intends to oversimplify the challenge of building out each country's digital physical infrastructure. However, it does underscore the importance of country-specific analysis when considering the opportunity for DPT. Whether the "last mile," "middle mile," or "early mile" of a national network—building physical digital infrastructure forms a first order priority.

How much would the relevant digital infrastructure cost to build? There are no firm numbers, but a 2020 ITU study estimates that $428 billion would be required to achieve universal broadband connectivity over the decade out to 2030, or more than $40 billion per year.[10] The same study estimates roughly a two-to-one ratio between required private and public financing, and 70 percent of the overall need being in low- and lower middle-income countries. Investment categories range from building mobile infrastructure to metro backbone and fiber, remote area coverage, network operation and maintenance, skills training, and support for policy and regulation. A 2019 study by the UN Sustainable Development Solutions Network estimates lower needs of approximately $14 billion per year in low- and lower-middle-income countries over the

—

[10] ITU (2020).

same period, alongside complementary investments of more than $50 billion per year in energy infrastructure and a broader SDG financing need of approximately $1 trillion per year.[11] These and other SDG financing-related studies suggest that digital infrastructure amounts to only a small fraction of overall SDG investment needs.[12]

—

[11] UN Sustainable Development Solutions Network (2019).
[12] See Kharas and McArthur (2019).

DPTs and the role of platforms in accelerating SDG success

Recognizing the variation of SDG challenges across countries, investments in digital technology will need to align with local policy priorities, which might reasonably emphasize a diversity of sector-specific strategies. There is no single policy or investment approach that should be equally prioritized in all cases. Consider, for example, a typical low-income country in sub-Saharan Africa with high rates of extreme income poverty and human deprivation, as embedded in goals 1 through 7 of the SDG framework. The majority of extremely poor people live in rural areas, where most households engage in subsistence agriculture and some also engage in local service enterprises. Transport infrastructure is limited, as is access to electricity, basic health, and education. Government social protection services tend to be minimal, if available at all.

In situations like this, even when the specific SDG challenges are very clear and well quantified, policymakers and analysts can reasonably debate which sector(s) to prioritize over which timeframes, well before deliberating over the appropriate DPT components of a particular strategy. A social protection strategy based on direct cash transfers might make the fastest inroads in boosting households with extremely low levels of income and consumption, but there might not be enough administrative capacity, political support, or fiscal space to implement it. Meanwhile, there is considerable aggregate evidence about the merits of agriculture-based investment strategies in reducing extreme poverty, but the return on those investments might hinge on building capital-intensive physical infrastructure to connect and empower markets. Some policymakers might prefer to prioritize a human capital-based strategy focused on education and health sectors, but the societal returns to these investments might not show up for a decade or more. Such natural variances in policy prioritization will yield natural variance in the role of DPTs for accelerating SDG trajectories.

Layers of a technology ecosystem

Inevitable variations in policy priorities do not reduce the importance of common building blocks even within specific sectoral strategies, which can often be bolstered by DPTs. Immunizations, for example, are foundational to any public health strategy. But DPTs need to be understood in the context of complex digital ecosystems that governments and service providers need to navigate. There is no agreed framework for defining the components of a system, although actors like the ITU, the Digital Impact Alliance, and the World Bank have shown a degree of convergence on key elements required.[13]

—

[13] See, for example, ITU (n.d.) and World Bank (2022a).

For simplicity, this paper draws from the construct presented by the OECD in the 2021 Development Cooperation Report entitled *Shaping a Just Digital Transformation.* The report describes three general layers of technologies needed: hard infrastructure, platforms, and applications that "ride on top" of the infrastructure, all of which enable delivery of services to end users.

Figure 6: Three layers of a digital technology ecosystem

Layer	Components
Physical Infrastructure	• Broadband • Mobile connections • Devices • Electricity • Data centers
Platform (Infrastructure)	• Registries for the unique ID of people/buildings/vehicles/land plots/products • Payments infrastructure • Knowledge infrastructure • Data exchange infrastructure • Mapping infrastructure
Apps-level Products	• Farmer information solutions • e-commerce • Telehealth • Much, much more

Source: Adapted from OECD (2021).

As shown in Figure 6, this construct is useful not only for its simplicity but also in illustrating the foundational role of physical and platform infrastructure in enabling applications and services to thrive across the public and private sectors. These infrastructure layers underpin every retail e-commerce solution, mobile and online banking interface, health and fitness application, e-government service, and much more. Together they enable a sort of Cambrian explosion of innovation—in the form of applications—that simply cannot be predicted or even limited. When present, pervasive, and designed well, physical and platform infrastructure have the potential for widespread use that serves all social and economic sectors, including those that promote SDG achievement.

Platform infrastructure is especially unique because it offers the promise of near infinite re-use, unlike the physical infrastructure which needs to be repeated in context after context (laying broadband fiber in city after city or building data centers in country after country). For example, when a digital infrastructure platform for interoperable payments is introduced in one country, the same software code can be used in another country. No platform will be a simple cut-and-paste solution for all countries or environments, but platforms can be designed in a modular way that enables adjustment for local context.

Platform infrastructure is also distinguished by the role it plays in promoting the data economy. Platforms are, at their core, mechanisms for transferring data—to authenticate a person, settle a payment, or share location or other data. And because they facilitate the application layers above, these platforms have generated data in unprecedented ways. Using cookies, heatmaps, signal tracking devices, and a variety of other tools, companies and governments alike gather insights about people they aim to reach.

Diverse forms of platform infrastructure

Though many countries continue to struggle with basic internet poverty, as physical infrastructure needs are increasingly met in low- and middle-income countries, the natural evolution will be to focus on supporting platforms for interoperability that generate economic and social returns. In this regard, at least five different DPT platforms can play important roles in supporting SDG acceleration.

First, **personal identification and registration infrastructure** form important tools for ensuring all citizens have equal access to basic rights and services. A person's ability to register their identity with public sector entities is fundamental to everything from receiving a birth certificate (SDG target 16.9) to a land title (SDG 1.4), bank account (SDG 8.10), driver's license, and government-sponsored social protection (SDG 1.3). It can also ensure access to publicly available basic services, such as access to public schools (SDG 4.1) and health clinics (SDG 3.8). Similarly, small businesses and other organizations need to register formally with public bodies (SDG 8.3) to comply with tax policies (SDG 17.1), receive access to basic financial services (SDG 9.3), public services, and benefit from any potential government support programs.

Second, **payments infrastructure** enables the efficient transfer of resources with low transaction cost. Such infrastructure can be used for any permutation of financial transactions between governments, citizens, and enterprises. From the government perspective, when payment platforms exist alongside identification platforms, they can enable unconditional payments or conditional payment approaches toward policy goals spanning a wide array of potential SDG outcomes. Conditional payments could be tied to a desired policy intervention; for example, cash support to low-income families who enroll their children in school (as famously pioneered in Mexico) or obtain a complete course of child immunizations (SDGs 1.2, 3.2, 4.1). Unconditional payment platforms can serve an array of purposes, ranging from emergency assistance to avoid a humanitarian crisis to digital food stamp vouchers for food insecure people, to cash transfers for ultra-poor families, to targeted neonatal support for single mothers with young children (SDGs 1.1, 2.1, 3.1, 3.2, 11.5).

Third, **knowledge infrastructure** can link resources and datasets in an open or permissioned way, depending on the use. Some provide open access educational curriculum for learners of all ages and public resources for citizens and professionals of diverse backgrounds. These types of resources not only provide direct learning and skills outcomes (SDG 4), but can also support professional skill development relating to any particular sector or industry (i.e., all SDGs). For educational purposes, open online courses can provide an avenue for educators to upload material and learners to download material to align with language backgrounds, learning styles, and learning goals. India has created the Digital Infrastructure for Knowledge Sharing (DIKSHA) platform as a free resource providing online courses, textbooks, digital content, and discussion forums for teachers and students.[14] Globally, open-access platforms like EdX and the Khan Academy also provide large-scale public learning materials to people from all backgrounds.

Fourth**, data exchange infrastructure** platforms enable interoperability of independent databases. For example, verification platforms can help spot counterfeit commodities by merging industrial supplier data with market access data for customers. This can help protect supply chains for medicines, precious minerals, fertilizers, seeds, and even food products (SDG 2, 3). Data exchange can also be crucial for service coordination, most notably in the field of medical health records (SDG 3). In a well-structured health information platform, diverse forms of service providers can intersect with individual-level health data while restricting access to ensure patient privacy. South Africa's District Health Information Software 2 (DHIS2) is now used in 73 low- and middle-income countries and has become the world's most widespread health management information system.[15]

Fifth, **mapping infrastructure** intersects with data exchange platforms to empower geospatially enabled diagnostics and service delivery opportunities. For the environmentally focused SDGs, this can provide publicly accessible tracking of physical ecosystems, such as when satellite data is matched with mapping data and property registries to spot real-time trends in illegal logging (SDG 15). Similar technologies can also be used to identify illegal fishing in protected marine areas (SDG 14). Mapping and air measurement technology can jointly track real-time, neighborhood-level air pollution (SDG 11.6), which is well established as a major cause of premature mortality and non-communicable disease around the world (SDG 3.4).

In fighting diseases, mapping technology can interface with health information systems and even citizen-level mobile data reporting to track outbreaks in real time (SDG 3.3, 3.8, 3.d), as Sri Lanka did in the early days of the COVID-19 pandemic.[16] For basic infrastructure like water pumps and sanitation systems, remote sensing equipment can also be used to track, report, and publish breakdowns, enhancing the incentives for upkeep and service continuity (SDG 6.1, 6.2). For economy-wide efficiencies, real-time maps of traffic flows can allow citizens and companies to minimize transport costs and thereby enhance productivity gains that generate income growth (SDG 8.3, 9.4, 11.2).

—

[14] Mukherjee and Maruwada (2021).
[15] Shivkumar and others (2021).
[16] Ibid.

Box 1: DPTs creating impact at scale during the global pandemic

The COVID-19 pandemic highlighted the power of well-designed DPT solutions across a range of contexts, even in countries with less mature DPT ecosystems:

- India's Aadhaar **identity platform** is integrated with the Universal Payments Interface, which allows for **seamless digital payments**, alongside a Data Empowerment Protection Architecture and DigiLocker, which allow individuals to hold a "data wallet" showing their credentials and transaction flows. When the global pandemic hit, India was able to utilize these DPTs to make instant cash transfers to the over 100 million of the country's poorest women, starting in April 2020.[17] The country also leveraged a range of DPTs through the launch of the CoWIN network in early 2021, to manage end-to-end vaccination from simple scheduling all the way through digital credentialing.[18] By digitizing this process, the Indian government and public have a real-time dashboard that tracks COVID-19 vaccination progress of more than one billion citizens.[19]

- In 2016, Mauritius, launched a **data exchange infrastructure** known as InfoHighway, which now provides a secure and scalable system for electronic delivery of more than 500 unique government services. The small island economy of 1.2 million people has an average per capita income greater than $10,000. Its government estimates the InfoHighway system allows data queries that would otherwise have taken more than six months to be completed within 30 minutes.[20] During the COVID-19 pandemic, InfoHighway facilitated real-time data sharing on caseloads and contact tracing. It was integrated with the OpenELIS system for managing business processes and clinical decisions in laboratories. For example, when the Central Health Laboratory receives a positive COVID-19 test result, it contacts the Communicable Diseases Control Unit, which in turn contacts the infected person or concerned authorities where the person is isolated. A Rapid Response Team then transfers the infected person to a treatment center, and updated statistics are shared with other health authorities.[21]

- Since 2014, Mozambique has relied on OpenLMIS—**a logistics management information system**—for two distinct purposes: managing the country's vaccine supply chain and managing its medical commodities supply chain. With a population of more than 30 million people and average per capita income of less than $450, Mozambique faces significant challenges in building its health systems. Nonetheless, these twin functions each now manage the supply chains for well over 1000 health facilities.[22] Early in the pandemic, officials were able to use OpenLMIS quickly to add global product definitions which allowed them to track personal protective equipment and vaccine supply. The enormous value of this supply chain tracking system will gain additional value when it can be integrated with other systems, such as patient management systems.

—

[17] Pande and others (2020).
[18] Exemplars in Global Health (n.d.).
[19] Ministry of Health and Family Welfare of India (2022).
[20] Ministry of Information Technology, Communication and Innovation of Republic of Mauritius (2022).
[21] Restore Data Rights (n.d.).
[22] OpenLMIS (n.d.).

Diverse approaches to promote public well-being

In line with the diversity of platform types, there is no single approach to promoting platform infrastructure to maximize public access or progress on any single dimension of the SDGs. During the COVID-19 pandemic, different countries deployed a range of DPT-linked strategies to tackle local challenges, as described in Box 1. In the future, innovative combinations of platform types could create many bold new applications, such as a recent proposal to blend evolving payment platforms with identification registries of non-human species to create "interspecies money."[23]

In practical terms, the physical and platform layers develop and maintain the infrastructure upon which all applications and services depend. They provide the rules, standards, and security guarantees so that local innovators and governments can develop new ideas more rapidly to meet ever-changing circumstances. But the presence of the physical and platform infrastructure does not guarantee that applications and services will thrive. Innovators need to make use of the infrastructure. To encourage them to do so, governments can take proactive steps, like investing to support the skills and talent base in a country, strengthening the early-stage financing support, and minimizing hurdles to new business development.

At least three levers can help "level the playing field" of platform infrastructure such that a wide array of service providers can utilize the infrastructure equally:

1. **Public ownership and governance**: The most straightforward way in which platform infrastructure can be designed to serve the public good is through public ownership. When a government owns the underlying platform and makes it freely available to utilize, the government is creating the conditions for interoperability on top of its platform.

2. **Public regulation**: A platform need not be publicly owned and governed for it to be non-excludable. There are several examples whereby ownership is private, but government regulators take a proactive role in setting rules that will maximize interoperability and, thus, non-exclusionary tendencies. Regulation can also create structural separation such that an infrastructure provider cannot be a service provider.

3. **Open code, standards, and protocols**: The design of platform infrastructure can be opaque in nature or opened to broader scrutiny and technical support using open-source code, standards, and protocols. The value of relying on the open-source community depends on a sufficiency of active participants who are ensuring platform infrastructure is secure and inclusive and fosters trust with users.

In practice, DPTs are built and deployed through a permutation of techniques, leading different public and private actors to extract benefits through distinct and often complex institutional pathways. A salient attribute is to create infrastructure that is widely

—

[23] Ledgard (2021).

available for use without preferential treatment to the infrastructure provider. Below we describe four examples of commonly referenced DPTs to highlight the complexities of DPT promotion in an ecosystem of public and private actors.

- **Modular Open Source Identity Platform (MOSIP)**: MOSIP is an open-source identity system modeled after India's Aadhaar system. The International Institute of Information Technology, Bangalore (IIT-Bangalore) receives financial support from international funders to maintain and upgrade MOSIP and build a community of systems integrators to deploy it in countries such as Ethiopia and the Philippines. Identity systems are among the most politically fraught and personally sensitive of platform infrastructures that can facilitate a range of harms including targeted surveillance and exclusion when used by ill-intentioned governments. In response, MOSIP prioritizes minimalistic data capture and strong data security in its design and has developed a set of non-binding Principles for Engagement.

- **Universal Payments Interface (UPI):** India's UPI creates a single interface for seamless and nearly free account-to-account interoperability for any regulated payments provider in the country. In addition to determining which companies can gain access to the UPI infrastructure, the Reserve Bank of India (RBI) caps payments providers from dominating more than 30 percent of UPI transaction flow, so that no single payment provider can dominate the payments infrastructure. UPI is not open source. It was designed and is maintained by the National Payments Corporation of India, a specialty division of RBI which is jointly owned by a consortium of banks and RBI. By taking a small fee on each transaction, NPCI generates a small profit allowing it to employ over 1,000 staff maintaining UPI and other products.

- **X-Road:** Estonia's X-Road data exchange solution is owned by the national government. It streamlines the way in which citizens engage their government by having a single portal for sharing information that can then serve different government functions including receiving permits, storing core documents, paying taxes, and registering for government services. Importantly, X-Road has a transparency portal, which notifies citizens when their personal data has been shared, by whom, and for what purpose. X-Road has been credited with creating great efficiencies for government processes and citizen-to-government interactions. Though X-Road facilitates some data sharing with the banking sector, it has largely remained a platform for e-government and not wider data sharing with private firms. Today, X-Road is an open source, decentralized data sharing solution maintained by the Nordic Institute for Interoperability Services (NIIS). The republics of Estonia, Finland, and Iceland are members of NIIS.

- **District Health Information System 2 (DHIS2):** The University of Oslo maintains DHIS2, which has been developed to ensure low- and middle-income countries can establish a robust health information system without "reinventing the wheel." DHIS2 has enjoyed stable funding over a long period of time, which has allowed the product to mature into a powerful, enterprise grade system. The widespread use of DHIS2 has fostered a community for training professionals and supported many other products to integrate with it. At the same time, critics argue DHIS2 is an expensive, complicated system to implement, support, and maintain, which has led to fragmentation of implemented versions. This is attributable to the funding required to perform upgrades and private vendor lock-ins prompted by the complexity of configuration.

Challenges and risks of platform infrastructure

While DPT platforms offer the potential to help advance many SDG strategies, design and deployment processes often raise considerable challenges. Among the most common operational problems are a lack of financial sustainability; limited capabilities within government to design, deploy, and oversee a platform; and government procurement obstacles, such as when procurement rules are unsuited to using open-source tools.

Beyond these key practical challenges, there are at least three ways in which DPTs can undermine SDG outcomes. These include:

- **Exclusion**: DPTs can risk compounding "digital and data deficits" that exacerbate existing inequities between communities that are digitizing and those who are not. Connectivity-constrained communities with low digital literacy risk becoming a new "digital underclass" that lags behind connected communities. Furthermore, digital technology can also deepen existing discrimination through data and tools that enable more precise segmentation of consumers. Biases in algorithms can exacerbate racial and gender inequalities. Effective design strategies are needed to maximize participation and inclusion.

- **Concentration of power**: Any platform infrastructure whose success depends on network effects needs to anticipate and avoid the problems of natural monopolies. While DPTs aim to thwart the commercial monopolies that gain economic and political power through the self-reinforcing cycle of data capture, they do not guarantee such an impact and, in fact, can simultaneously concentrate power in public entities. Because data is a strategic asset to any business and public sector department, there is a natural disincentive to open or share data for the sake of competition, consumer rights, or security. A political mandate to support safe data sharing (open data, individual data portability, and other such measures) is needed to undermine data hoarding behaviors that can result in potentially dangerous concentrations of power.

- **Data misuse and abuse**: Shortfalls in data safeguards present major risks to citizens who share and create data through platforms. With data concentrated among a smaller set of actors, government and commercial "data lakes" become targets for malicious attacks. Further, consumers are increasingly concerned about how the concentration of data makes it easier for companies or governments to surveil the population. These fears are not unfounded. The Edward Snowden affair and other judicial proceedings have raised concerns of mass surveillance extending beyond the limits of the law, even in longstanding democracies.[24] Political campaigns routinely spend millions of dollars each

—

[24] See for example BBC News (2014) and Nakashima (2020).

election cycle to create and spread false or manipulated information.[25] And government control is too often felt in the form of internet or social media shutdowns.[26]

These risks of exclusion, concentration of power, and data misuse and abuse are important in every society. They can be particularly challenging in countries with limited public administrative capacities or anti-democratic leadership. The risks are amplified when public institutions for oversight and redressal are weaker, digital literacy rates are low, and civil society institutions are less robust in holding governments and corporations accountable.

—

[25] Brown (2019).
[26] KeepItOn (2022).

International support for Digital Public Technologies

Considering the complexities inherent in deploying DPTs toward accelerated SDG progress, many emerging and developing economies could benefit from external support for their digital strategies. As background for this study, we undertook research on, and contacted representatives from, 22 bilateral and multilateral development-focused organizations. We inquired about the extent to which their official policies and strategies reference digital technologies in general, and DPT in particular. The upshot is that references to digital technologies are more an exception than a rule.

Among multilateral actors, the UN, World Bank, UNDP, and UNICEF are most engaged with digital issues and DPGs. Within the UN system, many efforts build off of the 2019 report of the UN Secretary-General's High-level Panel on Digital Cooperation, co-chaired by Melinda Gates and Jack Ma.[27] This was followed by the Secretary-General's 2020 Roadmap for Digital Cooperation, which presented an initial definition of a digital public good.[28]

Among bilateral actors, Estonia is not a large donor but is actively engaged in supporting DPGs and is frequently looked to as a model of how to implement e-government and e-economy. Meanwhile, Norway, Germany, the U.S., Sweden, and Finland appear to be most focused on digital technology and the DPGs. Some donor countries like Norway and the U.S. have explicit digital strategies or policies.[29] Digital strategies tend to prioritize expanding internet access and affordability, supporting the enabling environment, and mainstreaming digitalization across all sectors.[30] Donors that actively support DPT do so mainly through supporting international partnerships such as the DPGA, DIAL, MOSIP, and GovStack[31].

The new UK development strategy, released in May 2022, does not set digital technology as a primary objective, but mentions it as a recurring theme—for overall infrastructure and connectivity, and more specifically, for cash transfers, health, and identification systems.[32] Some donor countries, like Canada and Switzerland, reference digital in their broader foreign policy strategies and policies. Some development agencies acknowledge a need to mainstream digital strategies, but there is no clear evidence as to what that entails or whether it is happening.

—

[27] UN Secretary-General's High-Level Panel on Digital Cooperation (2019).
[28] UN (2020).
[29] Including Belgium, Denmark, France, Germany, Korea, Netherlands, Norway, Sweden, and the United States.
[30] OECD (2021).
[31] GovStack is a multi-stakeholder initiative led by GIZ, Estonia, ITU, and DIAL to provide governments with reusable software components called "building blocks" that can inform design of e-government services.
[32] UK Government Foreign, Commonwealth and Development Office (2022).

Among official donors, it is difficult to estimate how much funding is allocated to digital development for three reasons: First, there is no agreed definition for digital support or digitalization; second, the OECD's official data on donor assistance, the Creditor Reporting System (CRS) database, does not include a marker for tracking relevant funding flows; and third, a considerable amount of donor support for digital technology is embedded in sector programs—health, education, energy, government institution strengthening, finance, and economic growth—and hence not easy to identify.

Nonetheless, a 2021 OECD report suggests that relevant funding streams are modest if increasing.[33] The report uses proxy sector codes and tailored techniques to tease out the data, helping to inform estimates of relative magnitudes and trends. It identified $18.6 billion in relevant funding over the five-year period 2015-2019, growing from $2 billion in 2015 to $6.8 billion in 2019.[34] The largest share of the total was from multilateral donors, quadrupling from $1 billion in 2015 to $4.2 billion in 2019. Nearly four-fifths of this came from the Inter-American Development Bank (IDB) (10 percent of its portfolio), the Asian Development Bank (ADB), and the World Bank Group's International Development Association (IDA), International Bank for Reconstruction and Development (IBRD), and International Finance Corporation (IFC).

Bilateral donors were estimated to account for $6.3 billion of the aggregate funding over the same period, more than doubling from $0.9 billion in 2015 to $2.1 billion in 2019, mostly as concessional finance. The OECD estimates that five countries account for more than 60 percent of this amount—the EU, France, Germany, Korea, and the U.S.—although country-specific numbers are not available.[35] As an agency-specific point of reference within one country, the federal budget allocation to implement USAID's Digital Strategy in 2021 was $15.5 million and the request for FY2023 is $78 million.[36]

Major institutional philanthropies doubled their grant financing from less than $250 million in 2017 to $491 million in 2019. The largest contributors for the 2015-2019 period were the Bill & Melinda Gates Foundation ($556 million, 4 percent of its portfolio), Mastercard Foundation ($162 million, 19 percent of its portfolio), and Wellcome Trust ($80 million, 10 percent of its portfolio). The OECD estimates that private philanthropies are allocating a larger share of their portfolios to digitalization (around 4.5 percent) than multilateral institutions (2.5 percent) and bilateral institutions (1 percent).[37]

—

[33] OECD (2021).
[34] Bilateral and multilateral institutions also mobilized $700 million in private finance in 2019.
[35] OECD (2021).
[36] These numbers contrast with the 2021 final report of the National Security Commission on Artificial Intelligence (NSCAI), which recommend $200 million of annual funding for the USAID Digital Strategy.
[37] OECD (2021).

Key factors for DPT success

Digital technology's pace of change and diffusion will continue to evolve rapidly, as will the mix of opportunities for public and private sector innovators who are keen to leverage the underlying forms of progress. While DPT offers tremendous opportunity for accelerating many dimensions of the SDGs, any movement in this regard needs to take a holistic and multi-pronged approach that mitigates the risks described above. To this end, the following describes key considerations for governments, civil society, and funders, respectively.

Governments can:

- **Create participatory design and implementation processes**: The interests in, and impact of, DPTs are far more expansive than the individual departments that often are charged with designing and overseeing them. Stakeholders exist across government agencies, departments, and units, as well as across public, private, and non-governmental actors. The complexities of governing DPTs are further compounded by the pace of change in the digital economy—not only in the rapid introduction of new technologies but also in evolving consumer expectations with respect to their rights and capabilities. Against this backdrop, inclusive and participatory processes are important for ensuring DPTs are driving towards broad-based societal progress.

- **Establish citizen-centric data governance regimes**: A legal and regulatory environment needs to articulate people's rights over their personal data and clear mechanisms for exercising those rights. A sound legal framework can also articulate the obligations of the government and other entities who collect, store, and process personal data. Trust in DPTs and the data ecosystem they create rests on enshrining data rights and responsibilities into law and creating meaningful mechanisms for their enforcement.

- **Upskill public sector workforces**: New incentives can help attract new talent and upskill existing government workforces to design and deploy DPT, while also setting the data governance framework to ensure DPT remains trusted. Larger change management efforts can also support cultural shifts to work across government ministries, establish an atmosphere of data-informed operations, and broaden engagement with civil society.

- **Ensure clear accountability and responsive redressal systems**: The ability for individuals to seek redressal when their rights have been violated online is essential to maintaining trust in DPTs. Redressal mechanisms need to be independent, responsive, and authorized to correct problems efficiently.

Civil society can:

- **Represent diverse community voices in policy making**: A well-informed and active civil society is critical to ensuring DPTs support public well-being. Civil society organizations have the ability to organize, represent shared goals, and participate in policy making processes. They can help create more representative voices in the policy arena, bolster the public's ability to understand and advocate for technology policy positions that meet their needs, and highlight instances where such needs are not being met.

- **Spread digital literacy and rights**: Sustained efforts to have an informed population are critical to ensuring digital transformation serves the public interest—ranging from how to access and use digital technologies, to ways to stay safe online, and behave in ethical and effective ways while on digital platforms.

- **Hold governments and companies accountable**: Through various forms of research and community engagement, civil society organizations can strengthen collective understanding of how DPTs are benefiting different sectors of society and ensure appropriate use of data that results from their use.

Funders can:

- **Establish risk-based frameworks for support**: Donors are well advised to be mindful of the overarching risks of DPTs and consider what type of support is most valuable in any given context. For example, support for data protection legislation may aptly precede or move in parallel to a DPT deployment. By establishing a framework for assessing risks and adjusting investment strategies accordingly, donors can mitigate against harmful use of DPTs.

- **Finance the sustainability of interoperable, well-governed DPTs**: When supporting open-source tools, donors have a unique role to play in supporting the sustainability of those tools, such that ongoing maintenance and product enhancements are ensured. Donors can encourage characteristics of DPTs that strengthen relevant societal outcomes, including the SDGs. This includes ensuring open-source solutions are interoperable with others, governed by a broad group representing multi-stakeholder interests, and backed by sound documentation to facilitate uptake.

- **Invest in ecosystem players**: Donors can provide critical financial support to train companies on use of DPTs and civil society organizations that are critical to ensuring community needs are represented in DPT design.

Conclusion

Seven years ago, in 2015, the world banded together to forge the Sustainable Development Goals. Unfortunately, the world is woefully behind as it approaches the halfway mark to 2030. Millions of lives are at risk—as are hundreds of millions of livelihoods—if progress does not accelerate dramatically. Rapid advances in digital technology offer an important opportunity for taking action to pursue better SDG outcomes. This includes developing platform infrastructure as a key form of DPT, which has the potential to support many forms of SDG progress. Public actors can support platform infrastructure by owning digital assets, regulating digital assets, and supporting open-source solutions.

Nonetheless, as with many other forms of technological advancement, DPTs are not a turnkey solution for faster SDG progress. They can be powerful drivers of efficiency, innovation, and individual empowerment. But even with the best laid plans, there can be serious unintended consequences when introducing DPTs that aim to maximize participation and competition. Risks come in the form of user exclusion, concentrations of power, and data abuses of many kinds. Digital technologies can facilitate surveillance, weaponize personal data, and cause a range of other harms.

Perhaps most importantly, DPT needs to be understood as part of a long-term trajectory of change. There is little question that fast-changing digital technologies will continue to penetrate more and more dimensions of all societies and reframe options for human engagement with the physical world. The operative question is how best to leverage the relevant technologies toward the greatest benefits, while limiting harms. In this respect, international actors and funders would be well served to increase their focus on DPTs as key tools for advancing policy strategies and outcomes. A holistic approach to broadening digital access while building robust institutions, data governance regimes, and participatory processes could help drive much faster rates of progress for many SDG targets as the world approaches its 2030 deadline.

References

BBC News. 2014. “Edward Snowden: Leaks That Exposed US Spy Programme.” https://www.bbc.com/news/world-us-canada-23123964.

Brown, Eileen. 2019. “Online Fake News Is Costing Us $78 Billion Globally Each Year.” ZDNet. https://www.zdnet.com/article/online-fake-news-costing-us-78-billion-globally-each-year/.

Cuaresma, Jesus Crespo and others. 2022. “Internet Poverty: The Next Frontier in Development.” Brookings Future Development Blog Post. https://www.brookings.edu/blog/future-development/2022/03/31/internet-poverty-the-next-frontier-in-development/.

Digital Public Goods Alliance (DPGA). 2021. “2021 Annual Report: Reviewing a Year of Digital Public Goods.” https://digitalpublicgoods.net/2021-DPGA-Annual-Report.pdf.

Exemplars in Global Health. n.d. “CoWIN in India: The Digital Backbone for the Covid-19 Vaccination Program.” https://www.exemplars.health/emerging-topics/epidemic-preparedness-and-response/digital-health-tools/cowin-in-india.

International Telecommunication Union (ITU). 2020. “Connecting Humanity: Assessing investment needs of connecting humanity to the Internet by 2030.” https://www.itu.int/hub/publication/d-gen-invest-con-2020/.

————, 2021. “Measuring Digital Development: Facts and Figures.” https://www.itu.int/itu-d/reports/statistics/facts-figures-2021/index/.

————. n.d. “ICT4SDG.” https://www.itu.int/en/ITU-D/ICT-Applications/Pages/ICT4SDG.aspx.

Johnston, Matthew. 2022. “Biggest Companies in the World by Market Cap.” *Investopedia.* https://www.investopedia.com/biggest-companies-in-the-world-by-market-cap-5212784.

KeepItOn. 2022. “The Return of Digital Authoritarianism: Internet Shutdowns in 2021.” https://www.accessnow.org/cms/assets/uploads/2022/04/2021-KeepItOn-Report-1.pdf.

Kharas, Homi, and John W. McArthur. 2019. “Building the SDG Economy: Needs, Spending and Financing for Universal Achievement of the Sustainable Development Goals.,” Brookings Global Economy and Development Working Paper No. 131.

Kharas, Homi, and John W. McArthur. 2021. “Rethinking Development: Broadening the Goals and Altering the Approach.” In Douarin, Elodie, and Oleh Havrylyshyn (eds.), *The Palgrave Handbook of Comparative Economics*. London: Palgrave Macmillan.

Kharas, Homi, John W. McArthur, and Izumi Ohno (eds.) 2021. *Breakthroughs: The Promise of Frontier Technologies for Sustainable Development*. Brookings Institution Press.

Kharas, Homi, John W. McArthur, and Krista Rasmussen. 2018. "How Many People Will The World Leave Behind? Assessing Current Trajectories on the Sustainable Development Goals," Brookings Global Economy and Development Working Paper No. 123.

Kharas, Homi, John W. McArthur, and Odera Onyechi. Forthcoming. "Sixty Million Lives Lost? Taking Stock as the Sustainable Development Goal Midpoint Approaches" Brookings Global Economy and Development Working Paper.

Ledgard, Jonathan. 2021. "Interspecies Money." In Kharas, Homi, John W. McArthur, and Izumi Ohno (eds.), *Breakthroughs: The Promise of Frontier Technologies for Sustainable Development*. Brookings Institution Press.

Ministry of Health and Family Welfare of India. 2022. "CoWIN Dashboard." https://dashboard.cowin.gov.in/.

Ministry of Information Technology, Communication and Innovation of Republic of Mauritius. 2022. "InfoHighway." https://ih.govmu.org/.

Mukherjee, Anit and Shankar Maruwada. 2021. "Fast-Tracking Development: A Building Blocks Approach for Digital Public Goods." Center for Global Development. https://www.cgdev.org/sites/default/files/fast-tracking-development-digital-public-goods.pdf.

Nakashima, Ellen. 2020. "FBI and NSA Violated Surveillance Law or Privacy Rules, a Federal Judge Found." The Washington Post. https://www.washingtonpost.com/national-security/fbi-and-nsa-violated-surveillance-law-or-privacy-rules-a-federal-judge-found/2020/09/04/b215cf88-eec3-11ea-b4bc-3a2098fc73d4_story.html.

National Security Commission on Artificial Intelligence (NSCAI). 2021. "Final Report." https://www.nscai.gov/wp-content/uploads/2021/03/Full-Report-Digital-1.pdf.

OpenLMIS. n.d. "Impact: Mozambique". https://openlmis.org/implementation_region/mozambique/.

Organization for Economic Cooperation and Development (OECD). 2021. "Development Co-operation Report 2021 : Shaping a Just Digital Transformation." https://www.oecd-ilibrary.org/sites/ce08832f-en/index.html?itemId=/content/publication/ce08832f-en.

Pande, Rohini and others. 2020. "A Majority of India's Poor Women May Miss COVID-19 PMJDY Cash Transfers." Yale Economic Growth Center. https://egc.yale.edu/sites/default/files/COVID%20Brief.pdf.

Pople, Ashley and others. 2021. "Anticipatory Cash Transfers in Climate Disaster Response." Center for Disaster Protection Working Paper No. 6.

Restore Data Rights. n.d. "Transparency in Mauritius." https://restoredatarights.africa/resources/transparency-in-mauritius/.

Shivkumar, Govind and others. 2021. "How to Bring Digital Inclusion to the People Who Need It Most." World Economic Forum. https://www.weforum.org/agenda/2021/08/4-reasons-you-should-care-about-digital-public-infrastructure/.

Singh, Anuraag, Giorgio A. Triulzi, and Christopher L. Magee. 2021. "Technological Improvement Rate Predictions for All Technologies: Use of Patent Data and an Extended Domain Description." *Research Policy* v. 50, no. 9.

Tillemann, Tomicah. 2021. "How Digital Systems Will Transform the Future of Money and Development." In Kharas, Homi, John W. McArthur, and Izumi Ohno (eds.), *Breakthroughs: The Promise of Frontier Technologies for Sustainable Development*. Brookings Institution Press.

UK Government Foreign, Commonwealth and Development Office. 2022. "The UK Government's Strategy for International Development." https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1075328/uk-governments-strategy-international-development.pdf.

United Nations (UN). 2020. "Road Map for Digital Cooperation: Implementation of the Recommendations of the High-level Panel on Digital Cooperation." https://documents-dds-ny.un.org/doc/UNDOC/GEN/N20/102/51/PDF/N2010251.pdf?OpenElement.

United Nations Inter-agency Group for Child Mortality Estimation. (UN-IGME). 2021. https://childmortality.org/data.

UN Sustainable Development Solutions Network. 2019. "SDG Costing and Financing for Low-Income Developing Countries." https://irp-cdn.multiscreensite.com/be6d1d56/files/uploaded/FINAL_SDG%20Costing%20%26%20Finance%20for%20LIDCS%2028%20Oct.pdf.

UN Secretary-General's High-Level Panel on Digital Cooperation. 2019. "The Age of Digital Interdependence." https://www.un.org/en/pdfs/HLP%20on%20Digital%20Cooperation%20Report%20Executive%20Summary%20-%20ENG.pdf.

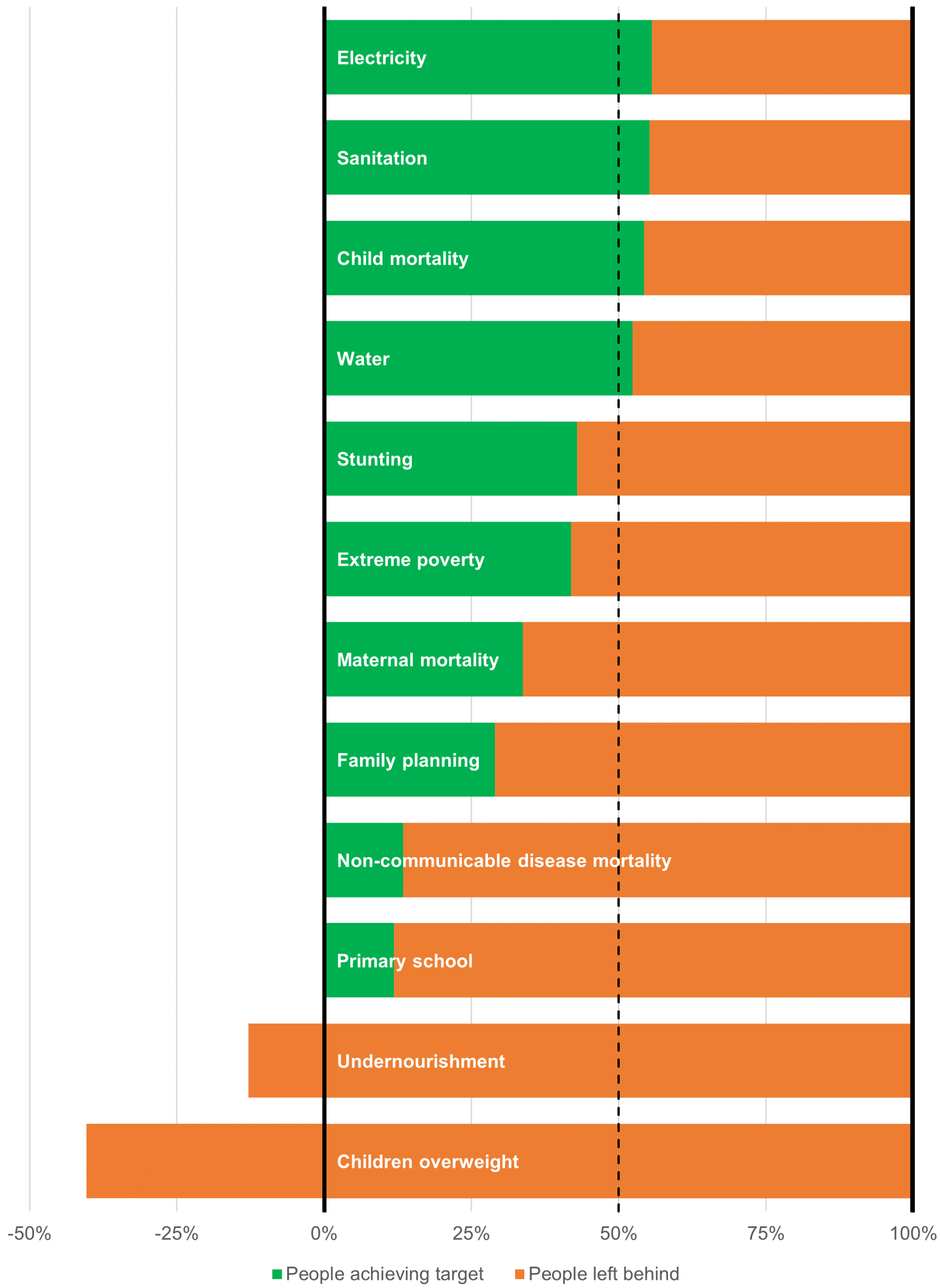
World Bank. 2022a. "A Digital Stack for Transforming Service Delivery: ID, Payments and Data Sharing." https://documents1.worldbank.org/curated/en/099755004072288910/pdf/P1715920edb5990d60b83e037f756213782.pdf.

World Bank. 2022b. "World Development Indicators Database." http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators.

World Data Lab. 2021. "World Poverty Clock." http://worldpoverty.io/.

Appendix

Figure A1: Aggregate SDG performance by 2030 under business-as-usual

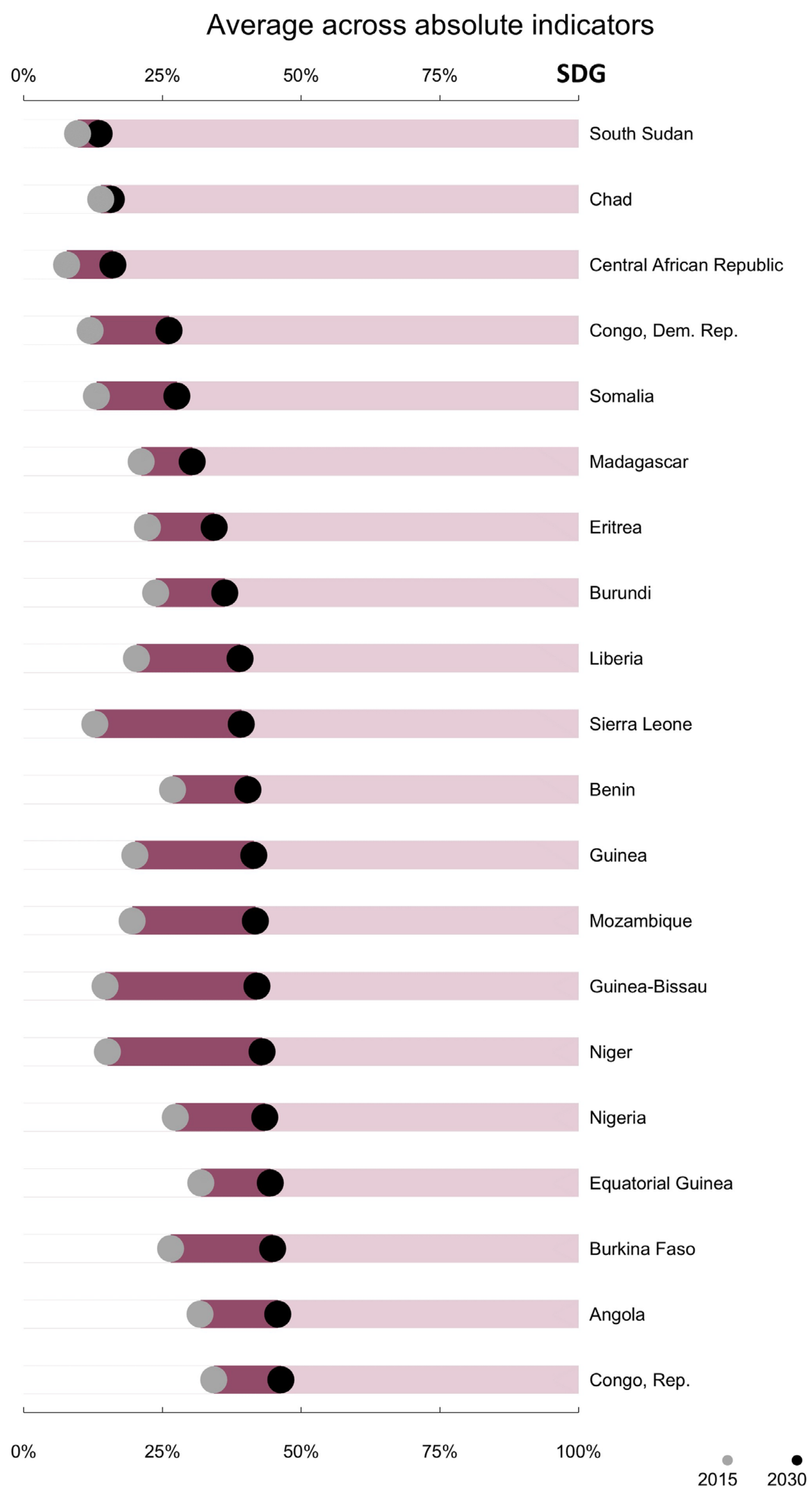


Source: Kharas, McArthur and Onyechi (forthcoming).

Figure A2: Estimated number of children lacking basic needs in 2030 due to SDG shortfalls

Source: Kharas, McArthur and Onyechi (forthcoming).

Figure A3: Countries on course to make least progress on a cross-section of 11 SDG absolute targets by 2030



Source: Kharas, McArthur and Onyechi (forthcoming).

1775 MASSACHUSETTS AVE NW
WASHINGTON, D.C. 20036

brookings.edu/SustainableDevelopment

Center for Sustainable Development at BROOKINGS