

# **Data Governance**

# **Network Paper**

Pathways to implement DPG-based DPI

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## 1. Introduction

Key building blocks such as digital identity, payments and data exchanges are being recognised for their ability to drive societal impact through their application in all sectors of development. These digital public infrastructure (DPI) are nation-scale projects with significant government involvement, intended to further national development priorities. An ecosystem of multilateral organisations and public sector focused technology providers, often supported by philanthropy, are involved in financing and executing many of these projects. Prominent successes across the world include Estonia's X-Road and India's Aadhaar, which have brought transformative changes in governance. Support for this model is also evident in India's G20 agenda for making such technology affordable and accessible globally<sup>1</sup>.

Acquiring the capabilities and achieving the necessary conditions for successful deployment of DPI is a resource intensive, long-term effort, requiring buy-in from all stakeholders. But building DPI from scratch is unnecessary and often not an option for many developing countries operating in resource-constrained environments. Pressing concerns such as public health and social protection require governments to move swiftly and scale their efforts to reach vulnerable, underserved groups, which is not easy to achieve with traditional approaches. Most legacy GovTech efforts around the world have been based on closed-source proprietary software, lacking interoperability and suffering from vendor lock-in<sup>2</sup>. This leads to inefficient service delivery and greater fiscal outlay given the need to build separate, siloed systems from scratch. To ensure DPI initiatives don't repeat mistakes of the past, use of digital public goods is paramount. The concept of Sustainable Development Goals-focused open code, content, standards and protocols designated as Digital Public Goods (DPG)<sup>3</sup> has received considerable attention in recent years, with stewardship from the Digital Public Goods Alliance (DPGA) and their network<sup>4</sup>. Their use in building DPI has been well established in public health<sup>5</sup>, with payments and digital identity being recent areas of focus globally<sup>6</sup>.

DPG-based DPI can address many issues faced by existing DPI and govtech initiatives. DPGs allow countries to retain strategic control of their digital assets. Governments can customise and deploy solutions as they see fit, with complete control over the code and data. The open source nature of DPGs provides full visibility of the code for security and audits, which is crucial for maintainability. DPGs are designed to use open standards and protocols, providing governments with the capability of linking them with existing systems, a key requirement for a coherent, whole-of-government approach to service delivery. By not charging royalties and licence fees, DPG-based DPI also provides medium and long term cost benefits.

This paper studies the efforts being made to support effective deployments of DPG-based DPI<sup>7</sup> and gaps in the ecosystem that could be addressed. Key areas examined include the developing business environment to make DPG-based DPI viable, functioning of public sector technology

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<sup>1</sup> Read more on India G20 agenda [here](#)

<sup>2</sup> For more details, refer to [World Bank report](#)

<sup>3</sup> Read more [here](#)

<sup>4</sup> Refer to the Digital Public Goods Alliance roadmap [here](#)

<sup>5</sup> Find the Global Goods Map [here](#)

<sup>6</sup> Find the 2021 ID4D and G2Px Annual Report [here](#)

<sup>7</sup> For more details, refer to [State of the Digital Public Goods Ecosystem 2022 Report](#)

procurement, the relationship between DPG providers and their prospective customers in government, mechanisms needed for governments and other stakeholders to improve their ability to successfully deploy them, and institutional choices of these deployments. The paper is structured in the following manner. Section 2 provides an overview of the current state of thinking around DPG-based DPI. Section 3 analyses the choices and efforts undertaken to strengthen the support needed across stages of the lifecycle of DP, examining self-sustaining communities of DPGs, enablers to envision and execute deployments, and policy and governance configurations of these DPI. Section 4 summarises the key gaps and ideas that need further examination.

## Section 2: Literature Review

Creation, maintenance and governance of DPGs have been widely studied due to their similarity to open source communities. Scholars have borrowed learnings from the past few decades of software development, which saw the evolution of models for sustainability and stewardship of open source software.<sup>8</sup> Digital Square's Global Goods Maturity Model<sup>9</sup> ranks health sector DPGs using self-reported assessments of their global utility, community support and software maturity. Development of a roadmap, enforcement of community norms and rules, and funding and sustainability have been identified as key aspects of DPG governance<sup>10</sup>. However, DPI lacks a correspondingly rich history and, therefore, institutional and implementation frameworks. Extensive additional work of systems integration, design and customisation is therefore required to create fit-for-purpose DPI that fulfils the governments' objective. The institutions managing these DPI also require more attention, as discussed in Richard Pope's Twin Institution Question<sup>11</sup>.

Impediments to deploying DPGs in government have been explored largely from one particular perspective – challenges to open source adoption in government<sup>12</sup>. That said, they have scope for a considerable range of other benefits. In addition to being open, DPGs claim to help attain the SDGs, do no harm by design and adhere to privacy and applicable laws, which makes them a suitable option for governments in their digital roadmap. More work is needed to understand the barriers faced by both parties -- DPG communities and governments -- in making DPG-based DPI a viable option.

Proprietary vendors and contracts dominate GovTech/DPI efforts and are entrenched in government, which makes it difficult for DPG communities and vendors to compete with them. The lack of local private sector and public sector capacity in areas of systems integration, cyber security, enterprise architecture and other technical domains to lay out the vision and maintain these DPG-based DPI is another key gap in their adoption<sup>13</sup>. DPGs themselves require a clear roadmap and governance to ensure that countries adopting and deploying them will have the necessary guidance and resources to tackle their ever-changing needs. Governments and central banks raise questions of credibility and trust, and with DPG stewards being mostly new entrants to the GovTech domain and lacking a track record of engaging with the public sector, likelihood of adoption is further impacted. The availability of open-source or DPG options may be limited in many domains<sup>14</sup>, requiring governments to adopt a balanced approach and opt for the most suitable solutions.

For any government choosing to deploy DPG-based DPI, capabilities and systems for governance, financing and technical development are essential<sup>15</sup>. A major element of

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<sup>8</sup> Read more [here](#)

<sup>9</sup> Find the Global Goods Maturity Model [here](#)

<sup>10</sup> Refer to Eaves et. al (2022)

<sup>11</sup> Read more [here](#)

<sup>12</sup> Read World Bank report [here](#)

<sup>13</sup> Refer to Ganapathy, S., Sippy, T., Sinha, V. & Adarkar, H. (2022). "Building the Foundations: Strengthening Technical Capacity in Government." Artha Global

<sup>14</sup> Read more on demand and supply side issues of DPGs [here](#)

<sup>15</sup> Read EY report [here](#)

governance is the institutional setup that can develop, safeguard and govern the ecosystem around the DPI, which requires a long-term view of the objectives of the DPI, alignment to the country's digital strategy and incorporation of key elements like grievance redressal and public value in its conception. Financing is the second key area, with ambiguity around availability of funding, sustainability and suitability of public-private partnerships<sup>16</sup>. The third is the design and implementation of the digital solution, which requires strategic technical talent within government to ensure that high level technical decision making has a whole-of-government view and maximises the value derived from these critical assets. DPGs play an important role in the last area, although its impact is felt throughout.

The key roles in the ecosystem to envision, design, implement, maintain and upgrade DPG-based DPI systems are

- **DPG creators:** These are institutions that primarily develop and govern DPGs. They may also support implementations of their DPGs with governance and architecture recommendations, and capacity building. Examples include eGov Foundation and Mojaloop Foundation.
- **Administrative authority:** The decision making authority, generally a senior government official/entity with the decision making powers for implementation of the DPI. These could be at a national, sub national or local level.
- **Program owner:** The entity that will use the deployed system to deliver services, goods, etc. These could be a range of entities, such as a national ID program, a central bank or a municipal tax authority.
- **Implementing agency:** The entity that manages the installation, configuration and maintenance of the DPI. These may be public sector or private information technology services providers (known as Systems Integrators) , and the roles may further be split up for different entities to handle initial rollout and support tasks (help desk, technical fixes, etc.)

Enablers of this ecosystem are philanthropies, civil society and multilateral organisations.

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<sup>16</sup> Matthan, R., Misra, P. & Agarwal, H. (2021). "Financing Models for Digital Ecosystems." Artha Global

### Section 3: Characteristics of the current state of deployments

Past attempts to analyse and improve deployment of digital technology in the public sector, and more recently open source software<sup>17 18</sup>, have covered aspects of governance and technology. We examine the characteristics of key DPI projects in India, their contributions to the DPG ecosystem, and relevant initiatives by global stakeholders to support DPG-based DPI, covering efforts by all stakeholders in the ecosystem - sovereign, multilateral, academia, market based, civil society and philanthropies. The analysis is done through primary interviews with stakeholders and supplemented with secondary research.

Table 1: Stakeholder roles in the lifecycle of DPG-based DPI

Stakeholder	Key role
Administrative authority	Institutional framework and strategic control
DPG creators	Technical development of DPGs
Program owner	Deployment and governance of the DPI
Implementing agency	Technical implementation of DPI
Philanthropy and multilaterals	Incubation and funding
Civil society	Accountability

Each stakeholder in this emergent space has a variety of considerations and challenges spanning policy, technology and ethical domains, and the last few years have seen frenetic activity to address them. An analysis of the ecosystem response follows.

#### Institutional framework and strategic control

DPI is viewed as supporting delivery of public services and essential infrastructure. The need for a flexible institutional framework which enables the government to maintain strategic control has seen proliferation of many new quasi-public sector institutions tasked with rollout of DPI.<sup>19</sup>

A trend among DPI implementations in India (Table 2) is the use of a section 8 company to act as the regulator and implementer of the program. DPI that have adopted this institutional approach have significant government ownership through a mix of PSUs, central and state governments. While the National Payments Corporation of India has 65 shareholders, a mix of banks and fintech institutions, the Goods and Services Tax Network, which previously included private banks is now fully government owned<sup>20</sup>. Sahamati is an industry alliance run by the members, mostly financial institutions, whereas DigiYatra Foundation is owned by the Airports Authority of India and private airports. These choices also reflect the growing importance of

<sup>17</sup> Read more [here](#)

<sup>18</sup> Refer to the [Report of the Technology Advisory Group for Unique Projects](#)

<sup>19</sup> Refer to the [Report of the Technology Advisory Group for Unique Projects](#)

<sup>20</sup> Read more on GSTN [here](#)

digital sovereignty among governments<sup>21</sup>, and put substantial demands on the government's capacity to effectively deploy and maintain them.

### Participation and architecture

Participation in these ecosystems is controlled by the owners,<sup>22 23 24</sup> with their own criteria for permitting access, rules to govern each actor's role. These could include capping the scale of a new entrant's rollout or attempting to enforce a check on the market share of major players in the ecosystem<sup>25</sup>. The architecture of the ecosystem, however, varies, ranging from open networks and protocols aiming to break up BigTech monopolies or interoperable data exchange layers to enable data portability<sup>26</sup> to closed platforms, allowing for participation through API integrations.

Table 2: Ownership and institutional framework of major DPI initiatives in India

Initiative/Program	Architecture	Owner	Institution type
Unified Payments Interface (UPI)	Digital platform with APIs for participants	National Payments Corporation of India	Not-for-profit, private limited, Section 8 company
Goods and Services Tax (GST)	Digital platform with APIs for participants	Goods and Services Tax Network	100% government-owned
Sahamati	Member-driven industry alliance formed to promote and strengthen the Account Aggregator ecosystem in India	DigiSahamati Foundation	Not-for-profit, Section 8 company
Open Network for Digital Commerce (ONDC)	Interoperable open network for digital commerce, comprising policies, technology and network participants	Quality Council of India and Protean eGov Technologies Limited	Not-for-profit, Section 8 company
DigiYatra	Digital platform with APIs for participants	DigiYatra Foundation	Not-for-profit, Section 8 company
Digilocker	Digital platform with APIs for participants	National e-Governance Division, Digital India Corporation	Not-for-profit, Section 8 company

<sup>21</sup> Read more [here](#)

<sup>22</sup> Read more on UPI ecosystem rules and regulations [here](#)

<sup>23</sup> Read more on the UIDAI ecosystem [here](#)

<sup>24</sup> Read more on COWIN Access and Integration [here](#)

<sup>25</sup> Read more [here](#)

<sup>26</sup> See [more](#)

CoWIN	Digital platform with APIs for participants	Ministry of Health and Family Welfare, Government of India	A program run by Government of India
Ayushman Bharat Digital Mission	Collection of registries and data exchanges with APIs for participants	National Health Authority	An attached office to Ministry of Health & Family Welfare, Government of India
Government eMarketplace (GeM)	Digital platform with APIs for participants	Department of Commerce, Ministry of Commerce and Industry	100 percent Government owned Section 8 company
Aadhaar	Digital platform with APIs for participants	UIDAI, Ministry of Electronics and Information Technology	100 percent government owned

Source: Author's analysis

### Contributing back to the DPG ecosystem

District Health Information System (DHIS2), a popular DPG, started as a free and open source project in 1994<sup>27</sup> and is in use by ministries of health in 80 low and middle-income countries.<sup>28</sup> X-Road is an open source version of Estonia's X-Tee and Finland's Suomi.fi Data Exchange Layer<sup>29</sup>. Multilateral organisations have contributed through key DPGs such as GeoNode<sup>30</sup>, developed by the Global Facility for Disaster Reduction and Recovery (GFDRR). DPGs may originate from ongoing DPI projects, mainly due to their established track record of delivery and performance, which provides confidence to potential users, or be funded to be built as an open source project with very specific use cases, as seen in Table 3. Not every DPG starts as a grassroots attempt to provide a freely available digital solution, and carving out a DPG from existing DPI is not a trivial task. Open Source Program Offices have been suggested as a viable solution for governments to not only improve their ability to use DPGs well but also contribute to the community.

<sup>27</sup> Refer to Braa, J., & Sahay, S. (2017).

<sup>28</sup> Find more details on DHIS2 [here](#)

<sup>29</sup> Find more details on X-Road [here](#)

<sup>30</sup> Read more on GFDRR's GeoNode [here](#)

Table 3: Linkages between DPGs and DPI

Contribution to the DPG ecosystem	Source and pathway
DIGIT	eGov Foundations, which had been building and implementing solutions for local governments since 2003, changed direction to making DIGIT an open, free -to -use building block in 2016 <sup>31</sup>
Modular Open Source Identity Platform (MOSIP)	Inspired by Aadhaar, funded by philanthropy <sup>32</sup>
Beckn protocol	Created by the Foundation for Interoperability in Digital Economy, used in the ONDC DPI <sup>33</sup>
Digital Infrastructure for Verifiable Open Credentialing (DIVOC)	Open-source platform that enables countries to digitally orchestrate large-scale health campaigns such as vaccination and certification programs, developed as part of the COVID-19 response <sup>34</sup>
CoWIN	DPI implemented by the Ministry of Health and Family Welfare, Government of India and UNDP. Work is underway to make it available as a DPG <sup>35</sup>

### Sustainably creating and funding DPGs

Sustainability and long term stability of DPGs is key to maintaining credibility and growing adoption. Recent events have seen open source companies putting limits on how their code can be used, in the name of protecting their revenue streams<sup>36</sup>. Nevertheless, the DPG ecosystem need to evaluate whether there are missing institutions to take responsibility of incubation, sales, support and ecosystem development of DPGs<sup>37</sup>. Recent entrants in this space are Germany’s Sovereign Tech Fund, which in its pilot phase ending in May 2023 provided funding to 35 OSS projects, focusing on security and resilience<sup>38</sup> and UNICEF’s Venture Fund, which has supported 18 DPGs with technical and strategic mentorship<sup>39</sup>. A focus on cybersecurity for these foundational digital goods, considered a key priority by all stakeholders in the ecosystem, is being provided by initiatives like CyLab in Carnegie Mellon University Africa<sup>40</sup>.

<sup>31</sup> Read more on DIGIT [here](#)

<sup>32</sup> Find details on MOSIP [here](#)

<sup>33</sup> Read more on Beckn Protocol [here](#)

<sup>34</sup> Read more on DIVOC [here](#)

<sup>35</sup> Read more on COWIN [here](#)

<sup>36</sup> Read The New Stack article [here](#)

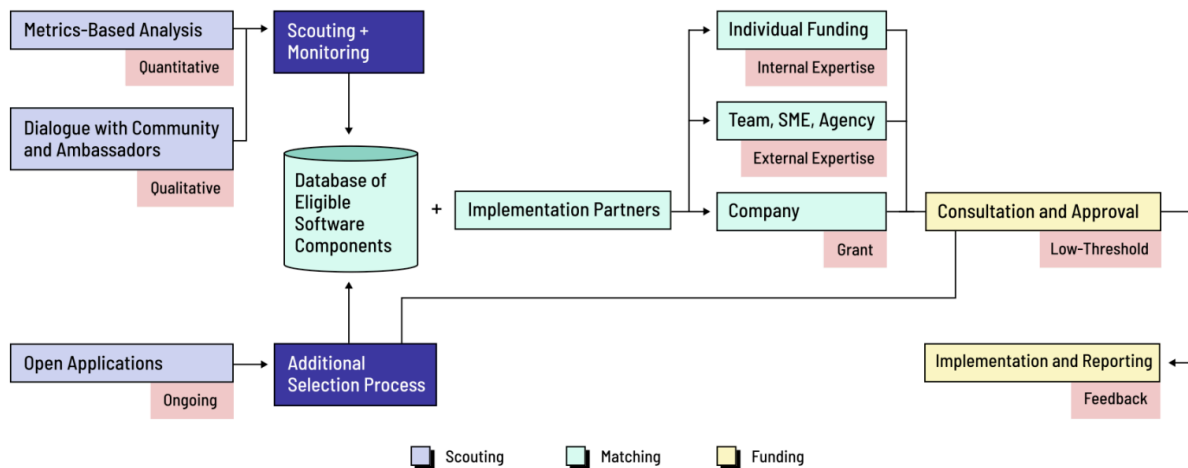
<sup>37</sup> Read Dial Global article [here](#)

<sup>38</sup> Read the Sovereign Tech Fund report [here](#)

<sup>39</sup> Find more details on UNICEF’s Venture Fund [here](#)

<sup>40</sup> Read more about CyLab [here](#)

Figure 1: Funding process of the pilot phase



Source: [Sovereign Tech Fund's pilot phase evaluation](#)

### Discovery and procurement of DPG based solutions

A key gap in matching high-quality DPGs with potential users is discoverability. Multiple efforts now catalogue DPGs and open source solutions (see Table 4), along with critical information about their licensing restrictions, privacy protections and use of open standards. These attempts to boost visibility of alternatives to traditional, commercial options are a first step in closing the gap between the current familiarity with private software procurement and unfamiliarity with open source software procurement<sup>41</sup>.

Support for adoption of DPGs by the public sector includes comprehensive toolkits for the full lifecycle of contracting and procurement<sup>42</sup>, and resources for evaluating total cost of ownership to aid government leaders, implementing partners, and investors in understanding what costs to include in budgeting for the sustainable implementation of DPGs, including operating expenses, common cost variances, and hidden costs.<sup>43</sup> Key ideas specifically geared towards improving procurement of open source solutions include designing tenders neutrally towards different technologies and modes of delivery, and reducing compliance barriers for participation by Free Software companies<sup>44</sup>.

### Deployment support and capacity building

The public sector's patchy record of technology project execution has been attributed to many factors such as the need for proper change management, avoiding vendor lock-in, and lack of technical capacity<sup>45</sup>, and many of these are not unique to procurement of DPG-based solutions. To address these issues, a number of initiatives have been launched and seen traction in the past few years. The need for a stack approach that is extensible, evolvable, scalable and promotes openness and interoperability have led to sectoral initiatives to support large scale

<sup>41</sup> Refer to Krasodonski-Jones, A., & Eaves, D. (2023)

<sup>42</sup> Read the guide for Procurement of Digital Technology [here](#)

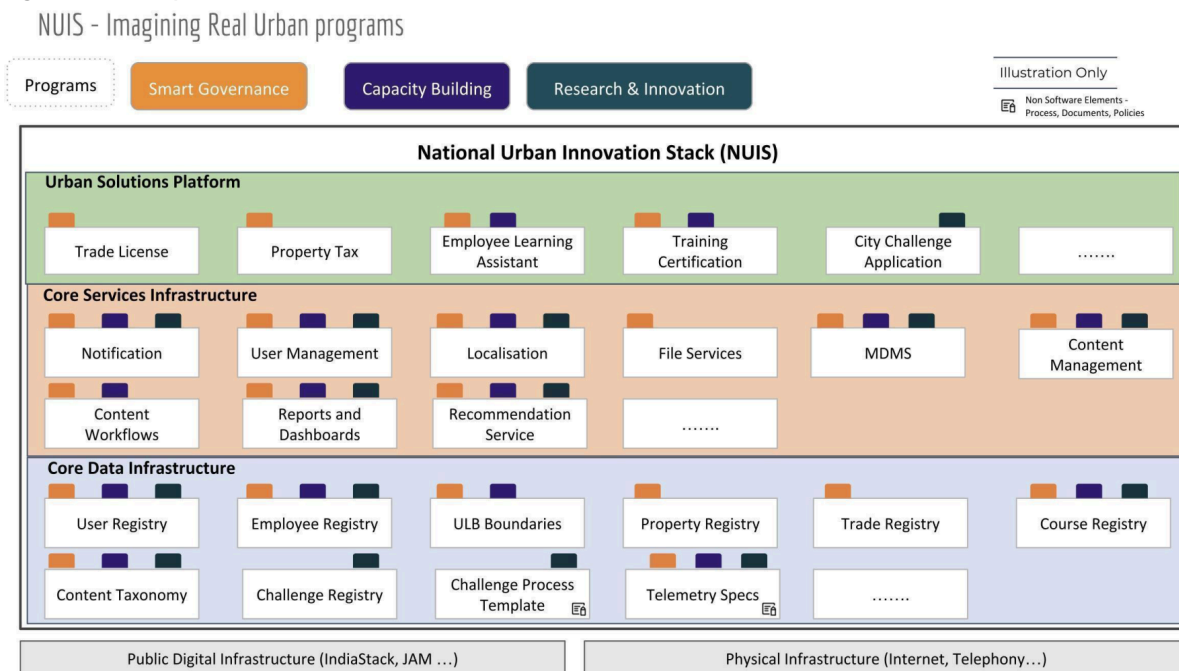
<sup>43</sup> Find more details on total cost ownership tool [here](#)

<sup>44</sup> Find more details [here](#)

<sup>45</sup> Refer to Holgeid, K. & Thompson, M. (n.d.)

adoptions of DPGs<sup>46</sup>. From providing reference platforms for urban and core services<sup>47</sup> to capacity building and governance frameworks at the local level, the programmatic approach by the Centre for Digital Governance, established by the National Institute of Urban Affairs (NIUA) hopes to potentially impact 4000 Urban Local Bodies and 40% of India's population.

Figure 1: Blueprint of the National Urban Innovation Stack



Source: [NIUA](#)

Other initiatives include global challenges to find proven digital solutions<sup>48</sup> and provide support to scale up what already works, reduce duplication, and improve coordination across development actors<sup>49</sup>. Acknowledging the need for building infrastructure thinking in strategic technical capacity worldwide, the recently established Center for DPI in Bangalore provides advisory support for technology architecture and execution<sup>50</sup>. The growth of the Systems Integrator ecosystem for DPGs is another key factor in scaling adoption, and it is a work in progress, since most DPGs are recent entrants to this domain. Evidence of successful implementations and creation of Communities of Practice<sup>51</sup> are being pursued to build confidence with country practitioners.

### A principled approach towards DPI

An overarching, urgent need is for increased scrutiny of the governance of DPGs and DPI considering the pace of adoption of these systems around the world. Initial attempts have

<sup>46</sup> Refer to NIUA report [here](#)

<sup>47</sup> Find more details [here](#)

<sup>48</sup> Read more on UNDP's DigitalX [here](#)

<sup>49</sup> Find more details on Digital X [here](#)

<sup>50</sup> Read more on Co-develop [here](#)

<sup>51</sup> Read more on DPGA's Communities of Practice [here](#)

focused on stakeholder voice and representation, building on the wealth of experience in OSS communities<sup>52</sup> to inform the nascent DPG movement, and rightly calls out the lack of access to examples of governance failures. On the DPI side, an approach that provides rule of law, risk and rights based tests for governance of digital ID systems<sup>53</sup> by civil society provides stakeholders with a range of starting points to engage with these systems. The World Bank's ID4D program, which supports implementation of digital ID systems, highlights the need for meaningful public engagement to avoid investing in systems that are not fit-for-purpose. Equally important are grievance redress mechanisms that can help address complaints about problems faced by individuals who are users of these systems<sup>54</sup>.

Guiding principles adopted by prominent stakeholders in the ecosystem (see Appendix) echo the need for 'responsible' or 'good' DPI but the utility of such principles that lack "teeth" or enforcement needs examination, and a dominant focus on them would be little more than a distraction<sup>55</sup>. The newer DPI approaches aiming for decentralisation may encounter the same anti-competitive behaviour that the closed ecosystems they attempt to replace have seen<sup>56 57</sup> <sup>58</sup> which requires rethinking suitability of the approach in different domains.

Public engagement is another key tool that provides opportunities for stakeholders to voice their concerns and offer their perspectives at all stages of the DPI implementation, but has not been given commensurate attention. Efforts to roll out a real-time dispute resolution mechanism for the UPI instant payments system began only after unprecedented growth surges in users led to a large number of failed transactions<sup>59</sup>.

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<sup>52</sup> Refer to Sinha, V. & Ganapathy, S. (2023).

<sup>53</sup> Find details on the Digital ID Decision Guide [here](#)

<sup>54</sup> Find details on World Bank's ID4D program [here](#)

<sup>55</sup> Refer to Munn, L. (2022)

<sup>56</sup> Read CNBC article [here](#)

<sup>57</sup> Read Economic Times article [here](#)

<sup>58</sup> Read Economic Times article [here](#)

<sup>59</sup> Read Economic Times article [here](#)

Table 4: Key institutions and their role in supporting DPG-based DPI

Initiative	Focus area in the DPG lifecycle					Year of launch/establishment
	Funding	Development	Discovery	Deployment and capacity building	Standards, frameworks, maturity models	
Sovereign Tech Fund	✓					2022
Centre for Digital Governance				✓	✓	2021
eGov Foundation		✓		✓		2003
SDG Digital Investment Framework					✓	2019
AI4Bharat		✓				2022
DigitalX			✓	✓		2022
Global Goods for Health			✓		✓	2020
WHO Open Source Program Office				✓		2022
Center for DPI				✓		2023
Digital Public Goods Alliance			✓		✓	2019

Source: Author's analysis

## 4. Conclusion

Significant momentum in the past few years has helped make DPG-based DPI a viable option but the ecosystem's ability to build on it will require continued focus on openness and willingness to collaborate. DPG-based DPI by themselves can provide a minimum level and expectation of technological safety, but well-designed governance of DPI is key to long-term growth and stability of the systems. The institutional configurations chosen provide the necessary agility to effectively implement complex technology programs but need to have proportionate measures to maintain accountability. Consistent and meaningful public engagement and increased involvement of civil society to truly enable multistakeholder governance can improve trust in DPI and have a positive impact on uptake. While DPGs bank on openness and interoperability to deliver more value than incumbent offerings, this requires additional focus and collaboration to develop and maintain open protocols and standards across sectoral domains. These efforts are also complicated by concerns of sovereignty that impact countries' willingness for collaboration or adoption. Business models for DPGs to sustain are an area that's seeing a lot of innovation, but the users/adopters of these DPGs will need to add value through support to maintain and steward these open source assets. Strong incentives exist for governments to adopt DPG-based DPI, and it is necessary to align them to promote responsible use of these technologies, apart from a focus on efficiency and service delivery.

## 5. Limitations and further research

This domain of study is currently seeing new initiatives and ideas launching every few weeks, so the analysis is not intended to be exhaustive in its scope. It attempts to identify ecosystem level patterns through existing, real-world examples that reflect the state of investment and thinking surrounding DPG-based DPI.

Related areas that that can be explored further

- Policy design choices - evaluating the need for DPI and their suitability
- Evolution in DPI approaches - the movement towards networks and protocols

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## Appendix

Table A

Framework	Organisation
<a href="#">Principles for Digital Development</a>	United Nations

<a href="#">Government Design Principles</a>	UK Government
<a href="#">Digital Investment Principles</a>	Digital Investment Principles
<a href="#">Principles for Good DPI</a>	Co-Develop
<a href="#">MOSIP principles of engagement</a>	MOSIP
<a href="#">Guiding Principles</a>	UNDP Digital Strategy
<a href="#">Principles for Responsible Open Digital Ecosystems</a>	Open Digital Ecosystems
<a href="#">Digital Public Goods Standard</a>	Digital Public Goods Standard
<a href="#">GovStack approach</a>	GovStack
<a href="#">Principles on Identification for Sustainable Development: Toward the Digital Age</a>	ID4D, World Bank