

Towards Market-Friendly Digital Public Infrastructure

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Koan Advisory Group is a New Delhi-based public policy consultancy. It specializes in policy and regulatory analysis in both traditional and emergent sectors and markets. For more information, please visit: <u>www.koanadvisory.com</u>

Authors Vrinda Maheshwari, Dhruv Shekhar

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contactus@koanadvisory.com | www.koanadvisory.com



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Abbreviations

AA	Account Aggregator
ABDM	Ayushman Bharat Digital Mission
AI	Artificial Intelligence
ΑΡΙ	Application Programming Interfaces
AUA	Authentication User Agencies
BBPS	Bharat Bill Payment System
DPI	Digital Public Infrastructure
DPG	Digital Public Goods
DPGA	Digital Public Goods Alliance
DEPA	Data Empowerment and Protection Architecture
eKYC	Electronic Know-your-Customer
НDМ	Health Data Management
күс	Know-your-Customer
MeitY	Ministry of Electronics and Information Technology
NPCI	National Payments Corporation of India
ONDC	Open Network for Digital Commerce
RBI	Reserve Bank of India
UIDAI	Unique Identification Authority of India
UPI	Unified Payments Interface



Introduction

Digital Public Infrastructure (DPI) enables basic functions essential to public and private service delivery, and was front and centre during India's G20 presidency.¹ The term was first used in a Co-Develop report² in 2021, which identifies three crucial categories of these digital platforms – identity, payments and data exchange – recommending greater international investment and cooperation in their development.

India is an early adopter of DPIs and has sought to increase their uptake through the G20. It made DPI a core pillar of the Digital Economy Working Group during its presidency, and has also initiated several bilateral initiatives linked to DPIs. Most recently, in June 2023, on Prime Minister Narendra Modi's state visit to the United States the two countries made a joint statement of their plan to "explore how to partner together and align...efforts to advance the development and deployment of robust DPIs, including appropriate safeguards to protect privacy, data security and intellectual property."³

DPIs are digital building blocks backed by interoperable and shared specifications or standards, and enable access to crucial public and private services at scale.⁴ The "public" in DPI refers to the capacity to further digital access and its benefits, not the nature of ownership, though it implies oversight by public authorities as needed to build public trust. DPIs are usually enabled by a defined institutional framework, and comprise structural horizontal use-cases such as digital identity, consensual data sharing and payment systems, and vertical use-cases (or "stacks") driving interventions in critical sectors such as benefits transfers, payments, healthcare, education and agriculture.

DPIs may include combinations of multiple proprietary and/or open-source solutions. This distinguishes them from digital public goods (DPGs), which are "open-source software, open data, open AI models, open standards, and open content that adhere to privacy and other applicable laws and best-practices, do no harm by design, and help attain the Sustainable Development Goals"⁵.

Building on DPIs

Sector specific applications can be built on top of DPIs, unlocking efficiencies for markets and societies. This is enabled by common standards shared across developers, and open application programming interfaces (APIs) that allow communication between different device systems. Regardless of ownership, developers can access and use DPIs only if they comply with certain minimum use restrictions. This structure has enabled the rapid adoption and expansion of technology such as the Unified Payments Interface (UPI), a fast retail payments DPI. UPI was used for930 crore transactions in June 2023, growing over 900 times in six years.⁶ This is greater than the combined digital payments volume of the US, UK, Germany and France.⁷

Private sector and governments must expand DPIs symbiotically. The private sector can promote DPI adoption and build user-facing applications on top of the infrastructure, while governments can regulate, institutionalise, and enable system-wide partnerships. For example, the government and private sector in Estonia have partnered to develop 'X-Road', a centrally managed distributed data exchange layer linking private and public e-service information systems so that they can be worked together. Other implementations include health services (such as digital record maintenance), mobility convenience (smart freight transportation) and ease of doing business (digitised taxation, banking and business registers), among others.⁸ Cybernetica, one of the technology companies that helped launch the initial iteration of X-Road in 2001, is also associated with creating Estonia's identity and i-voting solutions.⁹

Similarly, DigiLocker is a digital platform launched by the Government of India to offer citizens a secure and paperless way to store and access their important documents. This online repository lets users upload, store and share various documents and certificates digitally with verifiability built in.¹⁰ DigiLocker promotes a paperless system by eliminating the need for physical copies of documents and makes it easier for users to submit documents to access public services or for job applications or educational admissions. Extended to private sector use-cases, this functionality can reduce a lot of friction for citizens. For example, in December 2022 Google announced plans to integrate DigiLocker into the Files app in Android devices, making government documents more easily available to its large user base.¹¹

The DPI construct is explained in the "Co-Develop: Digital Public Infrastructure for an Equitable Recovery" Report,¹² released by the Rockefeller Foundation in association with the Digital Public Goods Alliance (DPGA) and the Norwegian Ministry of Foreign Affairs. The DPGA has also developed literature on the taxonomy and definitions of DPIs.¹³Local experiences are covered in the IMF Working Paper "Stacking Up the Benefits: Lessons from India's Digital Journey," where Alonso et al study India's experience of digitisation and DPIs with a special focus on improvements in public service delivery. This literature emphasises the role of DPIs in enhancing public goods and services, especially by governments, but the utility of DPIs for the private sector remains inadequately explored.

Chakravorti (Harvard Business Review)¹⁴ and Mohanty (Carnegie India Commentary)¹⁵ have written on the business case for investing in DPIs, while Eaves and Kedia (Observer Research Foundation)¹⁶ explore different financing models for these. Several important and unanswered questions on private sector participation remain, however, especially on the aspects of privacy, security, intellectual property rights, competition, conflict of interest, etc. This report seeks to address this gap.

The report focusses on the interplay between the private sector and DPIs. It will first unpack the imperative for private companies to invest in and adopt DPIs. The next section focuses on the role of foundational DPIs and illustrates how businesses have leveraged them in India. The next section addresses some key areas of concern for the private sector, and the last section offers first-principle recommendations to encourage private sector participation in the design and deployment of DPIs. Our research is based on a combination of secondary literature and primary inputs from leading experts in the field.¹⁷





Private Sector Participation Overview

Private Sector Participation Overview

Unlike traditional infrastructure (like roads) which is in the sole remit of governments, DPIs involve various additional players, including private sector corporations, civil society organisations and open source communities. Such players have important roles:

- *DPI design*: Philanthropic and private sector capital are amongst the predominant sources of investment for DPIs. Specialised funds also make early stage investments in these technologies as they impact the future of fintech and commerce. The private sector can also create DPIs when making open and interoperable digital systems. In this regard the Beckn Foundation has created the Beckn Protocol, an open and interoperable protocol for decentralised digital commerce.
- *DPI deployment*: Positive network externalities emerge only when enough players use the existing DPIs and build on top of them; the private sector plays an important role in enabling this. For example, companies like Google Pay, PhonePe and Paytm have built apps and products on top of UPI infrastructure, helping its mass adoption.

While the specific motivations of a private sector player will depend on the context, this section aims to identify some broad drivers.

Incentives to Private Sector Participation in the Development of DPIs

Government decision-making and funding cycles are often aligned differently from technology development. Advances in generative artificial intelligence, for example, significantly outpace state efforts to regulate the technology or capture derived value for its own purposes.¹⁸

Further, as only states provide public services, the quality of service provision is often no more than an afterthought.¹⁹ Consider the Aadhaar Payment Bridge System used for direct benefit transfer payments, which in the past has created confusion in these payments. For instance, the NITI Aayog in 2019 reported that 28% of maternity benefit payments under the Pradhan Mantri Vandana Yojana were made to a bank account different from that provided by the beneficiary.²⁰

There is a history of private sector contribution to creating backbone technologies that come to serve a wider public interest. For instance, credit card companies in the US and Canada collaborated to create the foundation for instant payments in North America.²¹ Card issuers (starting with department stores, and growing to include banks and credit card conglomerates) innovated with design and service offerings to reach more customers, ultimately shaping the market and building common standards of interoperability.²² The regulators arrived much later to ensure that consumer rights were protected.

The private provision of technology infrastructure can help societies and markets at large; an example of this is India Stack.²³ It refers to a collection of open APIs and disparate technology products and frameworks related to identity (Aadhaar), payments (UPI), data (DEPA Framework) and open networks (Open Credit Enablement Network). The various components are owned by different agencies.²⁴ Entities that want to build on top of India

Stack can reach out to the relevant owners or private sector intermediaries like Digio or Signzy for access to the relevant APIs or sandboxes. In such cases of private provision, governments need only intervene in cases of market failure or social risks, where private players cannot provide the range or quality of services necessary.²⁵

While private enterprise is in pursuit of profit, with public interest generally incidental, there are reasons why the private sector should be motivated to participate in the wide use of DPIs:

- Increase in addressable markets for companies: DPIs enable previously untapped communities with digital tools, and this can be a lucrative business opportunity. Moreover, companies have an incentive to participate in a growing market and not be left behind as their competitors adopt certain technologies. This was visible when payments companies began adopting UPI in their interfaces, even at the cost of adoption of their own mobile wallets.
- Improved business efficiency through cost-cutting: Common technology infrastructure can have multiplier effects. The associated efficiency gains can arise in multiple sectors. For example, Aadhaar based eKYC helped companies reduce their cost of verification, which lowers their customer acquisition cost. The reduction in some cases is significant: banks using eKYC halved their cost of compliance from 12 to 6 US cents per customer.²⁶ Likewise, insurers can combine the powers of India's digital identity DPIs through eSign, eKYC and Digilocker together with the payments DPI to "open accounts, enter contracts, disburse/collect money, and issue insurance policies directly into citizens' lockers without any physical interaction with the customer."²⁷ This can reduce payroll costs significantly.
- Access to data to improve business operations: Data is a key resource and companies are learning to leverage all available consumer behaviour data to optimise their business processes, such as improving marketing campaigns or generating more sales.²⁸ Estonia's X-Road project is used by over 900 organisations, private and public, as a secure data exchange. This DPI has evolved into a tool that connects multiple databases usefully and can transmit large datasets with ease. It can also be scaled up as new use-cases are found for it. Its scalable architecture and organisational model make X-Road exceptionally flexible, supporting various kinds of setups²⁹ It is now being adopted far beyond its initial scope, as private players around the world look to build on top of it. For instance, Japan's national energy operator Nippon Gas has worked with technology companies to build on top of X-Road to create a data exchange layer to bridge information technology gaps between its subsidiaries.³⁰ Increasingly, individuals' personal data is more often held by private corporations than governments, and they can leverage DPI systems to manage it more effectively.
- Enhanced consumer trust: DPIs enabled by the state can instil a sense of public trust in a system. For example, account aggregators licensed by the Reserve Bank of India can help consumers securely and digitally share information from one regulated financial institution to another. Not only does the system reduce friction for users, it leads to increased diversity of financial offerings. An example of this is NeoGrowth, a company that provides quick loans to the traditionally underserved banking segment of MSMEs, using Account Aggregator data instead of traditional collateral and document-heavy risk assessments.³¹ Users are likely also comfortable in the knowledge that the financial institution has relied on authentication with Aadhaar, in what is perceived to be a reputed repository of data.³²
- Innovation in product development: Interoperability requirements drive companies to collaborate to develop products and services that integrate seamlessly with those of their competitors.³³ Companies are also able to innovate on top of open-source infrastructure. An example of this is Mojaloop, an open-source payments platform to enable interoperability and financial transactions between payment platforms regardless of the infrastructure used.³⁴ It is currently in use in Uganda and Tanzania, with pilots initiated in Rwanda and Myanmar.³⁵

Encouraging Private Sector DPI innovation in India

India has made headway in enabling private sector participation in DPIs in recent years, and efforts are underway to ensure that private sector entities can increase their engagement with DPIs and also benefit from them. One such step is being planned by the Unique Identification Authority of India (UIDAI) and National Payments Corporation of India (NPCI) to set up an aggregator platform for eKYC facilities.³⁶ This will obviate the need for entities under the purview of the Securities and Exchange Bureau of India, the Reserve Bank of India, the Insurance Regulatory and Development Authority of India and pension regulators to individually register to undertake KYC using Aadhaar. It will also ensure user data is not shared with those using the platform. Nor will users have to share physical copies of their documents, which often results in misuse and data theft.³⁷

The Ministry of Electronics and Information Technology (MeitY) released the Aadhaar Authentication for Good Governance (Social Welfare, Innovation, Knowledge) Amendment Rules, 2023 for public comment in April. The proposed amendments would enable non-government organisations or private companies to use Aadhaar for a gamut of reasons, as long as they are in the public interest or promote "the ease of living".³⁸ The move highlights India's efforts to ensure foundational DPIs like digital identity are made available to private sector stakeholders to use.

The next section looks at the foundational DPIs – of identity, payments and data exchange –and highlights how the private sector has contributed to the growth of each of these.



Leveraging Foundational DPIs for Private Sector Growth



Leveraging Foundational DPIs for Private Sector Growth

India has operationalised DPIs through the India Stack,³⁹ each layer of which addresses a different need and enables the critical flows of people, money and information.⁴⁰ Multiple DPIs can complement one another and work together for a larger purpose to form digital stacks. For example, the proposed National Health Stack,⁴¹ meant to facilitate the collection of healthcare data across the country, is planned to be built on horizontal components such as digital health IDs, and would add in national health electronic registries, coverage and claims platforms, and a personal health record framework (Figure 1). The potential of such DPIs can only be realised with the active participation of private sector players: the National Digital Health Mission's creation of health identity numbers and related registries is of little practical use unless all hospitals (public and private) start using health lockers and sharing health records.

Figure 1: ABDM Digital Health Ecosystem



(Adapted from the Ayushman Bharat Digital Mission's Roll Out Literature, available here)

This section of the report takes a deeper look at each of the three foundational DPIs, and how companies in India have been able to leverage them.

Digital identity

Digital identity involves assigning a unique identifier to every individual, to facilitate the provision of efficient and cost-effective trust services through paperless and presence-less authentication. Digital identities permit an additional authentication layer for various trust services such as e-signatures, eKYC, public key infrastructure, and decentralised verifiable credentials.

Digital identification systems open up new market opportunities for private companies, which can tap into previously underserved communities, including those without traditional forms of identification, by leveraging a

reliable and standardised means of identification. This allows companies to extend their products and services to a wider consumer base, fostering market growth and greater revenue potential.⁴² These systems also enable better risk management for private companies, as they can mitigate fraud, identity theft, and other security risks by incorporating advanced authentication and verification mechanisms. This enhances trust and credibility among customers, facilitating secure transactions and reducing financial loss due to fraudulent activities.⁴³

Analysis of the Authentication User Agencies (AUA)⁴⁴ data from the UIDAI dashboard yields some insights in this regard. About17% of Aadhaar authentications are performed by private sector players. An indicative split by industry shows that sectors such as banking and public services have been availing authentication services the most(Figure 2).Other sectors can also benefit from the creative application of use-cases. The scope is enormous: for instance, there were 848 million eKYC transactions from October to December, 2022 alone.



Figure 2: AUA Dashboard on the UIDAI website

Private sector players have seen a number of benefits from leveraging identity DPIs to meet their business needs. For example, financial firms have seen the cost of onboarding clients reduce by as much as 90% owing to the reduced need for paperwork and personnel devoted to authenticating identity.⁴⁵The efficiency gains imply that the onboarding time for new customers is reduced significantly, by almost 80%,⁴⁶meaning that more clients can be signed up faster. The frictionless process also improves customer satisfaction.

The financial sector is especially well placed to leverage identify DPIs. Online discount brokerage firms such as Zerodha and UPstoxx have benefited from the implementation of Aadhaar-enabled e-KYC, which has streamlined customer onboarding by eliminating the need for physical document submission and branch visits⁴⁷. These companies have integrated Aadhaar's identification system to enhance security and accuracy and mitigate the risk of identity fraud.⁴⁸ Further, such companies have also been able to grow their customer base. Aadhaar-enabled e-KYC has played a crucial role in improving financial inclusion by letting people, especially in rural areas, easily access investment and trading accounts, expanding their reach and opening up opportunities.⁴⁹

However, data protection and privacy remain concerns with the use of digital identity DPIs. Aadhaar has seen numerous data breaches. Governments and private sector players will need to address these issues as they look to expand the scope of operation of digital identity DPIs.

Payments

DPIs for payments offer a common platform for the payer, payee and banks or other institutions to seamlessly transact or exchange financial information. For example, UPI's fast payments system facilitates peer-to-peer as well as person-to-merchant transactions between any two bank accounts. Designed on principles of interoperability, UPI is bank agnostic, vendor agnostic and provides easy and widespread access to consumers for making financial transactions. While conventional digital banking solutions do let users make paperless transactions, they have inherent inefficiencies and security risks. Traditionally, users share their financial information under multiple redundant steps such as sharing personally identifiable information to complete a transaction. This includes entering complex bank account details and codes and undergoing verification. These steps add frictions to the payment process and make it less secure. Payment DPIs like UPI address these issues by removing the need to provide complex personal information to complete a transaction. The NPCI has tried to improve the security of UPI transactions by masking sensitive financial information through a unique financial identifier.⁵⁰ Their interoperability helps further innovations by the private sector.

Millions of merchants and individual users use UPI every day, and 447 banks are part of this system.⁵¹ Growth in individual digital payment users is set to triple to 750 million in the next five years, according to NPCI Chief Executive Officer Dilip Asbe, while merchant users may double to 100 million.⁵² By 2025, digital transactions in India could amount to USD 1 trillion every year, with four of five transactions being made digitally.⁵³

UPI is widely adopted as a payments solution, benefitting from a user-friendly interface with incentives for private sector participation.⁵⁴ It is easily accessed on mobile devices, offers convenient payment initiation methods (such as aliases, QR codes, phone numbers) and ensures interoperability between financial institutions. These design choices have also helped enhance digital and financial literacy and onboard communities that previously lacked access to formal financial services. Further, UPI integration in well-established payment front-end solutions by Payments Service Providers such as Google Pay, PhonePe, and Paytm has also created positive consumer experiences and spurred adoption. This triumvirate of private players together accounted for over 96% of the transactional value generated through UPI payments in April 2023.⁵⁵

Payment gateways and aggregators have benefitted as well. The payment gateway industry is growing at a CAGR of 15%, boosted by an increase in digital payments.⁵⁶ Growth is visible on the aggregator side too, with 32 new payment aggregators approved in February 2023, and 18 more under consideration.⁵⁷ This will lead to innovation and the emergence of new business models in the sector.⁵⁸ These could take the form of data monetisation, developing B2B2C models using open APIs, and innovative partnerships and alliances to co-create and explore new use cases.

Apart from UPI, other payment platforms run by the NPCI offer a basis for developing low-cost payment solutions based on open standards and protocols. For example, the Bharat Bill Payment System (BBPS) is a common multichannel bill collection and payments platform. Consumer apps can add the functionality as a value-add for their users. If the scope of BBPS were extended to non-recurring bills (such as professional service fee, tax collection and rent payment) as proposed⁵⁹, there would be scope for new companies to fill these niches.

Payments DPIs have found the most traction around the world. Thailand's PromptPay, a leading example of a fast payment system,⁶⁰ lets people and businesses link a financial account to their ID or phone number, and helped the Thai government roll out cash assistance quicker and with greater assurance during Covid-19. Brazil's Pix is often cited in the same breath as UPI: launched in 2020, it is an instant payment system where user data is maintained in a centralised directory with the central bank of Brazil. Payment DPIs are especially interesting for their interoperability and potential to disrupt cross-border cash flows. In February 2023, for example, India and Singapore linked their digital payments systems, PayNow and UPI, to enable instant, low-cost fund transfers between the countries.⁶¹

The pervasiveness of UPI in the payments DPI has given rise to monopoly concerns.⁶² The NPCI proposed setting caps on the permitted market share of UPI apps but has extended the deadline to 2025.⁶³ The NPCI itself creates a concentration risk as it controls the entire payments DPI space. The Reserve Bank of India did invite bids for New Umbrella Entities to operate a new retail payments and settlement system in India, which would have been in competition with UPI, but this project has been put on hold for unknown reasons.

Data Exchanges

Data exchanges enable the seamless and secure flow of data between stakeholders by acting as intermediaries between government agencies, businesses, and citizens. They serve as centralised repositories of data, ensuring its availability for analysis, innovation, and decision-making processes. Data exchanges in India in the financial and healthcare domains have been provided a conceptual framework in the Data Empowerment and Protection Architecture (DEPA), developed by the Niti Aayog.⁶⁴

The DEPA framework is designed to give individuals control over their personal data while promoting innovation and fostering trust in digital systems. It is built on three key pillars: data empowerment, data privacy, and data accountability. Data empowerment involves giving individuals the ability to access, share, and use their personal data in a secure and transparent manner. Data privacy focuses on safeguarding personal information by implementing privacy safeguards and ensuring compliance with data protection laws. Data accountability emphasises the responsibility of data custodians and processors to handle data legally, maintain transparency, and be accountable for their actions.⁶⁵

An example of the DEPA framework in action is in the financial services sector in the form of the account aggregator system (Figure 3), introduced by the RBI and regulated by the Financial Stability and Development Council to facilitate the sharing of financial information between financial entities. Under DEPA, entities licensed as account aggregators(AAs) become the intermediaries between customers and financial institutions. These intermediaries let individuals consolidate their financial data from different financial institutions and view it in one place. The data may include bank accounts, mutual funds, insurance policies, pension funds, etc. At present there are 12 AAs in operation and a further 5 that have received approval in principle from the RBI and are likely to become operational within a year of receiving the NBFC AA licence.⁶⁷



Figure 3: Framework of Account Aggregator System

Adapted from "Account Aggregators: Putting the Customer In Charge", available <u>here</u>

The account aggregator (AA) system in India offers many benefits to the private sector. First, it enhances the consumer experience by giving financial institutions access to consolidated financial data, allowing them to offer personalised services, targeted product offerings, and tailored financial advice. This is likely to improve customer satisfaction and foster stronger relationships with customers.⁶⁸

Second, the AA system streamlines credit assessment for financial institutions, particularly lenders. Financial institutions can make more accurate lending decisions, better evaluate creditworthiness, and reduce default rates by obtaining consumer consent to access comprehensive financial data from multiple sources. This not only improves risk management but leads to more efficient and profitable lending practices. For instance, banks are cautious about lending to MSMEs, and these enterprises often face challenges in demonstrating their creditworthiness.⁶⁹ Recent government initiatives such as incorporating the GSTN as a financial information provider to the AA network may help change this situation.⁷⁰

The GSTN is a rich source of data on cash flows for the AA network, and will help banks and other regulated lenders extend credit to small businesses.⁷¹Such a measure along with initiatives such as the Open Credit Enablement Network, which provides a platform to connect borrowers with loan providers and enables a transparent credit scoring system for MSMEs, will help provide them credit access.⁷²Financial institutions can eliminate the need for individual data collection and verification by accessing accurate and up-to-date financial information through the AA system, resulting in reduced paperwork and manual processes and associated costs, increasing operational efficiencies and cost savings.⁷³

The AA system further promotes innovation and product development. Financial institutions can design innovative solutions tailored to specific customer needs, by leveraging the financial data made available through trusted intermediaries.⁷⁴ This fosters competition, drives product differentiation, and expands market opportunities for private sector players. Financial service providers such as the Axis Bank have already witnessed a 30% month-on-month increase in loan disbursals since going live on various account aggregator setups such as Anumati-AA, OneMoney-AA, FinViu–AA.⁷⁵ It will be interesting to compare data on the recovery rates on loans disbursed using AA information compared with those using regular means, to consider the viability of the business model, though such data is not yet available.

Another example of a data exchange network is in the healthcare domain: the Ayushman Bharat Digital Mission (ABDM), which aims to digitise the entire healthcare system in India, by creating digital health records and maintaining registries for health professionals and health facilities to create an integrated, interoperable framework.

The draft Health Data Management (HDM) Policy introduced under the ABDM describes the conceptual framework for securing individuals' health data.⁷⁶ It provides for consent aggregators (Health Information Exchange – Consent Managers) to facilitate the exchange of health information and manage consent. Consent aggregators would offer private firms the opportunity to use health data for multiple use-cases.⁷⁷ For instance, it would enable private insurance companies to design innovative insurance products, incentivise preventive care, and enable healthcare providers to create wellness programs based on reliable health data. These offerings enhance the value proposition of the private insurance and the wellness sector, driving market growth.

Further, private players can develop analytical tools and platforms toleverage the vast health data collected through these instruments, once it has been anonymised and is in compliance with domestic data protection legislation such as the Digital Personal Data Protection Act, 2023. These tools can help healthcare providers, researchers, policymakers extract meaningful insights, identify disease patterns, assess healthcare outcomes, and improve decision making. Private companies specialising in health data analytics can offer their services to clients in the healthcare sector, creating new market opportunities.

However, private hospitals have raised concerns regarding the interoperability of the NDHM, stating that if they let medical records be shared freely between hospitals, patients would not have an incentive to return to them.⁷⁸ Nor would aggregators be interested in ensuring portability of their arranged datasets. Balancing the needs of data federation with the broader public benefits that accrue from interoperable data will be an important task going forward.

Emerging Technologies

Emerging technologies like blockchain and AI will play a crucial role in the evolution of DPIs. Glimpses of these trends are visible already, and the consequent policy challenges will undoubtedly follow.

Blockchain-based digital identity solutions (known as self-sovereign identities) are proposed as a means to give individuals more control over their data, but come with significant cybersecurity concerns.⁷⁹ The decentralised and open nature of blockchains results in more complex systems with less control, and vulnerabilities can be exploited for new kinds of cyber threats such as consensus protocol threats or smart contract defects.⁸⁰

Adoption will also depend upon the extent of acceptance and prevalence of the technology. Private players building out such DPIs need to overcome the challenge of lack of interoperability as global standards for blockchain-based digital identification are still in their nascency.⁸¹Blockchain-based digital identity solutions will also need a robust and scalable infrastructure (including for example computer power and servers) to accommodate a large number of users and transactions.

Artificial intelligence (AI) algorithms are increasingly being proposed by private security companies as a tool for identity and access management.⁸² AI algorithms use machine learning to continuously analyse and evaluate user behaviour and context, and can thus be used for authentication purposes.⁸³ Furthermore banks can analyse a wide range of data points, including non-traditional data, to predict a borrower's likelihood of repaying a loan.⁸⁴

However, before such solutions can be rolled out for broader use in a country's DPI which impacts people at large, key challenges with AI will need to be addressed. These include alignment problems (the fact that people and AI tools may not share the same values) and social bias in the algorithms and underlying datasets, which may lead to discriminatory outcomes.⁸⁵ For instance, if digital identity systems are used to automate access to services or resources, biased AI algorithms may perpetuate or exacerbate inequities in beneficiary access.

This section outlined the benefits that DPIs offer the private sector. However, several concerns need to be recognised and addressed to spur private-sector and user adoption. Some of these are covered in the next section.



Key Hurdles to Private Sector Adoption



Key Hurdles to Private Sector Adoption

With the volume of international discourse focussing on DPIs and their advantages, it is tempting to take a rosy view. Given the significant impact of such technology on markets and societies, however, it is important to recognise the attendant challenges. This section of the report discusses some important areas of concern arising with private sector involvement in DPIs.

Privacy and Data Protection

Companies looking to invest in DPIs face conflicting challenges with respect to data. On one hand, a privacy-first approach to DPIs makes it harder to build new revenue pipelines involving data analytics.⁸⁶ On the other, DPIs increase data concentration risks, as they can create single points of failure. It is important for policymakers, the private sector and civil society to respond to this challenge.

Consider the example of the CoWIN data breach.⁸⁷ In June 2023, reports alleged that unauthorised access into a government database had taken place, possibly through the Covid vaccine booking service CoWIN, and that sensitive personal information tied to any mobile phone number had become available.⁸⁸ While the breach was denied by the Union government (though an arrest was made in this matter),⁸⁹ it may have undermined user trust in the application.

DPIs will need to evolve keeping in mind data-sharing requirements and contexts that can vary across jurisdictions. For instance, it was evident at the Global DPI Summit in Pune, June 2023, that adopting identity DPIs would gain better international traction if it did not involve capturing any biometric data.⁹⁰ Developed economies have also expressed reservations about a global interoperable payments DPI, as it would affect the existing financial players.⁹¹Adapting the existing solutions with such concerns in mind will be key to the increased adoption of DPIs.

Competition

Private firms invest in innovation with the expectation of returns. If they are involved in DPI systems, we expect to see complicated and interconnected incentive challenges. Vendor lock-in is one such challenge, which builds in inflexibility caused by dependence on select solution providers or infrastructures. Where there are substantial switching costs in shifting to alternatives, economic advantages accrue to incumbent technologies.⁹² This creates barriers to market entry for newer entrants, and ultimately hampers innovation. A similar problem is seen in other technological systems, such as cloud computing.⁹³

Concentration in the DPI system has competition implications as well. In fact, the lack of provider and technology neutrality was identified by several bodies tasked with implementing national ID systems as a major concern, particularly by countries in Africa that have recently introduced digital ID systems.⁹⁴

Conflict-of-interest issues are also important in the context of competition. Given the population-scale nature of the technology, it is imperative that related checks and balances are established at an early stage of DPI design. Consider the example of the National Payments Corporation of India (NPCI), a largely private organisation reaching all segments of the Indian population, but over which there is limited oversight. It runs the UPI system

and also creates the rules for it, thus regulating a segment that it itself operates in. The NPCI will tend to further its own interest when confronted with potential new entrants in the payments DPI space. In October 2022, for example, the Reserve Bank of India stalled the NPCI's plans to acquire a stake in the Open Network for Digital Commerce (ONDC) to develop its payments and settlement system, over concerns about conflict of interest.⁹⁵

Intellectual Property

Mandatory data sharing or data portability and interoperability requirements challenge the notion of exclusivity. The discourse on DPIs often focuses on open access, but there is a need to strike a balance with the protection of IP rights. Only then will the private sector be adequately incentivised to participate in building DPIs. This necessitates thoughtful deliberation from all stakeholders going forward in order to advance a balanced model: for example, a bare-minimum interoperability mandate that does not come at the cost of quality of service or platform integrity.

Mandatory data sharing regimes implicate intellectual property concerns. Under the Copyright Act, 1957, computer databases are protected as "literary works".⁹⁶ Generating value from datasets involves considerable investment of time and resources. It also requires creativity in identifying relevant data and arranging it in a manner that allows entities to derive more information and shape their strategies. In the case of *Eastern Book Company and Ors. v D.B. Modak and Anr.*⁹⁷, the Supreme Court of India laid down the "modicum of creativity" rule, which states that copyright can be assigned to work that exhibits intellectual creativity. Thus, datasets that involve a degree of creativity are protected under the Copyright Act, 1957.

In fact, this was also acknowledged by the Committee of Experts in the Revised Draft Non-Personal Data Governance Framework.⁹⁸ In this Revised Draft, the Committee noted that if an organisation exercises non-trivial skill and creativity in compiling and organising a database, it can claim copyright protection over it.⁹⁹ This is also the position under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), which India is a signatory to. Article 10(2) of TRIPS states that copyright subsisting in a compilation of data *shall be without prejudice to any copyright subsisting in the data or material itself*^{*}.¹⁰⁰

Recommendations

Thoughtful and responsible deployment of DPI is important to garnering private sector participation. Ultimately, DPIs will be strengthened only with contributions from the private sector. The private sector will bring business resources, financial discipline, risk management systems, and innovation capacity. This is to be paired with governments' public service objectives, planning horizons, and capacity to mitigate risk.¹⁰¹

As the scale and scope of DPIs expand, there will be inevitable clashes between the principles governing them. We recommend the following first-principles as a starting point for involving the private sector:

Privacy by Design: Given their wide scope and application, DPIs must include built-in technological and procedural safeguards, to ensure user privacy and user security based on international best-practices and related policy frameworks. As an example, digital identity DPIs, as detailed above, can enable many functionalities for users but need their sensitive personal data collected (which may include biometric information). The use of best-in-class cybersecurity measures (such as regular cyber risk assessments) should be required for DPIs based on a determined usage threshold, to ensure the critical and population-level data that is collected remains secure.

DPI development should focus on "privacy by design."¹⁰² This framework proactively embeds privacy into the design of IT systems and business practices, and does not rely on legal frameworks. When an entity begins developing a new product, system or process that will involve handling personal information, privacy is put at the forefront of the plan and baked into the very design.¹⁰³ The advantage of this model is it does not require an enabling legal framework to ensure privacy. Instead, principles such as purpose limitation and minimisation of the data collected are operationalised in the DPI design.

Calibrated Competition Principles: The World Bank's ID4D initiative suggests creating robust procurement procedures¹⁰⁴ that can help tackle some of the problems with vendor lock-in and system concentration. Another way to tackle these is by mandating interoperability, which can help develop efficient, sustainable and useful DPI systems.¹⁰⁵ However, interoperability brings with it the dangers of entrenching large players with a first-mover advantage who are best suited to leverage it. The challenges with interoperability as they relate to health data exchanges and global payments DPIs are highlighted earlier in this report.

A way forward is to use common standards for subsystem interoperability that would allow for a modular architecture and interoperability between devices, hardware, and software from different vendors. The ability to "plug and play" different components reduces the risk of vendor lock in and helps increase data portability across systems.¹⁰⁶ Private players may not be incentivised to create interoperable solutions, which can bring associated privacy and security risks. A certain degree of standardisation of common functionalities or standardised interfaces between interoperable products and services is necessary. Without standardisation, interoperability may create security risks, as different systems and technologies may be unable to communicate with each other securely.¹⁰⁷ Balancing these needs will be key to enabling private sector engagement with DPIs.

Additionally, international fora should be leveraged to develop codes of practice in areas such as conflict of interest between players in the DPI ecosystem or the importance of market-driven and market-based DPIs. For example, the G20 adopted High Level Principles for the Prevention and Management of Conflict of Interest in the Public Sector¹⁰⁸ in 2018: if adapted toward DPIs, these could help guide the response to the conflicts of interest that arise with India's payments DPI (as detailed earlier in the report).

Intellectual Property Protections: DPI deployments should be mindful of IP considerations. Any non-personal data governance frameworks should be voluntary in nature.

Long-Term Sustainability: The financial sustainability of DPIs is being discussed in global fora as governments work to devise viable funding mechanisms for them.¹⁰⁹ As long as they are supported by generous public budgets, DPIs can be scaled, but for them to thrive in the long run, practical operating models will have to be developed. For example, the NPCI has initiated a zero Merchant Discount Rate model for the use of UPI, where the merchant does not incur any cost for collecting payments. This is one of the reasons for its immense popularity so far, but the model cannot be sustained indefinitely.¹¹⁰

The key challenge is to figure out how to monetise DPIs so innovation and investment in the quality of service follows. There will also be adverse impacts on investments in innovation, cyber security, customer protection, and customer service unless financial independence can be built into DPIs.¹¹¹

A detailed analysis of possible financing channels or modes is outside the scope of this report, but it is important to note that accounting for lifecycle investments is critical. This is because compared to conventional infrastructure, the initial capital required may not be as high to set up digital systems, but the recurring costs of maintaining and upgrading software can be prohibitive. Collaborative solutions such as the proposed US–India Global Digital Development Partnership¹¹², which intends to bring together technology and resources from both countries to enable the development and deployment of DPIs, and the G20's One Future Alliance, or multistakeholder funds that take contributions and offer returns based on performance, offer one way forward. But these are subject to continuity in the political will to maintain such institutional partnerships. An organic, market-driven involvement of the private sector across the lifetime of a DPI – from design to scaling – can offer much needed resilience to the DPI model.

It is not possible to make private, secure, market-driven DPIs without commensurate focus on their funding. The Digital Economy Working Group¹¹³ observes that well-defined DPIs need sustainable financing, without which they run the risk of data breaches, privacy violations and violations of intellectual property rights. In this respect, an analogue can be drawn to climate financing, where mere public funding has been found inadequate to sustain preventive measures. Existing research on policy considerations that can increase private sector capital into climate research can be leveraged for DPIs as well. For example, the IMF suggests that public sector investment as well as the creation of standards and taxonomies is needed to support and incentivise private sector contributions.¹¹⁴

Additionally, the integration of emerging technologies with digital public infrastructure will bring both opportunities and challenges for communities to benefit from evolving digital solutions in the long-run.¹¹⁵ Technologies like AI and blockchain can be used in a variety of applications in DPIs. But designing such solutions is complicated by the multitude of stakeholders affected (and given the population-scale effects of DPIs, it is easy to imagine that end-user populations will be unfamiliar with these technologies) as well as the intricacy in governance mechanisms that will be needed.¹¹⁶

Overarching principles that govern the integration of emerging technologies in DPIs will have to be agreed upon by those who design and deploy DPIs. These could include:

- Stress testing: This can be done by testing emerging technology based DPIs through pilot deployments in controlled environments as a first step.
- Regulatory Compliance: Developers should work closely with regulatory bodies to establish and maintain compliance with relevant laws and regulations.¹¹⁷

• Transparency and Accountability: Clear governance frameworks should help ensure responsible use and prevent misuse.

By adhering to such principles, all the relevant stakeholders can better navigate the integration of emerging technology into DPIs while ensuring that it serves the best interests of the community as a whole.

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