

Approaches to Digital Public Infrastructure in the Global South

An Overview of India, Ukraine, Brazil, and Zambia

Romina Bandura, Madeleine McLean, and Caroline Smutny

Introduction

Digital technologies define a modern economy by allowing companies, governments, and citizens to connect, transact, and gain access to goods and services. Within a country’s digital ecosystem, digital public infrastructure (DPI) enables citizens to interact with governments and to pursue economic opportunities. As outlined by the United Nations Development Programme, if DPI is applied to the financial sector it could accelerate the economic growth of Global South countries by **20-33 percent** by 2030.

While not a new concept, the term DPI gained prominence during India’s 2023 Group of 20 (G20) presidency, and is **defined** as “as a set of shared digital systems that should be secure and interoperable, that can be built on open standards and promote access to services for all, with governance and community as core components of DPI.” A country’s DPI encompasses components such as a digital ID, a payment system, and a data exchange platform. Despite a common definition, there is no universal operating standard or model for DPI, and as such, countries are developing the concept in different ways to fit their own needs.

This paper describes how some countries in the Global South are approaching DPI by examining the positive elements and challenges facing each approach. As leaders in their respective regions, this paper highlights the DPI cases of India, Ukraine, Brazil, and Zambia, emphasizing different aspects of their approaches. As countries develop their digital ecosystems, these four case studies can provide guidance in moving forward and give both citizens and their governments a better understanding of the impacts that this infrastructure can have on their lives.

Case Study: India

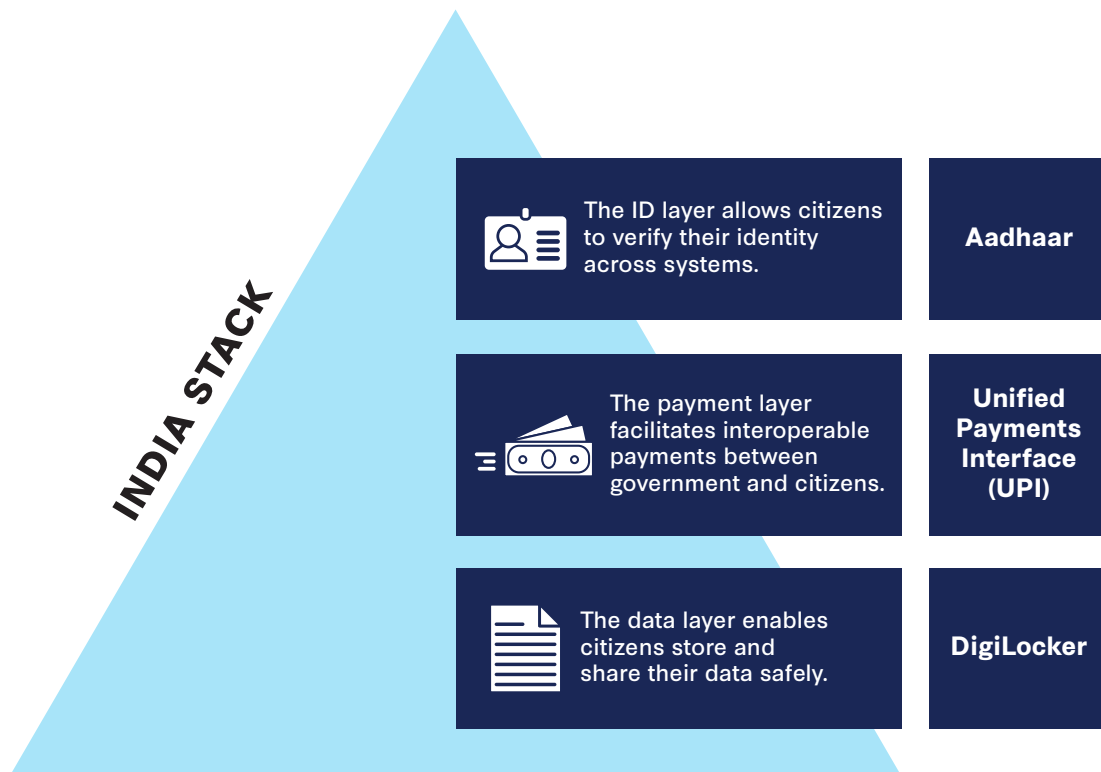
India has built a robust DPI, starting with an identification system. Just 15 years ago, one-third of the population (**approximately 400 million people**) had no form of official government identity, leaving much of the population unbanked, without access to credit, and unable to claim public benefits or social services. Rolled out in **2009**, India's Aadhaar (meaning "foundation") digital identity system allows Indian citizens to register for a unique biometric identity number. This enables government agencies, companies, banks, and others to verify a person's identity instantaneously. By 2022, **around 1.3 billion** Indian citizens were registered on Aadhaar.

Complementing the digital ID, India deployed an **open payment system**, Unified Payments Interface (UPI), in **2016**, which has made payments "**as easy as sending a text or scanning a QR code**," with **no added transaction costs** for merchants or consumers.

In addition to Aadhaar and UPI, India's DPI has a "data layer" to allow citizens to virtually store, authenticate, and consensually share a myriad of personal data ranging from driver's licenses and vehicle registrations to tax documents and medical records.

Taken together, these three layers comprise the core digital architecture of the "India Stack," a system of interoperable, government-backed platforms that are "**stacked**" together to provide users with access to everything from public benefits to loan applications (Figure 1).

Figure 1: The India Stack



Source: Vivek Raghavan, "India Stack: Driving Transformation In Financial Inclusion Through Digital Public Goods," ThoughtWorks, <https://info.thoughtworks.com/rs/199-QDE-291/images/India-Stack-DrivingTransformation-TWLliveIndia2019.pdf>.

The **ecosystem** and actors underpinning the India Stack are complex. Government agencies, tech firms, semi-public corporations, universities, and nongovernmental organizations (NGOs) all contribute different elements of the digital infrastructure. Aadhaar is owned and operated by the government; UPI is run by a public-private partnership; and other apps are built by NGOs and tech firms before being sold to state and local governments.

The India Stack has become a powerful tool for financial inclusion. Citizens can now open bank accounts in minutes rather than weeks, and account ownership **doubled** between 2011 and 2021, reaching 78 percent of the population. Hundreds of millions in India's welfare system can now receive "**direct benefit transfers**" to their Aadhaar-linked bank accounts, reducing bureaucratic red tape, slashing corruption, and saving the government **\$34 billion** between 2013 and March 2021. During the Covid-19 pandemic, the system helped disburse emergency funds with remarkable efficiency.

India's bid to go cashless in 2016 through its demonetization push raised the profile of its DPI model. For the fiscal year 2022-23, UPI processed roughly **\$1.7 trillion** in transactions, accounting for over three-quarters of India's digital retail transactions. This share is expected to rise to **90 percent by 2027**, even as the total volume of digital payments **quadruples**. Businesses **can now access** financial data from cash-based merchants who previously had evaded taxation, allowing the businesses to develop better underwriting capabilities and to extend credit to underserved entrepreneurs who formerly had been dependent on predatory lenders. The government has also benefited from increased tax collection efficiency, while consumers and merchants have earned greater interest income from going cashless.

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India's DPI model is spreading abroad through several channels. India's **Modular Open-Source Identity Platform** (MOSIP), **deployed in 2018**, is marketed as a cost-effective way for low-income countries with limited IT capacity to kickstart their DPI journey. With many developing countries lacking a national ID system—let alone a digital one—for their citizens, MOSIP has generated international interest. The Philippines was the first large-scale MOSIP test case, and **76 million** of the nation's 110 million citizens have been issued digital IDs through its **PhilSys** system. Other pilot projects are currently underway in **16 more countries**. Emerging in 2020, the export arm of the National Payments Corporation of India, **NPCI International**, is focused on deploying UPI abroad. In early 2023, NPCI International **announced** its new agreements to allow QR-based UPI payments in Cambodia, France, Hong Kong, Japan, Malaysia, the Philippines, South Korea, Taiwan, Thailand, and Vietnam.

The **growing visibility** and adoption of India's technological solutions also bring greater scrutiny to its products, thus identifying potential risks. Challenges include cybersecurity concerns, data privacy, and the risk of government surveillance. Tens of millions of Aadhaar records have reportedly been exposed in a series of **data breaches**, and analysts have warned about privacy and data protection **concerns**.

Critics **also argue** that the Indian government is subsidizing merchants using UPI to promote the system's growth while eroding demand for credit cards. Finally, the state's **regulatory oversight** has not kept pace with its digital push.

Despite these challenges, President Narendra Modi **aspires** to turn India into a world leader in digital technologies and made DPI **the centerpiece** of his country's 2023 G20 presidency. Offering a more inclusive, bottom-up approach to sustainable development and growth, the India Stack resembles a **"low-cost, software-based version of China's infrastructure-led Belt and Road Initiative."**

Case Study: Ukraine

Ukraine's digitalization journey began in 2014, when a wave of anti-corruption protests against the administration of former president Victor Yanukovich **compelled** a group of civic activists and tech entrepreneurs to **overhaul** the country's notoriously corrupt government procurement system. Their efforts produced Ukraine's flagship e-procurement system, ProZorro (meaning "transparent"). Noted for being **"more transparent and better integrated with commercial marketplaces than the U.S. [procurement] system,"** the platform has saved the Ukrainian government roughly **\$1 billion** a year and turned the **"most corrupt nation in Europe"** into a **recommended model** of digital procurement reform.

President Volodymyr Zelensky's vision to create a **"state in a smartphone"** in order to offer citizens **100 percent** of government services online has driven a strategic, systematic, and cross-sectoral approach to the digitalization of government services. Announced in 2019, Zelensky's digitalization agenda has produced major institutional shifts, policy reforms, and digital breakthroughs. His administration transferred responsibility for digital development to an empowered Ministry for Digital Transformation and appointed chief digital transformation officers in each government agency, both at the national and regional levels. At the policy level, the government has adopted various anti-corruption measures, digitalization initiatives, and digital skills development campaigns, all of which have complemented the rollout of new e-government services and digital solutions.

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Between 2016 and 2020, Ukraine digitized nearly all of its government registries. While only **8 percent** of Ukrainians used online public services in 2019, by 2020 nearly half of the population utilized digital public services. Ukraine is the first country in the world where digital smartphone passports **"have the same legal weight as the hard copy form of documents."**

Ukraine's DPI is based on the Diia app and the related data exchange platform **Trembita**. An Estonia-based system, Trembita was launched in Ukraine to facilitate the secure exchange of data between users and state databases. In conjunction with the **Vulyk automation system**, which stores digital records from roughly 600 administrative service centers across the country, Trembita's

standardization of data formatting and data sharing paved the way for the launch of Diia in 2020. The Diia app (meaning “action”) is an e-government web platform and mobile application that gives citizens access to government services via their smartphones. Like Ukraine’s other digital public goods, Diia was designed to reduce corruption and increase efficiency by making citizen-to-government interaction more direct, transparent, and impersonal. The Diia platform can be linked to different payment systems. Diia’s economic impact was **valued** at \$455 million in 2021 and \$1.34 billion in 2022. The core app has spawned a broader digital ecosystem of Diia-linked applications, offering public services ranging from digital literacy programs to entrepreneurial promotion.

Russia’s full-scale invasion of Ukraine in February 2022 has both **complicated and accelerated** Ukraine’s digital leap forward. Before the war, millions of Ukrainians were already using Diia to access digital IDs and medical records, pay taxes, receive pensions, and register vehicles and companies. With this foundation in place, the government was able to **rapidly scale up** Diia’s capacity to address wartime necessities, including registering internally displaced persons, recording property damage, logging the movement of Russian forces, purchasing war bonds, and accessing critical public information.

Diia’s user base has grown significantly since the start of the Russian invasion, and the platform now boasts **over 21 million users** and provides access to **over 120 public services**. The app has been downloaded on **70 percent** of the smartphones in Ukraine, and new features are added regularly. Ukraine’s remarkable DPI progress—scaled in the context of active hostilities—is widely considered a model of public sector **resilience** and **adaptability**.

While the invasion has accelerated digitalization, it also threatens to upend it. By the end of 2022, the total cost of repairing Ukraine’s telecommunications sector, damaged by Russian attacks, was estimated at **\$1.79 billion**. The obvious physical damage has been compounded by cyberattacks, a hallmark of Russia’s destabilization efforts worldwide. Ukraine’s implementation of state-of-the-art cybersecurity protections has thus far safeguarded personal data and kept government services online. As an important security measure, Diia does not store data directly and instead relies on Trembita and Vulyk to access information from decentralized databases. With **over 100** dispersed government registries and databases, Ukraine’s data storage system is less vulnerable to external attacks than centralized systems such as the India Stack.

In terms of exporting Ukraine’s digital technologies to developing countries, the United States Agency for International Development (USAID) plans to provide at least **\$650,000** to help jump-start the proliferation of Diia-like systems and the digital technology services that underpin them. This is just the starting point: USAID plans to work with private sector investors to facilitate the dissemination of this technology as well. Through additional funding, USAID has pledged to assist partner countries in South America and sub-Saharan Africa to complete technical assessments and take other steps necessary to develop their own Diia-like apps for government services. In March 2024, Ukraine made Diia **available** for export as open-source code to support the digitalization of government services abroad.

Case Study: Brazil

Brazil’s **lengthy** digitalization journey has centered around citizen-first policies and government best practices. Having assumed the G20 presidency in 2024, Brazil is using this forum to further a DPI agenda within the developing world. It has declared DPI as one of the four priorities of the G20 **Digital Economy Working Group**.

At the core of Brazil's DPI are two main platforms: **Gov.br** and **Pix**. Gov.br is a digital ID system used by the **entire** federal government; it emerged from government attempts to streamline the varying ID systems across Brazil's 27 states together and to make those and other IDs interoperable. In **2004**, Brazil acquired the capability to digitize biometric data, which led the electoral court to use it for **voter registration**. Over the past two decades, the government's investments in digital technologies and data security have resulted in the Gov.br system. Importantly, the program has focused on increasing **interoperability** for streamlined public service delivery. Today, approximately **146 million** citizens have registered their digital identities and signatures to access government **resources**.

While Gov.br focuses on digital governance and ID, Pix forms the backbone of Brazil's digitized payment infrastructure. In 2020, the **Central Bank of Brazil** created Pix, an instant payment system. Since it requires having a bank or payment account, Pix can be understood as the facilitator between individual accounts and businesses. By increasing the speediness of transactions and eliminating transfer costs, Pix supports **financial inclusion** efforts. Since its launch in 2020, Pix has registered approximately 70 percent of the population and 79 percent of the businesses in Brazil. Today, it facilitates **\$300 billion** worth of transactions per month. The Bolsa Familia, Brazil's social welfare program, uses the Pix system to distribute financial assistance to approximately **14 million** families, significantly reducing poverty rates across the country.

Despite the many opportunities available, Brazil's DPI faces challenges related to data security, digital literacy, and trust. Approximately **36 million** people lack internet access, and registration remains low in **rural areas**. Moreover, users often lack digital skills or do not understand how the system works, and **fraud** linked to Pix appears to be increasing. Finally, cyberattacks and user error have resulted in a series of technical issues facing **ConecteSUS**, the platform citizens use to access vaccination and healthcare information.

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The government of Brazil is working to address these issues and has announced plans to launch a national **data policy** to provide guidelines on data usage and protections across government agencies. This policy will outline specifically where and how a person's data will be used. The World Bank's Espírito Santo Digital Acceleration Project has pledged **\$76 million** to improve digital literacy and skills, build additional infrastructure, and strengthen data protection. The digital literacy programs will primarily focus on women and girls, addressing the digital gender gap.

Neither Gov.br nor Pix are exportable technologies, but Brazil has taken a leading role in highlighting the benefits of DPI for development. In 2023, Brazil participated in approximately 15 bilateral discussions on digital government initiatives and shared its experiences with the African Union to help strengthen digitalization projects in Africa. As president of the G20, Brazil has the opportunity to prioritize DPI as a strategic tool to help meet the United Nation's Sustainable Development Goals.

Case Study: Zambia

Zambia's DPI journey has been propelled by strong political support. Appetite for DPI is evident in the recent **wave** of policies focused on e-governance, digital IDs, financial services, and the passage of official **data exchange and protection legislation**.

The **Smart Zambia Institute** (SZI), housed in the Office of the President, coordinates all e-government developments across agencies. Established through the **Electronic Government Act No. 41** in 2021, SZI's stated mandate is to coordinate information and communications technology (ICT) developments across the country and to build platforms that "**facilitate Government (G2G), Government to Business (G2B) and Government to Citizens (G2C) services in a secure and robust environment.**" **Zamportal**, the "one-stop shop" to access Zambia's e-government offerings and to make digital e-service payments, houses over 250 services across 26 agencies.

Working to create a unified digital ID, Zambia has adopted the new biometric Integrated National Registration Information System. This public-private collaboration represents the first overhaul of Zambia's ID system since **1965** and is in the process of distributing digital IDs to **everyone** over the age of 16. This new system is expected to cost \$54.8 million and will streamline processes, provide increased access to government services, and improve the national e-Know Your Customer platform. Moreover, the government has emphasized the importance of the interoperability of systems throughout Zambia's digital transformation. The 2023 **Electronic Government (General) Regulations** state that all e-government services must "maintain and promote integrated and interoperable systems in the provision of services."

Given that government-to-people and people-to-government services are at the nexus of its DPI, Zambia has focused on the development of government-to-people (G2P) payments. For example, the country is currently **partnering** with MOSIP and OpenG2P to provide financial assistance to combat the impacts of drought, which is affecting much of southern Africa. The country has also undergone a **national financial switch**, enabling bank-to-bank, bank-to-mobile, and bank-to-other payments to take place.

Zambia has seen a widespread shift toward digital payments and digital tools. As a result of these efforts, in 2023 mobile phone ownership increased **2.3 percent** and mobile money subscribers reached 17.3 million people. As of 2024, approximately **7 million** Zambians (out of a population of 20 million) possess a digitized ID, giving them access to e-government portals. The value of mobile money transfers rose **127 percent** from 2017 to 2021, and the government has been working toward increasing the interoperability of its databases so that citizens have a more seamless e-government experience. Electronic government services have the potential to save Zambia approximately 0.9-1.1 percent of the country's GDP, as laid out in the 2023-2026 **National Electronic Government Plan**.

Although the Zambian government has made significant strides in building the country's digital public infrastructure, challenges persist. The **costs** of building hard infrastructure (e.g., ICT, energy, and internet connection), especially in rural areas, mean that low-income households are limited in the digital services they can use. In addition, there is **insufficient** coordination across government agencies, which slows down the operation and sustainability of digital services. Finally, limited **digital literacy** and technical skills, a lack of willingness to adapt to new technologies, and a high turnover rate of information and communication technology specialists have all diminished the potential to pursue leapfrog development of DPI.

Limited digital literacy and technical skills, a lack of willingness to adapt to new technologies, and a high turnover rate of ITC specialists out of the public sector have all diminished the potential to pursue leapfrog development of DPI.

Zambia is continuously working with stakeholders to build and strengthen its DPI. In 2023, the government entered into a **memorandum of understanding** with the Centre for Digital Public Infrastructure at the International Institute of Information Technology Bangalore to support the SZI's implementation and scaling-up of DPI. Also in 2023, Zambia entered into an **agreement** with the government of Malawi to lower data prices and build internet connectivity through the Diplomatic Data Corridor. In June 2024, Zambia joined the **50-in-5 Campaign**, a partnership of foundations, government agencies, and multilateral development banks aimed at developing safe and inclusive DPI. Moreover, to combat digital illiteracy, the SZI is actively working to increase digital fluency and awareness of digital services and has established several digital transformation centers across the country to support digital learning.

Conclusion

The four case studies outlined above represent a diverse set of country circumstances. However, the impact that DPI can have, including streamlining government services, strengthening financial inclusion efforts, and integrating forgotten citizens into society, is evident across India, Ukraine, Brazil, and Zambia. Given the plethora of DPI approaches being developed, countries have the opportunity to learn from each other by sharing best practices and mitigating technology-related risks. ■

***Romina Bandura** is a senior fellow with the Project on Prosperity and Development at the Center for Strategic and International Studies (CSIS) in Washington, D.C. **Madeleine McLean** is a program coordinator and research assistant with the Project on Prosperity and Development at CSIS. **Caroline Smutny** is a program coordinator and research assistant for the Project on Critical Minerals Security at CSIS.*

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