Understanding interrelationships between AI and digital public infrastructure (DPI) in India and Brazil

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Abstract
The conversation around artificial intelligence (AI) has gained tremendous momentum, especially since the onset of widespread use of generative AI. While certain countries dominate AI's discourse, development and deployment, others are rushing to see how AI strategies can be built for their economies, in an effort to avoid missing out on potential benefits. To that end, many countries, including the BRICS nations, are seeking to develop their own competencies for AI development and are working towards greater AI sovereignty. In this context, the conversation around digital public infrastructure (DPI) is critical, given that both AI and DPI have the potential, when implemented well, to mutually advance the public good. In this article, we discuss the interrelationships between AI and DPI, with a particular emphasis on how this interrelationship is being operationalised in India and Brazil. We suggest two broad frames—AI for DPI, and DPI for AI—and examine the frameworks that integrate AI and DPI. We also point to some emergent risks and future considerations that countries and their policymakers need to take into account when considering interactions between AI and DPI.

Keywords
artificial intelligence (AI), digital public infrastructure (DPI), digital public goods, AI sovereignty, public values, AI governance

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1. Introduction

In September 2024, the UN Summit of the Future adopted the Global Digital Compact, which suggests that digital public infrastructure (DPI) is key to inclusive growth and pushes for greater investments to this end (UN, 2024b). DPI is a subset of a more general category, public infrastructure, which comprises fundamental services, public goods, and long-term systems including, but not limited to, railways, roads, telecommunications, and public transport (Bowker et al., 2010). Such infrastructure is frequently cited in political and economic discourses as essential for comprehensive, large-scale solutions crucial to a population's quality of life (Edwards et al., 2009). Within the digital subset of public infrastructure—the DPI—a core current dimension may be the role played by artificial intelligence (AI). Accordingly, the focus of this article is on interrelationships between AI and DPI, with a focus on how these interrelationships are linked to the AI sovereignty aspirations of two members of the BRICS bloc of countries, India and Brazil. These two nations are leaders, along with fellow BRICS member South Africa, in foregrounding DPI within the BRICS bloc and, more broadly, within the G20 bloc of the world's largest economies.

DPI

The concept of DPI, as a specific class of digital infrastructure, is emergent and contested, particularly with respect to the notion of "public" (Mazzucato et al., 2024; Samdub, 2025a; Samdub & Rajendra-Nicolucci, 2024). For the purposes of this article, we adopt an understanding of DPI as open, interoperable software development at scale on a platform architecture that has several hardware dependencies, often promoted by state mandate. This combines a normative definition of DPI, as adopted in international fora, with a critical analysis of the forms actually being taken by DPI around the world. The DPI agenda achieved a measure of global consolidation during India's G20 presidency in 2023, with the G20 New Delhi Declaration framing DPI as "an evolving concept" that refers to

> a set of shared digital systems, built and leveraged by both the public and private sectors, based on secure and resilient infrastructure, [which] can be built on open standards and specifications, as well as open-source software [that] can enable the delivery of services at societal scale. (G20, 2023)

Building upon that consensus, while also localising the concept, the Brazilian Government, chair of the G20 in 2024, defined DPI as

> structuring solutions that adopt networked technology standards for the public interest. They are designed to be used by various entities in the public and private sectors, following the principles of universality and interoperability. (Federal Government of Brazil, 2024c)

While DPI can be defined broadly, the dominant version of DPI is associated with systems for digital identification, payments, and data exchange (Samdub, 2025a) built on a platform architecture that can be accessed by a range of ecosystem actors. Such DPI systems are active in India and Brazil. Systems with wide-scale adoption, including India's Aadhaar biometric identification project and Brazil's Pix digital payments system, have attained scale due to state mandates. While other BRICS countries have built advanced systems for ID, payments, and data exchange, they have generally not used the term DPI to refer to them.

While also considering software as infrastructure, the field of information infrastructure studies emphasises material aspects as key to defining infrastructure (Star, 1999). Other dimensions are also central to infrastructure, such as transparency, embeddedness, and modularity, with infrastructure providing a foundation for multidimensional effects (Frischmann, 2012). Digital infrastructure in general includes submarine and terrestrial cables, optical fibre, towers, satellites, and the internet, as well as technical standards and, as in the case of the domain name system (DNS), organisations that maintain the technical standards. Such infrastructure enables data flow, nationally and internationally (Bowker et al., 2010). These hardware and technical infrastructures are critical dependencies for the functioning of software DPIs.

AI

Agreeing upon and defining AI precisely has involved considerable confusion and numerous challenges, and its definition has also seen significant evolution over the years. As early as 1950, Alan Turing defined AI as "the science and engineering of making intelligent machines, especially intelligent computer programs" (as cited by Pellicelli, 2023, p.140). More recently, the Organisation for Economic Co-operation and Development (OECD) 2024 AI definition specifies as follows:

> [a] machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment. (OECD, 2024, p. 4)

UNESCO's (2021) definition of AI as "information-processing technologies that integrate models and algorithms" provides potential overlaps with DPI. Critical and structural components of AI systems, such as open AI models, may be considered DPI, as recognised by the aforementioned UN Global Digital Compact (UN, 2024b). Moreover, AI technologies may be applied to DPI, for purposes such as detecting fraud in cash transfer programmes or enabling identity verification. Although researchers have noted the links and potential synergies between DPI and AI, there have not, to our knowledge, been systematic critical accounts of the interrelationships between DPI and AI (Nagar & Eaves, 2024).

AI sovereignty

AI sovereignty, as defined by Belli (2023), refers to a nation's capacity to "understand, muster and develop AI systems, while retaining control, agency, and, ultimately, self-determination over such systems" (2023, p. 29). Contemporary AI development depends on access to and control over resources that are highly concentrated in the hands of US-based tech firms, namely Microsoft, Google, Meta, and Amazon (AI Now Institute, 2023). These include, among others, high-quality datasets, cloud-computing infrastructure, high-performance semiconductors, and large-scale models. DPI, when implemented well, may play a critical role in creating greater autonomy and control over technological systems by nations (via the actions of state and/or non-state actors) while promoting the public good. It is through this lens that we have prepared this article, trying to understand DPI's potential for furthering AI sovereignty while proposing a structure for making sense of the relationships between DPI and AI.

It is important to note that the notion of AI sovereignty—or sovereign AI—is also increasingly being cited by Big Tech companies seeking to provide AI as an offering to governments. NVIDIA, a large tech corporation with the largest GPU market share (Yahoo Finance, 2025), defined sovereign AI as "nations' capabilities to produce artificial intelligence using its own infrastructure, data, workforce and business networks" (Lee, 2024). In NVIDIA's Q2 2025 earnings press release NVIDIA's CEO mentioned sovereign AI as a promising multibillion-dollar vertical future market (Keegan, 2024). While not using the term sovereignty, OpenAI recently announced a new initiative called "OpenAI for Countries", which pledges to support national AI development across various points of the AI value chain (including data centres and customised ChatGPT, among others) (OpenAI, 2025). While Belli's framework of AI sovereignty looks at developing autonomy at different layers of the AI stack, the use of sovereign AI as a term of art by global Big Tech companies, whose very dominance is partly what AI sovereignty seeks to challenge, has the potential to act as a counterforce.

In this article, we categorise two possible linkages—DPI for AI and AI for DPI—and present examples from India and Brazil to explain these phenomena. We then propose an analytical framework to explore these relationships further and also to situate them in the context of AI sovereignty. We then conclude by offering some insights into the potential risks of DPI-for-AI and AI-for-DPI approaches, and some questions that could be explored when developing these solutions.

2. AI for DPI

AI for DPI refers to the ways in which AI is used to enable or extend the functioning of DPI. Different kinds of AI are being and can be applied at various sites along the chain of DPI implementation. DPI is often described as the "rails" of digital society. We understand AI for DPI as a situation in which AI technologies are used in the construction of these rails. We now turn to exploration of a range of AI integrations into DPI, from the most rudimentary to the most sophisticated.

If we define AI in its broadest sense as automated decision-making (ADM) systems, it is essential to the functioning of DPI. For example, AI enables DPI for identification. One of the key operations in DPI for identification is the process of de-duplication, i.e., the determination and deletion of repeat citizen records across government databases. The determination of these repeat records takes place using ADM techniques, matching possible duplicates with each other and flagging them for deletion. Many implementations of identification DPI, such as the Indian Aadhaar system, depend on biometric authentication to verify identity. The matching of a user's fingerprint, retina, or face to a record in a database is a probabilistic process that returns a confidence percentage rather than a definitive yes/no answer (Ranganathan, 2020). As such, these algorithmic processes are rudimentary forms of AI that are ubiquitous in DPI.

AI systems are also used to automate administrative tasks in DPI. AI can be applied to detect fraud in financial transactions, supporting anti-money-laundering schemes and easier know-your-customer (KYC) procedures. It can also be used to facilitate the eligibility of beneficiaries within a given social information management system. For example, Brazil's CadUnico is a database and beneficiary identification tool that differentiates the needs of target populations according to the characteristics of each family. The entire procedure takes place through a single gateway and with a single application, storage, and governance scheme. In 2023, CadUnico was integrated with Brazil's National Social Information Registry (CNIS), a pre-existing system that supports the granting of social security benefits. AI is used to identify inconsistent and updated registries within CadUnico and the beneficiaries of social protection programmes (Grossman, 2025). We consider such relatively rudimentary uses of ADM as AI for DPI because they enable the automated processing of information at a large scale and volume.

As part of their modular, extensible, and interoperable architecture, several DPIs offer application programming interface (API) access, enabling government agencies and private companies to build on top of their "rails". Such AI systems, built on top of DPI, may be used for citizen–state interactions with the goal of improving citizens' access to public services. These forms of AI for DPI are similar to the DPI-for-AI examples discussed in the next section, in that they "plug in" to DPI. However, we analytically distinguish them from DPI for AI based on the following distinction: the goal of AI for DPI is to enhance access to DPI and deliver public value, while the goal of DPI for AI is to provide support for AI development that caters to domestic public needs or creates an enabling environment for domestic AI development.

The widespread promotion of chatbots in public service delivery (Garcia, 2024) is a key example of AI for DPI. These chatbots interact with citizens to impart knowledge about government services, with the promise of improving access. For example, India's Jugalbandi chatbot, developed by AIforBharat and Microsoft, makes information about government schemes available in vernacular Indian languages. The recently launched Hello UPI! conversational payments technology in India layers an AI conversational chatbot on top of the Unified Payments Interface (UPI) payments system (Ministry of Finance, 2023). While previously UPI needed to be accessed using an app interface, Hello UPI! uses API access to UPI to allow users to make payments using voice commands, with the AI providing automatic speech recognition, language translation, intent verification, and voice output. The goal of this feature is to increase financial inclusion by easing access to the financial system, especially for people who are not literate.

3. DPI for AI

DPI for AI comprises ways in which DPI is leveraged to advance a country's AI-related interests. Examples range from the creation, collection, and collation of large datasets for AI training to the Open Cloud Compute (OCC) system proposed by India's People+ai. DPI for AI can aid in creating access to large datasets, which is an ongoing priority for Global Southern countries seeking to build their AI sovereignty. However, such DPI-for-AI uses do not preclude the possibility of coded harms of bias facilitated through algorithmic decision-making, and they raise concerns around, inter alia, privacy, data security, compliance with local regulations of data storage, and data minimisation.

We now turn to consideration of two DPI-for-AI examples in India—the aforementioned OCC system, and the BhashaDaan function of the Bhashini language translation platform—as well as Brazilian policy directions with relevance to DPI for AI. It is important to note that the use of DPI to improve or enable AI is a nascent idea at this stage, with few rollouts and limited evidence of the public value that it generates or other success parameters. However, we anticipate that the ongoing convergence of DPI and AI in global forums necessitates this current discussion.

Market concentration has been a major strand of study and investigation across industries in both economics and law. The Sherman Act of 1890 in the US was one of the first major acts by Congress with the aim of combating anti-competitive practices, reducing monopolistic power, and preserving economic competition (Micelli, 2009). Even in the AI industry, market concentration in the hands of a few tech giants has been a cause for major concern. Market concentration, while being impacted by various factors traditionally, particularly suffers from the role of network effects in social media platforms, which is now also seen with AI companies. While network effects have various definitions in economic theory, Church, Gandal, and Krause (2002) emphasised, building on the contribution of others, that a "network effect exists when consumption benefits depend positively on the total number of consumers who purchase compatible products" (2002, p. 1). This framing of network effects applies well to generative AI companies, where the greater use of a generative AI product leads to more data collection and learning, which may lead to better model performance.

At the heart of the AI sovereignty conversation is, then, the issue of taking back some of the control that US Big Tech firms enjoy. Even in Global Northern contexts, competition authorities (e.g., in the US and the UK) have been looking at the close links between generative AI firms and their Big Tech investors. In April 2024, the Competition and Markets Authority in the UK raised concerns about an "interconnected web" of over 90 partnerships and strategic investments established by Google, Apple, Microsoft, Meta, Amazon, and NVIDIA in the market for generative AI foundation models (Kersley, 2024).

Fundamental to AI is the need for computing infrastructure. The global cloud compute market is estimated at USD500 billion annually and is expected to have a value of USD1.5 trillion by 2030 (Yahoo Finance, 2023). One of India's responses to the issue of the current bundled model of mega data centres, and diminished bargaining power for end-users when dealing with large cloud service providers, is the OCC initiative (People+ai, 2024). OCC is slated to be a network of interoperable, micro data centres that are built on common standards, which facilitates India in building its requisite computing infrastructure. The team at People+ai and EkStep Foundation, the organisations facilitating the creation of this network, suggests that through OCC, a digital infrastructure approach to AI is being taken. OCC has been framed as a DPI for compute power and is also seen as an effort to enable "faster processing, lower latency,[1] and stronger data sovereignty" (India Times, 2024). It aims to create an open network of providers, governed through protocols. The promise of OCC is presented as the ability for small businesses to discover various kinds of compute service offerings, and they have the option to select services on the basis of their requirements. As of May 2024, the OCC project had 24 partners, including Oracle, Dell, Tata, and E2E Networks (Mohanty, 2024).

1 Latency refers to the time that it takes for data to travel between the user and a server.

Bhashini is an AI-driven language translation system that aims to create accessibility to public services in different Indian languages (Fidel Softech, 2024). In addition, it hopes to create access to open-source data and efficient translation tools. The Bhashini platform is slated to be listed as a digital public good, with the aim of contributing to "linguistic accessibility and technological empowerment on a national scale" (Digital India Bhashini Division, 2024). Under Bhashini sits the project of BhashaDaan, which is an initiative to crowdsource language inputs for diverse Indian languages from citizens so as to build an open repository of data in multiple languages. In line with India's interest in creating localised datasets and improving its AI capability, the intention here is to create large datasets for Indian languages, which can be used to train AI models for use by different stakeholders. The intention of the creation of these products is listed as being the "betterment of society", which we consider below (Vikaspedia, n.d.). As suggested, the datasets created from BhashaDaan can be used for training various AI models. In this way the larger Bhashini project can also act as DPI for AI.

Brazil's Minister of Management and Public Service Innovation, Esther Dweck, recognised the role of DPI for AI during the summit of Digital Public Infrastructure Safeguards convened by the Office of the UN Secretary-General's Envoy on Technology. The Minister stated that this convergence is key for digital sovereignty, especially regarding developing autonomous capacity for a Brazilian Portuguese-trained AI model (Federal Government of Brazil, 2024a). The Brazilian AI Plan 2024–2028 allocates a total budget of BRL23 billion (equivalent to roughly USD4.5 billion), with approximately 25% directed toward AI infrastructure and development. The final version was published in June 2025 (CGEE, 2025). One-quarter of the total amount of investment is expected to be on infrastructure, with the AI Plan stating that "[w]e aim to establish Brazil as a global reference in sustainable AI infrastructure, with innovative models of energy efficiency and the responsible use of natural resources."

In addition to developing AI models in Brazilian Portuguese, the Plan also supports National Data Infrastructure, which can be seen as an example of DPI for AI. One of the pillars of the National Data Infrastructure is the consolidation of a "Sovereign Cloud" to store and manage the data generated in the country; another is the expansion of supercomputers in the country. The two major Brazilian Federal IT companies have promoted a "Government Cloud" programme, guided by the Ministry of Management and Public Services Innovation. However, the system relies on the services of mainstream cloud companies', such as Google, Oracle, Amazon, and Huawei (TI Inside, 2025). It also encompasses the creation of a unified education database for the development of applications and the use of AI in that sector. These educational digital infrastructures are relevant convergent factors within an agenda for digital sovereignty (Barbosa & Gonsales, 2024).

4. Layered integration of AI and DPI

Today, both AI and DPI development take place on a platform architecture. This architecture is characterised by API access points that enable other applications to be built on top of them in a stack (Plantin et al., 2018). Due to this platform architecture, DPI for AI and AI for DPI are integrated with each other across layers and iteratively. That is, DPI can be used as a foundation for AI, which in turn may be used to promote DPI, and vice versa. For example, as described in the previous section, the Indian state-promoted BhashaDaan linguistic database is a DPI that offers access to language data through APIs. This data is used by the Jugalbandi initiative alongside OpenAI's GPT model to provide a broad AI platform to develop vernacular language chatbots. This Jugalbandi platform, itself described as a stack, is in turn used to build chatbots that promote vernacular-language access to sectoral DPIs in law, healthcare, and government services (Jugalbandi, n.d.).

Where and how DPIs and AI relate to each other in their respective stacks is crucial in determining the outcomes of such systems. The DPI stack consists of foundational DPI for payments, identity and data exchanges, as well as sectoral DPI in health, travel, education, and other domains. The AI stack is composed of data, compute, and applications. This iterative and layered integration means that integrating AI and DPI at more foundational levels in their respective stacks has the potential to multiply impact. For example, the successful use of AI for foundational DPI, such as for identity, can increase the value of all applications built on top of it. Conversely, harms can also be multiplied: for example, someone wrongly identified by an

AI identification system may be excluded from all downstream systems. More targeted AI for DPI, such as the Hello UPI! system described in a previous section, will have fewer knock-on effects, both positive and negative.

As seen in section 3 above, DPI for AI has the potential to occupy the data (Bhashini) and compute (OCC) layers of AI development. If successful, DPI may have the potential to disrupt the hyper-centralised and consolidated power structures of AI dominated by US hyperscalers, enhancing competition and AI sovereignty (AI Now Institute, 2023). If these DPI are transparent and accountable, this could lead to more democratic AI development. We now turn to the existing and potential risks of integrating AI and DPI.

5. Existing and emerging risks of AI and DPI convergence

In both AI and DPI, there is an ongoing conversation about the risks and harms that these technologies may pose. The UN's Universal DPI Safeguards Framework, for example, categorises DPI risks into inclusion, safety, and structural vulnerability (UN, 2024a). AI risks and harms have been the subject of far more debate, and they may include various social, political, and economic harms (Acemoglu, 2021). In this section, we turn our attention to risks at the intersection of AI and DPI.

Within the Indian DPI ecosystem, one of the metrics used to display success has been the number of enrolments to systems like Aadhaar, or the number of transactions via UPI. However, a system designed for public benefit should aim to benefit those at the greatest extremes of marginalisation. This means that it is essential to ask the question as to whom such systems ultimately exclude. Efficiency has been a central issue in the discourse on public administration and the current global discourse on DPI creates an expectation of inclusion, affordability, and access. However, as has been seen in the case of various DPI rollouts in India—denial of services and welfare benefits to those without Aadhaar to compulsory enrolments for new digital health IDs under Ayushman Bharat Digital Mission (ABDM)—there continue to be significant pain points to citizens (Parsheera, 2024).

In several cases, DPI exclusions are linked to incorrect decisions made by AI systems that have, for example, denied people access to the welfare to which they have a constitutional right; AI integration that increases efficiency has the potential to exacerbate harms such as exclusion. For example, the centrality of fingerprinting algorithms in Aadhaar has led to manual labourers whose fingerprints are worn out, and who do not return a positive biometric match, to be denied access to welfare (Frayer & Khan, 2018). As with all AI systems, the use of these systems opens up questions about transparency, accountability, and redress that have not been adequately addressed. Even as these AI systems may increase neutrality and efficiency in public service delivery, they may also lead to "barriers in access to welfare or the exercise of individual rights, and the dispossession of people's claims and entitlements to varying degrees" (Joshi, 2021).

In the context of AI for DPI in Brazil, there has been limited information about the use of automated systems in major digital public infrastructures, such as PIX, the instant payment system led by the Central Bank of Brazil, and GOV.br, the digital government ecosystem that includes the country's legal digital identity scheme. Further analysis should include a thorough examination of the newly approved rights- and risks-based AI regulation by the Brazilian Senate (2023), which includes guidelines on using biometric identification for security purposes. Additionally, the Brazilian Artificial Intelligence Plan, 2024–2028, relies heavily on the national identity card database (Federal Government of Brazil, 2024b). Moreover, private banks have begun integrating AI with PIX to interpret clients' intentions and enable automated transactions, while also leveraging machine-learning to detect data patterns, without an explicit impact assessment, indicative of risky behaviour (Nubank, 2023).

In early 2024, India made commitments to invest upwards of USD1.2 billion (₹10,300 crores) over five years on AI projects, including but not limited to computing infrastructure (*Reuters*, 2024). It is evident that there is an interest in moving towards greater AI sovereignty for the nation, and in building infrastructure to that end. It is important to consider the financing models that are being used to build this infrastructure, and the extent to which the infrastructure will serve the public interest. It is also important to note that, while there have been several public announcements about initiatives at the intersection of AI and DPI, their adoption

and long-term use is unclear. For example, there have been no public updates about the aforementioned Jugalbandi since its launch in 2023 and the service's website is no longer accessible (Samdub, 2025b). DPI and AI financing must be based not on one-time costs but on lifetime costs, so as to provide clarity on the full extent of costs and also allow for benchmarking between countries (Eaves & Kedia, 2024).

Also requiring consideration are the negative environmental impacts that AI can have, such as impacts on energy and water resources, particularly given that India and Brazil both already experience extreme weather conditions. Environmental sustainability therefore must, inter alia, be factored into plans to expand compute power. Also important is cognizance of the fact that while DPI can contribute to levelling the playing field to compete with US Big Tech, it must not be allowed to generate domestic monopolies. DPI carries the risk of promoting "alt Big Tech" entities that are no more accountable to the public than foreign Big Tech (Parsheera, 2024). Careful, people-centric design and governance choices are essential to avoid this outcome.

6. Conclusion

This article has outlined an approach for making sense of the interrelationships between two key dimensions of the digital world—AI and DPI—with a focus on examples from two of the leading BRICS countries, India and Brazil. We have also explored how certain DPIs are creating technological systems that may contribute to achievement of AI sovereignty. We have categorised AI—DPI interactions as either AI for DPI or DPI for AI. Our framing has shown that AI and DPI are not independent; rather, DPI and AI are integrated at various levels via APIs, thus forming a layered structure. We have also highlighted existing and potential harms present in integrations of DPI and AI. While the discussion around DPI and AI is still somewhat nascent, it is important to begin to thoroughly investigate current gaps in public service delivery that DPI and AI can help to bridge, to foster a more concerted approach to integrating AI and DPI. Better impact evaluations are also needed, to allow for improved understanding of the successes and challenges of such approaches.

Finally, while our focus on the Indian and Brazilian cases has privileged the nation-state as level of analysis, it is important to note that individuals and communities should be the ultimate beneficiaries of digital technologies. In order to not lose sight of that goal, a layered and iterative integration of AI and DPI is required. Both AI and DPI are currently characterised by a concentration of power in the hands of a few organisations: in AI, power is largely in the hands of US Big Tech; in DPI, power is nominally in the hands of public entities, but in practice it is often held by private-sector actors. It is important to ensure that AI and DPI technologies expand, and not constrain, sovereignty—with sovereignty understood as the power to make choices about one's path—at multiple levels, from the nation to the community to the individual.

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