

Digital Public Goods/Infrastructure for Development:

the essential conditions for the adoption of Digital Public Goods and investments in Digital Public Infrastructure.

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Summary

DPGs are defined as open-source software, data, AI models, standards, and content that adhere to privacy laws and best practices, promote SDGs, and are used for digital economic development. Notable examples of DPGs include the Indian Aadhaar identity system, Estonia's X-Road data exchange platform, and the DHIS2 health information system.

DPI, on the other hand, represents the foundational digital layers necessary for powering daily lives, much like physical infrastructure such as roads and bridges. DPIs must be designed to enable innovation, be interoperable, and benefit all individuals and communities. When DPGs become widely adopted and integrated, they become part of DPIs, providing a platform for various digital services and systems to be built upon.

The benefits of DPGs include reducing duplication of effort, faster adoption and customization of proven systems, and transparency in public service delivery. They also offer opportunities for engaging stakeholders in the design and development process. There are essential conditions for effective DPG and DPI adoption including Harmonized Policy and Legal Frameworks, developing skills and capabilities, following a Market System Development (MSD) Approach and using case-based adoption.

Development partners and financial institutions play roles in identifying integration needs, supporting the advancement of DPGs, and advocating for their benefits. The adoption of DPGs and DPIs are gaining momentum, especially in the context of the COVID-19 pandemic, and it is crucial for countries to have the necessary conditions in place to harness the benefits of these innovations for sustainable development.



Open AI Systems



Open-Source



Open Data



Open Content

Current development discourse around digital development is continually featuring the topics and benefits around adoption and investment in Digital Public Goods (DPGs) and Digital Public Infrastructure (DPIs).

Development partners and finance institutions are promoting the agenda with financial support included for the adoption of digital public goods and the development of capacity for the same. This has formed into a [global digital cooperation model](#) spearheaded by the UN Secretary-General and centered around harnessing the benefits from the adoption of these global digital public goods. Just recently, the [G20 summit held in India has given additional impetus to the momentum](#) when 19 of the G20 member states signed an agreement committing to ramp up investments in DPIs. Leading the technical and development work on the topic is the Digital Public Goods Alliance-DPGA.

The Digital Public Goods Alliance is 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.*ⁱ The alliance was initially formed by the close collaboration of the Government of Sierra Leone, the Norwegian Agency for Development Cooperation (Norad), and UNICEF (United Nations Children's Fund). The governance of the board of the DPGA (Digital Public Goods Alliance) has now expanded to include the German Federal Ministry for Economic Cooperation and Development (BMZ), iSPIRT, and UNDP (United Nations Development Programme); while the alliance members has also expanded to include a larger set of government's, development finance organizations, UN agencies as well as foundations, bilateral organizations, and private sector institutions. The work of the DPGA as well as the conversation around expanding investment in digital public infrastructures has recently gained wider audience and stronger momentum within the development discourse, especially around the contributions of DPI and DPG for the attainment of the Sustainable Development Goals(SDGs). [Ethiopia has also just joined the DPGA on 21 June 2023](#). This is indeed a big step in enabling the country to join a coalition of international organizations promoting and implementing key digital public goods and infrastructures for advancing growth and development.

So, what really are Digital public Goods and Digital Public Infrastructure and why do they matter? The appropriate place to start is by re-visiting the core definition of public goods. The economic application or definition of public goods refers to services or commodities that are made available to all members of society without any form of discrimination or exclusion from usage. Commonly these goods and services are paid for collectively through public taxation and are provided for or administered by governments. Some typical examples of public goods include law enforcement, national defense, and the rule of law. Similarly, within the same definition applying, public infrastructure, which in this case falls within the category of public goods, also included public transport or railways, highways, or motorways etc. In 1954, Paul Samuelson, an economist from Massachusetts, developed the concept of public goods which he also called [The](#)

[Pure Theory of Public Expenditure](#). Samuelson defined what he called a “collective consumption good” as:

“[a good] which all enjoy in common in the sense that each individual’s consumption of such a good lead to no subtractions from any other individual’s consumption of that good.... (Samuelson 1954: 387)ⁱⁱ

Defining Digital Public Goods (DPGs)

With this backdrop, digital public goods are defined by the DPGA as “open-source software, open data, open AI (Artificial Intelligence) 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.”ⁱⁱⁱ The core departure point from the public goods definition is that many of these products and services are digital, largely developed by private sector or public/private partnerships and applied for advancing digital economic development.

Digital Public Goods are merely a passive set of digital assets made freely available (think open source) having its own lifecycle and governance in the form of specifications, software, and/or content. They are technology components or building blocks that can be used to create solutions and systems, and these components can be in the form of code, standards, or specifications. What makes a component a DPG is when it is made available for use through an open license framework.^{iv} (Sunbird© 2023)

Some of the notable DPGs frequently mentioned and also vastly applied include the Indian Modular Open-Source Identification Platform-MOSIP used for registering a vast volume of Indian population in a short period of time under the Aadhaar Unique Identification system as a national foundational ID. In addition, the university of Oslo, Health Information System Program (HISP) lead DHIS2 software which is an IT (Information Technology) system for collecting, validating, analyzing, and presenting data for health information management activities^v is also a DPG that has gained wider adoption and application. The Estonian X-Road[®], an open-source software and ecosystem solution that provides unified and secure data exchange between private and public sector organizations^{vi} is also part of the DPGs framework. These systems and platforms have enabled governments across various geographic areas to ease the process of providing efficient public services and enabled credible decision making, policy and programming based on concrete information and data.

Aadhaar:

The Indian unique identification system, termed as Aadhaar, is a 12-digit unique identity number that can be obtained by the citizens of India and resident foreign nationals who have spent over 182 days (about 6 months) in twelve months. Started in September 2010, Aadhaar has ended up generating unique identification numbers for over a billion

of India's large population. In an October 2017 interview with the Hindustan Times, Mr. Nandan Nilikani, the former chair of [Unique Identification Authority of Indian \(UIDAI\)](#) and the current non-executive chair of [Infosys](#) stated that "the Indian government's Aadhaar card scheme, which has enrolled more than 1 billion people, has helped the exchequer save about \$9 billion by eliminating fraud in beneficiary lists"^{vii}. What is more, Mr. Nilikani had also stated that through Aadhaar, "the government has transferred about \$12 billion into bank accounts electronically in real time to the world's largest cash transfer system."

X-Road

This Estonian data exchange platform that was developed to allow the nation's various public and private sector e-service information systems to link up and function in harmony. The "X-Road connects different information systems that may include a variety of services. It has developed into a tool that can also write to multiple information systems, transmit large data sets, and perform searches across several information systems simultaneously. X-Road was designed with growth in mind, so it can be scaled up as new e-services and platforms come online."^{viii} The government of Estonia has reported that today "X-Road is [implemented in over 20 countries around the world.](#)" In addition, "X-Road provides built-in support for [cross-border data exchange through federation,](#)"^{ix} allowing them to exchange and consume data with each other based on clearly set data governance, privacy, and protection principles. The X-Road is reported to have enabled over 52,000 organizations as indirect users of X-Road services, 1.5 billion transactions per year and over 3,000 e-services.^x

DHIS2:

The District Health Information Software, commonly termed as DHIS2 is stated to be the "world's largest health information management system — developed through global collaboration led by the University of Oslo (UiO). It is reported that more than 80 countries worldwide use DHIS2 for collecting and analyzing health data. 3.2 billion people (40% of the world's population) live in countries where DHIS2 is used. DHIS2 is offered free of charge as a global public good."^{xi} By design, the DHIS2 is an open source, web-based platform mostly used as a health management information system (HMIS). Ethiopia is one of the countries who has also transitioned to the use of this open-source system for the national health information management system. The federal Ministry of Health has conducted customization of the software to the Ethiopian context and conducted user acceptability and field application tests and successfully achieved legacy data migration.^{xii}

Defining Digital Public Infrastructure

The most practical definition for DPIs comes from the [Digital Impact Alliance \(dial\)](#), an alliance established with the vision of “a world where everyone, everywhere has access to the trusted digital tools they need to fully participate in society’. Here, digital public infrastructure is defined as representing “the foundational digital layers necessary for powering our daily lives, just as our physical roads, railways, and bridges are crucial to a smooth-running society”^{xiii}. However, dial states that for DPIs to enable a positive digital society — where it not only powers our lives but improves them, it must

- *Be designed to enable public, private, and civil society innovation. This is caled **servng the whole of society**.*
- *Create a platform that connects digital services. In technology terms, this means it has to be **interoperable**.*
- *Be in service to and provide benefit to all individuals and communities. In other words, it **puts people at the center**.*^{xiv}

When digital public goods become ubiquitous by application and adopted by critical mass service giving organizations, they become digital public infrastructure that allow for other services and systems to be bult up on. The Indian model is a true testament for this. The [India stack](#) is a system that enabled for the development of various complementary stack of systems for public service provision that started off Aadhaar as the foundational ID and enabled for additional public services to be stacked up on.

Brought together, Digital Public Infrastructures serve as the rail and tracks on which key public services or digital public goods can ride on. The [IndiaStack](#) is described as “the moniker for a set of open APIs and digital public goods that aim to unlock the economic primitives of identity, data, and payments at population scale.” Despite the name this composite of systems and APIs has been adopted in many other countries and “helped promote financial and social inclusion and positioned the country for the Internet Age.”^{xv}

A similar initiative is the [GovStack](#) , which is a multi-stakeholder initiative led by the German Development Cooperation (GIZ), Estonia, the International Telecommunication Union (ITU) and the Digital Impact Alliance, with the objective “to break down the barriers to building sustainable digital public infrastructure and help governments create human-centered digital services that empower individuals, improve well-being and build more inclusive and resilient societies”.^{xvi}

What are the benefits?

In general, DPGs pose the opportunity to reduce duplication of effort in development of systems, standards, software, and platforms across various sectors. They offer tried and tested systems that could be quickly and easily adopted; thereby reducing development and build time and focusing only on adoption and customization. Unlike the industry practice in the market, these open-source systems and software are not products whose market value has dwindled and are being provided for free as they no longer have returns. Rather, these are products which are on live applications in many parts of the world and being used to drive effective public service and development activities. Therefore, DPGs enable a more affordable and dynamic delivery of public services using technology with utmost transparency in delivery of the public services; as has been seen in the direct benefit transfer scheme in India and other parts of the world.

From a social goal perspective, the development and roll-out of the DPGs offer good opportunities to engage the ecosystem actors and target groups in the design of the products and services. This creates a collaborative process of development and reduces frictions in implementation by early detecting any gaps in the products and services or breaches against legal and policy frameworks.

Ethiopia had already adopted [Modular Open-Source Identity Platform – MOSIP](#) as a digital public good for the National Digital ID initiative (Fayida), prior to becoming a member of the DPG alliance. This platform has enabled Ethiopia to build its national digital ID registration system. The collaboration with MOSIP has also come with capacity development and technical assistance support for the national ID program.

Essential conditions for the effectiveness of DPGs/ and DPIs

Cognizant of the current momentum of DPGs/DPIs adoption, there are clear lessons learnt and benefits to harvest from the experience of countries that have already been through the journey of implementing and investing in these systems, software, and standards. These, are classified below as the essential and necessary conditions that need to be in place for the successful and high impacts adoption and implementation of DPGs and DPIs.

- [Harmonized and enabling policy, legal and regulatory frameworks](#). This is by far the most essential and critical of all the requirements to advance the adoption of DPG/DPIs. Lessons from the countries that have gone through the design and implementation of DPGs, such as India for the Aadhaar foundational identity system, have proven the need for harmonizing legal frameworks. Aadhaar has gone through various litigations related to issues of data privacy and protection, which have stalled critical implementation time. Similar case in point

is with the previous Kenyan Digital Identity system, Huduma Numba and the [civil society case against](#)^{xvii} its perceived infringement on privacy and data protection as well as exclusion. In October 2021, the Kenyan supreme court had ruled Huduma Numba illegal for violating key data protection acts. The litigation outcome has revealed that the process of rolling out the Huduma Numba could have benefited from an extensive and close consultation with civil society and privacy rights organizations that would have highlighted the missing components of the programme, thereby saving critical resources and time for the roll out of the foundational identity system. Although this may not be the entire cause, Huduma Numba is now scrapped, and Kenya is embarking on a new digital identity system. Similarly in Uganda, the national Digital ID roll out process has been [challenged by key civil society organization advocating for privacy and protection of personal data of citizens](#). One of the core issues raised was that the enrollment process was discriminatory against certain groups of the population. Digital Identity no doubt has a strong impact serving as a Digital Public Good that could further enable unlocking additional systems and services in the digital economy. It is one of the vastly implemented DPGs at the moment and also one that has entertained numerous legal and policy issues in relation to privacy and data protection. As the experiences from neighboring countries show, key legal frameworks and provisions are essential for its successful implementation.

With other digital public goods such as finance and data sharing services, there is also a similar need for policy and regulatory frameworks that govern these systems and services. In cases where these do not exist, at least the appetite for running innovation labs or sandboxes; or any form of flexibility to allow for testing and piloting of new and potentially high impact digital products and services based on global experiences and results would enable the proper grounding of innovation within the respective ecosystem.

- **Skills and capabilities:** The need to build the key skills and capabilities in the digital economy are essential for anchoring, localizing, and sustaining innovation and adoption of DPGs and DPIs. Even without the DPG/DPIs discussion, digital skills and capabilities are the mainstay of a burgeoning digital economy. The skill sets and capabilities required span from the basic digital literacy to be able to make productive use of digital systems and platforms, to the advanced skills required for adoption, localization and anchoring of DPGs and administration of DPIs. In addition to safeguarding against dependence on imported expertise, strengthening these capabilities is also essential for the ownership and sustainability in the implementation and administration of DPGs and DPIs.
- **Market system development (MSD) approach:** In adopting DPGs and DPIs, opting to engage the key member of the ecosystem with the respective sector is one of the key essential conditions for ensuring effective adoption as well as sustained implementation and

ownership of digital public goods and infrastructure. Market system development approach enables leveraging the roles and behaviors of existing players on the market such as users and producers of digital services and enabling them to drive value out of the adoption of the specific DPGs/DPIs. Doing so would enable not only the engagement of key ecosystem actors such as the private sector, civil society, and other non-state actors; but also ensure ownership and commitment for anchoring and investment on the expanded implementation of these systems and platforms.

- **Use case-based adoption** – The DPGA has developed a carefully curated composite registry of more than 120 digital public goods ready for adoption. These DPGs are solutions and systems developed by various institutions and contribution to supporting efforts in the respective areas of all the Sustainable Development Goals. To ensure productive and sustained adoption, it is also an essential condition to have clearly developed use cases for these DPGs. Doing so will help differentiate the nice-to-haves from the must-haves and enable prioritization of essential investment in key sectors.

What roles could the ecosystem actors play in the process?

In the discourse and process of adoption of DPGs and investments in DPIs, development partners and finance institutions have many roles to play in supporting countries. This can be summarized into three key roles.

- The first is in terms of identification and mapping out the needs for integration and investment in DPGs and DPIs together with respective governments and advising on the value addition of these systems and platforms.
- Secondly, partner organization could serve as incubation and acceleration role through a continued investment in the advancement and maturity of Digital Public Goods. Organizations such as UNCDF directly engaged in supporting government in the respective sectors in the digital economy are uniquely positioned to support low-income countries through catalytic and strategic investments and financing towards the attainment of the SDGs. Hence, some of these investments could potentially be directed to supporting the maturity and localization of DPGs.
- Promotion and advocacy for DPGs and DPIs based on the merits they bring to enabling countries localize globally tried and tested systems and solutions for sustainable development, is also an added role for development partners to play in this process.

In conclusion, the pathways for digitalization for the attainment of the Sustainable Development Goals are being supported by new and practical technological solutions, digital public goods, and

infrastructure. The global focus on ensuring the expanded adoption and investment in these technologies will continue to gain additional momentum. The COVID-19 pandemic has accelerated the strong need for innovation in delivery of public services and the even stronger need for adopting technology for doing so. During this time, the emphasis in and around DPGs/DPIs has taken extensive root, and it is here to stay long-term. The most prominent issue is to ensure and enable countries have the necessary and sufficient conditions in place to be able to amass the productive value from these digital innovations and towards making progress on the attainment of the SDGs in collaboration with development partners and finance institutions. It would be interesting to see what additional innovations from the DPG/DPIs registry would be suitably adopted for supporting the country's digital pathways.

ⁱ <https://digitalpublicgoods.net/who-we-are/>

ⁱⁱ <https://plato.stanford.edu/entries/public-goods/#DefiPublGoodDistBetwDiffKindPublGood>

ⁱⁱⁱ <https://digitalpublicgoods.net/who-we-are/>

^{iv} <https://www.sunbird.org/explore/articles/27-why-dpg-dpi>

^v <https://www.mn.uio.no/hisp/english/about/history/>

^{vi} <https://e-estonia.com/solutions/interoperability-services/x-road/>

^{vii} <https://www.hindustantimes.com/business-news/aadhaar-helped-government-save-9-billion-nandan-nilekani/story-7dPISNcEZJsAhUdBAZSshP.html>

^{viii} <https://e-estonia.com/solutions/interoperability-services/x-road/>

^{ix} *ibid*

^x *ibid*

^{xi} <https://dhis2.org/about/>

^{xii} Biruk Abate et al (2019) From Parallel Systems to a Singular, Open-Source, and Government owned HMIS: A Strategic Approach to DHIS2 Implementation in Ethiopia

^{xiii} <https://dial.global/good-dpi/>

^{xiv} *ibid*

^{xv} <https://indiastack.org/>

^{xvi} <https://www.govstack.global/about/>

^{xvii} <https://privacyinternational.org/long-read/3373/kenyan-court-ruling-huduma-namba-identity-system-good-bad-and-lessons>