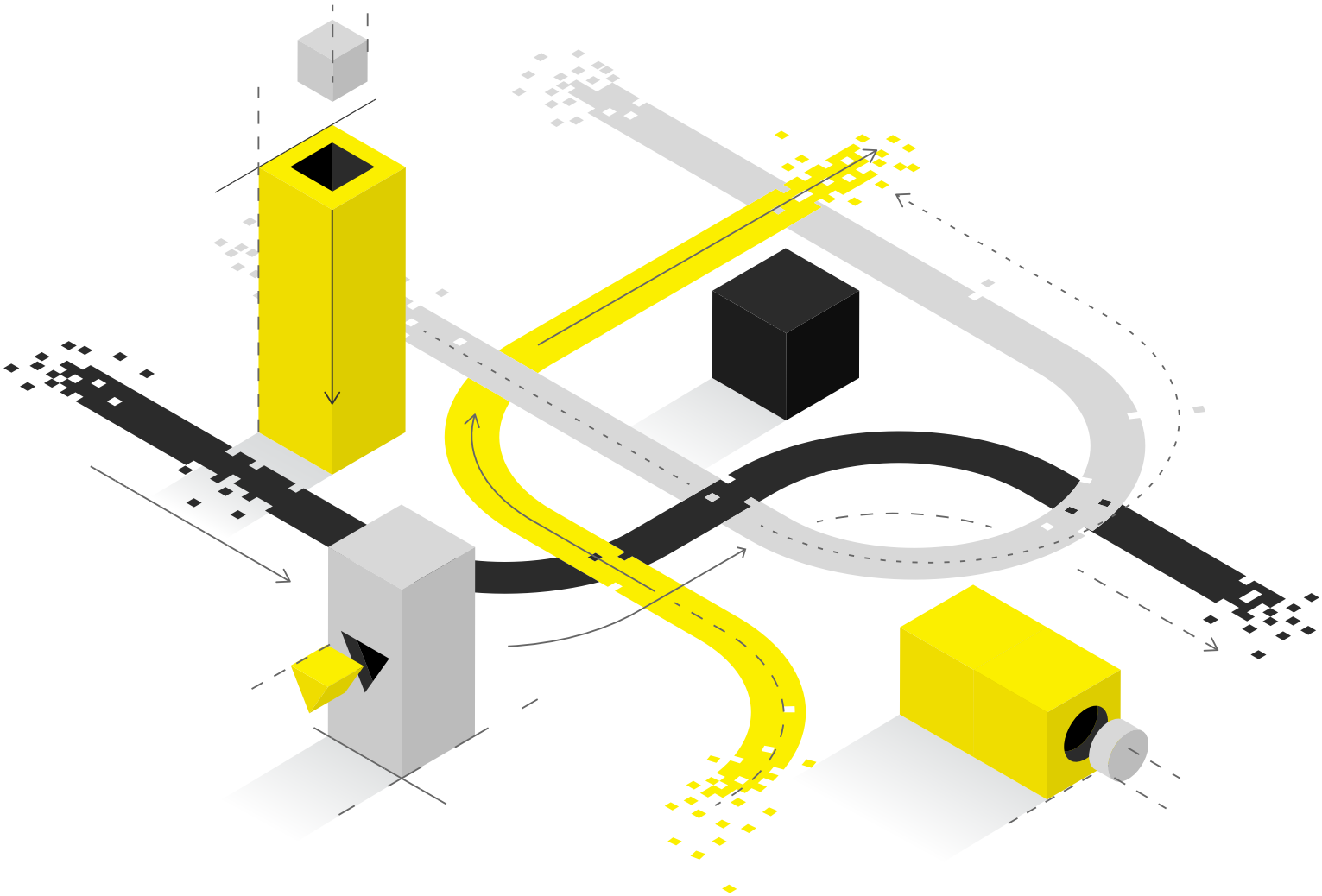
"DIGITAL PUBLIC INFRASTRUCTURE" AT A TURNING POINT

from definitions to motivations



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EXECUTIVE SUMMARY

This paper examines the evolution of the concept of “digital public infrastructure”, tracing a history from an initial phase of openness through the phase of global popularization to a current phase of localization. It highlights the consolidation of a dominant model based on digital identity, payments and data exchanges driven by a coalition of funders, policymakers, and technology stakeholders. Today, as the scope of digital public infrastructure expands, it is moving beyond this dominant model.

Key Phases of DPI Development:

1. **Openness (2012-2020):** The term "digital public infrastructure" emerged organically in discussions around open data, deliberative democracy, and public digital goods. Various interpretations coexisted without a standardized framework.

2. **Consolidation (2020-2024):** A dominant model took shape, largely influenced by the Indian experience of digital identity, payments, data exchanges. Multilateral organizations, funders, and governments promoted digital public infrastructure (now referred to using the acronym DPI) through expert recommendations, repositories, and broad consensus definitions, leading to widespread adoption.

3. **Localization (2024-Present):** As digital public infrastructure spreads globally, local adaptations and new interpretations emerge. These range from digital commons, to digital public infrastructures’ role in industrial policy to its relation with Artificial Intelligence.

Based on this genealogy of digital public infrastructure, the paper calls for a shift from the dominant technocratic, state-led, one-size-fits-all conception of the term to one that is guided by national, regional and local motivations.

It proposes an expanded conception of digital public infrastructure that focuses not only on software and governance but also on hardware and social infrastructures, which are the necessary conditions for successful technological rollouts. It also pushes for an open, democratic conversation about the multiple goals that digital public infrastructures can fulfill.

Digital public infrastructure is at a turning point. While it has gained global traction, its future depends on how it is shaped by regional priorities, governance models, and technological choices. A follow-up study, based on interviews in India, Brazil, the US and Europe, will further investigate these dynamics and propose a framework for making sense of digital public infrastructure in diverse contexts.

NOTE ON TERMINOLOGY

In this paper, the term "digital public infrastructure" refers to the broad field of projects that are digital, public and infrastructural without limitations on motivations, goals or designs. The acronym "DPI" is used to refer to the specific, Indian-influenced model of digital public infrastructure that, as this paper shows, has been promoted globally between 2020-2024. The term "public digital infrastructures" is meant to designate digital infrastructures designed to maximize public value by combining public attributes with public functions and various forms of public ownership. Finally, the term and acronym "Public Digital Infrastructure" (PDI) refer to non-extractive alternatives to platforms and communication services essential to provide access to digital public spaces.

INTRODUCTION

In its ongoing work, Open Future advocates for Public Digital Infrastructure (PDI) as a means of supporting digital public space.[1] PDI (which puts the "public" first) is adjacent to digital public infrastructure, a term that has rapidly gained traction in global digital policy conversations. Today, digital public infrastructure is used to refer to a wide range of digital projects around the world in very different contexts. Its meaning is being debated, fleshed out and compared between these contexts. Several fora have proposed and accepted minimal common definitions. Others have noted that the concept is contested, with multiple models. This paper sketches the landscape of digital public infrastructure to bring conceptual clarity to a popular but undertheorized concept.

The paper is composed of two sections:

Genealogy of "digital public infrastructure": The majority of this paper reconstructs a genealogy of digital public infrastructure until present. The paper finds that digital public infrastructure began with an initial period of openness, characterized by ad-hoc uses of the term that indexed broader debates on telecommunications, digital space, development and sovereignty. In a second period of consolidation and popularization, an explosion of grey literature provided recommendations, repositories were set up and official definitions were adopted. Promoted by a transnational coalition, DPI (now referred to as an acronym) was broadly defined yet in practice referred to an Indian-influenced model of interoperable ID, payments and data exchanges. Today, digital public infrastructure is entering a moment of localization, where it is once again in flux as it is reinterpreted in the new contexts where it is being taken up around the world.

From Definitions to Motivations: Taking stock of the present moment of localization, the paper sketches an approach to digital public infrastructure via context-sensitive goals and designs. The intention is not to provide a normative view of "digital," "public," and "infrastructure" in abstract universal terms. Digital public infrastructure should not be understood and evaluated based on seemingly neutral technical definitions or principles that don't account for geographical variation. Rather, this paper argues for understanding each of these terms as based in the history, problems and needs of a given community, country or region. Such an approach leads to an understanding of digital public infrastructure based on 1) the goals that are socially demanded in a given place and 2) the concrete design choices implemented to meet those goals. The proposed approach hopes to better understand, evaluate, critique, and support the range of practices referred to as digital public infrastructure.

The paper takes a mixed-methods approach to its subject matter. These methods include: a thorough literature review of the grey and academic literature; 12 semi-structured interviews with scholars, policymakers, and civil society working with digital public infrastructure in India, Brazil, Europe and the USA; and targeted keyword searches on social media, the Internet, and newspaper archives to reconstruct its genealogy.

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[1] Jan Krewer and Zuzanna Warso, "Digital Commons as Providers of Public Digital Infrastructure" (Open Future, October 2024), https://openfuture.eu/publication/digital-commons-as-providers-of-public-digital-infrastructures/.

A GENEALOGY OF DPI: FROM OPENNESS TO CONSOLIDATION TO LOCALIZATION

This section uses discourse analysis to reconstruct the genealogy of digital public infrastructure to understand the possibilities and urgencies of the present moment. This can be divided into three phases that roughly correspond to the following periods:

1. Openness, 2012-2020
2. Consolidation and popularization, 2020-2024
3. Localization, 2024-present

The phase of openness refers to the period when the term digital public infrastructure and its variations first began to be used. The phase of consolidation and popularization refers to the period when, referred to by the acronym DPI, a narrowed model was promoted by a transnational coalition of actors, culminating in the creation of definitions and an explosion of grey literature. This was a moment of closure, in which an Indian-influenced model of Digital ID, payments and data exchanges dominated the discourse of digital public infrastructure. Finally, localization refers to the present moment, when amidst a push to implement digital public infrastructure around the world, there is a renewed possibility to interpret and implement it at local and regional levels.

As a method, genealogy traces the development of the present by attending to how meanings have changed over time. It foregrounds the messiness of the past, the contingency of our current categories and the paths not taken.[2] As such, these phases leak into each other. Consolidation continues even as localization picks up. And many of the aspirations expressed during the period of openness are reanimated during the current period of localization.

The genealogy was reconstructed using a range of methods. Advanced X (formerly Twitter) searches for phrases "digital public infrastructure," "public digital infrastructure," and "Digital Public Infrastructure (DPI)," filtered by date, reveal the first use of each term. The former two queries mainly reveal early uses of these terms that are ad-hoc and improvisational. The latter, in which the phrase has become an acronym, suggests the formalization of the concept. X is far from a perfect source. When X accounts are deleted, they are excluded from this archive. And solely relying on X data risks missing other announcements. For this reason, X searches were supplemented by targeted Google searches, newspaper archive searches on LexisNexis as well as archived versions of websites accessed on archive.org. Although this is an incomplete archive, it enables a reconstruction of the evolution of the term.

[2] Paul Rabinow, ed., "Nietzsche, Genealogy, History," in *The Foucault Reader*, by Michel Foucault, 1st ed (New York: Pantheon Books, 1984), 76–100.

Phase 1: Openness, 2015-2020

In the first moment of digital public infrastructure discourse, the term was used in an ad hoc manner. Its meaning was not yet formalized and it was often used interchangeably with other similar terms. The acronym "DPI" had not yet emerged. This period was characterized by openness and improvisation. In this phase, people using the term were generally not aware of others' use of the term; they were operating separately, yet the term clearly indexed a broad zeitgeist. This phase coincides with the beginning of critiques of Big Tech's power and with conversations around what a "public interest" internet might look like.

EARLIEST USES OF THE TERMS

The earliest uses of the terms "digital public infrastructure" and "public digital infrastructure" are ad-hoc and unsystematic, encompassing a wide range of concerns. The term "public digital infrastructure" is used as early as 2012. An article titled "Breaking Open the Digital Commons to Fight Corporate Capitalism", the first use of the term encountered in this research, centers digital commons and the need for a state-promoted digital infrastructure.[3] A 2012 blog post refers to "public digital infrastructure" in terms of open data portals, hinging on the example of the city of Montevideo.[4] The earliest use of the term "digital public infrastructure" on X links to an article about a hack of a high school's network in Canada in 2013, where the phrase "digital public infrastructure" is used to refer to cybersecurity.[5] A 2015 Brookings Institution blog post mentions "digital public infrastructure," focussing largely on platforms for deliberative democracy. [6] A key case study in the article is the Decidim open source system for participatory decision-making, which continues to be a touchstone today.

GOVERNMENT AS A PLATFORM

The idea of government as a platform was first proposed by internet pioneer Tim O'Reilly in 2010. O'Reilly wrote: "How does government become an open platform that allows people inside and outside government to innovate? How do you design a system in which all of the outcomes aren't specified beforehand, but instead evolve through interactions between government and its citizens, as a service provider enabling its user community?"[7] Government-as-a-platform

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[3] Michael A. Peters, "Breaking Open the Digital Commons to Fight Corporate Capitalism," *Truthout*, July 15, 2012, https://truthout.org/articles/global-information-systems-education-and-new-media-networks/.

[4] Guillermo Moncecchi, "Towards a Public Digital Infrastructure: Why Do Governments Have a Responsibility to Go Open?," *Open Knowledge Foundation Blog* (blog), November 1, 2012, https://blog.okfn.org/2012/11/01/towards-a-public-digital-infrastructure-why-do-governments-have-a-responsibility-to-go-open/.

[5] Martin Robson [@robsonmanaged], "Hacked Website at Halifax Area School Shows Importance of Maintaing Digital Public Infrastructure: ... Http://Bit.Ly/11VisaM @robsoninc," Tweet, Twitter, April 25, 2013, https://x.com/robsonmanaged/status/327482366039834624.

[6] Hollie Russon-Gilman, 'The Power of Small Data: Big Data Isn't King', *Brookings* (blog), 26 February 2015, https://www.brookings.edu/articles/the-power-of-small-data-big-data-isnt-king/.

[7] Tim O'Reilly, 'Government as a Platform', in *Open Government : Collaboration, Transparency, and Participation in Practice,* ed. Daniel Lathrop and Laurel Ruma (Beijing ; Cambridge [Mass.] : O'Reilly, 2010), http://archive.org/details/OpenGovernment.

approaches were embraced in Estonia, the UK (through its Government Digital Service), India and Singapore through the 2010s.

In India, the term "digital public infrastructure" was gradually embraced to refer to IndiaStack infrastructures that facilitated open API access to government services. Launched in 2015 by the Indian Software Products Roundtable (iSPIRT), the IndiaStack project initially combined the Aadhaar digital ID, the soon-to-be-launched Unified Payments Interface and the Digilocker system as open APIs that enabled "cashless, presenceless and paperless" interaction with the state.[8] By 2016, Indian source describe IndiaStack as a digital public infrastructure, though they use the term interchangeably with "public digital infrastructure".[9] A 2016 newspaper feature mentions "a need to create a digital public infrastructure to enable creation of businesses." [10] As late as 2019, the term is used expansively. For example, an International Telecommunications Union report on digital transformation uses the term in the context of India's Aadhaar but understands it to "include high-speed Internet access, cradle-to-grave digital identity; digital financial inclusion; and secure cloud storage for personal documents." [11]

Globally, "digital public infrastructure" began to be embraced by the government-as-a-platform movement. A September 2018 article on government as a platform by Tom Loosemore mentions the term offhand, as part of a long list of phrases: "Have we invested enough in new digital public infrastructure?" Loosemore mentions it in the context that new infrastructures need new institutions, flagging continuing concerns around governance.[12]

DIGITAL PUBLIC GOODS

In June 2019, the United Nation Secretary General's High-Level Panel on Digital Cooperation's report "The Age of Digital Interdependence" recommended the creation of a broad, multistakeholder alliance to create a platform for sharing "digital public goods". At this time, digital public goods were understood as "many types of digital technologies and content – from

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[8] Jyoti Panday, "India Stack: Public-Private Roads to Data Sovereignty" (Internet Governance Project, 2023).

[9] Nandan Nilekani: Government Should Create Public, Digital Infrastructure', *The Times of India*, 3 August 2016, https://timesofindia.indiatimes.com/tech-news/nandan-nilekani-government-should-create-public-digital-infrastructure/articleshow/53527014.cms

[10] N. S. Ramnath, 'Aadhaar 2.0: Creating India's Digital Infrastructure', Mint, 28 June 2016, sec. politics, https://www.livemint.com/Politics/afjuy0dHgS4beFggSTVddP/Aadhaar-20-Creating-Indias-digital-infrastructure.html.

[11] International Telecommunications Union, "Digital Transformation and the Role of Enterprise Architecture" (International Telecommunications Union, 2019), https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-DIG_TRANSF-2019-PDF-E.pdf.

[12] Tom Loosemore, 'Making Government as a Platform Real', *Public.Digital* (blog), 25 September 2018, https://public.digital/pd-insights/blog/2018/09/making-government-as-a-platform-real.

This article is based on a 2015 talk which is on YouTube (https://www.youtube.com/watch?v=VjE_zj-7A7A). While the talk covers broadly the same questions and concerns, it does not use the term "digital public infrastructure" and instead refers to "new public infrastructure" that "requires new public institutions". Clearly the term came to Loosemore's attention some time between 2015 and 2018 and was inserted into his cleaned-up transcript post facto. Yet it is still very nascent, a throwaway line, in 2018.

data to apps, data visualization tools to educational curricula… [that are] freely and openly available with minimal restrictions".[13]

Later that year, the Digital Public Goods Alliance (DPGA) was launched as a partnership between UNICEF, NORAD, the Government of Sierra Leone and iSPIRT. An early version of the DPGA website refined the conception of digital public goods to "open software, open data and content and open standards." Digital Public Goods were specifically tied to the motivation of "accelerat[ing] attainment of the Sustainable Development Goals in low- and middle-income countries." Notably, the 2022 version of the website also contained a caveat, a "note on connectivity" that pointed out that nearly half of the world's population was not online, and that "being connected to the Internet is vital for the organization and distribution of digital public goods." [14]

Digital public goods were soon spoken of in the same breath as digital public infrastructure, though it wasn't always clear how they related. A 2020 report from the Brookings Institution and Rockefeller Foundation's 17 Rooms initiative, which would be influential in the phase of consolidation, saw the two as synonymous, remarking that "digital public infrastructures [are] also referred to as digital public goods or platforms."[15]

DIGITAL PUBLIC SPACE

In 2020, digital scholar Ethan Zuckerman published an influential article that saw digital public infrastructure as a form of "public service digital media" on the model of public radio. [16] He defines digital public infrastructures as "the infrastructures that let us engage in public and civic life in digital spaces," a conception championed by community-oriented organizations like Wikimedia. Zuckerman's radio model, which supports infrastructures of expression, differs significantly from the metaphor of roads that became dominant during consolidation.[17]

This notion of digital public infrastructure built on discussions around public space in the digital emerged amidst the increasing privatization of online spaces. In 2018, for example, a group of European organizations came together as the PublicSpaces coalition. The coalition's manifesto outlined a commitment to an alternative software ecosystem that was open, transparent, accountable, sovereign and user centric.[18]

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[13] United Nations, "The Age of Digital Interdependence" (United Nations, June 2019).

[14] "Digital Public Goods Alliance", February 16 2020, *Internet Archive*, http://web.archive.org/web/20200216095701/https://digitalpublicgoods.net/#expand

[15] 17 Rooms Initiative Room 9 Summary report (Rockefeller Foundation and Brookings Institution, 2020), https://www.rockefellerfoundation.org/wp-content/uploads/2020/11/9.pdf

[16] Zuckerman, Ethan, "The Case for Digital Public Infrastructure," 2020, https://doi.org/10.7916/d8-chxd-jw34

[17] Mila T Samdub and Chand Rajendra-Nicolucci, "What Is Digital Public Infrastructure? Towards More Specificity," *Tech Policy Press* (blog), November 25, 2024, https://techpolicy.press/what-is-digital-public-infrastructure-towards-more-specificity

[18] "PublicSpaces Manifesto," *PublicSpaces International* (blog), accessed January 21, 2025, https://english.publicspaces.net/publicspaces-manifesto/

Several themes can be identified in this phase:

- Deliberative democracy and the public sphere
- Increasing governmental efficiency
- Promoting a domestic software industry
- Improving socio-economic development outcomes
- Open public data
- Hardware and connectivity
- Cybersecurity

Some of these themes will be taken up and centered during consolidation, others have been largely excluded from DPI discourse, and still others are making a comeback today.

Phase 2: Consolidation and popularization, 2020-2024

In the phase of consolidation and popularization, the term "digital public infrastructure" became formalized, the acronym "DPI" first emerged, and the features of today's dominant model were articulated. This consolidation hardened the concept's boundaries, taking up certain of the themes (government as a platform, digital public goods) from the previous period and excluding others (hardware and connectivity, digital public space). Multilateral organizations defined DPI in abstract and universal terms, while a new donor-funded grey literature of expert recommendations provided concrete guidance on adoption and implementation. Promoted by a powerful group of actors, consolidation turned DPI into the widely popular concept it is today.

The first use of the phrase "Digital Public Infrastructure (DPI)" on X, which indexes the emergence of the acronym, occurred as late as 2019—the tweet in question links to a report by the Canadian organization Open City Network. Already, DPI has several of the characteristics that are dominant: the report uses a "stack" diagram to illustrate DPI; it is positioned against Big Tech's monopolization of resources; it cites Estonia's X-Road as an example. Yet this use of the term is still transitioning between openness and consolidation, for DPI is understood here as "smart city architecture, standards and exchange protocols, and to maintain them as critical public institutions, under public governance." [19]

By 2021, DPI had become the self-contained model of digitalization it is today. A report published by the Rockefeller Foundation, the Digital Public Goods Alliance and the Norwegian Ministry of Foreign Affairs sketched a complete picture. Building on ideas from the 17 Rooms initiative, the report, titled "Co-Develop: Digital Public Infrastructure for an Equitable Recovery" laid out the agenda for DPI in the phase of consolidation. DPI were understood as IndiaStack-

[19] Open City Network, "Briefing: Digital Public Infrastructure," December 2019, https://web.archive.org/web/20200603025914/https://theopencity.org/wp-content/uploads/2019/12/Open-City-Network-Briefing-December-2019.pdf.

inspired interoperable systems for ID, payments and data exchanges which could serve as the foundations for other technologies. They could serve a range of motivations from inclusion in the digital economy to climate resilience. Rather than being synonymous, DPI were now seen as complementary to digital public goods: Since most countries do not have the resources to implement DPI from scratch, digital public goods were seen as a set of modular building blocks that could, among other things, be used in the construction and deployment of DPI.[20] The report catalyzed the formation of a new multi-funder initiative called Co-Develop. Promoted by a multistakeholder coalition, this vision of DPI was ready to be popularized.

Consolidation and popularization can be understood as the construction of "boundary objects", objects, representations or definitions that are shared across different actors. Boundary objects derive their utility from the fact that they are weakly defined, enabling collaboration even as each actor defines them according to their needs in their work. They are "plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites."[21] Through boundary objects, DPI transcended the limits of its specific original geographies to become applicable around the world.

As Louis and Martens note in relation to the language employed by international organizations, "generalizations and simplifications…convey a sense of neutrality" in ways that often result in the depoliticization of issues that are deeply political.[22] Boundary objects function through an oscillation between localized precision and broadly acceptable vagueness.[23] DPI consolidation tacks back and forth between the production of detailed expert knowledge and a capacious, big-tent definition. The combination of precision and vagueness has enabled the promotion of the IndiaStack approach to DPI—which has particular political consequences—without it being explicitly named.

Several boundary objects are at work in the consolidation of DPI. Three are explored here:

- Expert recommendations that provide guidance on how countries can use DPIs
- Repositories that recognize a range of projects as DPIs
- Minimal, consensus-based definitions

CONSOLIDATION AS EXPERT RECOMMENDATIONS

The production of expert recommendations around DPI began during the COVID-19 pandemic and exploded during the Indian presidency of the G20 in 2023. This grey literature provides

[20] Rockefeller Foundation, Digital Public Goods Alliance, and Norwegian Ministry for Foreign Affairs, "Co-Develop: Digital Public Infrastructure for an Equitable Recovery," August 2021.

[21] Susan Leigh Star and James R. Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social Studies of Science* 19, no. 3 (1989): 387–420.

[22] Marieke Louis and Lucile Maertens, *Why International Organizations Hate Politics: Depoliticizing the World* (London: Routledge, 2021), https://doi.org/10.4324/9780429466984

[23] Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things out: Classification and Its Consequences*, First paperback edition, Inside Technology (Cambridge, Massachusetts London, England: The MIT Press, 2000).

normative answers to questions of implementation and governance. For example, a trope of DPI grey literature is the unpacking of what is meant by the three constituent elements in DPI: "digital," "public," and "infrastructure." [24] Other such literature has tried to abstract from the particular experiences of DPI implementation in a handful of countries, especially India, to general "best practices." One exercise at developing a principles-based approach, for example, sees DPI as characterized by a "common design" philosophy, "robust governance," and "private sector participation." [25] Meanwhile, a "playbook" produced by the UNDP and the Indian government distills DPI implementation into six distinct and easily digestible "plays." [26]

Expert recommendations cloak particular approaches to DPI in the language of abstract universals. For example, in a widely-cited report supported by Co-Develop, Eaves et al. write:

> *"Although there is yet to be a single definition for DPI, there is a consensus around it being reusable digital components that enable public benefits at a societal scale. Three types of DPI are widely recognised – digital ID, payments and data exchange systems –, and sectoral DPI are also emerging."*[27]

A 2023 UNDP document (co-authored with the Government of India) likewise moves from the four broad abstract universal characteristics of DPI to the "emerging consensus" of ID, payments and data exchanges.[28]

This is a repeated move in the grey literature: A leap from an abstract universal definition ("reusable digital components that enable public benefits at a societal scale") to a particular concrete architecture (digital ID, payments and data exchange) whose legitimacy is derived from its being "widely recognized" or there being an "emerging consensus". Description becomes prescription. Such discursive moves position the IndiaStack-inspired ID, payments and data exchange architecture as a default even though consensus definitions don't explicitly refer to them.

CONSOLIDATION THROUGH REPOSITORIES

Another lever of consolidation has been the production of "repositories," which make expert recommendations concrete by collating a range of cases. The Global DPI Repository, launched by the Indian government during India's G20 Presidency, maps DPI deployments in 16 countries and

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[24] David Eaves, Mariana Mazzucato, and Beatriz Vasconcellos, "Digital Public Infrastructure and Public Value: What Is 'Public' about DPI?," Working Papers Series (UCL Institute for Innovation and Public Purpose, 2024); Avani Airan et al., "The Governance of Digital Public Infrastructure" (Aapti Institute, 2024).

[25] Keyzom Ngodup Massally, Rahul Matthan, and Rudra Chaudhuri, "What Is the DPI Approach?," *Carnegie Endowment for International Peace* (blog), May 15, 2023, https://carnegieendowment.org/research/2023/05/what-is-the-dpi-approach?lang=en

[26] "The DPI Approach: A Playbook" (United Nations Development Programme, August 2023), https://www.undp.org/publications/dpi-approach-playbook

[27] Eaves, Mazzucato, and Vasconcellos, "Digital Public Infrastructure and Public Value: What Is 'Public' about DPI?"

[28] "Accelerating The SDGs Through Digital Public Infrastructure: A Compendium of The Potential of Digital Public Infrastructure," n.d.

territories around the world.[29] UCL's Co-Develop-funded DPI Map maps 57 countries with digital ID systems, 93 countries with digital payment systems and 103 countries with data exchange systems.[30] Like expert recommendations, by listing examples of systems for Digital ID, payments and data exchange, these delimit the scope of DPI. At the same time, they redefine preexisting systems as DPI, even though they were often built without any reference to the DPI concept. For example, such systems may not be interoperable and they may be not be adopted at a large scale.

CONSOLIDATION AS DEFINITIONAL WORK

Consolidation and popularization culminated in the adoption of universal, abstract definitions of DPI that are broadly acceptable to a range of actors. By 2024, DPI had been defined and recognized in multilateral fora from the G20 to the UN.

A commitment to DPI was adopted as part of the 2023 New Delhi declaration of the G20:

> *DPI, is described as a set of shared digital systems that should be secure and interoperable, and can be built on open standards and specifications to deliver and provide equitable access to public and / or private services at societal scale and are governed by applicable legal frameworks and enabling rules to drive development, inclusion, innovation, trust, and competition and respect human rights and fundamental freedoms.*[31]

This definition was largely copied by the UNDP in its Universal DPI Safeguards Framework adopted in 2024:

> *a set of shared digital systems which are secure and interoperable, built on open standards and specifications to deliver and provide equitable access to public and/or private services at societal scale and are governed by enabling rules to drive development, inclusion, innovation, trust, and competition and respect human rights and fundamental freedoms.*

And the UN's Global Digital Compact, the first comprehensive global framework for digital cooperation, adopted in 2024 recognized DPI more broadly as:

> *Resilient, safe, inclusive and interoperable digital public infrastructure has the potential to deliver services at scale and increase social and economic opportunities for all. We recognize that there are multiple models of digital public infrastructure, and that each society will develop and use shared digital systems according to its specific priorities*

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[29] Government of India, "Global DPI Repository," 2023, https://www.dpi.global/

[30] "DPI Map," 2024, https://dpimap.org/dpimap. To justify the broad criteria for inclusion on the map, the authors note that the map "determine[s] some form of DPI to exist in a country, but not necessarily identifying "good" DPI."

[31] "G20 New Delhi Leaders' Declaration" (New Delhi: G20, September 2023).

and needs. Transparent, safe and secure digital systems and user-centred safeguards can promote public trust and use of digital services.[32]

Such definitions empty DPI of specificity. Instead of referring to concrete architectures, they define DPIs vaguely, in order to encompass a wide range of implementations and motivations.

Despite their vagueness, these boundary-object definitions all refer to "shared digital systems." They formalize at least four principles of DPI:

- Scale: DPI is understood as delivering services at scale. Often, scale is qualified by the term "societal."
- Trust: DPI is understood as infrastructures that are trustworthy, safe, and respecting human rights and fundamental freedoms.
- Public goals: DPI is variously understood as facilitating "social and economic opportunity" and "development, inclusion, and innovation."
- Open and Interoperable: Though absent from the UN Global Digital Compact, openness and interoperability are recurrent architectural principles in DPI definitions.

WHO IS PROMOTING DPI CONSOLIDATION?

The boundary objects used to consolidate DPI all reduce "digital public infrastructure" to an apparently neutral technical definition. The digital, the public and infrastructure are all vague categories with no internationally agreed definitions. Whose interests are encoded in the closure of digital public infrastructure? "The creation or reshaping of a boundary object is always an attempt to make a hegemonic intervention," Ista Huvila points out.[33] Who gains from DPI consolidation, and whose interests are sidelined?

The consolidation of DPI has been carried out and promoted largely by a coalition of institutional funders including the Gates Foundation, the Rockefeller Foundation and Omidyar; the Indian state and Indian software industry; and international organizations like the World Bank and the UNDP.

For funders, DPI in its consolidated form—software, public-private, interoperable, ID-payments-data—promises a low-cost, widely replicable model of technological intervention that can maximize their funding. For the Indian state, DPI extends both soft power and infrastructural power, establishing India's technological leadership on the global stage.[34] For its software

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[32] "Global Digital Compact" (United Nations, September 2024), https://www.un.org/global-digital-compact/sites/default/files/2024-09/Global%20Digital%20Compact%20-%20English_0.pdf

[33] Isto Huvila, "The Politics of Boundary Objects: Hegemonic Interventions and the Making of a Document," *Journal of the American Society for Information Science and Technology* 62, no. 12 (2011): 2528–39, https://doi.org/10.1002/asi.21639

[34] Nalin Mehta, "G20: India's New Soft Power Is Digital Public Infrastructure," *The Times of India*, accessed January 31, 2025, https://timesofindia.indiatimes.com/blogs/academic-interest/g20-indias-new-soft-power-is-digital-public-infrastructure/

industry, which has developed on top of IndiaStack systems over the past 10 years, the globalization of the Indian model opens a potential export market.[35] For international organizations, meanwhile, DPIs provide a readymade template that promises to enable countries to meet developmental goals.

The power of large institutional funding is particularly important.[36] US-based foundations provide funding for pilot implementations of DPI around the world, often acting through the organization Co-Develop and the 50-in-5 initiative. At the same time, they have supported the creation of a research program around DPI.

The results of donor-funded DPI research are often predetermined, expecting and prescribing the production of evidence that supports the model. A 2021 report that catalyzed much of the current movement around DPI, for example, argued that "evidence that DPI results in progress against the Sustainable Development Goals and national priorities are needed to drive financing, funding, and political commitment."[37] In July 2024, the Gates Foundation made a grant to University College London in order to "make the economic case for building Digital Public Infrastructure (DPI) in low and middle-income countries (LMICs), demonstrating the benefits this approach can bring for citizens & governments." [38] The resulting evidence has played up DPI's benefits while downplaying its drawbacks.

Much of this grey literature does not address serious concerns with the underlying Indian model. While Indian DPI are undoubtedly an enormous technical and administrative feat of implementation at scale, they have been criticized on human rights grounds relating to exclusion, on transparency and accountability grounds, for increasing the state's surveillance powers and for facilitating an upward distribution of wealth from the poor to domestic tech capitalists.[39] Even if these concerns should be addressed in future implementations, India's unique context –a combination of a largely unaccountable state and a powerful and rich software industry– mean that the Indian model may be difficult to replicate elsewhere.

Despite these shortcomings, combined with the malleability of boundary objects, funding provides a strong incentive to adopt DPI, drawing in a further range of actors. The emerging DPI coalition is largely agnostic to the motivations that actors bring to it, as long as they use the concept. Developing countries in the Global South, then, reframe their existing digital projects

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[35] Amlan Mohanty, "The Business Case for DPI," *Carnegie Endowment for International Peace* (blog), June 27, 2023, https://carnegieendowment.org/posts/2023/06/the-business-case-for-dpi?lang=en

[36] Stephanie Diepeveen, Sumedha Deshmukh, and Anonymous, "The Global DPI Agenda: Promises vs. Realities in the Evolution of DPI for Digital Transformation," Draft Working Paper, 2025, https://early-paint-426.notion.site/The-Global-DPI-Agenda-Promises-vs-Realities-in-the-Evolution-of-Digital-Public-Infrastructure-DPI-191557d32fa08072a585d79ea5d9da22.

[37] Rockefeller Foundation, Digital Public Goods Alliance, and Norwegian Ministry for Foreign Affairs, "Co-Develop: Digital Public Infrastructure for an Equitable Recovery."

[38] "Committed Grants > University College London," Bill & Melinda Gates Foundation, July 2024, https://www.gatesfoundation.org/about/committed-grants/2024/07/inv-075658

[39] Reetika Khera, ed., *Dissent on Aadhaar: Big Data Meets Big Brother* (Hyderabad, Telangana: Orient BlackSwan, 2019); Aria Thaker, "The New Oil: Aadhaar's Mixing of Public Risk and Private Profit," *The Caravan*, May 1, 2018, https://caravanmagazine.in/reportage/aadhaar-mixing-public-risk-private-profit

within the vocabulary of DPI to align themselves with IO best practices and access foundational funding. Civil society organizations apply for DPI funding to sustain their research and advocacy work. Somewhat counter-intuitively, even US Big Tech companies like Google and Amazon are positioning themselves as DPI service providers.[40]

The consolidation of DPI has taken place within a broader post-Covid conjuncture characterized by growing US-China competition, an increased appetite to respond to Big Tech monopoly and a renewed interest in state-led industrial policy around the world.[41] In this situation, DPI promises to offer a third way between the US and China, using state infrastructure provision to promote a more democratic form of technology. Whether or not the consolidated version of DPI is up to the task, there is a clear desire around the world for approaches to digitalization that can meet these needs.

A Nascent Phase 3: Localization, 2024-present

Today, digital public infrastructure is undoubtedly entrenched, with institutional buy-in from several prominent actors. Yet, its diffusion into new locales lays the ground for a renewed capaciousness in its meaning, a multiplicity of digital public infrastructures. In Europe, for example, digital public infrastructures are being spoken of in connection with a new turn to the construction of large-scale infrastructure.[42] Longstanding movements on the funding and support of open digital infrastructure are coming into conversation with digital public infrastructure.[43] Open Future argues for the adjacent notion of "public digital infrastructure," emphasizing the "public" quality of these services, and arguing that they can be achieved through digital commons to enable the provision of digital public spaces.[44] And even within the dominant DPI model, differences exist with respect to, for example, the extent and manner of state and private involvement.

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[40] Dave Levy, "Digital Public Infrastructure Is High Priority for Governments Worldwide | AWS Public Sector Blog," *AWS Public Sector Blog* (blog), October 2, 2024, https://aws.amazon.com/blogs/publicsector/digital-public-infrastructure-high-priority-governments-worldwide/; Shouvik Das, "After G20 Consensus, Google to Export India's Digital Public Infrastructure | Company Business News," *Mint,* October 3, 2024, sec. Companies, https://www.livemint.com/companies/news/after-g20-consensus-google-to-export-india-s-digital-public-infrastructure-11727943761487.html

[41] Yakov Feygin et al., "The Geopolitics of Industrial Policy," *Dissent Magazine*, 2023, https://www.dissentmagazine.org/article/the-geopolitics-of-industrial-policy/

[42] "Toward European Digital Independence: Building the Euro Stack", European Parliament, Brussels, 24 September 2024. https://theinternetofthings.eu/toward-european-digital-independence-building-the-euro-stack
Francesca Bria, "European Digital Independence: Building the EuroStack," *AI Now Institute* (blog), October 15, 2024, https://ainowinstitute.org/publication/x-european-digital-independence-building-the-eurostack; Robin Berjon et al., "#Eurostack: European Strategic Sovereign Digital Infrastructures," January 10, 2025. Though the most recent framing of the Eurostack initiative distances itself from digital public infrastructure.

[43] Digital Infrastructure Insights Fund, 2024. https://infrastructureinsights.fund/

[44] Jan Krewer and Zuzanna Warso, "Digital Commons as Providers of Public Digital Infrastructure" (Open Future, June 2024), https://openfuture.pubpub.org/pub/digital-commons-public-digital-infra/release/2

A prominent development in localization has been the articulation of how digital public infrastructures relate to other imaginaries of digital development and transformation. How do digital public infrastructures relate, for example, to digital commons, to open source, to digital public space, to digital sovereignty, to critical internet infrastructure?[45]

Involving a range of stakeholders and broadening the conversation, this new phase, in which digital public infrastructure is yoked to the needs and problems of particular locales, enables a new degree of contestation over the concrete systems that the term refers to. As digital public infrastructure comes up in new geographies, new questions are being raised by a broader network of actors beyond funding agencies and IOs. For example, consumer-facing digital public infrastructures have been in existence for over a decade, but how can they be used within industry? How can digital public infrastructures tackle the hardware concentration around semiconductors that characterizes contemporary AI development?[46] What can digital public infrastructures look like at scales other than the nation-state?

To better understand and support these localizations, this paper calls for further attention to the concrete and varied motivations guiding support for digital public infrastructure in particular contexts. These motivations, rather than vague definitions, lay the conditions for digital public infrastructures' concrete architectures and their effects on communities and economies.

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[45] Krewer and Warso; Renata Avila et al., "Governing Digital Public Infrastructure as a Commons," G20 / T20 / Task Force T05 - Inclusive Digital Transformation, 2024, https://blog.okfn.org/wp-content/files/2024/07/T20-Brasil-TF05-Policy-Brief-Governing-Digital-Public-Infrastructure-as-a-Commons.pdf; Vy Dang et al., "Synergising Digital Public Infrastructure and Digital Commons for Sustainable Development" (Gateway House, 2024), https://www.gatewayhouse.in/wp-content/uploads/2024/03/Gateway-House-Publication_Synergising-Digital-Public-Infrastructure-and-Digital-Commons-for-Sustainable-Development.pdf; Manu Misra, Jyoti Panday, and Nicolo Zingales, "Applying the CII Framework to DPIs: Considerations, Challenges and Opportunities," T20 Policy Brief, 2024, https://t20brasil.org/media/documentos/arquivos/TF05_ST_02_Applying_the_CII_Fr66cccfcd2a0e3.pdf; Cecilia Rikap et al., "Reclaiming Digital Sovereignty: A Roadmap to Build a Digital Stack for People and the Planet," December 2024; Luca Belli, "Building Good Digital Sovereignty through Digital Public Infrastructures and Digital Commons in India and Brazil," *CyberBRICS* (blog), September 11, 2023, https://cyberbrics.info/building-good-digital-sovereignty-through-digital-public-infrastructures-and-digital-commons-in-india-and-brazil/.

[46] Sarosh Nagar and David Eaves, "Interactions Between Artificial Intelligence and Digital Public Infrastructure: Concepts, Benefits, and Challenges" (arXiv, December 7, 2024), https://doi.org/10.48550/arXiv.2412.05761

FROM DEFINITIONS TO MOTIVATIONS

Today, there is little consensus about what ends digital public infrastructure should achieve in the world. Delve into the regional, national and local contexts in which they are put to work and digital public infrastructures fracture into a range of different solutions for different problems.

Contemporary threads on the localization of digital public infrastructure pick up on motivations that have persisted since the phase of openness. A preliminary list of such motivations includes:

1. Creating infrastructures to strengthen the digital public sphere
2. Increasing government efficiency to improve service delivery for citizens
3. The promotion of domestic technological capabilities to build sovereignty
4. Improving socio-economic development outcomes
5. Maintaining and securing the shared open foundations of the internet stack[47]

These motivations are not exclusive. Digital public infrastructures can be oriented towards more than one of them. For example, the Aadhaar biometric identity system has been tied to motivations for increasing government efficiency, promoting a domestic software industry, as well as socio-economic development. The open question is which of these motivations have been fulfilled, and to what extent? In order to answer that question, digital public infrastructure should be understood in terms of concrete goals—which are more specific than motivations—and designs—which facilitate particular ends.

Both goals and designs are in urgent need of further articulation. If their goals remain unarticulated, there is a strong risk of turning the provision of digital public infrastructures into its own end. This can be seen in a common move in the grey literature, which treats adoption as the primary metric of success.[48] If a broad range of actual and possible designs for digital public infrastructures remain unarticulated, actors risk adopting default designs—such as the Indian one—that aren't suitable for their goals. Recognizing this can enable a move towards architectures that are socially specific and rooted in the contexts, problems, and capabilities of the places where they are implemented.

Digital public infrastructure should not be understood as a one-size-fits-all model, nor even a one-size-fits-all toolkit that can be adapted depending on location.[49] Instead, to be truly successful, digital public infrastructures should be approached as projects of "medium design,"

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[47] For a similar list of four "social demands" for public digital infrastructure, see Krewer and Warso, "Digital Commons as Providers of Public Digital Infrastructure."

[48] Diepeveen, Deshmukh, and Anonymous, "*The Global DPI Agenda: Promises vs. Realities in the Evolution of DPI for Digital Transformation*."

[49] As described previously, this is the promise of digital public goods.

centering the people they affect, acting as bridges across multiple registers of action, and working not in isolation but in interaction with other infrastructures.[50]

The following section provides initial reflections on how thinking through designs and goals can support digital public infrastructures. These will be systematically expanded in a follow-up paper to be published in the summer of 2025.

Designs

Design includes technical choices in digital public infrastructure systems, such as interoperability, licensing, and information storage, but it also encompasses institutional organization, governance structures, funding, and social and material infrastructures. Design is related to what Lawrence Lessig calls "architecture," the capacity of technical systems to bring about changes in behavior through their structure.[51] Yet the history of the built environment – the source of Lessig's metaphor – shows that its impact on human behavior is never quite as intended, with the potential to go fatally wrong. To paraphrase the subtitle of James C Scott's pathbreaking *Seeing Like a State* puts it, "certain schemes to improve the human condition have failed." [52] How can digital public infrastructures avoid that fate?

Evidence from dominant DPIs recapitulates Scott's insight. For example, while the Indian Aadhaar system has succeeded by adoption metrics, journalistic, activist, and ethnographic evidence show how it often fails in implementation, having led to exclusions and, in the most dire cases, the deaths of people who depended on Aadhaar to access welfare.[53] At the same time, Aadhaar's concrete design, which privileges open APIs that are accessible to the private sector, has promoted the interests of India's software industry over those of its citizens.[54]

Hence, a broader view of design is desirable. Inspired by what design theorist Keller Easterling calls "medium design", design can encompass the ways in which projects are planned as well as all the multiple, entangled registers at which they are implemented. Design must include technical architecture encompassing software and hardware, governance mechanisms, and social infrastructures that facilitate use on the ground.

In technical design, the dominant conception of DPI conflates "digital" with "software," excluding questions around the ownership, governance, and access to the hardware that these systems run on. Thus, network infrastructure, access to computers and mobile phones, internet connectivity, and cloud infrastructure are critical to the success of digital public infrastructure. Yet, they have been excluded by the DPI discourse of consolidation. While these concerns are being raised

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[50] Keller Easterling, *Medium Design: Knowing How to Work on the World* (New York: Verso, 2021).

[51] Lawrence Lessig, *Code and Other Laws of Cyberspace* (New York: Basic Books, 1999).

[52] James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale Agrarian Studies (New Haven, Conn.: Yale Univ. Press, 2008).

[53] Khera, *Dissent on Aadhaar*.

[54] Mila Samdub, "Digital Public-Private Infrastructures" *Phenomenal World* (forthcoming).

during the process of localization, especially when it comes to concentration among cloud providers, hardware and connectivity must be site of a more robust conversation.[55]

While the conversation on the institutional governance of digital public infrastructure is relatively well developed, social infrastructures have received far less attention.[56] Accountability, transparency and public participation are critical factors in institutional design.[57] Social infrastructures refer to the often invisibilized work that people and communities perform to enable the functioning of society and economy.[58] In digital public infrastructures, they include human intermediaries, community networks, local organizations, business associations, and social movements that do the work of making technical deployments function in complex local realities.[59] Social infrastructures are often unsupported, unrecognized, and unfunded – and even viewed as a problem to be eliminated—by DPIs' promoters.[60]

In this design conception, the stack includes not only technical components but also institutional and social layers, which are often sites of failure. Here, DPIs' potential lies not in disrupting or displacing existing organizations—whether local governments, software industries, or social movements—but in their interplay with them.

Goals

A prevalent strand in the discourse around digital public infrastructures is that they don't have goals; they are a "shared means to many ends," a verbiage drawn from work of infrastructure scholar Brett Frischman.[61] Digital public infrastructures are, according to this understanding, enablers of other goals. While this is useful as a broad theorization of infrastructure, when

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[55] James Görgen, "Brussels Effect Under Attack: Fatigue, Digital Fallacies, and Reinvention," *Tech Policy Press* (blog), September 10, 2024, https://techpolicy.press/brussels-effect-under-attack-fatigue-digital-fallacies-and-reinvention; Cristina Caffarra, "Europe Needs to Do More than Scratch at the Ramparts of Big Tech's Castle | TechPolicy.Press," *Tech Policy Press* (blog), August 26, 2024, https://techpolicy.press/europe-needs-to-do-more-than-scratch-at-the-ramparts-of-big-techs-castle

[56] Airan et al., "The Governance of Digital Public Infrastructure"; David Eaves et al., "Best Practices for the Governance of Digital Public Goods" (Ash Center for Democratic Governance and Innovation, April 2022).

[57] Aaditeshwar Seth et al., "A Governance Framework for Digital Public Infrastructure: Learning from the Indian Experience," T20 Policy Brief (G20, July 2023).

[58] Julia Elyachar, "Phatic Labor, Infrastructure, and the Question of Empowerment in Cairo," *American Ethnologist* 37, no. 3 (2010): 452–64, https://doi.org/10.1111/j.1548-1425.2010.01265.x. Note this understanding of social infrastructure, deriving from anthropology and sociology, is distinct from the economic understanding of social infrastructure espoused by Brett M. Frischmann, *Infrastructure: The Social Value of Shared Resources* (New York: Oxford University Press, 2012).

[59] Ranjit Singh, "Intermediaries as Infrastructure: Interrogating the Phatic Labor of State-Building," *Journal of Sociology* 60, no. 3 (September 1, 2024): 577–98, https://doi.org/10.1177/14407833241234675

[60] Bidisha Chaudhuri, "Paradoxes of Intermediation in Aadhaar: Human Making of a Digital Infrastructure," *South Asia: Journal of South Asian Studies* 42, no. 3 (May 4, 2019): 572–87, https://doi.org/10.1080/00856401.2019.1598671

[61] David Eaves and Jordan Sandman, "What Is Digital Public Infrastructure?," Co-Develop, accessed October 1, 2024, https://www.codevelop.fund/insights-1/what-is-digital-public-infrastructure; Frischmann, *Infrastructure*.

applied to specific projects, it risks allowing implementers of digital public infrastructure to avoid defining explicit goals, evading accountability.

Within the dominant DPI model, claims of success are underpinned by impressive adoption metrics. While large-scale adoption, as seen in India and Brazil, is an impressive technical and institutional feat, requiring large amounts of effort and capital in the face of Big Tech monopoly. adoption metrics do not constitute evidence of any impact beyond the uptake of the digital system itself. The impressiveness of that feat doesn't attest to other outcomes. Indeed, a fixation on adoption metrics risks elevating the rollout of the DPI as its own goal and privileging scale over everything else.[62]

Digital public infrastructures should be evaluated in terms of their outcomes as well as outputs. Robust and context-specific evaluation frameworks should center affected populations. Otherwise, digital public infrastructure rollouts come to mirror the tech industry's strategy of "growth before profits," and these systems may become "alt big tech," as they have in India.[63]

The appropriate venue for deliberation on goals should be specific to the context. It depends on the motivations for digital public infrastructures. If digital public infrastructure is primarily implemented as a project to make administrations more efficient, for example, they might remain a more or less technical matter for experts. If, however, it is an industrial policy intervention that uses public money and capacity to provide support to domestic capitalists—with possibly redistributive consequences—then goals should be a subject of popular and democratic debate. Or, if a digital public infrastructure is underpinned by a broad motivation of socio-economic development, then the UN's Sustainable Development Goals may be a broad guideline, while at the local level, the intended beneficiaries ought to have a say in its goals. Given that most digital public infrastructures will have a combination of context-specific motivations, an appropriate framework for articulating and evaluating goals would be context-specific.

Goals and designs are similar to—but more democratic and less technocratic than—Eaves et al.'s notions of functions and attributes.[64] Unlike functions, goals imply a democratic process of debate, negotiation and dissent. Digital public infrastructures stand to deeply impact the social and economic organization of our collective worlds; they are too significant to be reduced to a technocratic understanding of function. While attributes refer to characteristics of technical systems, design is relational: it requires an accounting of how the technical relates to the institutional, social, and material. Shifting from functions to goals and attributes to designs also necessitates a consideration of the processes by which designs and goals are adopted.

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[62] Diepeveen, Deshmukh, and Anonymous, "*The Global DPI Agenda: Promises vs. Realities in the Evolution of DPI for Digital Transformation*."

[63] Smriti Parsheera, "India's Policy Responses to Big Tech: And an Eye on the Rise of 'Alt Big Tech,'" SSRN Scholarly Paper (Rochester, NY, December 14, 2022), https://papers.ssrn.com/abstract=4343996

[64] Eaves, Mazzucato, and Vasconcellos, "Digital Public Infrastructure and Public Value: What Is 'Public' about DPI?"

The current technocratic discourse around DPI leaves little to no space for the people who are impacted by these systems to influence either their goals or their designs. Civil society participation has been severely limited and when it is solicited, it is usually as an afterthought. Digital public infrastructures' goals and designs must be reinvigorated as sites for broad democratic deliberation.

CONCLUSION

In conclusion, this paper shows that, following a phase of consolidation, digital public infrastructure is entering a period of localization today. As the idea of digital public infrastructure gets taken up in new locales, the conversation should be oriented toward the context-specific question of motivations. A focus on motivations leads to a concrete discussion about digital public infrastructures' goals and how these goals can be brought about through designs.

This paper's critique of digital public infrastructure is a call to systematically expand how the concept is understood and approached. Strong interests have narrowed digital public infrastructure to DPI for identity-payments-data. Yet digital public infrastructure refers to a much broader range of systems that work towards a diversity of motivations. This is already recognized by a burgeoning literature and communities of practice that have appropriated the digital public infrastructure concept for their own use.

A follow-up to this paper will be published in Summer 2025. That paper, based on interviews with policymakers, scholars, civil society and technologists from India, Brazil, the US and Europe, will propose an approach for understanding the range of digital public infrastructure motivations, and a concrete discussion of goals and designs that puts a broader range of options back on the table.

ABOUT OPEN FUTURE

Open Future is a European think tank that develops new approaches to an open internet that maximize societal benefits of shared data, knowledge and culture.

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