digital impact alliance

A Greener Future

Navigating the Digital Frontier for Climate Action

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SECTION 1

Introduction

Last year's deadly floods in Pakistan were a grim example of the escalating climate disasters around the world. The floods forced 33 million people to flee their homes, claimed 1,600 lives, destroyed over 2 million houses, and left hundreds of villages uninhabitable.[1]

According to the International Panel on Climate Change (IPCC) Sixth Assessment Report, more than 40% of the global population is highly vulnerable to climate change-related disasters based on their location or the circumstances in which they live. And people living in low- and middle-income countries (LMICs) that are considered "climate hotspots" are particularly vulnerable due to poverty, poor infrastructure, and low capacity for response.[2]

As wildfires, droughts, storms, and heatwaves increase in intensity and frequency across the planet, countries need to take urgent action. However, despite the urgency, the world is falling short of meeting the Paris Agreement goals of limiting the global temperature rise to 1.5 degrees Celsius. The IPCC has warned that even if effective actions are put in place to meet this goal, there is a locked-in level of planetary degradation that is now irreversible. The resulting harm from a warmer planet will disproportionately impact vulnerable populations in LMICs. In Pakistan's example, it ranks eighth in countries most susceptible to long-term climate risk, despite being responsible for less than 1% of global greenhouse gas emissions.[3]

Loss and damage refers to the irreversible consequences of climate change that humans cannot mitigate against or adapt to, such as coastal degradation and melting glaciers.[4] Future projections of loss and damage depend on the extent of global efforts to mitigate and adapt to climate change. Some estimates suggest that costs could be anywhere between $290 billion and $580 billion by 2030, and more than $1 trillion by 2050. At the 27th United Nations Climate Change Conference (COP27), country delegates agreed to direct loss and damage funding to those countries most affected by climate disasters. However, the global community still needs to determine the mechanisms to mobilize this funding.

COP28 later this year will mark the conclusion of the first global stocktake to adopt policies that support climate action, including formal channels for loss and damage funding.[5] These efforts reflect the growing recognition of the urgent need to address the disproportionate impacts of climate change on the most vulnerable communities, particularly those LMICs that are least responsible for causing climate change but are the most affected by it.

From the IPCC: "The global stocktake is a critical turning point when it comes to efforts to address climate change – it's a moment to take a long, hard look at the state of our planet and chart a better course for the future. The global stocktake enables countries and other stakeholders to see where they're collectively making progress toward meeting the goals of the Paris Agreement – and where they're not. It's like taking inventory. It means looking at everything related to where the world stands on climate action and support, identifying the gaps, and working together to agree on solutions pathways (to 2030 and beyond)."

Given the urgency of the climate crisis and the narrowing window of opportunity for action, what role does digital technology need to play to maximize progress on climate goals? This paper examines the implications, both the opportunities and the risks, of leveraging climate funding for digital public infrastructure (DPI) and offers commentary on important variables that need to be considered.

How Digital Transformation Can Help

DPI is a collection of foundational digital systems similar to physical infrastructure. In the same way that highways and bridges are critical economic enablers, DPI is made up of applications and software systems that facilitate public- and private-sector innovation, fuel balanced growth, and empower people and small businesses. The global discourse on the DPI agenda is running concurrent to the dialog on the climate crisis, and there is a valid intersection between both agendas that needs to be further explored. At the UN General Assembly last year, progress was made on digital cooperation when countries committed to sharing technology and funders committed to investing in a more sustainable world,[6] of which climate is a critical component. Left unchecked, climate change can negatively impact the economic and social well-being of societies, and threaten the long-term viability of the planet,[7,8] and digital can play a role in beneficial climate intervention.

On the surface, climate action and DPI are separate goals—one pressing for a more livable and sustainable planet and the other driving towards an inclusive, digitally enabled society. The twin transition can leverage commonalities to concurrently move towards a low-carbon, climate-resilient future, and a digital future where technologies and innovation are leveraged to achieve sustainable development goals.[9,10]

Proponents of the twin transition appreciate that digital transformation offers an immense promise to drive gains in climate action by optimizing costs, improving transparency, maximizing benefits, and strengthening resilience. The twin transition is an important concept in the discourse around sustainable development as it provides a framework for understanding the interplay between two key drivers of change and the need to manage the trade-offs between them.

The climate agenda's primary goal is decarbonization since carbon dioxide emissions and other greenhouse gases are the main drivers of global warming. Keeping the goal of the twin transition in mind, the next wave of DPI should support, rather than undermine, the shift to a low carbon economy in two ways:

1. **Greening of digital:** Designing technology so that its lifecycle impacts on the environment are more sustainable, such as through powering data centers with renewable energy.

2. **Greening by digital:** Harnessing the power of digital technology to achieve sustainability goals, such as by using digital technology to monitor and manage smart grid systems.

Due to the limits on development financing, funding allocated to LMICs can be used to target a twin transition, leveraging the common goals of digital and climate at the critical juncture of the global stocktake. While targeting funding to climate alone can be beneficial, the single most compelling reason to invest in digital technology in service of climate is to prevent mounting uncoordinated disaster debt assistance to low- and middle-income countries, and instead use DPI to help channel scarce resources toward resiliency, moving away from reactionary funding models to proactive investments.

If designed and managed well, DPI can be a means to accelerate progress on climate goals by mitigating, adapting, and overcoming the threats of climate change. On the other hand, the negative implications of DPI on the climate are not well-studied, and it is important to prioritize climate safeguards in the design and use of digital infrastructure. The twin transition agenda can intentionally push for climate safeguards in digital through positive governance models, key partnerships, and consideration for decarbonization.

SECTION 2

Balancing Opportunities and Challenges

Opportunities

There are clear opportunities for the next stage of national DPI to mitigate the impacts of climate change and support the transition to a low-carbon, sustainable future without building bespoke solutions that lead to duplicated or wasted investments.

The ways in which digital was used to respond to the COVID-19 pandemic demonstrate how digital can mitigate large-scale disruptions. The lessons learned in digital from the pandemic can be applied to rising climate disasters around the world. Countries that have foundational DPI such as digital IDs, data exchange, and digital payments have greater digital maturity, which was a key contributor to a country's successful response and resiliency to the pandemic, according to studies.

This section will provide four evidence-based examples of how DPI contributed to a country's pandemic response and an overview of how digital use cases can directly support a move towards climate-resilient economies.

1. Digital IDs are a cornerstone to the empowering of people after climate disasters.

Digital IDs can improve the human-centered outcomes of climate disasters. For example, countries with digital ID systems in place were able to provide pandemic-response support for 51% of their population, on average. In contrast, countries that did not have an ID system were able to reach only 16% of their citizens.[11] National digital IDs that could be verified and authenticated in real time helped save time and costs for governments seeking to reach their citizens.

Further advancements in digital IDs could improve inclusion outcomes for the 3.4 billion people who do not yet have a digital ID.[12] For example, the UN High Commissioner for Refugees (UNHCR) estimates that 20 million people will leave their homes every year due to extreme weather events.[13] When individuals flee dangerous situations, they leave behind important paperwork that can help prove their identities, as well as provide essential access to job opportunities, personal bank accounts, and relief resources allocated by governments and aid agencies. In some cases, without a legal ID, displaced people can also suffer from discrimination and abuse. Digital IDs that can be authenticated across borders, even without access to personal property, and can empower people and improve their ability to bounce back after a climate disaster by allowing them to access a range of services that require proof of identity.

2. Data exchange is essential for climate resiliency.

Data exchange is the system that allows stakeholders to publish, access, share, and use data. The pandemic highlighted the need for timely, high-quality, shareable, and standardized data that can help policymakers with their decision-making, contact tracing, and early interventions. With the variations in the way different countries collect and report data, removing the technological barriers can be a key driver for best practices in data sharing and in providing transparency in the methods used to obtain the data.[14]

Although the experience of health information exchanges (HIEs) during the pandemic cannot be fully applied vis-à-vis climate data, there are some lessons that can help. Data exchange can enable climate preparedness and early warning systems. Shared data can improve the accuracy of forecasts, enabling the identification of regional trends, historical climate patterns, and extreme weather events, to provide early warnings to citizens. At a national level, data can help with decision-making for food security and development planning, improving machine-learning tools, and minimizing the waste of resources. Open data plays an integral role in systemizing and accelerating climate preparedness but needs to be balanced with data privacy standards and considerations.

3. Digital payments can be a gamechanger for climate resiliency.

Advances in digital payments have changed the way people access their bank accounts, transfer money, and make purchases. During the lockdown, digital banking made it easier to maintain social distancing while continuing to use essential financial services. The modernization of banking systems has also had an outsized impact on inclusion, with 36% of adults in developing countries (76% globally) now having an account at a bank or money institution.[15] In Kenya, for example, mobile money lifted 1 million people out of extreme poverty between 2008 and 2014, and in India, digital banking allowed households to increase their savings by 131% over a span of three months.[16]

In Pakistan, the rollout of the Asaan Mobile Account platform allowed flood-affected people, particularly those who were underbanked, to receive emergency funding. Through the Asaan Mobile Account (AMA) platform, any Pakistani holding a valid digital national ID can open a bank account digitally in any AMA participating bank, from anywhere, at any time by using the SIM of any mobile operator. Being able to receive and access emergency payments even in times of catastrophic events or internal displacement can significantly improve people's ability to bounce back.[17]

The vast potential of digital payment mechanisms can also help move towards a low-carbon economy. For example, pay-as-you-go models for electricity have the potential of providing 733 million people with access to renewable energy, significantly reducing their reliance on harmful cooking fuels such as charcoal, wood, and kerosene.[18]

4. Use cases for digital in climate action.

Beyond foundational DPI solutions, there are a multitude of examples where digital technologies can serve climate outcomes by becoming "smarter" through the introduction of traceability, flexibility, and predictability. Digital can help reduce greenhouse gas emissions, improve energy efficiency, and support the development of sustainable development strategies. For the individual, digital can help promote transparency, accountability, and participation in climate action.

How Digital Technology is Helping Climate-Specific Use Cases

USE CASE	DESCRIPTION	EXAMPLE
Smart energy management/ smart grid systems	Optimize energy distribution and usage while reducing waste to reduce greenhouse gas emissions from the energy sector and monitor and manage the production and consumption of renewable energy sources like solar, wind, and hydro power.	OpenRemote is an open-source internet of things (IoT) solution that is used for fleet management, smart cities, power line monitoring, and more.
Carbon emissions tracking (transportation)	Governments can use real-time traffic and transportation data to optimize traffic flow and reduce congestion, which can reduce emissions from transportation.	OpenTraffic is a data collaborative that supports open-source software development and collects accurate, real-time traffic data from individuals and organizations across the transportation sector.
Climate adaptation	With weather and climate data, governments can develop early warning systems and emergency response plans to help protect citizens from the impacts of extreme weather events.	OpenEEW is an initiative of Grillo, IBM, and the Linux Foundation to create low-cost, open-source, IoT-based earthquake early warning systems (EEWs).
Climate monitoring and prediction	Support the collection, analysis, and sharing of environmental data, which can help identify areas of high environmental impact and support the development of mitigation strategies.	moja.global open-source software for forestry, agriculture, and other land uses is designed to meet the needs of governments, the private sector, and other users in measuring, reporting, and verifying (MRV)—or forecasting—greenhouse gas emissions and removals from agriculture and forestry.

Challenges

Opportunities need to be balanced with the challenges of digital for climate, and policies and standards for digital need to be defined while keeping climate outcomes in mind. The risks described in this section are broken down in two categories: direct environmental risks of digital technology and the potential downside of digital and data in general. These risks highlight the need for a more sustainable and responsible approach to the development and deployment of digital technology, as well as the need for increased transparency and accountability in the digital sector. Digital transformation must remain aligned with efforts to mitigate the impacts of climate change, and the negative environmental impacts of digital technology must be addressed through better design and deployment. Some challenges are outlined in this section.

Direct Environmental Risks of Digital Technology

Mounting energy consumption

Digital technology is energy intensive from production to consumption. The production of digital devices, such as computers and smartphones, requires significant amounts of energy and materials. Additionally, data centers, computers, and other devices consume large amounts of energy, contributing to greenhouse gas emissions and exacerbating climate change. Some estimates calculate the carbon footprint of running a single data center to be the equivalent of the electricity required to run 50,000 homes.[19] Linking the energy of data centers with renewable sources and perpetuating energy efficiency with smart infrastructure in data centers can help promote a cleaner approach to digital growth.

Lifecycle impacts of digital and the dilemma of e-waste

As demand for digital technology increases and the material footprint of these products continues to rise, the environmental impact of the digital lifecycle may significantly worsen. From the extraction of precious metals and raw materials that are used for devices, to the transportation burden, and accumulation of e-waste, the costs to the environment are high.[20]

The rapid pace of technological change and the increasing use of digital devices that require constant upgrading has led to a growing problem of electronic waste (e-waste). This is harmful to the environment and human health. More than 50 million metric tons of e-waste, or 7 kilograms per capita, is generated globally every year.[21]

Mandating green procurement practices for digital technology can encourage principles of circular economy, including the right to repair, maintain, reuse, redistribute, refurbish, and/or recycle.[22] Although still early in the evolution, there are many efforts currently underway to explore the greening of procurement related to digital technology, such as a policy approach for extended producer responsibility (EPR) which holds manufacturers responsible for the environmental impacts of their products throughout the entire lifecycle, including after they are sold and no longer wanted by consumers. EPR is is increasingly being used as a tool for promoting a circular economy and reducing waste.

Infrastructure requirements and land use

The rapid expansion of internet and telecommunications infrastructure requires the alteration of the physical use of land. This compounds the impact of the carbon balance on Earth as carbon sinks are removed and natural habitats and ecosystems are destroyed, such as through deforestation. Land use changes can also lead to other devastating impacts, such as soil degradation and water scarcity.

There must be in-built considerations for the role of land use change in digitalization and develop policies that support sustainable and resilient landscapes and further research on more efficient layouts, such as vertical data centers, can help promote greener practices for digital infrastructure.

Potential Downside of Digital and Data

Even as the direct environmental risks of digital technology are considered and measures are put in place to guard against these outcomes, it is important to consider how the increasing use of digital as part of climate change response efforts may contribute to the broader data governance context. Without intentional action to ensure that policies, oversight and accountability, and capacity are in place to realize the opportunities presented by these digital technologies, data will continue to naturally consolidate with incumbent actors. This imbalance has the potential to exacerbate existing power dynamics, constrain decision-making for public and individual benefit, and limit competition and innovation in the market.

While climate-specific efforts alone will not determine data governance regimes, there are ways in which they can contribute to a data ecosystem that is representative and participatory, fosters trust, and catalyzes innovation:

Prioritize intentional approaches to creating representative data. Even as the volume of data has increased, the representation of marginalized groups in the data has not kept pace.[23] This is largely due to two factors: 1. the exclusion of marginalized people and communities from the formal economy, where data is often generated, and 2. lack of access to and literacy on the technology necessary to engage online.

Groups are also frequently rendered invisible in data due to historical biases. Climate-specific efforts cannot simply rely on historical data or large datasets but rather must take intentional steps to ensure that data includes otherwise marginalized populations.

Contribute to data-sharing mechanisms that increase data mobility while also ensuring transparency, accountability, and privacy. To maximize the value of climate data, it is necessary to open relevant datasets, share it across organizations and sectors, and reuse and combine it with other data in myriad ways. This openness and data movement create risks around data misuse and abuse. Fortunately, new models for data governance are emerging that seek to emphasize the welfare of data subjects and provide a measure of control over how individual, or community-level data is used, by whom, and for what purposes. Many of these models, like data fiduciaries, data collaboratives, and data trusts, to name a few, take a community-oriented view of data as they consider complex issues such as data ownership, data sharing and reuse arrangements, and consent models. Experimentation is already happening and will continue in this space. Climate initiatives should seek to learn from these emerging efforts as well as contribute to the evolution of these mechanisms for data governance that maximizes the data's value while also maintaining data security and preserving individual rights.

SECTION 3

Commentary on Twin Transition

Sustainability and digitalization are cross-cutting priorities for many sectors. Coupling both goals in a twin transition can accelerate progress on 1) mitigating the lifecycle impacts of digital technologies and 2) harnessing the power of digital technology to achieve climate goals. However, these benefits need to be balanced with the overarching risk of overcommitment, and it's important to ensure there is an adequate focus on each individual goal without one dominating the other. Ultimately, for the twin transition to be successful, stakeholders need to have ownership of the outcomes. Important variables to consider include the following:

Consider the enabling environment for data sharing.

Data exchange layers of DPI are particularly relevant in the climate discourse and play a central role in enabling equitable, open, and resilient climate action. However, efforts to improve data sharing cannot be effective without considering the enabling environment. Enabling variables such as clear governance, technical infrastructure, capacity building, and common standards, will become increasingly important as the reliance on data for effective climate mitigation increases.

Focus on inclusion.

Digitalization is costly, and putting the cost burden on individuals can widen the digital divide. For example, transitioning to renewable sources of energy should be a priority, but for individuals living without electricity, it cannot be achieved without supporting structures that improve access to electricity in the first place. The twin transition should account for the social impact, ensuring that it benefits everyone across the digital divide.

Technology transfer is essential.

Technology transfer for climate is important because it can help address the urgent need to reduce greenhouse gas emissions and mitigate the impacts of climate change. Many developing countries, which are often the most vulnerable to the impacts of climate change, have limited access to the technologies, resources, and supporting structures needed to transition to a low-carbon economy. On the other hand, forecasts suggest that without their active participation in decarbonization, achieving a 1.5-degree scenario will be very difficult.[24] Tech transfer can help these countries gain access to sustainable and clean technologies such as renewable energy, energy-efficient buildings, low-emission transportation, and climate-resilient agriculture.

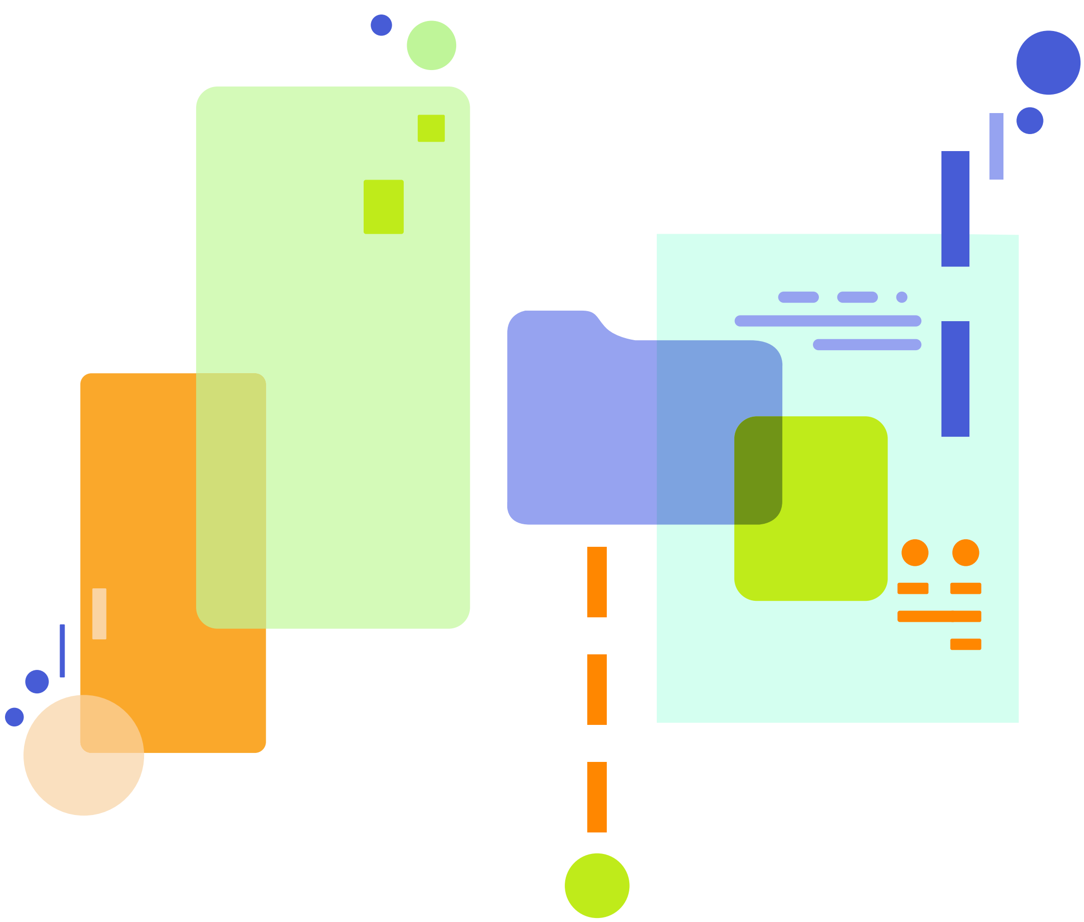
By facilitating the transfer from technology advanced countries to technologically underdeveloped countries, it can help accelerate adoption of climate action, which can significantly reduce global greenhouse gas emissions, enhance energy security, and promote sustainable development.

Ensure public-private partnerships.

Progress on DPI is being led by national governments. To accelerate progress, private-sector investment and innovation must work hand in hand with public-sector priorities and objectives to achieve greater impact and more sustainable outcomes than many national governments would be able to achieve on their own.

The energy system plays a central role.

The energy system is a central variable for effective climate action, since 73.2% of global greenhouse gas emissions are caused by the energy sector.[25] Greening the energy system is a huge opportunity for accelerating wins toward a sustainable planet, particularly in energy-intensive industries. Decarbonization of energy systems is made possible by digital services, where the rise of on-demand energy consumption and microgrids and the move away from centralized energy systems provide an opportunity for more energy efficient systems. With many countries realizing the potential of DPI for better service delivery to their citizens, DPI should be built without adding an additional burden to the energy system.



SECTION 4

Conclusion

In 2022, Pakistan's floods were one of 42 climate disasters that exceeded $1 billion in costs.[26] As human-induced global warming persists, millions of people face the imminent danger of higher temperatures, rising sea levels, catastrophic weather events, and warming oceans. In 2023, climate-related events persist, and at the time of this paper's writing, tropical cyclone Freddy has devastated the southern African region. The aftermath of the cyclone leaves many people in dire need of assistance, ecosystems in need restoration, and infrastructure in need of repair.

Many known impacts of climate change are irreversible, such as coastal degradation and the permanent loss of land due to rising sea levels. And there are many impacts that have yet to be fully understood, including how climate patterns impact the spread of disease, the global food supply, and human migration patterns. What is clear, though, is that vulnerable populations, especially those in low-and middle-income countries, are at particular risk, and there is an unambiguous urgency to address their needs.

One of the key promises for digitalization is the ability to break down boundaries between sectors, increase flexibility, and enable integration for whole-of-society benefits, both as core services provided by DPI (such as digital IDs and cash transfers) and value-added innovations in service delivery. Digitalization is a tool which can promote progress on climate goals, leading to a twin transition for addressing the pressing global challenges of climate change and digital inequality, and for unlocking new opportunities for economic growth and innovation. There are several key drivers of the transition, such as the enabling environment, technological innovations, and public-private partnerships. However, it also poses significant challenges and trade-offs, such as the need to balance short-term costs with long-term benefits, and the risk of exacerbating existing inequalities and vulnerabilities.

This paper has offered a high-level discussion of the potential and limitations of the twin transition. To fully realize its potential however, the global community must coalesce on the understanding the implications of greening by digital and greening of digital. Future research is required to measure the environmental and social impact of digital, understand how technological and digital innovations can meet existing gaps in climate, and evaluate the impacts of policy and governance frameworks that support the combined agenda. While the transition will require significant investment and changes in behavior, it also offers the potential for economic growth, increased efficiency, and improved environmental outcomes.

To successfully navigate digital interventions in service for climate, it will be important for all stakeholders to work together, embracing innovation, collaboration, and a commitment to sustainability. But with the right policies, investments, and partnerships in place, the twin transition can pave the way for a more prosperous, equitable, and sustainable future for all.

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