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State of DPI in India

REPORT

ON THE

STATE OF DIGITAL PUBLIC INFRASTRUCTURE IN INDIA

2025

ABOUT CENTER FOR DIGITAL PUBLIC GOODS AT IIM BANGALORE

The Center for Digital Public Goods (CDPG) at IIM Bangalore is envisioned as a Global Centre of Excellence dedicated to advancing the theory and practice of Digital Public Goods (DPGs). Established in collaboration with iSPIRT, CDPG serves as a comprehensive repository of knowledge, data, and experience emerging from India's pioneering efforts in building Digital Public Infrastructure (DPI). These efforts have catalyzed innovation across sectors such as finance, healthcare, and commerce, and are increasingly influencing global discourse.

CDPG's core mission is threefold: to consolidate and document tacit and distributed knowledge on DPGs; to undertake rigorous, multi-disciplinary research evaluating the efficacy, architecture, governance, and impact of DPG initiatives; and to provide thought leadership and strategic guidance for deploying DPGs in diverse contexts. The Centre supports policy formulation, ecosystem development, and capacity building, enabling replication and adaptation of India's DPI models globally. Through its work, CDPG aims to empower stakeholders: researchers, practitioners, and policymakers, with actionable insights and frameworks for inclusive digital transformation.

ABOUT PROTEAN eGOV TECHNOLOGIES LIMITED

Protean began its journey as the first Central Securities Depository in India in 1996 and went onto transform the Indian Capital Markets. Alongside the enactment of Depositories Act, the company was incorporated in 1995 as a professionally managed organization with prestigious and marquee public sector institutions as its founding promoters, viz. National Stock Exchange Investments Ltd. (NSEIL), Industrial Development Bank of India (IDBI) and Specified Undertaking of Unit Trust of India (SUUTI).

In Nov 2023, Protean became India's first ever Digital Public Infrastructure company to be publicly listed.

Over the last 30 years, Protean has been one of the cornerstones of Digital India evolution – right from creating population scale e-governance platforms for Taxation and Social Security (Pension CRA) to enabling digital identity through foundational DPIs across Identity, Payments & Data. Aligned with India's visionary DPI framework built on open standards and protocols, Protean continues to contribute towards multisectoral Open Digital Ecosystems across e-Commerce, Transport & Mobility, Agriculture, Education & Skilling, Health and Sustainability.

PREFACE

It gives me great pleasure to present the inaugural edition of the ***State of DPI in India 2025*** report, commissioned by Protean eGov Technologies Ltd. and produced by the Center for Digital Public Goods (CDPG) at IIM Bangalore. This report marks the beginning of an annual effort to systematically document and analyse the evolution of Digital Public Infrastructure (DPI) across key sectors in India.

As the Chairperson of CDPG, I had the privilege of leading this initiative, supported by a dedicated team comprising my colleagues at the center, a current doctoral student, and an alumnus of our doctoral programme. Together, we undertook a rigorous process of stakeholder interviews, data collection from diverse sources, and analytical synthesis to arrive at the insights presented in this report.

This first edition focuses on two sectors that represent contrasting stages of DPI adoption: financial services, where DPI implementation has seen significant maturity and impact, and healthcare, where adoption is still nascent and faces structural and operational challenges. Through this dual-sector lens, we aim to highlight the transformative potential of DPI and elucidate the critical gaps that need to be addressed for inclusive and sustainable progress.

Our aspiration is for this report to become an authoritative source of data, insights, and policy guidance on India's DPI journey – tracking its status, measuring its progress, and identifying priorities for future action. We envision that each subsequent edition will expand its scope to include additional sectors, thereby offering a comprehensive view of DPI's role in shaping India's digitalization initiatives.

We take this opportunity to record our gratitude and appreciation to the leadership at Protean eGov Technologies Ltd., who not only sponsored the effort, but continued providing support as sounding boards, questioning our assumptions, validating our inferences, and shaping this report. We also thank all our respondents, key leaders in both the sectors and the government, who readily provided their time and shared their experiences and insights.

We are delighted to unveil this report at the Global Fintech Fest 2025 in Mumbai, a fitting platform that brings together innovators, policymakers, and thought leaders committed to advancing digital ecosystems. We hope this report serves as a valuable resource for all stakeholders working to build robust, inclusive, and citizen-centric digital public infrastructure in India.

Srinivasan, R
Chairperson, Center for Digital Public Goods
Indian Institute of Management Bangalore

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EXECUTIVE SUMMARY

India's digital public infrastructure (DPI) has emerged as a powerful enabler of inclusive growth, efficient governance, and private innovation. Anchored in foundational layers such as identity, payments, and consent-based data sharing, DPIs have evolved into a broad ecosystem spanning finance, healthcare, education, logistics, and commerce. Together, these interoperable and open systems form the backbone of India's digital economy, empowering citizens, enhancing transparency, and low-cost service delivery at scale. This report analyses the current state of DPI in India, with a focus on two contrasting sectors: financial services and healthcare.

Financial services demonstrate the maturity and impact of DPIs. Aadhaar has simplified verification, Unified Payments Interface (UPI) has revolutionized payments, and Account Aggregator is expanding access to credit. Private innovation on top of these public rails — from fintech apps to credit marketplaces — has delivered significant financial inclusion, reduced costs of compliance, and driven market expansion. Healthcare, in contrast, illustrates the early stages of DPI adoption. The Ayushman Bharat Digital Mission (ABDM) has established core registries for patients, professionals, and health facilities, alongside consent-based data sharing. Pilot implementations have shown promise. However, gaps remain in awareness, ecosystem readiness, and integration between public and private health providers. The path ahead requires coordinated investment, strong governance, and trust-building among patients and practitioners.

Looking across these two sectors, several lessons stand out. DPIs succeed when governance, technology, and markets align to create citizen-centric solutions. Public-private collaboration is critical. While the state seeds foundational rails, private actors bring user-centric innovation and scale. At the same time, safeguards on privacy, security, and digital inclusion are essential to build trust and ensure equitable access.

India's DPI model is now globally recognized as a blueprint for inclusive digital transformation — a "middle path" between state-driven infrastructure and market-driven innovation. Going forward, success will depend upon strengthening data governance frameworks, integrating emerging technologies like AI, ensuring digital sovereignty, and fostering cross-sector interoperability. For practitioners, the opportunity lies in leveraging DPIs to design scalable, cost-effective solutions; for policymakers, it lies in sustaining the delicate balance between enabling innovation and protecting citizens.

Report on the State of Digital Public Infrastructure in India 2025

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GLOSSARY OF ABBREVIATIONS

AA	Account Aggregator
ABDM	Ayushman Bharat Digital Mission
ABHA	Ayushman Bharat Health Account
AePS	Aadhaar-enabled Payment System
AIIMS	All India Institute of Medical Sciences
APAAR	Automated Permanent Academic Account Registry
APB	Aadhaar Payment Bridge
API	Application Programming Interfaces
ASHA	Accredited Social Health Activist
AYUSH	Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy
BBPS	Bharat Bill Payment System (now branded as Bharat Connect)
CM	Consent Managers
DBT	Direct Benefit Transfer
DEPA	Data Empowerment and Protection Architecture
DHIS2	District Health Information System 2
DIGIPIN	Digital Postal Index Number
DIKSHA	Digital Infrastructure for Knowledge Sharing
DPG	Digital Public Goods
DPI	Digital Public Infrastructure
DY-BBS	Digi Yatra Biometric Boarding System
EFT	Electronic Fund Transfer
FHIR	Fast Healthcare Interoperability Resources
FIDS	Flight Information Display System
GeM	Government e-Marketplace
GPS	Global Positioning System
GST	Goods and Services Tax
GSTN	Goods and Services Tax Network
HFR	Health Facility Registry
HIP	Health Information Provider
HIU	Health Information User
HPR	Healthcare Professionals Registry
HRP	Health Repository Provider
IATA	International Air Transport Association
IIMB	Indian Institute of Management Bangalore
iSPIRT	Indian Software Product Industry Round Table
JAM	Jan Dhan – Aadhaar – Mobile
KYC	Know Your Customer
MeitY	Ministry of Electronics and Information Technology, Govt. of India
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act, 2005
MoHFW	Ministry of Health and Family Welfare, Govt. of India
MSME	Micro, Small, and Medium Enterprises
NABL	National Accreditation Board for Testing and Calibration Laboratories
NASSCOM	National Association of Software and Service Companies
NBFC	Non-Banking Financial Company

NDHM	National Digital Health Mission
NETC	National Electronic Toll Collection
NGO	Non-Governmental Organization
NPCI	National Payments Corporation of India
OCEN	Open Credit Enablement Network
OECD	Organization for Economic Co-operation and Development
ONDC	Open Network for Digital Commerce
PFMS	Public Financial Management System
PMGKY	Pradhan Mantri Garib Kalyan Yojana
PMJDY	Pradhan Mantri Jan Dhan Yojana
PM-KISAN	Pradhan Mantri Kisan Samman Nidhi
PM-WANI	Prime Minister Wi-Fi Access Network Interface
RBI	Reserve Bank of India
RFID	Radio Frequency Identification
RTI	Right To Information
TOD	Transit-Oriented Development
UHC	Universal Health Coverage
UIDAI	Unique Identification Authority of India
ULIP	Unified Logistics Interface Platform
UNDP	United Nations Development Programme
UPI	Unified Payments Interface
VPA	Virtual Payment Address
WCAG 2.0	Web Content Accessibility Guidelines Release 2.0

INTRODUCTION

Change is all around us. Individuals, businesses, governments, and societies need to adapt quickly to keep pace. However, while the *need* for change is unquestionable, the *process* of change has left much desirable. There is a significant proportion of the world's population—often the poorest and the most vulnerable—who do not have access to the tools and resources that guide and support change. In particular, as digital technologies are increasingly becoming a part of our daily lives (and its associated economic activities), it is important to ensure that the digital world is inclusive and equitable, advancing the global development objectives—reducing poverty, increasing human capital, ensuring sustainability and creating opportunities for a better life for all[1].

The Need for Digital Public Infrastructure

In the post-pandemic years, there has been a policy shift from government-demand and public investment leading the economy in the pandemic recovery, to an explicit policy drive for private sector leadership and deregulation. Over the years, reforms have increasingly focused on ease of doing business and reducing regulatory frictions[2]. Further, human development (education, skilling, health), especially for women, rural poor, and MSMEs, has become an integrated pillar of growth strategy by 2024–25.

Digital public infrastructure (DPI) has played the perfect foil in addressing the above need for change as well as the concerns of policymakers. In particular, DPI has played a pivotal role in democratizing governance, through making citizen services inclusive and accessible to all[3]. DPI has enabled governments (along with other private stakeholders) to address urgent challenges facing society. For instance,

- Aadhaar has enabled direct benefit transfers (DBT) at population-scale. DBT has supported disbursements of 328 schemes from 56 governmental ministries.[4]
- COWIN portal has enabled monitoring, tracking and delivery of over 200 CR vaccinations across the country – including first, second, and precaution doses.[5]
- UPI has enabled private players, such as PhonePe, PayTM, Google Pay, to innovate on top of standardized open APIs controlled and governed by NPCI, a non-profit consortium of private and public sector banks.

[1] https://www.cgdev.org/publication/fast-tracking-development-building-blocks-approach-digital-public-goods, accessed 19 Sep 25
[2] Based on insights from Economic Survey of India Reports (2022 – 2025).
[3] https://www.weforum.org/stories/2021/08/4-reasons-you-should-care-about-digital-public-infrastructure/, accessed 19 Sep 25
[4] https://dbtbharat.gov.in/central-scheme/list, accessed 17 Sep 25
[5] https://www.cowin.gov.in/, accessed 17 Sep 25

The key benefits of DPI

In India, DPI is a key driver for improving governance and public sector delivery, while also ensuring better access to services for citizens across the country. Some of the benefits delivered by DPI in India are:

1. **Transparency and Accountability**: DPI enhances transparency by providing real-time access to information, eliminating bureaucratic red tape, and reducing human discretion in decision-making. This allows citizens to access government services and benefits easily, monitor government actions, and hold officials accountable for service delivery.

Examples:

- Direct Benefit Transfer (DBT): The DBT system ensures that subsidies and welfare benefits reach the right beneficiaries directly in their bank accounts. This minimizes leakages and corruption, as it removes intermediaries who may otherwise misappropriate funds.
- Public Financial Management System (PFMS) allows real-time tracking of government funds. For instance, beneficiaries of schemes like the PM-KISAN (Pradhan Mantri Kisan Samman Nidhi) can track whether money has been transferred directly to their account.
- RTI (Right to Information) Portal: Citizens can file RTI requests online, which are processed digitally, and the response is provided via an online platform. This reduces the possibility of delays or rejections and helps ensure that the public sector remains answerable.

2. **Scale at Speed**: Digital infrastructure allows governments to scale services rapidly without requiring huge physical infrastructure investments. DPI enables the government to provide services to millions of people simultaneously, overcoming barriers like geographical distance or administrative bottlenecks.

Examples

- Aadhaar: Aadhaar has been critical during the COVID-19 pandemic for identifying and delivering relief packages at a speed that would have been impossible through traditional methods. For instance, the Pradhan Mantri Garib Kalyan Yojana (PMGKY) was implemented at scale, distributing cash transfers and free food grains to millions using the Aadhaar platform
- National Digital Health Mission (NDHM)**:** The NDHM aims to digitize health records for all Indian citizens, allowing health data to be securely shared between health providers, patients, and other stakeholders. This has been a step toward quickly

scaling health services across India, especially in rural areas, and providing efficient healthcare delivery during emergencies like the pandemic.

3. **Cost Reduction:** The digitization of public services dramatically reduces administrative costs, paper-based processes, and the need for physical infrastructure, thereby lowering the overall cost of service delivery. It also leads to savings by eliminating inefficiencies, fraud, and duplication of efforts.

Examples

- UPI: The UPI (Unified Payments Interface) platform allows individuals to make instantaneous bank transfers at no cost, eliminating the need for cash handling and reducing transaction costs for both users and financial institutions.
- M-Governance**:** Mobile governance apps, such as the MyGov App, streamline access to government services, thus cutting down administrative overheads. For example, through e-District, a citizen can apply for certificates (birth, death, etc.) and track the status, reducing the need for manual verification processes and saving operational costs.

4. **Efficiency Improvement**: DPI accelerates processes, streamlines workflows, and makes service delivery more responsive. The automation of routine tasks, digitization of records, and integration across government departments all lead to faster decision-making, better coordination, and reduced processing times.

Examples

- e-Governance Platforms**:** The Goods and Services Tax Network (GSTN) has automated the entire tax system in India, from filing returns to tax collection, making tax compliance quicker and more efficient. It has reduced the time spent by businesses on tax filing and reduced human errors in assessments.
- e-Courts: e-Courts is another example where digitization has made the judicial system more efficient. Online case tracking, e-filing of petitions, and virtual hearings have improved the speed and transparency of judicial processes

5. **Financial Inclusion and Access:** DPI enhances financial inclusion by providing access to banking and financial services in remote areas, reducing barriers to entry for marginalized communities, and increasing the reach of government schemes

Example

- Jan Dhan Yojana (PMJDY)**:** The Pradhan Mantri Jan Dhan Yojana is a financial inclusion initiative that has opened over 46 crore bank accounts for rural and economically disadvantaged populations. These accounts are linked to Aadhaar and mobile

numbers, enabling people in remote areas to access direct transfers, credit, and insurance services.

6. **Empowerment and Citizen Engagement**: DPI provides platforms for citizens to access information, engage with government services, and participate in the decision-making process. This encourages accountability from both government institutions and public officials

Example

- MyGov Platform**:** The MyGov platform is an online portal where citizens can participate in governance processes by providing feedback on policies, participating in discussions, or even volunteering for public campaigns. This empowers citizens and gives them a voice in the policy-making process.

In the Indian context, DPI has provided substantial benefits in terms of transparency**,** accountability**,** efficiency**,** cost reduction**,** and scale at speed. DPI has helped streamline operations, improve service delivery, and reach underserved populations.

DPI, DPG, and building blocks approach

DPI embodies an infrastructure-based approach that uses technology to achieve societal goals through an ecosystem (comprising technology, markets and governance) built in the public interest that leverages competitive private innovation within regulatory guardrails[6]. DPI is commonly seen as a set of shared digital systems built on open standards and specifications to deliver and provide equitable access to public and private services at societal scale[7].

There are, however, two aspects that need to be satisfied for a digital technology to qualify as DPI. Firstly, mere digitization is not DPI. Digitizing existing physical processes or workflows to create a government portal or crafting enterprise architecture, though important to achieving overall outcomes, may not enable private innovation and accordingly fall short of the definition of DPI. For an initiative to operate as DPI and reach the associated scale and impact, a variety of third parties should be able to utilise the infrastructure as an intermediate building block to innovate and offer diverse final services[8].

[6] https://dea.gov.in/sites/default/files/Report of Indias G20 Task Force On Digital Public Infrastructure.pdf, accessed 19 Sep 25
[7] https://g7g20-documents.org/fileadmin/G7G20_documents/2023/G20/India/Sherpa-Track/Digital Economy Ministers/1 Ministers' Language/G20_Digital Economy Ministers Meeting_Outcome_Document_and_Chair_Summary_19082023.pdf, accessed 19 Sep 25
[8] https://dea.gov.in/sites/default/files/Report of Indias G20 Task Force On Digital Public Infrastructure.pdf, accessed 19 Sep 25

Secondly, for DPI to qualify as 'infrastructure' it should satisfy the basic principle of non-exclusivity while also offering opportunities for public value capture. In being non-exclusive (also termed as non-rivalrous in some legal parlance) the infrastructure is non-discriminatory in nature and, hence, inclusive by design. Further, the infrastructure should not only serve the public but also return social, economic, or environmental value to the public sector or community.[9]

Examples of public infrastructure from the Indian Context

Digital example: Aadhaar

- Non-exclusivity: Available to all residents of India for identity verification, without restricting access based on socio-economic status.
- Public value capture:
    - Enables financial inclusion (e.g., opening bank accounts).
    - Reduces leakages in subsidy delivery.
    - Supports innovation by allowing Fintech and other startups to build on the stack (e.g., UPI).

Physical example: Delhi Metro

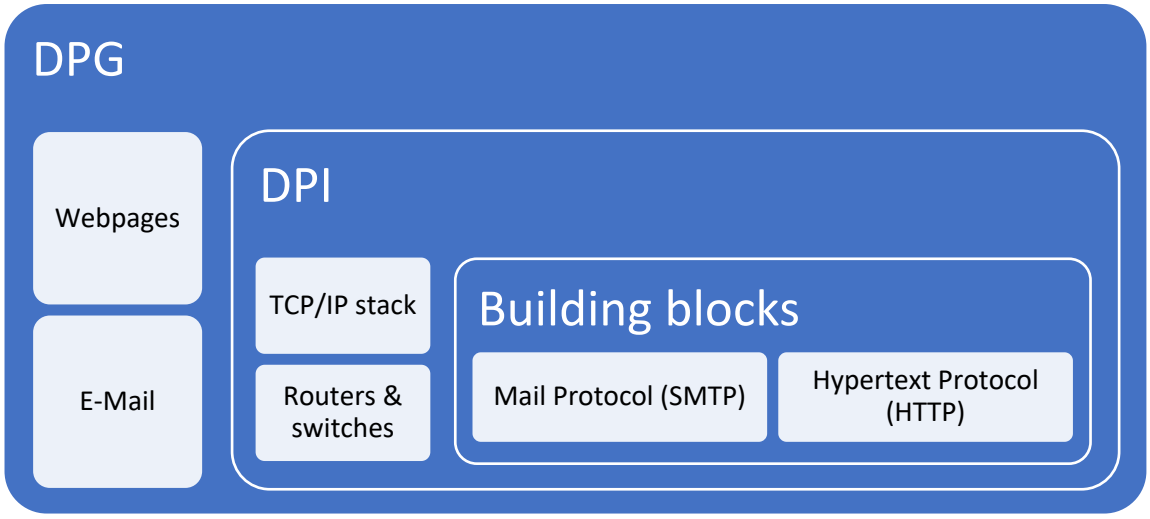
- Non-exclusivity: Open to the general public at a subsidized fare, with high accessibility across socio-economic groups.
- Public value capture:
    - Boosts economic activity around metro corridors.
    - Reduces pollution and congestion (social value).
    - Land value appreciation around stations captured through Transit-Oriented Development (TOD) policies and land monetization.

DPI is composed of interoperable digital solutions layered on top of each other, delivering increasing impact collectively rather than in isolated, vertical silos. DPI in India has followed a layered approach consisting of building blocks at the core, which have enabled the building of digital infrastructure on top of which digital public goods (DPG) have provided market-facing services.

Figure 1.1 shows the layered relationship between building blocks, DPI, and DPG using examples of common internet services. As can be seen, the transfer protocols form the building blocks on top of which infrastructure components such as the Transmission Control Protocol/Internet Protocol stacks and switches operate. These infrastructural components are then leveraged by digital services such as websites/webpages and e-mail that interface with the users.

[9] https://www.iimb.ac.in/cdpg/pdf/Monograph-Decoding-DPI.pdf, accessed 19 Sep 25

Figure 1.1: Example of building blocks approach in the Internet



Source: Authors' representation

Definitions

DPI are a set of shared, secure, and interoperable digital systems – built on open standards and governed by enabling rules (i.e., policies, regulations, institutions) – that provide a basis to deliver equitable access to all citizens and enable provision of services at population scale.

Key attributes:

- Typically assembled as a stack of interoperable **building blocks.**
- Governed with an emphasis on privacy, consent, and inclusion.
- Anchored in open standards and often public-led, enabling equitable market participation.

Building blocks are modular, reusable, interoperable software components such as software code, applications, or Application Program Interfaces (APIs) that can fulfil an atomized digital functionality and, hence, recombined across different contexts to serve different higher-level functions.

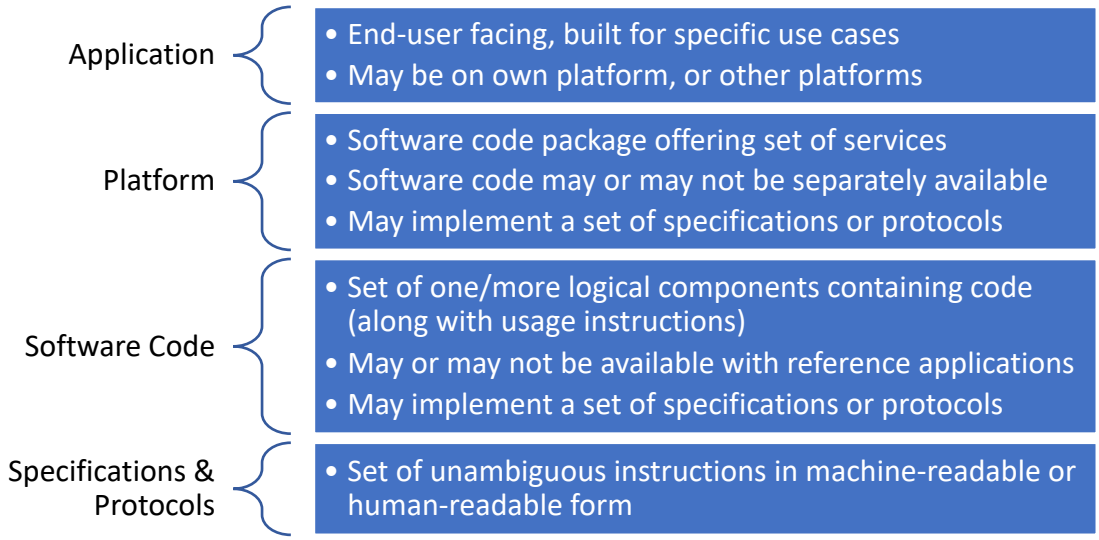
Key attributes: The blocks are autonomous, generic, interoperable, and iteratively evolvable (i.e., capable of iterative improvement)[10]

- Autonomous: Is standalone in nature.
- Generic: Reusable service or set of services, flexible to use across contexts (or use cases).

[10] https://www.digitalpublicgoods.net/blog/unpacking-concepts-definitions-digital-public-infrastructure-building-blocks-and-their-relation-to-digital-public-goods, accessed 19 Sep 25

- Interoperable: Ability to combine, connect, and interact with other building blocks through open protocol specifications.
- Iteratively evolvable: Can be improved even while being used as part of solutions.

Figure 1.2: The four kinds of digital building blocks



Source: https://www.cgdev.org/publication/fast-tracking-development-building-blocks-approach-digital-public-goods, accessed 19 Sep 25

DPGs are open-source software, open data, open AI models, open standards, or open content that adhere to privacy norms and best practices, are designed to do no harm, support SDGs, and are freely available for use, modification, and redistribution[11]. DPGs form the user-interfacing layer where services are provisioned and, typically, private players can participate through their innovative offerings.

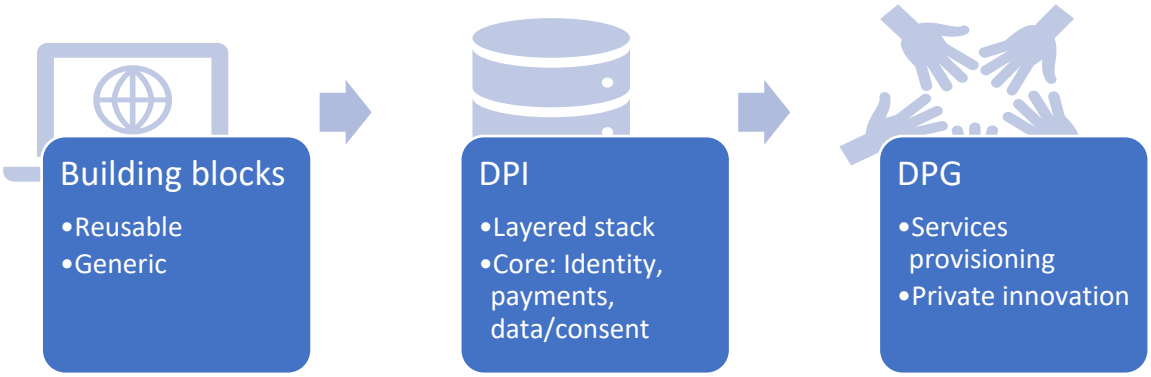
Structure of implementation

DPI is, typically, implemented as layers of interoperable "building blocks" on top of which market actors and governments deliver end-user services (often in the form of DPGs). However, this is just a fundamental perspective and can have exceptions. For instance, Beckn protocol[12] which serves as a foundational framework for constructing DPIs[13] also plays the role of a DPG insofar as it is (freely) available to other countries that may be interested in building inclusive and interoperable digital systems.

Figure 1.3 shows the typical structure of a DPI implementation, where building blocks form the underlying core and DPGs act as the user-interfacing layers at the periphery.

[11] https://www.digitalpublicgoods.net/blog/unpacking-concepts-definitions-digital-public-infrastructure-building-blocks-and-their-relation-to-digital-public-goods, accessed 19 Sep 25
[12] https://becknprotocol.io/about/, accessed 27 Sep 25
[13] An example of a DPI built on the Beckn Protocol is the Digital Energy Grid. For more information, see https://becknprotocol.io/about/, accessed 27 Sep 25

Figure 1.3: The Building Blocks Approach to DPI Implementation



Source: Authors' representation

An example of the building blocks approach is the direct benefit transfer (DBT) process: DBT is a system for transferring subsidies and benefits directly to beneficiaries' bank accounts, using the Aadhaar database for authentication. The DBT system was launched to reduce leakages, ensure the timely delivery of benefits, and promote financial inclusion.

Table 1.1 shows the series of steps involved in effecting DBT transfers. Each step is a building block that can also be employed for several other use cases. Figure 1.4 how the building blocks are enveloped by the DPI and DPGs as the core is utilized in offering manifold services.

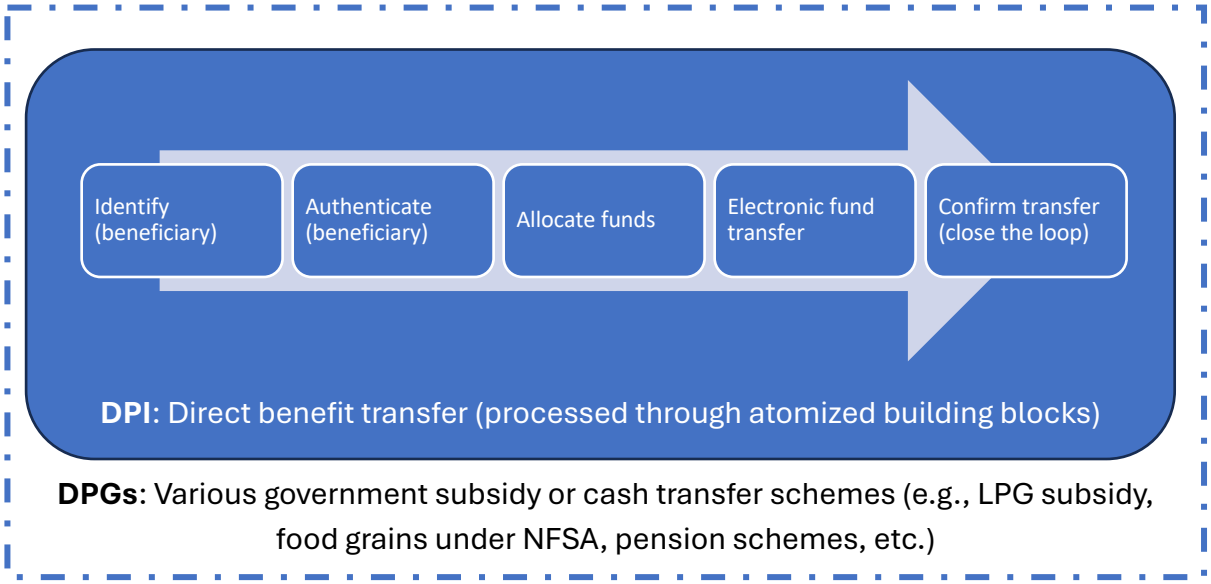
Table 1.1: Steps in DBT transfer process

Sl.	DBT activity	Details	Other use cases
1	Identification of eligible beneficiaries	Source: Registries such as Government schemes, databases like National Social Assistance Programme (NSAP), state schemes, etc.	• Creation of registries • Creation of new subsidy schemes • Reporting
2	Aadhaar authentication	Biometric authentication (fingerprint or iris scan) or OTP-based authentication using UIDAI's Aadhaar Authentication Service.	• Opening a bank account • Purchasing a new SIM card
3	Fund allocation (by the government)	Concerned government department (e.g., Ministry of Consumer Affairs for food subsidies) releases funds to the beneficiaries	• Budgetary allocations to different schemes
4	Electronic Fund Transfer (EFT) – to the beneficiary's account	Public Financial Management System (PFMS) and National Payments Corporation of India (NPCI) facilitate the transfer requests	• Bank transfers • Other payment transactions

Sl.	DBT activity	Details	Other use cases
5	Transfer confirmation	Beneficiary receives a notification of the successful transfer, through SMS from the bank or government portal	• SMS for other banking transactions • SMS for scheme advertising

Source: Author's representation. Some details sourced from https://dbtbharat.gov.in/data/documents/SOP%20for%20DBT%20Payments.pdf#:~:text=The%20DBT%20payment%20process%20is%20broken%20into,of%20Payment%20file%20&%20Payment%20to%20Beneficiary, accessed 22 Sep 25.

Figure 1.4: DPG-DPI-Building Block representation of DBT transfer process



Source: Author's representation.

India's DPI Story

The seeding of India's DPI through JAM trinity

This significant growth in India's DPI was fuelled by the launch and massive penetration of the JAM trinity – Jan Dhan bank accounts, Aadhaar enrolment, and mobile phone penetration across the length and breadth of the continent. By 2015, the JAM trinity had attained wide coverage across the country.

JAM Coverage and Penetration numbers as below:[14]

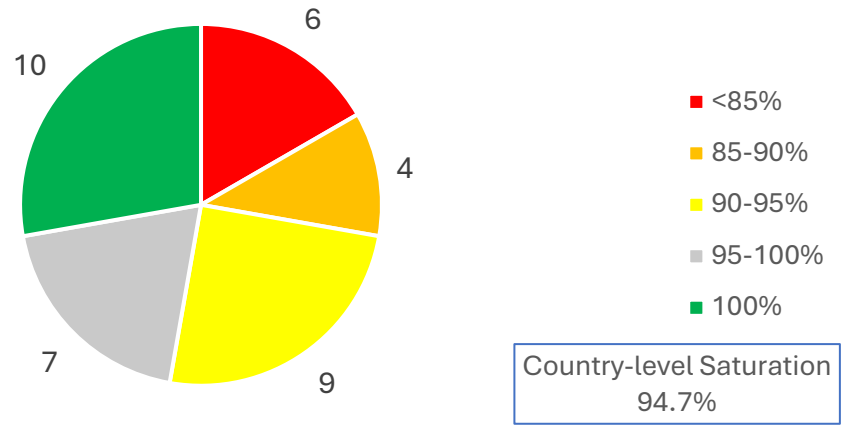
- Aadhaar
  - By end of 2015, 975 million individuals had Aadhaar – covering 75% of the population and nearly 95% of adults.

[14] Insights drawn from Economic Survey of India 2014-15.

  - Aadhaar penetration was above 90% in about one-third of states; only Nagaland (49%), Mizoram (38%), Meghalaya (3%), and Assam (2%) had <50% coverage.
- Jan Dhan Yojana (PMJDY)
  - Nearly 120 million accounts were opened in 2015 alone, averaging 3 lakh accounts per day.
  - Overall, more than 200 million accounts had been opened within months (Guinness World Record: 18 million in one week in August 2014).
- Mobile Phones
  - Mobile penetration was above 60% in almost all states, except Bihar (54%) and Assam (56%).
  - India had ~1.01 billion mobile customers and 1.4 million service posts, i.e., a ratio of 1 service point per 720 customers.

By 2019, JAM had touched critical mass and was considered an established, working system[15]. The JAM system, as an infrastructure (accounts, Aadhaar, mobile linkages + capacity), was sufficient for large scale DBT/benefit transfers. Aadhaar has gone on to become foundational for the country's DPI ecosystem, which has at its core identity, payments, and data. As of FY 2023-24, Aadhaar coverage was more or less saturated throughout most of the country, achieved through consistent growth in coverage over the years.

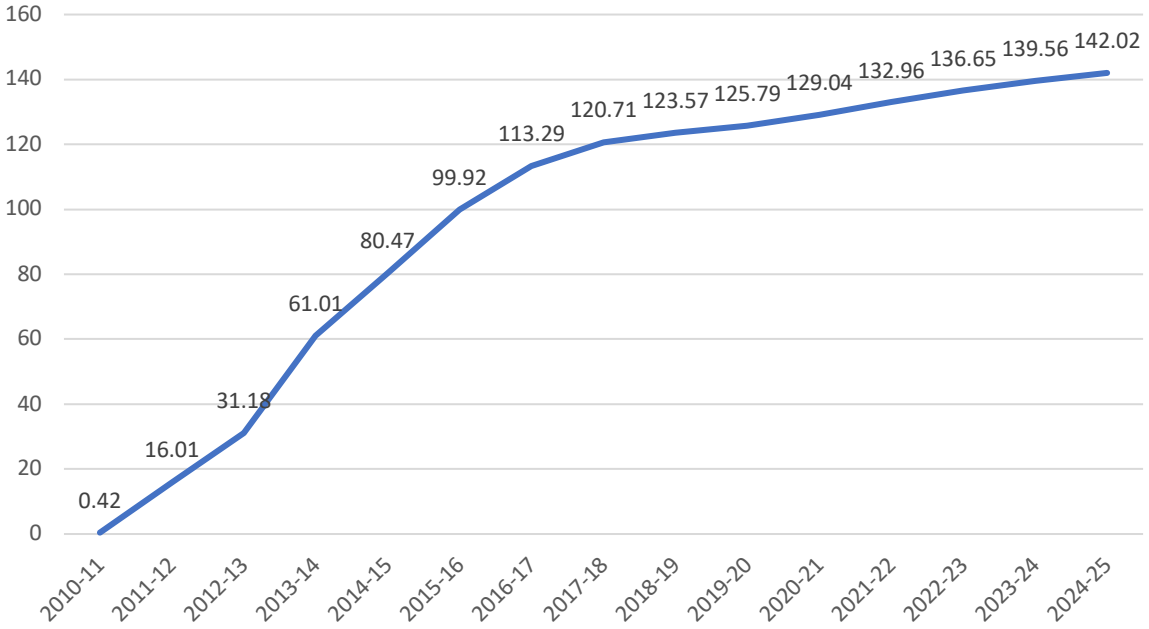
Figure 1.5: Count of states by Aadhaar saturation percentage (as on 31 Aug. 25)



Authors' representation. Source: https://uidai.gov.in/images/AadhaarSaturationReport.pdf, accessed 22 Sep 25

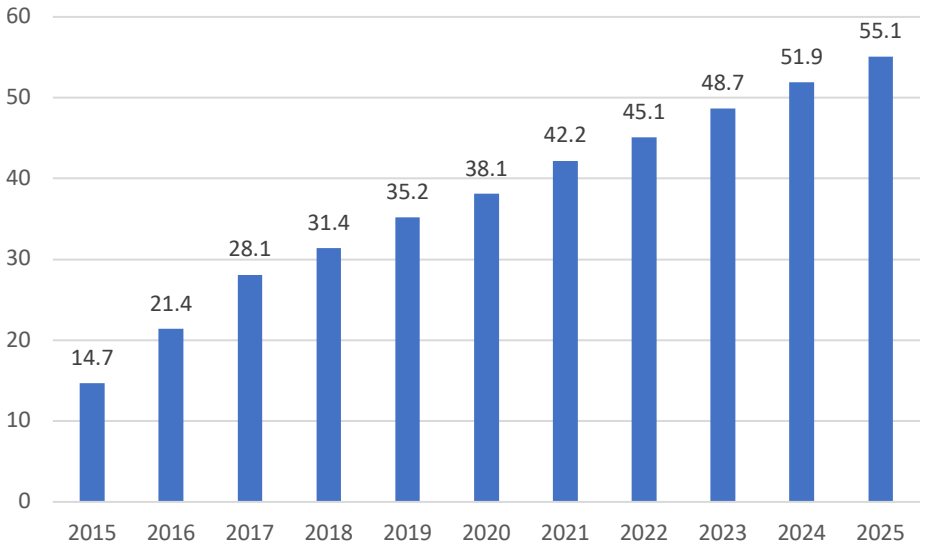
[15] Insights drawn from Economic Survey of India 2018-19.

Figure 1.6: Cumulative Aadhaar generation (in crores) since the first Aadhaar number issued in Sep 2010



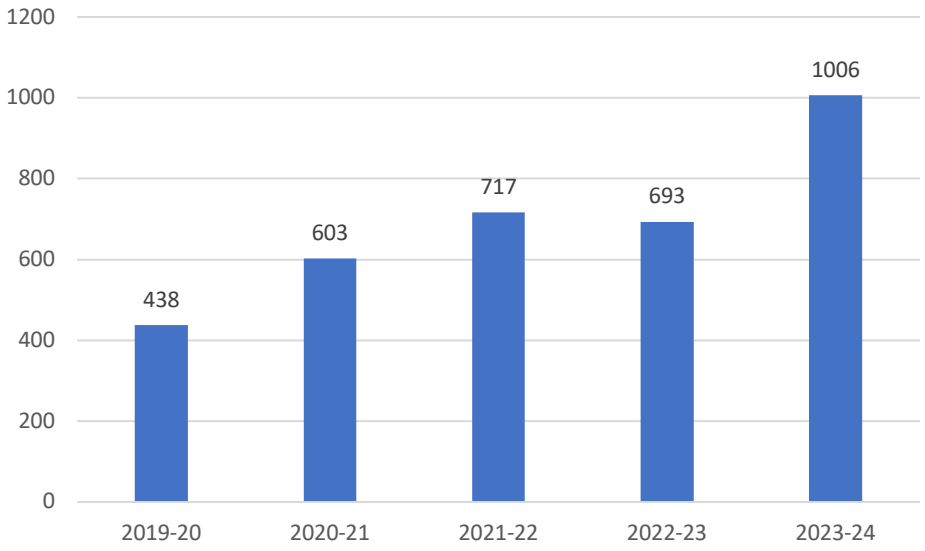
Authors' representation. Source: UIDAI Annual Report 2023-24, and https://uidai.gov.in/aadhaar_dashboard/india.php, accessed 22 Sep 25

Figure 1.7: Number of Jan Dhan accounts opened by year (cumulative, in crores)



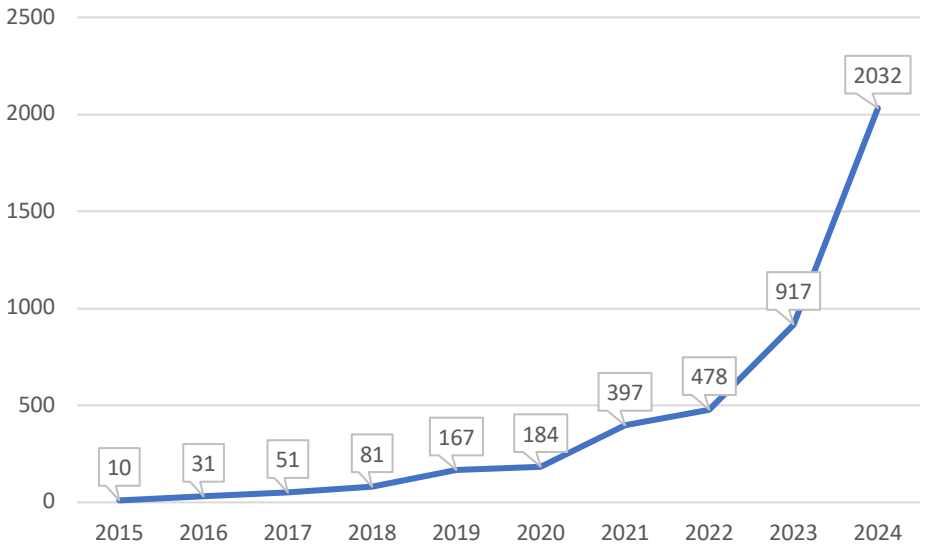
Authors' representation. Source: PMJDY archives

Figure 1.8: Volume of DBT transactions (in crores) per FY



Authors' representation. Source: dbtbharat.gov.in, accessed 17 Sep 25

Figure 1.9: Number of Digilocker enrolments by year (in lakhs)



Authors' representation. Source: Digilocker statistics

The state of India's DPI ecosystem in recent years

1. Economic Survey 2022-23

DPI and DPG were positioned as core structural reforms and growth drivers, contributing to "trust-based governance", ease of doing business, and inclusive welfare. Anchored in

the “JAM Trinity” (Jan Dhan-Aadhaar-Mobile), DPI was seen as an enabler of financial inclusion, and government service delivery.

Key Pillars and Examples

The key pillars were Aadhar, UPI, Digital Document Services and Goods and Services Tax Network (GSTN). Aadhaar was the largest unique digital identity platform, facilitating e-KYC, DBT, and underpinning virtually all welfare schemes. The Unified Payments Interface (UPI) was revolutionizing retail payments—massive adoption (billions of transactions monthly), zero-fee instant transfers and open API enabling innovation. Digital Document Services like Digilocker, e-signatures, digital land records and digital repositories for education and health. Tax compliance and formalization was facilitated with the GSTN.

Achievements and Impact

The impact on financial inclusion is represented by bank account coverages which are up from ~53% (2015-16) to 78% (2019-21). UPI’s monthly volumes outstrip most other payment networks worldwide. DBT enabled faster, targeted disbursement of welfare (food, cash, subsidies), showcasing delivery efficiency. DPI/DPG enable cost-effective e-KYC, MSME access to credit (through Account Aggregators, Trade Receivables Discounting System) and GST as a formalization tool. e-NAM for digital agri-market access enabled Digitalization in agriculture.

2. Economic Survey 2023-24

The positioning and evolving focus is ensuring that DPI is more deeply embedded as a platform for economic resilience and service delivery, not just inclusion. Digital Financial Inclusion (DFI) and FinTech’s role significantly amplified post-pandemic. Adoption of DPI, even by the informal sector, is emphasized.

The transformative framing and narrative of DPI is described as “Churning the Wheels of the Economy” with the Identity Layer, the Payments Layer, and the Data Governance Layer. With nearly 140 crore Aadhaar IDs issued, which is foundational for digital KYC, reducing costs from $12 to $0.06 per e-KYC, building the Identity Layer. The spectacular growth of the UPI which is handling ₹200 lakh crore (FY24, up from ₹0.07 lakh crore in FY17) is building the Payments Layer with penetration and interoperability that drive costless, instant, real-time payments. Account Aggregator for secure, user-consented data sharing (enabling MSME/retail credit, financial innovation by third parties) ensured the thrust on the Digital Governance Layer while DigiLocker, e-Sign and Bharat QR provide paperless access and authentication.

Microfinance and social sector delivery through Ddgital microfinance, eSwasthya, digital insurance, with Aadhaar to extend welfare and deepen coverage for women, rural poor, and SC/STs. e-NAM (National Agriculture Market) for farmers’ access, with digital record keeping and payments promotes digital agriculture.

Digital platforms are mentioned repeatedly as direct enablers of beneficiary targeting and more accurate delivery (health, pensions, scholarships, food security, etc.), thus empowering the social sector.

3. Economic Survey 2024-25

The strategic policy shift observed in the survey of 2024-25 recognizes that DPI and DPG are India's answer to the China challenge and western regulatory overreach. Digital infrastructure is explicitly cited as the “backbone” for productivity, inclusion, and competitiveness, especially as global trade headwinds increase and supply-chain resilience becomes crucial. The deregulation agenda is being met by removing friction in business, compliance, and welfare by expanding and simplifying digital rails.

The Macro-Policy Framing and Narrative

India’s resilience and future growth will depend on maintaining open, interoperable DPI/DPG ecosystems; avoiding both under-regulation (privacy risk/exclusion) and over-regulation (stifling innovation, UPI cost over-run) and a rapid rollout in states, rural and small-town India, and new sectors (Health, Agri, MSME, Supply Chain, Skilling, Climate information).

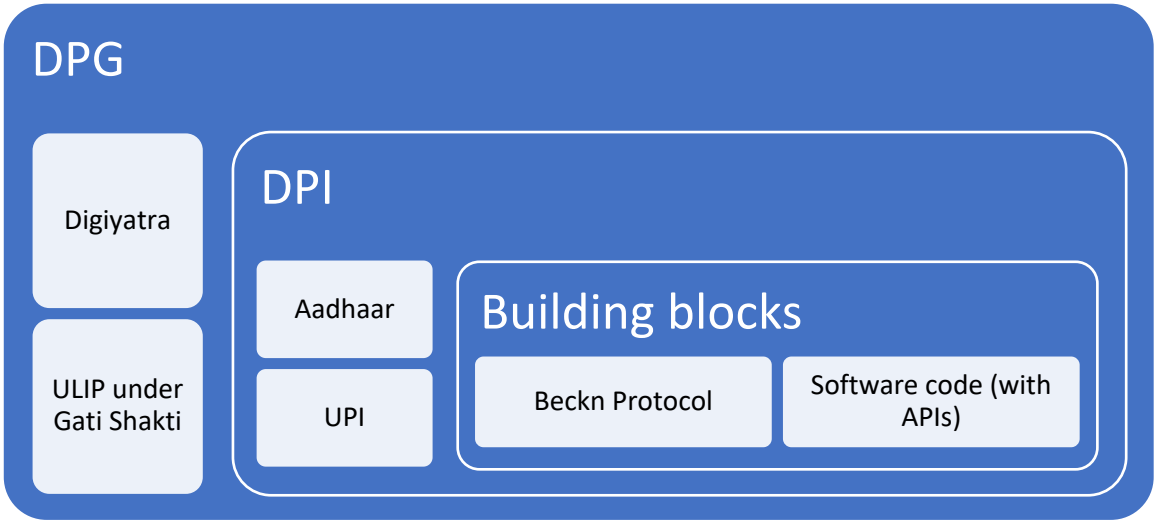
Table 1.2: Comparative Table – DPI/DPG Evolution

Year	Strategic Framing	Economic Role	Sectoral Touchpoints	Global Dimension
2022-23	Foundational inclusion infra	Cut leakages, enable last-mile delivery	MSME credit, agriculture subsidies, DBT, payments	India Stack model shared
2023-24	Productivity multiplier	Enhance credit, commerce, skills; spur SMEs	ONDC, e-NAM, DIKSHA, health stack	DPI diplomacy under G20
2024-25	Deregulation + competitiveness tool	Reduce compliance cost, enable AI-ready infra	MSME onboarding, supply chain DPI, health/skills registries	DPI-as-a-Service export

Benefits of DPI through the Building Blocks Approach

India’s DPI, by incorporating the building blocks approach, has demonstrated benefits of scale and speed. Digiyatra and ULIP (under Gati Shakti) are two examples of DPGs that have been built using building blocks methodology, and have delivered several benefits to citizens and businesses.

Figure 1.10: Building blocks approach to India's DPI



Source: Author's own representation

Table 1.3: Examples of the DPI benefits (realized through the DPG interfaces)

DPG	Underlying DPI	User Benefits
Digiyatra – A digital initiative promoted by the Ministry of Civil Aviation that aims to provide a paperless, contactless, and fast airport travel experience using facial biometrics.	**Aadhaar** (for verifiable credentials) **DY-BBS** (biometric boarding system at Indian airports) **IATA Resolutions** (for e-ticket or boarding pass format recognition) **Airline DCS** (departure management interface with the airlines) **FIDS** (Real-time flight information display system) **WCAG 2.0** (Guidelines for mobile applications)	• Paperless travel – Eliminates the need to carry physical tickets or boarding passes. Saves paper, avoids misplacing of tickets. • Seamless experience – Reduces wait times at security checkpoints and immigration clearances • Enhanced security through biometric facial recognition • Contactless journey through the airport • Improved crowd management and resource planning for airport personnel and airlines staff • Promoting environmental sustainability through paperless processing
ULIP under Gati Shakti –	**GPS** (for location tracking)	• Integrates 33+ government systems across 10

DPG	Underlying DPI	User Benefits
ULIP (Unified Logistics Interface Platform) is a digital initiative by the Department for Promotion of Industry and Internal Trade to act a centralized, cloud-based gateway for logistics data.	**RFID** technology (for goods identification and monitoring) **GST** network (for e-way bills) **APIs** of various ministries connected with shipping and transportation[16] **IIMB** (Carbon Emission Calculator)	ministries, offering API-based access for businesses • Access to services like end-to-end cargo tracking, warehousing, and transportation • Democratizes logistics information, increases transparency, and reducing costs.

Source: Authors' analysis and representation. Some details sourced from https://www.civilaviation.gov.in/sites/default/files/2023-07/Digi%20Yatra%20Policy%20%28DIGI%20YATRA%29.pdf (for Digiyatra) and https://goulip.in/home (for ULIP under Gati Shakti), both portals access 22 Sep 25

India's DPI is a Middle Way Between Public and Private

Beginning with the foundational identity platform Aadhaar, India has steadily developed an integrated digital ecosystem that enables secure identity verification, frictionless payments, trusted data exchange, and inclusive access to government and market-facing services. This approach has not only accelerated digital adoption within the country but has also demonstrated how technology, when designed as a public utility, can drive inclusion, innovation, and efficiency at population scale.

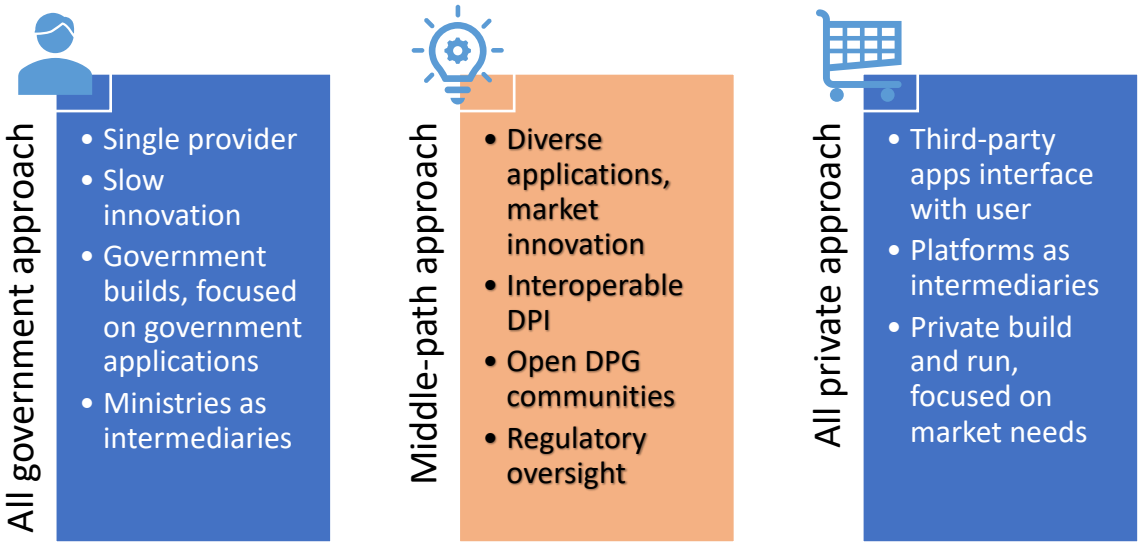
The story of India's DPI is, in many ways, the story of digital nation-building at scale. By combining policy vision, technological innovation, and collaborative governance, India has created building blocks such as Aadhaar (identity), UPI (payments), DigiLocker (digital credentials), and Account Aggregator (data empowerment), which together enable citizens, businesses, and the state to interact seamlessly. These digital layers form the backbone of what is increasingly seen as a global model for inclusive digital transformation—one that reduces barriers to participation in the digital economy, empowers individuals with greater control over their data, and fosters a thriving ecosystem of public and private innovation.

The DPI approach provides a compelling 'middle way' between a purely public or purely private approach. In doing so, India's DPI has served as a bridge between regulators' drive

[16] Systems such as Port Community System (PCS), Terminal Operations System (TOS), Inland Waterways Authority of India (IWAI), Air Cargo message exchange system (ACMES), Air Cargo Community System (ACCS), AAI Cargo Logistics and Allied Services (AAICLAS), Vahan, Sarathi, Indian Customs Electronic Gateway (ICEGATE), NICDC Logistics Data Services (NLDS) – LDB, Director General of Foreign Trade (DGFT), Freight Operations Information System (FOFOIS).

for effective governance, and private sector's hunger for innovation and diverse market application.

Figure 1.11: India's DPI follows a "middle-path" approach

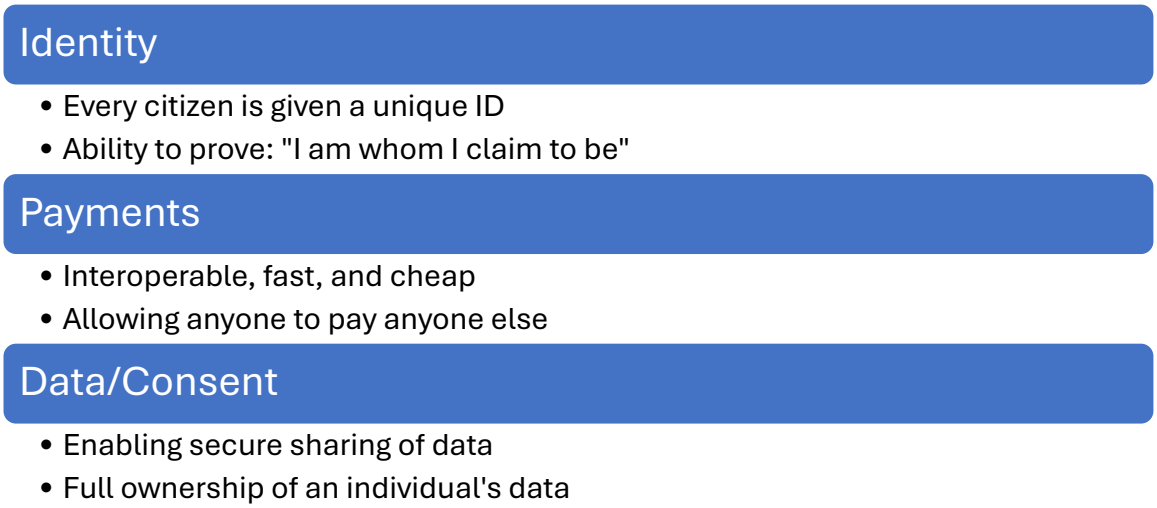


Authors' representation. Source: https://dea.gov.in/sites/default/files/Report of Indias G20 Task Force On Digital Public Infrastructure.pdf, accessed 19 Sep 25

Structure of India's DPI – Stack and rails

India's DPI is globally recognized for its scale, modular design, and public-good approach. Its structure is best understood using the concept of "Digital Stacks" and "Digital Rails."

Figure 1.12: The three-layered stack at the heart of India's DPI



Source: Authors' representation

The digital stack model divides DPI into layers that can work independently but are designed to interoperate.

- **Identity layer**: This is the foundational layer that provides unique digital identity to individuals.
    - Key component: Aadhaar
        - A 12-digit unique identity number.
        - Uses biometric + demographic data.
        - Enables KYC (Know Your Customer) and authentication.
        - APIs Provided: eKYC, Authentication, eSign, Digital Locker.

- **Payments layer**: This provides interoperable, real-time, and low-cost digital payments infrastructure.
    - Key component: UPI
        - Interoperable across banks and apps.
        - Uses mobile number and VPA (Virtual Payment Address)
    - Other components
        - Aadhaar Enabled Payment System (AePS)
        - BBPS (Bharat Bill Payment System or Bharat Connect)
        - RuPay (domestic card scheme)
        - FASTag (for toll payments)

- **Data layer**: Provides mechanisms for secure data sharing, consent management, and privacy protection.
    - Key component: Account Aggregator (AA).
        - Federated data-sharing model.
        - Enables user-consented data transfer across financial and other institutions.
        - Promotes data empowerment (vs. data extraction).
    - Key component: Data Empowerment and Protection Architecture (DEPA)
        - Lays out principles of consent, privacy, and portability.

Digital Rails: The infrastructure that enables the stack

Rails refer to the underlying infrastructure and standards that all actors (public and private) can use to build services. These include:

- APIs (Application Programming Interfaces)
    - APIs are the fundamental "rails" that enable access to the identity, payment, and data layers.
    - Built and maintained by organizations like UIDAI, NPCI, RBI, MeitY, etc.
- Open Standards

    - Protocols and data schemas are open, allowing interoperability and reducing vendor lock-in.
    - Examples:
        - Beckn Protocol for e-commerce (ONDC)
        - OCEN (Open Credit Enablement Network) for credit delivery
- Consent Architecture
    - Consent managers (CMs) act as intermediaries for managing permissions for data sharing
    - Consent is granular, revocable, and auditable

The set of DPIs in the country can be categorised into five main groups which fall within and across multiple sectors[17]

- Verifiable Identity and Registries (e.g., Aadhaar)
- Data Sharing, Credentials, and Open Models (e.g., Digilocker)
- Signatures and Consent (e.g., eSign, AA, DEPA)
- Discovery and Fulfilment networks (e.g., ONDC)
- Payments (e.g., UPI, BBPS, APB, AePS)

India's DPI follows a co-creation model as shown in Table 1.4:

Table 1.4: Co-creation model

Role	Entities Involved
Governance	Government of India (MeitY, RBI, NPCI, UIDAI, etc.)
Infrastructure	Public institutions (e.g., NPCI, DigiLocker), open protocols
Service Delivery	FinTechs, banks, startups, state governments, etc.
Development	Collaboration with industry bodies, open-source communities (e.g., iSPIRT)

The co-creation model has provided a fertile ground for private sector participation. Though the government gets credit for taking initiative and seeding foundational services (like Aadhaar and UPI), several actors outside the government have played key roles in implementation of the DPI/DPG components, as well as enhanced the potential of the DPGs through their innovative power. The current state of DPI in India is, thus, government-driven, and private-sector-energized. The private sector has contributed in two distinct ways:

[17] https://dea.gov.in/sites/default/files/Report of Indias G20 Task Force On Digital Public Infrastructure.pdf, accessed 19 Sep 25

1. Implementation of DPI/DPG Components (building and maintaining infrastructure, enabling standards, contributing to codebases). These are instances where private actors have been part of building or operationalizing the infrastructure itself.

    - **UIDAI's Aadhaar Ecosystem Partners**: Private enrollment agencies, biometric device manufacturers (e.g., Morpho, Mantra Softech, IDEMIA) supplied tech, devices, and services that made Aadhaar operational at scale.
    - **NPCI's UPI System Development**: While NPCI is a not-for-profit consortium, it is jointly owned by a mix of public and private banks. Several private banks (HDFC, ICICI, Axis) and payment companies contributed to UPI's implementation and scaling.
    - **Account Aggregator Framework (AA)**: Technology Service Providers (TSPs) such as Finvu, CAMS Finserv, and Sahamati (an industry alliance) built the rails for consent-driven data sharing. These are largely private entities ensuring the AA ecosystem runs.
    - **FASTag / NETC**: NPCI partnered with private tag issuers, banks, and toll operators for seamless RFID-enabled tolling.
    - **Open Network for Digital Commerce (ONDC)**: Private tech players (Infosys, Microsoft, Paytm, PhonePe) contributed to developing the open protocols and operationalizing the network.
    - **Open Credit Enablement Network (OCEN)**: Fintechs like Setu (acquired by Pine Labs) worked closely with iSPIRT to develop and pilot OCEN standards for embedded credit.

2. Enhancing/leveraging DPI through innovation (creating products, services, and business models on top of DPIs). These are instances where private players took the base DPI and built innovative services/products on top.

    - **UPI-based Innovations**:
        - PhonePe, Google Pay, and Paytm built user-friendly interfaces that massively boosted adoption.
        - Startups like BharatPe innovated with QR codes for merchants, driving small-business digitization.
    - **Aadhaar-enabled Services**:
        - eKYC used by telecom providers (e.g., Jio, Airtel) drastically reduced SIM activation times.
        - Fintech lenders use Aadhaar eKYC + DigiLocker to provide instant, paperless loans.
    - **Aadhaar-enabled Payment System (AePS)**: Fintechs and BC agents enabled rural cash-in/cash-out services, banking the unbanked.
    - **DigiLocker Integrations**: Private educational institutes, insurance companies, and banks integrated DigiLocker APIs for KYC and document verification.

- **FASTag Ecosystem Expansion**: Beyond tolls, fintechs like Paytm and PhonePe extended FASTag into fuel payments, parking, and logistics fleet management.
- **ONDC-based Innovations**: Startups and e-commerce players are piloting ONDC-based marketplaces for groceries, fashion, and mobility — offering alternatives to Amazon/Flipkart models.
- **Health DPI (ABDM)**: Healthtech startups like Eka Care, DRiefcase, and Practo are integrating with Ayushman Bharat Digital Mission registries and APIs to create patient apps, record-linkage solutions, and digital health lockers.
- **AA/OCEN in Fintech**: Players like Cred, Moneyview, and Lendingkart are starting to use AA and OCEN protocols to underwrite credit for underserved consumers and MSMEs.

The big picture – India's DPI ecosystem

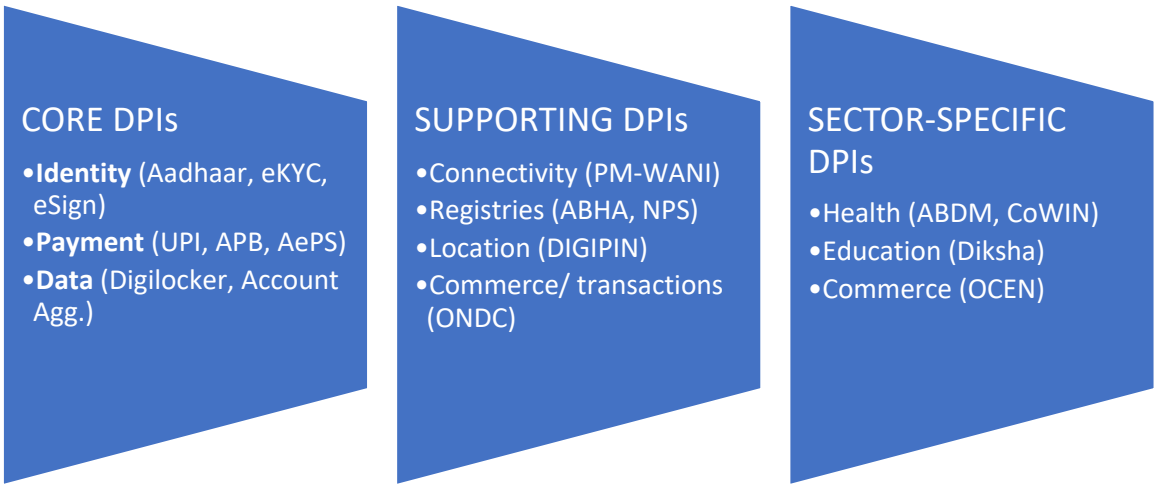
Over the course of past two decades, India has developed and deployed a wide spectrum of DPIs. Establishing the foundational identity DPI (Aadhaar) has created a fertile ground for several DPIs that were developed over the years through the co-creation of public and private efforts. Table 1.5 is a non-exhaustive list of some of the common DPIs that have found traction in the country's DPI ecosystem.

Table 1.5: India's DPIs

DPI	Launched	Brief Description
Aadhaar (UIDAI)	2009	Unique digital identity, with biometrics + demographics; used for authentication and verification.
eKYC / Aadhaar-based Authentication / eSign	Gradually added after Aadhaar	Allows fast verification of identity, enables legally valid digital signature.
Aadhaar Enabled Payment System (AePS)	2011	System for bank-account based payments via Aadhaar authentication
Aadhaar Payment Bridge (APB)	2013	System to route government payments/ subsidies into bank accounts
Digilocker	2015	System to store, access, share digitally-signed documents (e.g. certificates, licenses, etc.).
Unified Payments Interface (UPI)	2016	System for instant real-time payments over mobile / digital rails
Government e-Marketplace (GeM)	2016	Procurement platform for government departments to procure goods / services
Goods and Services Tax Network (GSTN)	2017	System for filing goods and services tax, e-way bills, etc.; enables tax compliance
Diksha / National Digital Education Architecture	2017 onwards	System for delivering educational content, conducting assessments, etc.

DPI	Launched	Brief Description
Open Credit Enablement Network (OCEN)	2020	System for credit distribution, enabling financial institutions and lenders to connect and offer financial products to MSMEs
CoWIN	2020	Platform for managing vaccine registration, delivery, certificates of vaccination
Ayushman Bharat Digital Mission (ABDM)	Pilot 2020, Launch 2021	Provides Health ID ("ABHA"), registries of health professionals and facilities, interoperable health records, patient consent mechanisms
Account Aggregator framework (AA)	2021	Enables consent-based sharing of financial data (and potentially other regulated data) across institutions, with control by the user.
Data Empowerment & Protection Architecture (DEPA)	2021	Enables consented data sharing; underlies the Account Aggregator etc.
PM-WANI (Public Wi-Fi Access Network Interface)	2021	Infrastructure for public/shared internet access
ONDC (Open Network for Digital Commerce)	2022	Open network for discovery & fulfilment across e-commerce; letting smaller sellers connect to buyers without dependence on big platforms.
DIGIPIN / Digital Postal Index Number	2025	A geo-coded, grid-based digital address system: each address gets a unique alphanumeric code tied to precise map coordinates

Figure 1.13: Broad mapping of India's DPIs: core, supporting, and sector-specific domains



Source: Authors' representation

The above DPIs have been selected on the basis of their significant / potential impact on society. While Aadhaar, UPI, and Account Aggregator (or DEPA) are viewed as foundational DPIs, in the sense that they represent the core elements of the "India Stack",[18] many other DPIs have been built around the core either as supporting DPIs, or with the aim of advancing sector-specific digitalization objectives.

Evaluation of India's DPI

DPI is now a core pillar of India's growth strategy, moving beyond identity and payments into health, education, logistics, and data empowerment. It is seen as both a domestic inclusion tool and a global export model. DPI is being positioned as a pillar of *Amrit Kaal* growth strategy, with emphasis on expanding into agriculture (Agri-stack), logistics (ULIP), and education (DIKSHA)[19].

A three-level framework is proposed to evaluate the state of DPIs in the country. This framework has been built by reviewing maturity and lifecycle framework in several sources as listed below:

- **UNDP**: Accelerating the SDGs through Digital Public Infrastructure[20] – Includes a maturity stage framework for DPI across multiple dimensions.
- **OECD**: Digital Public Infrastructure for Digital Governments (2024)[21] – Discusses enablers of DPI success (governance, funding, safeguards, public-private collaboration).
- **World Bank**: Digital Public Infrastructure and Development: A World Bank Group Approach[22] – Emphasises foundational digital building blocks, interoperability, and conditions for leverage through adoption and cross-sectoral use.
- **Global Solutions Initiative**: A Framework for Digital Public Infrastructure to Scale Transformation[23] – Policy brief highlighting build, adopt, and implement phases.
- **NASSCOM**: India's DPI Maturity Index[24] – Classifies Indian DPIs as nascent, budding, or mature.

[18] More about India Stack available at https://indiastack.org/, accessed 27 Sep 25.
[19] Insights drawn from Economic Survey of India 2023-24
[20] https://www.undp.org/publications/accelerating-sdgs-through-digital-public-infrastructure-compendium-potential-digital-public-infrastructure, accessed 17 Sep 25
[21] https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/12/digital-public-infrastructure-for-digital-governments_11fe17d9/ff525dc8-en.pdf, accessed 17 Sep 25
[22] https://openknowledge.worldbank.org/entities/publication/cca2963e-27bf-4dbb-aa5a-24a0ffc92ed9, accessed 18 Sep 25
[23] https://www.global-solutions-initiative.org/publication/a-framework-for-digital-public-infrastructure-to-scale-transformation/, accessed 18 Sep 25
[24] https://community.nasscom.in/sites/default/files/publicreport/Digital%20Public%20Infrastructure%2022-2-2024_compressed.pdf, accessed 18 Sep 25

- **Universal DPI Safeguards Framework**[25] – Defines a life-cycle: Conception, Strategy, Development, Deployment, Operations.

Based on the above sources, we suggest a mapping of three stages, as suggested below:

- **Implementation** – DPI under development / pilots / early use cases
- **Adoption** – DPI rolled out; beginning to gain traction
- **Leverage** – Multiple use cases; widespread application

The three stages correspond with our reviewed sources as shown in Table 1.6:

Table 1.6: Correspondence of the three stages with literature

Our Stage	Closest Match in Sources	Key Indicators
Implementation	Conception, Design, Development (UNDP, World Bank, Safeguards)	Pilot projects, legal foundations, early users
Adoption	Deployment, Uptake, Use (World Bank, UNDP, OECD)	User uptake, penetration, service integration, measurable impact
Leverage	Scale, Reuse, Ecosystem Leveraging (World Bank, OECD)	Multiple use-cases, widespread adoption, private sector building, ecosystem maturity

Table 1.7 is an analysis of some of India's DPIs using our suggested three-level evaluation scale:

Table 1.7: Evaluation of various DPIs using our framework

DPI	Assigned Stage	Rationale
Aadhaar	Leverage	It's at very high scale (over 1.38 billion numbers issued), used across very many use-cases: welfare, identification, e-KYC etc.
UPI	Leverage	Huge uptake, large transaction volumes, widely used by individuals, merchants; de facto standard payment infrastructure in India.
Digilocker	Leverage	Significant user base (37+ crore users), many documents, many issuers; usage is strong but whether all potential use-cases are fully realized could imply still some room to grow.
DIKSHA	Adoption	Many learning sessions, enrolments etc. Wide reach in education sector; but perhaps narrower in types of use-cases (mainly education/learning) as compared to something like UPI or Aadhaar.

[25] https://www.dpi-safeguards.org/framework, accessed 18 Sep 25

DPI	Assigned Stage	Rationale
Account Aggregator (AA)	Adoption	AA has crossed 100 million consents, growing fast; but still early in terms of full ecosystem leveraging, and adoption by non-financial domains.
ONDC	Adoption	Rapid growth in transactions, many sellers, many cities; but still newer, UX issues, still scaling, still building out trust & consistent quality.
ABDM / Health ID etc.)	Implementation / Early Adoption	Though officially launched, piloted in some territories, building up registration, building registries, standards, etc. The ecosystem is still being built, though growing.

Conclusion

Everett Rogers, in his seminal work on how innovations are adopted, observed that innovation diffusion is a social process, influenced by the characteristics of the innovation, communication channels, adopter categories, and the broader social system[26]. According to Rogers, adoption happens progressively, not instantly, and is shaped by both individual perceptions and social dynamics.

Figure 1.14: Rogers' research with hybrid seed corn

Rogers' research showed how **Iowa farmers** adopted **hybrid seed corn** in the 1930s–1940s.

- **Innovation**: Hybrid seed corn increased yields significantly compared to traditional seeds.
- **Diffusion pattern**: Adoption took over a decade, with:
  - **Innovators** trying the seed early, despite risks and uncertainty.
  - **Early adopters** (respected local farmers) influencing their peers.
  - **Late adopters** and **laggards** waiting until nearly all others had adopted, often due to skepticism or cost.
- **Finding:** Peer influence and interpersonal networks (especially neighbor farmers) were more persuasive than mass communication in driving adoption.

Rogers observed the adoption of an innovation occurs over time through five stages:

- Knowledge – The individual (or decision-making unit) is exposed to the innovation and gains an understanding of how it works.
- Persuasion – The individual forms a favourable or unfavourable attitude toward the innovation.

[26] Everett M. Rogers. 1962. Diffusion of Innovations. NY: Free Press of Glencoe.

- Decision – The individual engages in activities that lead to a choice to adopt or reject the innovation.
- Implementation – The innovation is put into use.
- Confirmation – The individual seeks reinforcement of the adoption decision but may reverse the decision if exposed to conflicting messages.

In line with Rogers' framework, research has found that found that trust & awareness were central in adoption of the Account Aggregator DPI. Because awareness was low and concerns about safety and third-party data sharing were high, increasing understanding and confidence were critical to adoption.[27] However, the success of DPIs in India is a phenomenon that has brought to bear forces beyond Rogers' "diffusion" story. It has been a result of the combined effort of forward-looking mindset by the government (*sarkar*), complemented by timely innovation by private players in the market (*bazaar*), which has created a system that has delivered access, inclusion, and transparency / accountability to individual citizens (*samaaj*). Nevertheless, the citizens have not been passive beneficiaries. The *samaaj* has demonstrated its active role through increased compliance and endorsement that has brought many from the informal sector to the formal economy.[28]

India's DPI ecosystem represents a transformative model of inclusive digital governance, enabling seamless delivery of public and private services at scale. Built on foundational layers like digital identity (Aadhaar), real-time payments (UPI), and consent-based data sharing (Account Aggregator/DEPA), India's DPIs span a wide spectrum of sectors such as finance, healthcare, education, commerce, and social welfare. These interoperable, open, and scalable systems empower citizens, enhance transparency, and improve service delivery across urban and rural areas. India's DPI model is increasingly recognized globally as a blueprint for digital development, especially in the Global South, combining innovation, affordability, and accessibility to drive socio-economic transformation.

Having set the above context, the rest of this report analyses two sectors in detail. Chapter 2 maps the ecosystem in financial services sector. Then, it analyses the usage of DPI in the sector, evaluating the impact of the DPIs. Chapter 3 does the same for the healthcare sector. The choice of these sectors is to showcase contrasting DPI penetration. The conclusion assesses the overall DPI impact and influence and charts a way forward for the country, both in policy and strategic terms. We hope that you, the reader, will find this report an enjoyable and fruitful read.

[27] https://www.cgap.org/blog/trust-and-awareness-will-be-key-for-open-finance-adoption-in-india, accessed 19 Sep 25
[28] https://www.imf.org/en/Publications/fandd/issues/2024/09/Creating-Value-for-Taxpayers-Chandra-Vaid-Varma, accessed 27 Sep 25.

STATE OF DPI IN FINANCIAL SERVICES

Mapping the ecosystem

The Banking, Financial Services, and Insurance (BFSI) ecosystem in India can be structured across several key categories, each of which plays a unique role in the functioning of the financial system in the country. These categories are interconnected through regulation, capital flows, infrastructure, and technology. The ecosystem actors are as follows:

Banking Sector

Banks are at the core of the BFSI ecosystem, providing deposit-taking, lending, and payments infrastructure. They are regulated by the Reserve Bank of India (RBI). Categories include:

- Public Sector Banks (e.g., SBI, PNB, BoB)
- Private Sector Banks (e.g., HDFC Bank, ICICI Bank, Axis Bank, Kotak Mahindra)
- Foreign Banks (e.g., Citi, HSBC, DBS)
- Regional Rural Banks & Cooperative Banks.

Banks interact with NBFCs via co-lending, with Fintechs via API partnerships, and with regulators for capital adequacy, compliance, and KYC.

Non-Banking Financial Companies (NBFCs)

NBFCs provide credit to segments often underserved by banks, such as MSMEs, small-ticket retail loans, and vehicle financing. They partner with banks for co-lending, rely on Fintechs for sourcing borrowers, and are regulated by the RBI. The key segments under this category are:

Large diversified NBFCs

Bajaj Finance, Tata Capital, Aditya Birla Finance, Mahindra Finance, L&T Finance, IIFL Finance, Piramal Capital & Housing Finance, Cholamandalam Investment & Finance.

Housing Finance Companies (HFCs)

LIC Housing Finance, PNB Housing Finance, Can Fin Homes, Aavas Financiers, Home First, Aptus Value, Sundaram Home Finance, India Shelter, Indiabulls Housing (in transition), Piramal Housing.

Microfinance Institutions (MFIs)

CreditAccess Grameen, Spandana Sphoorty, Satin Creditcare, Ujjivan (origin), Bandhan (now bank), Asirvad, ESAF (SFB link), Annapurna, Muthoot Microfin, Fusion Microfinance.

Gold loan and Niche lenders

Muthoot Finance, Manappuram Finance, IIFL Gold, Indiagold (digital), Rupeek (digital arranger).

Vehicle/consumer/SME fintech lenders (illustrative list)

ZestMoney (BNPL), KreditBee, Cashe, MoneyTap, Capital Float, NeoGrowth, Kinara Capital, Indifi, InCred, Vivriti Capital, Electronica Finance, Lendingkart.

Asset Management Companies & Mutual Funds

Mutual Funds mobilize retail and institutional savings into capital markets. Major players include SBI MF, HDFC MF, ICICI Prudential MF, and Nippon India MF. They are regulated by SEBI. Distribution is increasingly driven by digital channels (Groww, Zerodha, Paytm Money). Segment-wise examples are as follows:

Mutual Funds / AMCs (selected)

SBI MF, HDFC MF, ICICI Prudential MF, Nippon India MF, Aditya Birla Sun Life MF, Kotak MF, Axis MF, UTI MF, IDFC/ Bandhan MF, Mirae Asset, DSP MF, Franklin Templeton, Tata MF, Motilal Oswal MF, PPFAS MF, Canara Robeco, HSBC MF, Edelweiss MF, Invesco MF, Sundaram MF, Quant MF, WhiteOak MF.

Brokerages & Wealth Platforms (selected)

Zerodha, Groww, Upstox, Angel One, ICICI Direct, HDFC Securities, Kotak Securities, Axis Direct, Sharekhan, Motilal Oswal, IIFL Securities, Edelweiss, 5Paisa, Paytm Money, smallcase (thematic), ETMoney, Kuvera.

Alternate Investment & PMS (illustrative)

AIF Category I/II/III managers (True North, ChrysCapital, Sequoia/Peak XV, Multiples, KKR, Blackstone, Motilal Oswal AIFs, IIFL AMC, Avendus, Edelweiss, ICICI Prudential AIF, Kotak Alt, TPG, etc.); PMS providers across banks/brokers/AMCs.

Market Participants

Investment banks (Kotak, Axis Capital, JM Financial, ICICI Securities, HDFC Bank, SBI Capital, Jefferies, Morgan Stanley, Goldman Sachs), custodians (HDFC Bank, Citi, Deutsche, SBI-SG), trustees, RTAs (CAMS, KFin Technologies).

Insurance Agencies

Insurance provides risk protection for individuals and businesses. Key segments in this category are:

Life Insurers (selected)

LIC, HDFC Life, SBI Life, ICICI Prudential Life, Max Life, Bajaj Allianz Life, Kotak Life, Tata AIA Life, PNB MetLife, Canara HSBC Life, Edelweiss Tokio Life, Aviva Life, Ageas Federal Life, Birla Sun Life (ABS Life), IndiaFirst Life.

General/Non-life Insurers (selected)

New India Assurance, United India, National Insurance, Oriental Insurance; ICICI Lombard, HDFC ERGO, Bajaj Allianz General, SBI General, Reliance General, TATA AIG, Kotak General, Future Generali, Royal Sundaram, Cholamandalam MS, Universal Sompo, Digit Insurance, Acko General, Go Digit, Navi General (transitioning).

Standalone Health Insurers (SAHI)

Star Health, Niva Bupa, Care Health (Religare), ManipalCigna, Aditya Birla Health, HDFC Ergo Health (ex-Apollo Munich, folded into HDFC ERGO), Kotak Health (as applicable).

Reinsurers

GIC Re (dominant domestic reinsurer) and foreign reinsurers' branches in GIFT City and onshore.

They are regulated by IRDAI. Distribution is done via agents, bancassurance, and digital Insurtech platforms (Policybazaar, Acko, Turtlemint).

Pensions & Retirement Funds

Pension and retirement schemes are regulated by PFRDA. The National Pension System (NPS) is a key instrument, with Central Recordkeeping Agencies (Protean, CAMS) playing a pivotal role. Employers and individuals contribute, and fund managers manage investments.

Public Policy & Regulators (the rule-setting layer)

- Ministry of Finance (MoF): Sets financial sector policy; oversees financial regulators & public sector institutions.
- Reserve Bank of India (RBI): Central bank; monetary policy; bank/NBFC/PPI/payment system regulation & supervision; FX management.
- Securities and Exchange Board of India (SEBI): Regulates securities markets, stock exchanges, brokers, MF/AMCs, investment advisors, research analysts, credit rating agencies, and market infra institutions.
- Insurance Regulatory and Development Authority of India (IRDAI): Regulates life/non-life/health insurers, reinsurers, insurance intermediaries.
- Pension Fund Regulatory and Development Authority (PFRDA): Regulates National Pension System (NPS) and pension intermediaries.

- Insolvency and Bankruptcy Board of India (IBBI): Regulates insolvency professionals, processes under IBC.
- Financial Intelligence Unit (FIU-IND): AML/CFT data collection & analysis.
- Competition Commission of India (CCI): Competition/antitrust oversight.
- Data Protection Board (DPB): Personal data protection enforcement (Digital Personal Data Protection Act).
- Other overseers/specialized: DICGC (deposit insurance – RBI subsidiary), NABARD (agri/rural dev finance), SIDBI (MSME dev finance), EXIM Bank (trade finance), NHB (housing finance), IEPFA (investor education & protection), IFSCA/GIFT City (international financial services).

These regulators ensure stability, consumer protection, and orderly development of markets.

Core Market Infrastructure (the plumbing)

Payments & ID rails

- NPCI: Operates UPI, IMPS, RuPay, NACH, AePS, BBPS, NETC; also BharatQR.
- Card Networks: RuPay (NPCI), Visa, Mastercard, American Express, Diners.
- India Stack & Digital Public Infrastructure – Aadhaar, eKYC, eSign, DigiLocker, eNACH, Account Aggregators (AA) framework (Sarahmati network), OCEN rails, ONDC (for commerce; touchpoints with payments/credit), Open Credit Enablement Network.
- CKYCR (Central KYC Registry): Centralized KYC repository.

Capital market infra

- Exchanges: NSE, BSE, MCX (commodities), NCDEX (agri commodities), IIBX (GIFT City).
- Clearing Corporations: NSCCL (NSE), ICCL (BSE), MCXCCL (MCX), CCIL (govt securities/FX/derivatives).
- Depositories: NSDL & CDSL (hold demat securities); Kfin & CAMS act as RTA platforms serving MFs/AMCs.
- Data / GovTech service providers
- Protean eGov Technologies (formerly NSDL e-Gov): PAN issuance infrastructure, NPS CRA (with others), OVD validation rails, e-KYC facilitation for various schemes.
- UIDAI: Aadhaar authority; authentication services.
- CERSAI: Central registry of securitisation, asset reconstruction & security interest (collateral registry).
- Credit Bureaus: TransUnion CIBIL, Equifax, Experian, CRIF High Mark.

Fintech Landscape

Fintechs in India leverage digital infrastructure such as Aadhaar, UPI, and Account Aggregator to deliver innovative financial products. Categories include:

- Digital Payments: PhonePe, Google Pay, Paytm, Amazon Pay
- Lending Tech: KreditBee, Lendingkart, Capital Float, Yubi
- WealthTech: Zerodha, Groww, Upstox, smallcase
- InsurTech: Acko, Digit, Policybazaar, Turtlemint
- RegTech & Infra: Signzy, Karza, HyperVerge, Perfios
- API Banking & Neobanks: Open, Niyo, Setu, M2P

DPIs in use

The following DPIs form the core of the Indian financial services ecosystem:

Identity and Verification:

Aadhaar and Know Your Customer (KYC): Aadhaar was created to provide every citizen a unique identity denoted by a 12-digit number. The IDs are regulated by the Unique Identification Authority of India (UIDAI)[29]. Along with being the proof of identity for KYC, these IDs also formed the basis for opening Jan Dhan bank accounts[30], popularly known as zero-balance accounts, which are driving financial inclusion among the underserved by becoming the 'financial address' of the account holder[31].

End Use: Aadhar IDs created a database for identity credentialing and authentication, which is also used by financial institutions like public and private sector banks and other financial service providers. Moreover, it's the primary proof of identification used for several other public and private services. The first usage of Aadhaar was to fix leakages in the DBT for Liquefied Petroleum gas (LPG) through the PAHAL scheme[32]. Additionally, the first phase of DBT was initiated in 43 districts and later 78 more districts were added in 27 schemes pertaining to scholarships, women, child and labour welfare. DBT was made a pan India operation and also schemes like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) was brought under its ambit[33].

As of September 2025, over nine crore authentications take place every day, which shows the level of utility of Aadhaar in people's everyday lives. UIDAI is also working to develop and promote face authentication transactions (18.6 crore such transactions carried out

[29] https://uidai.gov.in/en/about-uidai/unique-identification-authority-of-india.html#:~:text=Under%20the%20Aadhaar%20Act%202016,the%20security%20of%20identity%20information, accessed 17 Sep 25

[30] These are zero balance bank accounts opened solely on the basis of Aadhaar cards as the primary identification proof. Source: https://pmjdy.gov.in/scheme, accessed 17 Sep 25

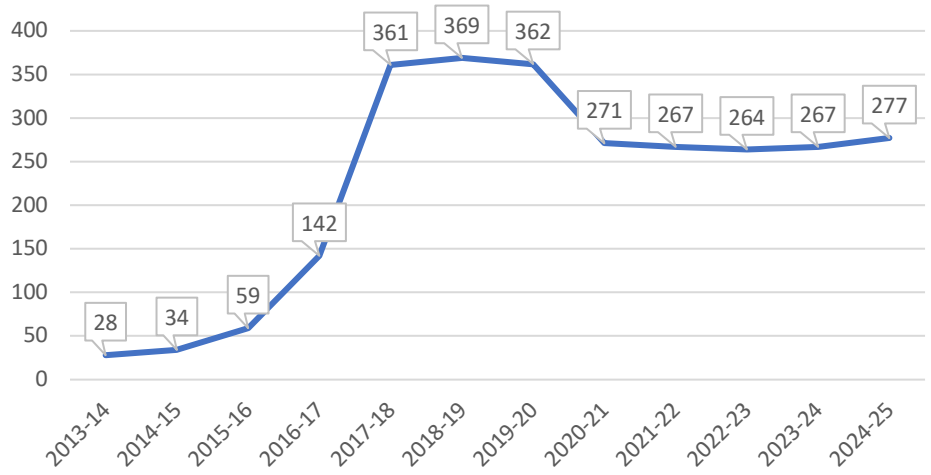
[31] https://uidai.gov.in/images/2023-24_Final_English_Final.pdf, accessed 17 Sep 25

[32] https://mopng.gov.in/en/marketing/pahal#:~:text=PAHAL%20aimed%20at%20rationalizing%20subsidies,consumers%20have%20joined%20the%20scheme, accessed 17 Sep 25

[33] https://dbtbharat.gov.in/static-page-content/spagecont?id=1, accessed 17 Sep 25

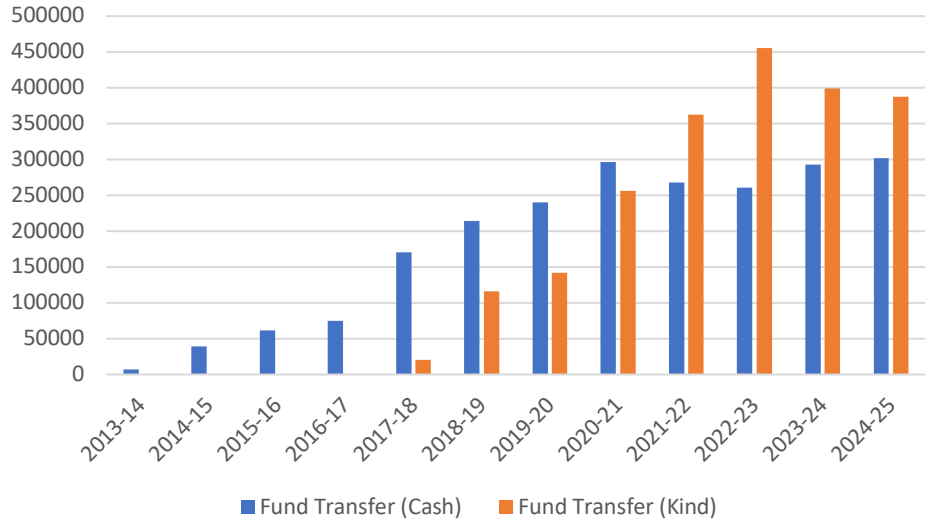
in August 2025) and AI/ML-based services[34]. For services like electronic KYC, the numbers have gained traction and gone past Rs. 2268 crore by January end 2025. The cumulative data of State/UT-wise Aadhaar saturation as of 31 July 2025 stands at 1,336,507,069[35]. For the APB transfers (DBT), large schemes like PAHAL and MGNREGS etc, have paid over Rs. 12,59,294 crores as on March 2024 (Data source: NPCI, UIDAI Annual Report 2024). As per 2025-26 data there are 282 cash schemes, In-kind transfer of Rs 164822.9 cr., and 88.9 cr. DBT beneficiaries[36].

Figure 2.1: Number of DBT (cash) schemes from 2013-14 to 2024-25



Authors' representation. Source: https://dbtbharat.gov.in/, accessed 17 Sep 25

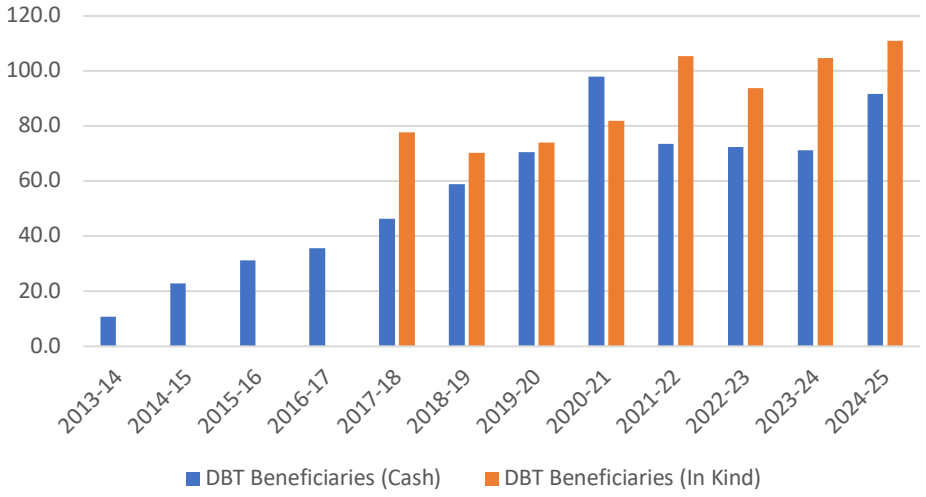
Figure 2.2: Year-wise fund transfer (in crores) from 2013-14 to 2024-25



Authors' representation. Source: https://dbtbharat.gov.in/, accessed 17 Sep 25

[34] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2100685, accessed 17 Sep 25
[35] https://uidai.gov.in/images/AadhaarSaturationReport.pdf, accessed 17 Sep 25
[36] https://dbtbharat.gov.in/, accessed 17 Sep 25

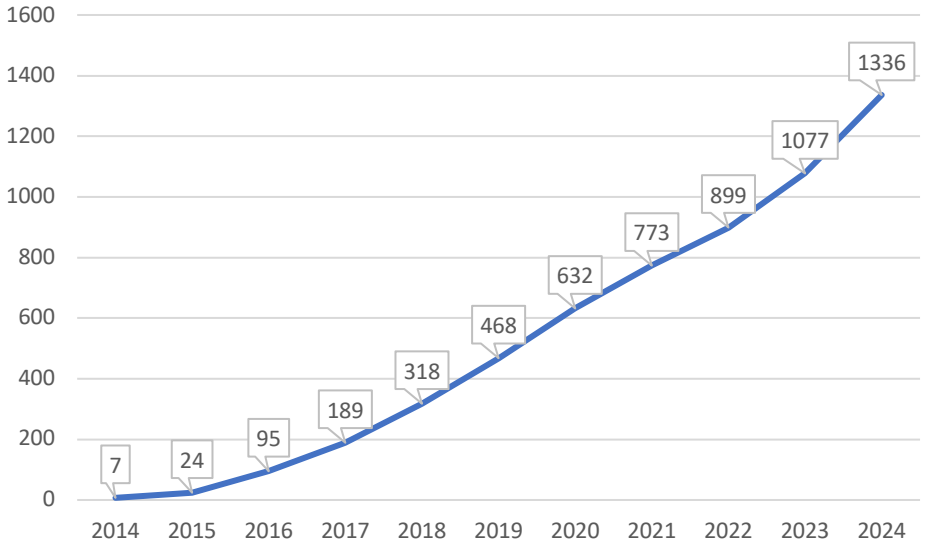
Figure 2.3: Year-wise DBT beneficiaries (non-unique, in crores) from 2013-14 to 2024-25



Authors' representation. Source: https://dbtbharat.gov.in/, accessed 17 Sep 25

Aadhar Payment Bridge (APB): APB is largely a Government to Citizen (G2C) and Business to Consumer (B2C) platform for remitting funds to an Aadhaar number holder. Bank accounts linked with Aadhaar through NPCI mapper (repository of Aadhaar numbers maintained by APB system and used for the purpose of routing the APB transactions to the destination banks[37]) can receive funds from APB platform.[38]

Figure 2.4: Progress of APB transactions for benefit transfer



Authors' representation. Source: UIDAI Annual report 2023-24

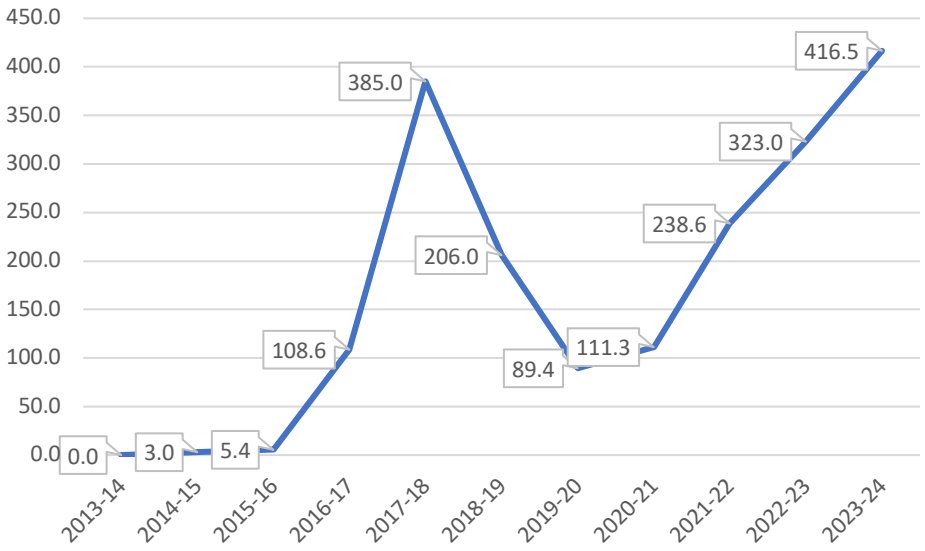
[37] https://www.npci.org.in/what-we-do/nach/faqs/banks, accessed 17 Sep 25
[38] https://uidai.gov.in/images/2023-24_Final_English_Final.pdf, accessed 17 Sep 25

Electronic EKYC (eKYC): KYC is the physical proof of identity (Aadhaar) which is used by multiple financial and non-financial institutes. UIDAI also provides the mechanism to verify the identity of an Aadhaar holder through the paperless and online process of eKYC. It provides an instant, authenticated verification of the identity[39].

End Use: Not only does it speed up the process, but also brings the cost of paper and document handling significantly lower. It provides privacy in data sharing, security in the form of backing by UIDAI, and inclusion due to the possibility of wide adoption.

Till 8 September 2025, there have been a total of 24,065,303,826 eKYC transactions across 285 eKYC authentication agencies[40].

Figure 2.5: Year-wise e-KYC transactions (in crores)



Source: UIDAI Annual Report 2023-24

CKYC Registry: CKYC is central repository of KYC records that ensures that users do not have to submit their KYC documents multiple times for every financial transaction[41]. This repository has uniform KYC norms and inter usability of the records across various sectors for reducing the burden of producing identity/KYC documents every time a customer creates a new relationship with a financial entity. The registry was launched in 2016 and by 2023 it boasted of hosting more than 5000 regulated entities and 700 million KYC records[42].

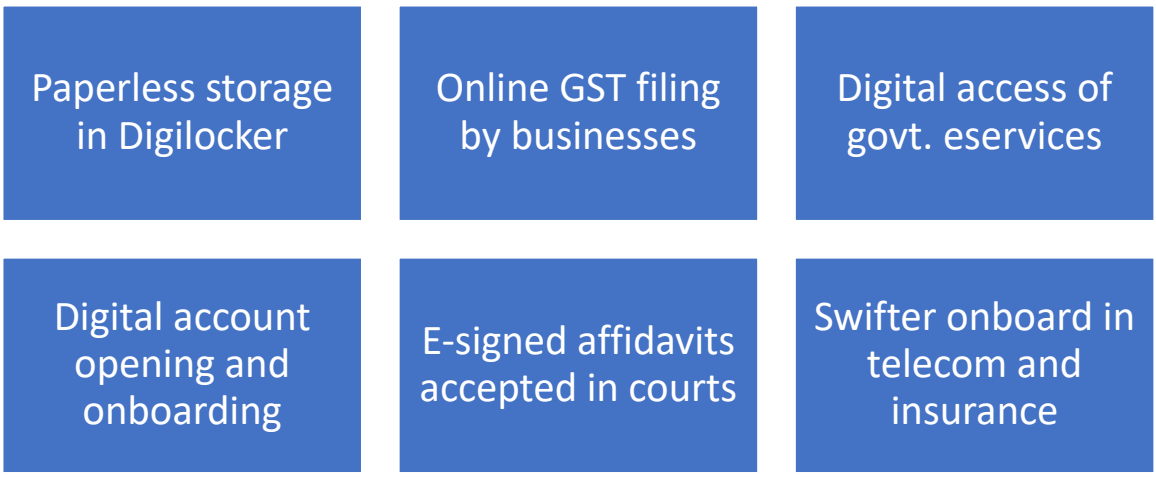
[39] https://uidai.gov.in/en/ecosystem/authentication-devices-documents/about-aadhaar-paperless-offline-e-kyc.html, accessed 17 Sep 25
[40] https://uidai.gov.in/aadhaar_dashboard/ekyc_trend.php, accessed 17 Sep 25
[41] https://testbed.ckycindia.in/ckyc/?r=home, accessed 17 Sep 25
[42] https://testbed.ckycindia.in/ckyc/assets/images/About-us.pdf, accessed 17 Sep 25

End Use: One time KYC compliance and updating which can be used across multiple institutes and products. No repeat KYC documentation is required; the process is paperless and available pan India.

eSign: Before eSign came into picture, Digital Signatures (DSC) issued by authorised Certifying Authorities (CA) in a dongle was the only option to use a digital signature.[43] eSign is a digital signature product built on top of Aadhaar allowing any Aadhaar holder to create a legally valid digital signature on a document. This provides an anywhere anytime benefit to all. It works on a consent basis which is received as a One Time Password (OTP) sent to the user's Aadhaar-linked mobile number[44].

End Use: The paper-based processes and issuance of hardware cryptographic tokens were not able to scale to a billion people[45]. For this to happen, paperless mass adoption of digital signature was necessary which was enabled by Aadhaar based eSign. The objective of eSign services is to allow users to sign their documents online in a legally accepted manner. The two major challenges that is user authentication and trust, both are resolved through eSign by use of Aadhaar and Public Key Infrastructure[46]. As on September 2025, the transactions for PAN OPV stood at 7.25 bn, transactions for Aadhaar authentication stood at over 2bn, transactions for eKYC stood at over 950mn, and transactions for eSign stood at over 240mn[47].

Figure 2.6: Benefits of the Aadhaar eSign system



Authors' representation. Source: https://proteantech.in/articles/evolution-esignature-08-05-2025/, accessed 18 Sep 25

[43] https://nesl.co.in/aadhaar-e-sign-delivering-digital-signature-to-every-citizen-of-india/#:~:text=Aadhaar%20e%2DSign%20has%20transformed%20the%20concept%20of,nearly%20100%25%20of%20the%20present%20adult%20population., accessed 17 Sep 25
[44] https://indiastack.org/identity.html, accessed 17 Sep 25
[45] https://cca.gov.in/eSign.html, accessed 17 Sep 25
[46] https://esign.cdac.in/, accessed 17 Sep 25
[47] https://www.proteantech.in/services/esign/, accessed 17 Sep 25

DigiLocker- DigiLocker is an initiative by the Ministry of Electronics and Information Technology (MeitY) for the Digital India initiative[48]. It is a digital document wallet which aims to drive digital empowerment of citizens by providing easier, authentic and anytime/anywhere access to their documents. It has been legally identified as being at par with physical documents Rule 9A of the Information Technology (Preservation and Retention of Information by Intermediaries providing Digital Locker facilities) Rules, 2016.

End Use: It provides direct benefits to citizens by enabling digital document exchange with consent and enabling faster service delivery. It also provides benefits to agencies reducing administrative overheads, promoting digital transformation, providing a secure document gateway and enables real time verification of data[49]. One of the prominent examples of using Digilocker is to access the APAAR ID[50] which stores student's academic accomplishments and facilitates seamless transitions between different institutions for education. This involves consent from parents to create APAAR ID, generation of APAAR ID through the required system (UDISE) and finally the storage of the APAAR ID in the Digilocker.

As per September 2025 data, the total number of registered Digilocker users stands at 58.31 Crores, with 839.4 Crore documents issued, while the yearly user registration (in Lakhs) has risen sharply in last 5 years with September 2025 data in Lakhs as 1479.11[51]

Payments and Remittances

Unified payment Interface (UPI): The UPI is a system that channels multiple bank accounts into a single mobile application of any participating bank, thereby providing several banking features, seamless fund transfer, and payment mechanisms on one interface. UPI was initially launched with 21 pilot banks in 2016 by Dr. Raghuram G Rajan, then Governor, RBI Mumbai[52].

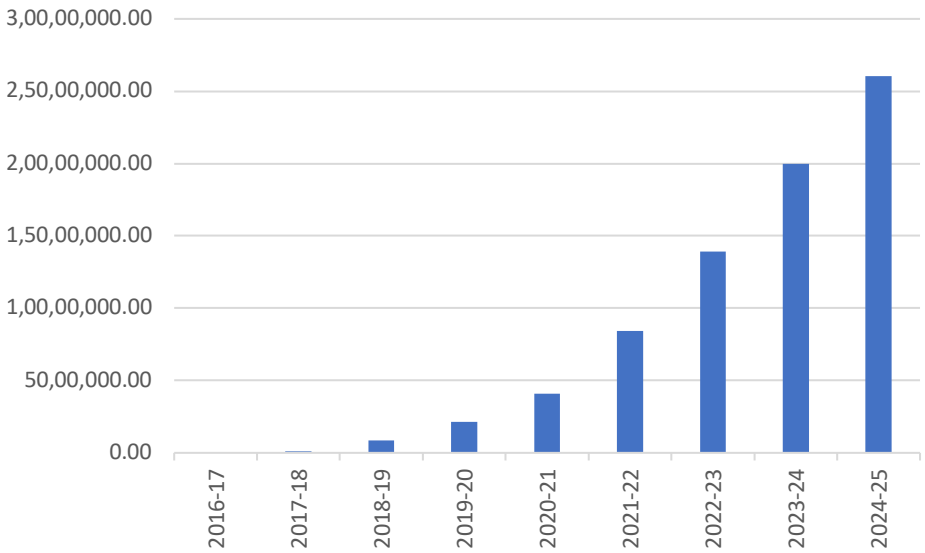
End Use: It helps the final users for transactions, collections and even lets them schedule payments. It has also improved bill payment process through QR Codes scan and pay based payments. The security aspect is ensured by two-factor authentication which is aligned with regulatory guidelines. Added security is provided by creating virtual address of customer for pull and push transactions thereby eliminating the need of entering account numbers, IFS codes etc[53].

The UPI ecosystem contains payer PSP, payee PSP, remitter Bank, beneficiary Bank, NPCI, Bank account holders, and merchants. As on August 2025, UPI has been used for

[48] https://www.digilocker.gov.in/web/about/about-digilocker, accessed 17 Sep 25
[49] https://www.digilocker.gov.in/web/about/about-digilocker, accessed 17 Sep 25
[50] https://apaar.education.gov.in/, accessed 17 Sep 25
[51] https://www.digilocker.gov.in/web/statistics, accessed 18 Sep 25
[52] https://www.npci.org.in/what-we-do/upi/product-overview, accessed 18 Sep 25
[53] https://www.npci.org.in/what-we-do/upi/product-overview, accessed on 17 Sep 25

around Rs. 2485472.91crores through 20008.31million transactions. Figure 2.7 shows how the value of UPI transactions has grown over time.

Figure 2.7: Growth in the value of UPI transaction (in crores)



Growth in the value of UPI transaction. Source: https://www.npci.org.in/what-we-do/upi/product-statistics, accessed 28 Sep 25

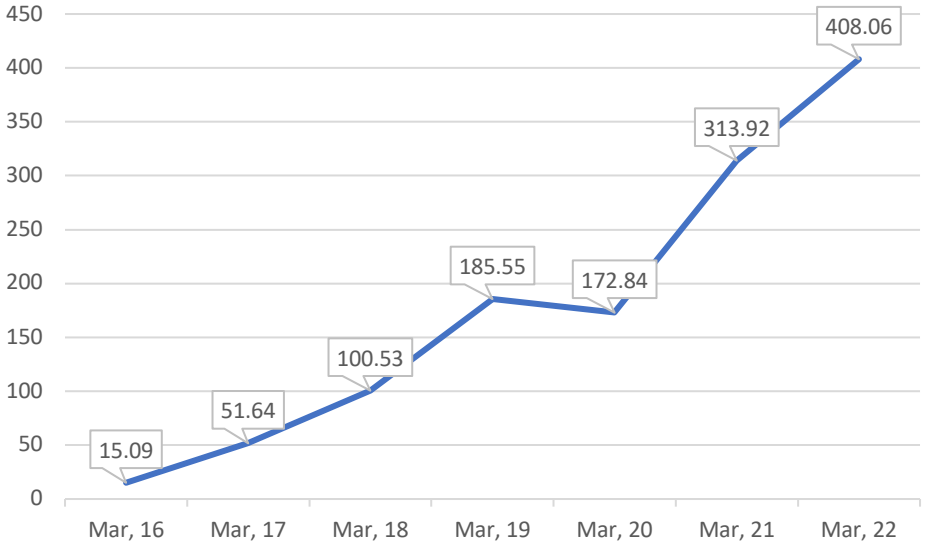
Aadhaar enabled payment system (AePS): AePS is a bank led model which allows interoperable financial inclusion transactions Point of Sales (PoS) machines through the assistance of business correspondence of any bank. It uses Aadhaar based authentication for the transactions. AePS uses the bank name, Aadhaar number and biometric captured during enrolment[54]. It offers multiple other services like cash deposit and withdrawal, BHIM Aadhar pay, balance enquiry eKYC etc to name a few.

End Use: AePS empowers the end user to carry out varied Aadhaar based transactions through the services of business correspondent. It promotes financial inclusion due to a wider coverage through the business correspondent model and promotes last-mile banking for those at the bottom of the income pyramid[55]. It also promotes electronification of retail payments and plays a pivotal role in disbursement facilitation of Government entitlements like MGNREGA, Social Security Pension Handicapped Old Age Pension etc, of any government body as long as it is supported by UIDAI[56].

As of August 2025, there were a total of Rs. 597.57 million total approved transactions and 47.71 million successful eKYC conducted on AePS. Table 2.2 below gives an idea of the progression of AePS usage in terms of transactions and their values March 2016 to March 2022:

[54] https://www.npci.org.in/what-we-do/aeps/product-overview, accessed 18 Sep 25
[55] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1903147, accessed 18 Sep 25
[56] https://www.npci.org.in/what-we-do/aeps/product-overview, accessed 18 Sep 25

Figure 2.8: AePS approved transactions (in millions)



Source: https://www.npci.org.in/what-we-do/aeps/product-statistics, accessed 19 Sep 25

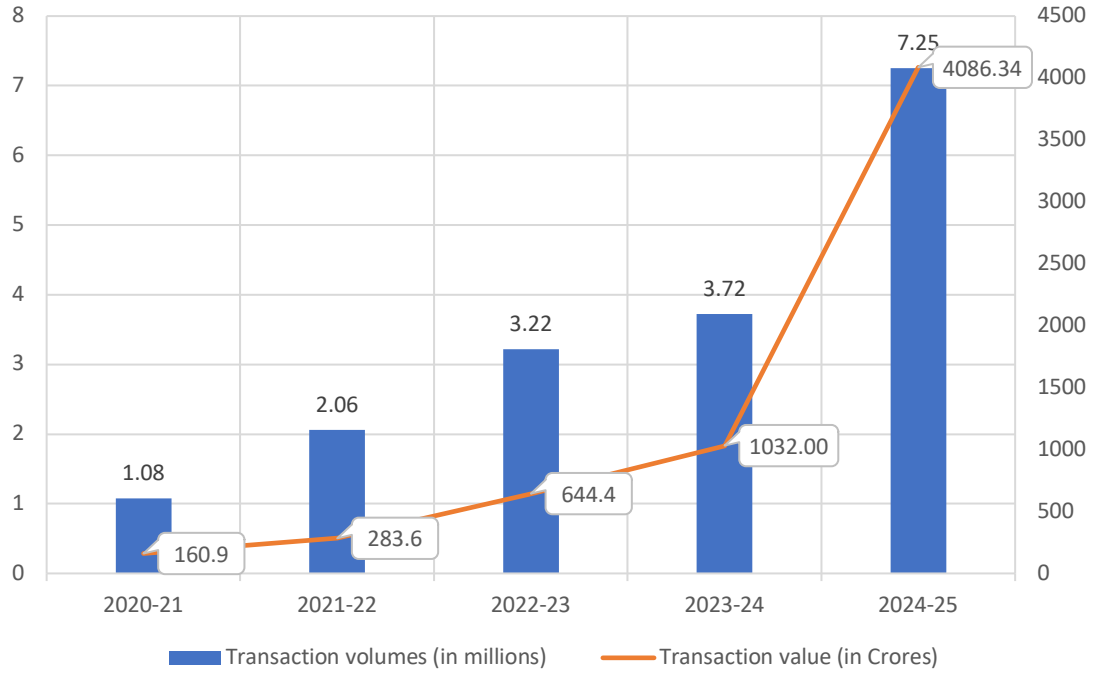
Bharat Connect (Formerly Bharat Bill Payment System-BBPS): Bharat connect is the platform which powers bill payment systems like Bharat Bill Payment System (BBPS). BBPS is a Reserve Bank of India conceptualised system which has created an integrated, accessible and interoperable bill payment services for customers pan India. The services include bill payment services to consumers through a network of agents /retail shops/ bank branches and other digital channels like the online banking system, mobile banking system, cards, UPI, AePS, wallet and even offline services like cash payments. The BBPS ecosystem consists of participants like the customers, Agent Institutes or independent agents, banks, BBPCU, aggregators/service providers and billers. BBPS is operated by Bharat Bill Payment Central Unit (BBPCU) with several operating units. It covers RBI approved bills like utility bills, institutional fees, and other payments like monthly instalments and investments[57].

End Use: Bharat Connect platform (formerly known as Bharat Bill Pay) offers technological solutions to bring business and customers under one system and facilitates payment and collections[58]. The bill payment system operation through the platform is user friendly and provides ease of payment for customers. The end users receive real time confirmation of the bill payments, and all transactions are securely recorded digitally. Its grievance redressal system is centralized and offers dispute management through the lodging of complaints.

[57] https://www.npci.org.in/PDF/npci/bbp/notified-documents/BBPS_Product_Presentation.pdf, accessed 19 Sep 25
[58] https://www.bharat-connect.com/about/, accessed on 17 Sep 25

As of September 2025, the Bharat Connect ecosystem boasts of 48 live partners in Biller Operating Units; 67 live partners in Customer Operating Units; 22,397 live billers; and 1016 live partners/agent institutions[59]. The transactions for year 2025-26 so far stand at 9.57 Mn, and transaction value stands at 6647.88 Crores.

Figure 2.9: Bharat Connect ecosystem performance



Source: https://www.bharat-connect.com/statistics/, accessed 18 Sep 25

Data and credit

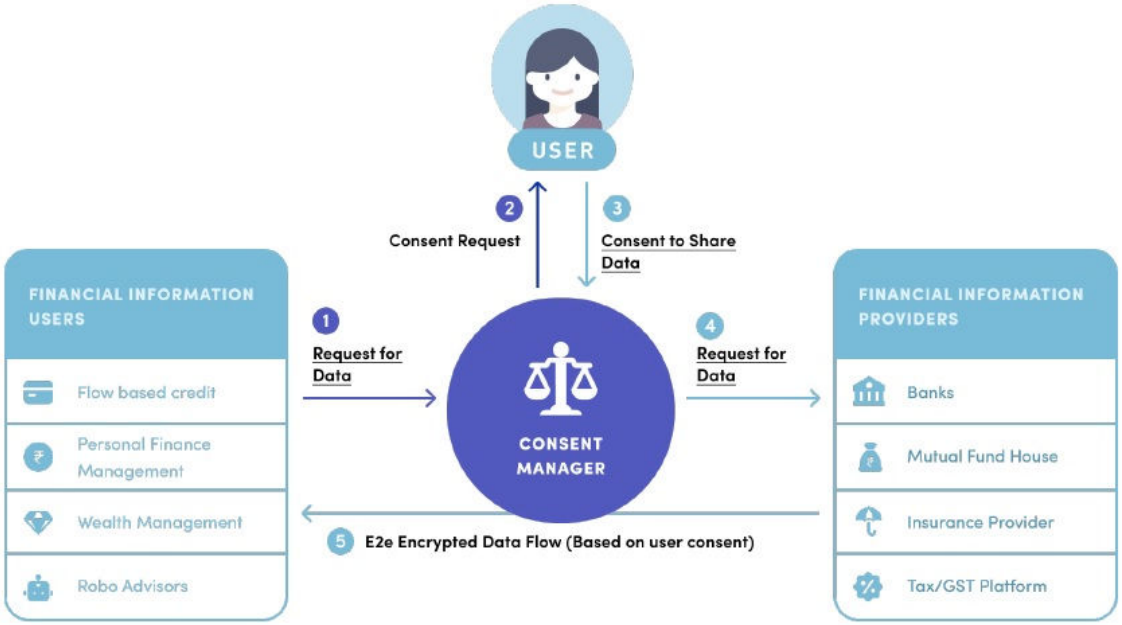
Data Empowerment and Protection Architecture (DEPA) framework: The last layer of the India Stack and also the data layer of India's financial services rests on the DEPA which aims to maintain control and ownership over user data for the rightful owner. There are three main parts of the DEPA architecture at the core: Personal Data Protection Bill which gives right of data ownership to citizens of India; Electronic consent artefact that establishes standardised and programmable protocol for capturing user consent for data sharing; and Regulated entities, also known as 'consent managers' (Account Aggregators in Financial Services) who play the role of data traffic regulators[60]. Figure 2.10 shows how the DEPA framework allows data flow between providers and users of data, based on the owner's consent

End Use: DEPA provides a mechanism and set of rules and standards for data sharing which can enable further development of financial goods and services for all segments

[59] https://www.bharat-connect.com/statistics/, accessed on 17 Sep 25
[60] https://indiastack.org/data.html, accessed on 17 Sep 25

of the society. It enables the gradual removal of traditional paper-based processes and facilitates the linking of multiple actors for smooth, consent-based data exchange.

Figure 2.10: DEPA framework



Source: https://depa.world/training/depa, accessed 27 Sep 25

Account Aggregator (AA): Account aggregators facilitate secure exchange of data between multiple parties like the user, financial institutions, insurance agencies and others to name a few. The exchange of data is consent based, and it solves for multiple personal and business-related financial needs. After receiving consent from the user, the AA collects his/her digital data from one or more sources and delivers it to the institute which requires that data for providing certain services to the user[61]. The main participants of the AA are Financial Information Provider (FIP), the AA based on DEPA framework, and the Financial Information Users (FIU) who work together to make data sharing simpler and smoother. The AA also providers security features like its inability to share data without user consent, non-storage of data, encryption of data, and power with the user to give or revoke consent at any point of time.

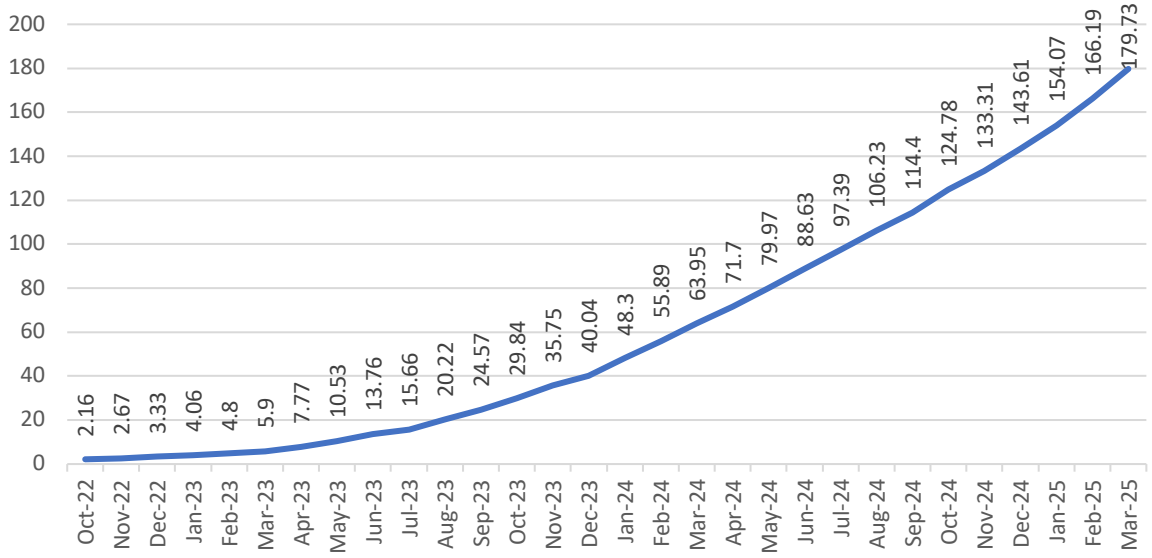
End Use: The AA has transformed the way financial services like loans and credit are now availed and/or disbursed. The process is now more hassle free, since data sharing is now seamless. The AA enables fast access and sharing which provides more comprehensive user-profile creation at the lender's end and optimises the processes. Since the information is real time, transparent, verified, and synced with accounts, it reduced the probabilities of error and provides better financial management for the user[62].

[61] https://sahamati.org.in/what-is-account-aggregator/, accessed 17 Sep 25
[62] https://sahamati.org.in/what-is-account-aggregator/, accessed 17 Sep 25

Figure 2.11: The concept of account aggregator

Source: https://sahamati.org.in/what-is-account-aggregator/, accessed 19 Sep 25

Figure 2.12: Cumulative successful consents in AA (in millions)



Source: https://sahamati.org.in/wp-content/uploads/2025/05/Account-Aggregator-Adoption-update-for-website-Mar-25.pdf, accessed 17 Sep 25

Networks and Protocols

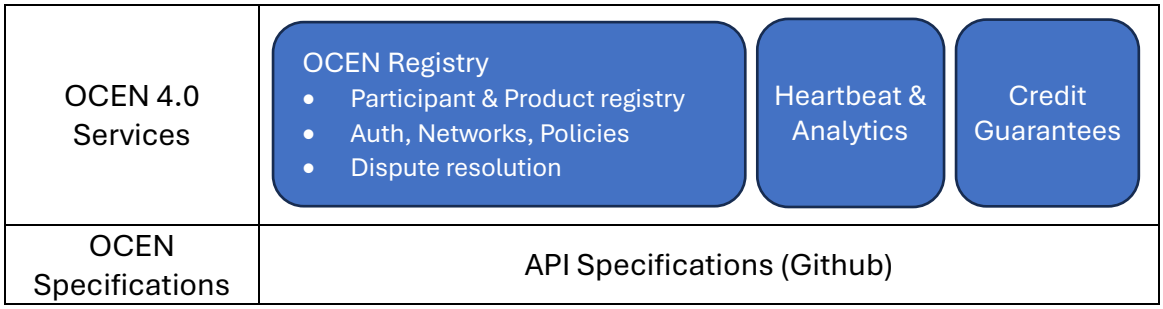
Open Credit Enablement Network (OCEN): As of September 2025, the credit gap for MSMEs is Rs. 20-25 trillion, while less than 11% of MSMEs have access to formal credit[63]. OCEN is an attempt to solve this problem by creating a network of lenders, borrowers and

[63] https://ocen.dev/, accessed 17 Sep 25

loan agents where the borrowers can avail short tenure and small ticket loans even through lenders operating in remote geographies through consented access of transactional data history.

OCEN is an initiative to unbundle the lending landscape and create specialized entities for roles like sourcing/distribution, identity verification, underwriting etc[64]. This system functions on a Loan Agent model (LA) who help borrowers get access to affordable formal credit. The system works as a network where all these participants come together to serve a particular product to a set of borrowers via LA. OCEN functions on two separate registries- Participant Registry for Participants, and Product Registry for products that are maintained via Self-regulatory Organisations (SROs). The registries are accessed through a shared UI portal.

Figure 2.13: Components of OCEN



Authors' representation. Source: https://ocen.dev/docs/ocen_components, accessed 17 Sep 25.

End Use- Since loan processing in OCEN is based on the business data (e.g. data on turnover, account statements, GST returns and others), the network provides the lender sufficient data signals to make decisions. Additionally, it improves speed both for lenders and borrowers, since the process is entirely digital and paperless[65].

Open Network for Digital Commerce (ONDC) Finance: ONDC is a section 8 company formed by the Quality Council of India and Protean eGov Technologies Limited[66]. It is a network initiated by Department of Promotion of Industry and Internal Trade (DPIIT) that employs open specifications that connect various players on the ONDC ecosystem. This allows multiple financial institutions to be connected together enabling the final consumer to get easy access to credit.

End Use: The benefits of lending options on ONDC primarily revolve around accessibility and convenience, where borrowers can easily apply for a loan on the network without

[64] https://ocen.dev/docs/intro, accessed 17 Sep 25
[65] https://perfios.ai/blogs/unlocking-ocen-an-introduction-to-indias-lending-ecosystem/, accessed 17 Sep 25
[66] https://proteantech.in/articles/ondc-lending-benefits/, accessed 17 Sep 25

visiting a bank. Since the process is completely digital, this may be utilised in remote areas of the country as well. It also provides diverse lending options where borrowers can select a tailor-made product as per their requirements. It allows multiple lenders to offer services at competitive interest rates. Being digitalised, the process is transparent, fast, and efficient[67].

Impact of DPIs in Financial Services

Aadhaar

Providing one's identity documents was a major hassle in the pre-Aadhaar days, especially for the underserved and marginalised section of the society. This also caused obstacles in in accessing and availing benefits and subsidies from government schemes[68]. The practices of fund divergence and leakages within the system also presented the economy with multiple challenges. Aadhaar was launched with an aim of giving identity to Indian citizens based on collection of minimal demographic data. This also created a means of verification and authentication of citizen identity while removing duplicate and fake identities. Not only this, Aadhaar also led to the development of multiple new initiatives like the JAM trinity which enabled DBT, e-KYC, APB, AePS, UPI, GST and others. These initiatives provided the much-needed transparency and accountability in public systems while increasing their efficiency and speed. Nobel laureate Paul Romer, 2018 Economics Prize winner, praised India's Aadhaar system and called it as one of the most significant technological developments globally[69].

The increasing trends getting reflected in the numbers like the beneficiaries of the DBT scheme (refer Figure 2.3) show that Aadhaar-based systems are covering a larger population section with each passing year. With 9 crore transactions taking place every day, Aadhaar has created a massive utility for itself for citizens pan India. The year-on-year data from August 2024 to August 2025 shows an increase of 10% in Aadhaar authentication transactions[70]. Aadhaar enabled DBT scheme of 34 lakh crores has led to a savings of Rs.2.7 lakh crores. DBT has been hailed by institutes like the world bank which appreciated the scale at which DBT impacts people's lives, while IMF called it a 'logistical marvel'[71]. The UIDAI Annual report 2023-24 also showcases the impact of Aadhaar as the foundational entity for government reforms. With the 12-digit, Aadhaar number uniquely linked with every bank account (82.37 crores as on March 2024), it becomes the financial address of every individual and helps drive the mission of financial inclusion at country level scale. Aadhar has also played a big role in providing the basis

[67] https://proteantech.in/articles/ondc-lending-benefits/, accessed 18 Sep 25
[68] https://uidai.gov.in/images/Aadhaar_Brochure_Nov_22.pdf, accessed 18 Sep 25
[69] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2067940, accessed 18 Sep 25
[70] https://uidai.gov.in/en/, accessed 18 Sep 25
[71] https://www.digitalindia.gov.in/initiative/direct-benefit-transfer-2/, accessed 18 Sep 25

of further development of systems like AePS, APB, BHIM Aadhaar and others through National Payment Corporation of India (NPCI) which has further actualised the mission of financial inclusion.

Way Forward:_While Aadhaar has been setting new benchmarks every month, e.g. Aadhaar face authentication doubling from 100 Crores to 200 Crores transactions in 6 months[72] new digital technologies have been making the Aadhaar journey more impactful. The infrastructure provided by Aadhaar has enabled multiple fintech companies to build services in multiple financial domains. This is expected to drive further financial product and services innovation in future. Driven by the availability of affordable smartphones and internet data, the Aadhaar enabled online transactions in both semi urban and rural areas are expected to see further growth. With increasing usage of face-based authentication, UIDAI's efforts to incorporated AI and ML based solutions, and UIDAI's open-source on-premise private cloud, Aadhaar is set to provide a noticeable boost to the country's economic activities. And with new initiatives like Aadhaar based authentication framework for Cooperative Banks, it is set to drive social causes of last mile banking, digital and financial inclusion, and security[73].

Aadhar Payment Bridge (APB)

The APB, as a payment system, has been instrumental in alleviating challenges related to banking transactions and has brought benefits to both the government and citizens[74]. APB has been widely accepted at the ecosystem level and has gained trust by being a Reserve Bank of India (RBI) approved payment system. While the traditional system was fraught with challenges like delays, multiple channels and paperwork, APB enables transfers of benefits and subsidies in an efficient and seamless manner[75]. It has also reduced the hassles of opening multiple bank accounts for receiving benefits from government schemes at the citizen level. The APB system has also helped in improving the transparency and accountability of wage distribution while reducing leakages and corruption to ensure the transfer of wages to intended beneficiaries[76]. Figure 2.4 (Progress of APB transactions for benefit transfer) clearly shows the upward trend in the number of transactions for benefit transfers in Aadhaar-linked bank accounts. This also shows the impact of APB usage by national banks, regional rural banks, and multiple cooperative banks going live on the APB.

Way forward:_The implementation and performance of APB through schemes like MGNREGA in various states and Union Territories is being monitored by the government by various mechanisms such as Mid Term review, common review mission, labour budget

[72] https://uidai.gov.in/images/Press_Release-17.pdf, accessed 18 Sep 25
[73] https://uidai.gov.in/images/Press_Release_20.pdf, accessed 18 Sep 25
[74] https://uidai.gov.in/images/2023-24_Final_English_Final.pdf, accessed 18 Sep 25
[75] https://paytm.com/faqs/aadhaar/aadhaar-payment-bridge-advantages, accessed 18 Sep 25
[76] https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=2155685, accessed 18 Sep 25

meetings, national level monitoring, virtual conference meetings and field visits[77]. This ensures compliance and also assesses the future requirements and needs for effective implementation of the system. This provides a suitable roadmap for future course of action for Aadhaar seeding and integration of financial entities on the bridge.

Electronic KYC (eKYC)

The use of eKYC has streamlined customer identity verification while ensuring secure and compliant transactions. eKYC leverages the Aadhaar ecosystem and enables faster go to market timelines for the partners. Figure 2.5 shows a consistent and upward trend in the numbers which showcases the level of adoption pan India. E-KYC services have resulted in effortless execution of various government applications such as filing of income tax returns and issuance of Permanent Account Number (PAN) cards. eKYC has created a major change by providing paperless online KYC authentication services and brought down the costs of paper handling and storage while also driving a positive environmental impact. It has also resulted in reduction of risk of forged documents. Since Aadhaar enabled eKYC services are real time, it results in instant delivery of services to the intended beneficiaries. Services like disbursement of PM-Kisan Samman Nidhi using face authentication has had a positive impact on speed of and scale of fund transfer. It has helped people like farmers with worn out fingers through hassle free DBT. Not only government schemes, the service is highly useful for entities like banking institutes, Non-Banking Financial Corporations (NBFC) and telecom service providers who are now adopting face authentication for eKYC for the issue of products and services.

Way forward: eKYC services aided by new methods like face authentication, secure QR code, Iris, and contactless devices eliminate the need for physical documents and paperwork, which improves efficiency and transparent distribution of benefits. With increasing adoption rates, it is expected to be a crucial driver in further reduction of risks like fraudulent claims and corruption in practices.

CKYC Registry

The CKYC registry which maintains a digital repository of KYC records across various banking and non-banking institutes has played a crucial role in streamlining KYC compliance across geography. Bound by rigorous timelines and regulations for KYC reporting, updating and similar communications, the registry has maintained its accuracy and built trust. It has created robustness of records and also created a big impact by reducing cases of money laundering, financial crimes and created a platform for accessible records, better tracking of identities and improved accuracy. This process too reduces paperwork, eliminates friction and brings safety and transparency.

[77] https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=2155685, accessed 18 Sep 25

Way Forward: The existing setup of CKYC is also undergoing a change where measures for further efficiency enhancement, redundancy reduction and security improvement in relation to KYC process across financial sectors are being implemented[78]. Further simplification of verification process and data security will further benefit both citizens and various financial institutions through quick access to their documents digitally. Government of India has further proposed safety measures like masking KYC identifiers to prevent data frauds and allow CKYC registry to carry out its role without probabilities of data fraud[79].

eSign

Earlier, India used to rely heavily on physical documents and manual verifications. The Information Technology Act 2000 brought forth the notion of digital signatures where the act legally recognised digital signatures and records. Since the earlier Digital Signature Certificates (DSCs) had limitations like use of hardware dongles, need for certificate renewals and hurdles in mass usability, Aadhaar eSign brought relief to all users and heped entities like banking and financial institutions, the legal sector, telecom and insurance sector[80].

Way Forward: Due to its secure and authentic features, eSign has provided a robust system of anytime and anywhere signing and authentication. This area is further open to further innovations through use of Blockchain for signed documents storage, AI-powered ID verification and even authentication across borders. With adequate knowledge regarding its usage, Aadhaar-based eSign can bring more power across digitally divided demographics.

Digilocker

Since the idea of Digilocker itself is based on reducing paper-based documentations, it has brought forth an era of paperless governance by digital issue and verification of documents. It has enabled both citizens and institutes to depart from paper-based procedures and adopt paperless operations[81]. This has positively impacted citizens by empowering them with anytime, anywhere access to crucial documents. It has found both beneficiaries and stakeholders in education sector, traffic police and enforcement agencies, railways, airports, BFSI, Ration card/Public distribution system, and health sector[82]. For example, CBSE board has started using Digilocker for publishing class X and

[78] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2117797, accessed 18 Sep 25.
[79] https://economictimes.indiatimes.com/industry/services/advertising/et-snapchat-gen-z-index-planet-over-profit-gen-zs-rulebook-for-brands/articleshow/123088897.cms, accessed 18 Sep 25.
[80] https://proteantech.in/articles/evolution-esignature-08-05-2025/, accessed 18 Sep 25.
[8181] https://www.digitalindia.gov.in/initiative/digilocker/, accessed 18 Sep 25.
[82] https://www.digilocker.gov.in/web/case-study, accessed 18 Sep 25.

XII marksheets on Digilocker on real time basis due to which students now do not have to wait for obtaining hard copies. This helps them to apply for higher studies opportunities in a timely manner. Digilocker has also gained recognitions from some foreign universities which can verify student data online on DigiLocker repository via eSanad, which is a system developed by Ministry of External Affairs for academic documents[83]. Similarly for vehicle drivers, there is now no need for carrying physical licenses and registration documents every time. Also, for the BFSI/Online brokerage sector, issue of digital policies and verification of KYC documents from Digilocker has streamlined the entire process and also increased citizen comfort.

Way forward: Digilocker as a service is being enhanced by inclusion of more private and government partners to grow the list of document types and categories. On the security front, advances PKI infrastructure and stronger encryption is being built into the process for secured access and standardisation. Standardisation would also bring cross border and global compatibility, readiness and acceptance which will drive India towards a more digital future[84].

Unified Payment Interface (UPI)

The digital payment transactions in India have seen a tremendous growth, and as per ACI worldwide report around 49% of the global real-time payments are happening in India[85]. Out of these, UPI payments form a fair share and have grown steadily across years (refer Figure 2.7). UPI has helped India establish itself as one of the global leaders in real time payment systems and overall growth of digital transactions. At national level, UPI has been a major driving force in increasing adoption of digital payments and collection with 81% of all country transactions being carried through UPI (as in FY 2024-25)[86]. UPI has placed India on the map by exporting the UPI model to multiple countries where UPI is live and functional, namely Bhutan, France, Mauritius, Nepal, Singapore, Sri Lanka, and UAE[87].

Way Forward: NPCI International Payments Limited (NIPL) has recently signed an MoU with Google where both entities are going to work together for creating a UPI like model for international payments. This model will be interoperable and will make cross border remittances quick and seamless[88]. Additionally, in line with India's G20 Presidency goals

[83] https://www.digilocker.gov.in/web/case-study, accessed 18 Sep 25.
[84] https://www.digilocker.gov.in/web/development-roadmap, accessed 18 Sep 25.
[85] https://financialservices.gov.in/beta/sites/default/files/2025-05/Annual-Report-2024-25.pdf, accessed 18 Sep 25.
[86] https://financialservices.gov.in/beta/sites/default/files/2025-05/Annual-Report-2024-25.pdf, accessed 18 Sep 25.
[87] https://www.npci.org.in/what-we-do/upi-global/upi-global-acceptance/live-members, accessed 18 Sep 25.
[88] https://www.npci.org.in/PDF/npci/press-releases/2024/NPCI-Press-Release-Google-Pay-India-signs-MoU-with-NPCI-International-for-Global-Expansion-of-UPI.pdf, accessed 18 Sep 25.

on Digital Public Infrastructure and promoting innovative digital technologies like UPI, both a task force and additional governance frameworks have been set up. These new initiatives along with growing adoption and new business models on top of UPI are driving both digital transformation and entrepreneurship forward in India.

Aadhaar enabled payment system (AePS)

The product statistics in Figure 2.8 showcase the speed of adoption of AePS transactions and usage, suggesting the wide scale of adoption across India. AePS as a transaction service has created a large social impact in form of improved financial services especially in remote and rural areas where traditional and banking infrastructure may be limited. Through the banking correspondent and kiosk model, it enables people to perform transactions at any AePS enabled point of service. By covering a wide variety of transactions like cash withdrawal, enquiry, fund transfer though biometric authentication, AePS enhance security and convenience and has played a crucial role in financial inclusion by providing a simple yet effective way for including people in financial transactions and furthering the formal financial systems net.

Way Forward: In line with the rising usage of AI/ML and Blockchain technologies, services like AePS can benefit from innovative additions for speed, access and safety. Technological integrations, awareness among the masses and wider touchpoints are the future mechanisms for improving and strengthening the AePS system across India.

Bharat Connect

Bharat Connect's transaction and overview data (Figure 2.9) show the fast-paced rise of usage, along with the rising participation of live partners, customer operating units, billers, and live partners/agent institutions. Bharat Connect has enabled seamless payments for recurring and one time bill payments and collections by offering advanced technological solutions that bring business and customers together under the Bharat Bill Payment System[89]. Bharat connect has enabled customers make payments though both physical touchpoints like branches and agent outlets and digital platforms including apps and websites, thus ensuring access throughout the country. Bharat Connects facilitates seamless bill payments through multiple payment modes and providing access to over 22,000+ billers to millions of customers.

Way Forward: Bharat Connects enables payments across 25+ categories and also expects new categories like National Common Mobility Card (NCMC) and National

[89] https://www.npci.org.in/who-we-are/group-companies/npci-bharat-billpay-ltd/bharat-connect-overview, accessed 18 Sep 25.

Pension Scheme (NPS) to soon be supported[90]. This interoperable platform is expected to roll out new features while enhancing usability and support end users for seamless bill payments.

Rupay

The RuPay card system, developed by the National Payments Corporation of India (NPCI), has revolutionized India's digital payments ecosystem since its inception in 2012. It offers a domestic alternative to global networks like Visa and Mastercard, facilitating secure, cost-effective transactions within India. Rupay system operates in a highly integrated environment, leveraging various DPIs. UPI allows seamless real-time fund transfers across banks, and RuPay cards are fully integrated into the UPI ecosystem. Aadhaar facilitates authentication (via biometrics and OTP) and serves as a reliable method for linking individuals to bank accounts and digital payment systems like RuPay. The NETC system, which allows for cashless toll payments on highways, has been integrated with RuPay. NETC leverages FasTag technology (powered by RuPay), allowing seamless toll payments at highway toll booths and reducing congestion. NETC has become a part of the broader smart infrastructure in India, where RuPay users can benefit from contactless payments. RuPay cards support BharatQR, enabling users to make payments at any merchant using a standard QR code. BharatQR is a standardized QR code system that facilitates small-value payments between users and merchants.[91]

Way Forward: While RuPay has made strides in countries like Singapore, Bhutan, and the UAE, further international partnerships can expand RuPay's global footprint. Strengthening collaboration with global payment networks (e.g., JCB, Discover) could boost acceptance of RuPay cards internationally[92]. Also, to cater to a broader demographic, RuPay should look to offer digital loans, insurance products, and investment tools, especially for users in rural areas, to complement their payment services. Therefore, integration with open banking and digital wallets could help RuPay reach a broader user base and better integrate with fintech innovations.

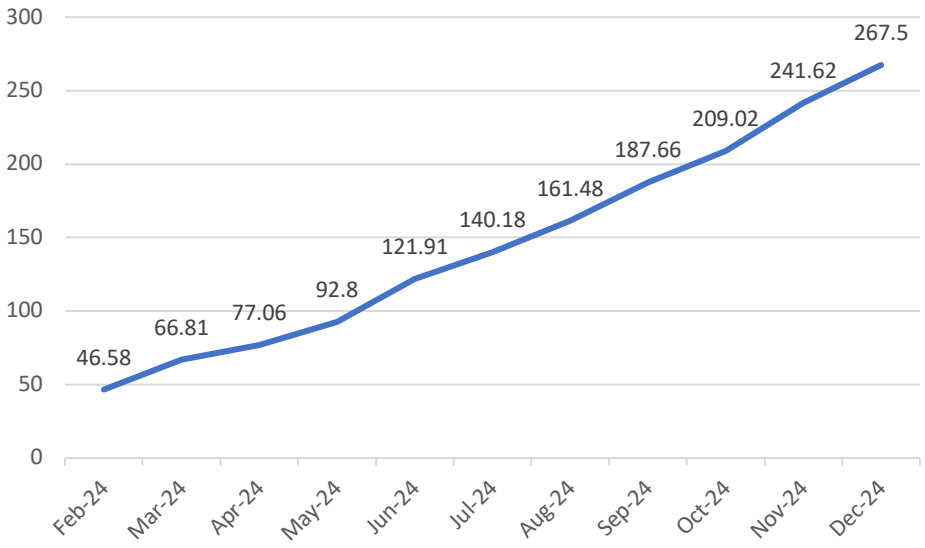
DEPA framework and AA

DEPA has provided a mechanism and set of rules and standards for data sharing which can enable further development of financial goods and services for all segments of the society while gradually removing traditional paper-based processes and facilitating the linking of multiple actors for smooth, consent-based data exchange. AA which is built on top of DEPA to actualise the use of consent-based data transfer follows the RBI issued Master Direction viz Non-Banking Finance company (NBFC)- Account Aggregator (Reserve Bank) Directions, 2016. As per Department of Financial Services (DFS), more

[90] https://www.bharat-connect.com/#:~:text=What%27s%20new?,digitalised%20process, accessed 18 Sep 25.
[91] https://www.npci.org.in/what-we-do/rupay/product-overview, accessed 19 Sep 25
[92] https://www.hindustantimes.com/genesis/rupay-credit-cards-reshaping-digital-payments-in-india-101753264261289.html, accessed 19 Sep 25

than 221 crore transactions have taken place for successfully sharing data via AA till December 2024[93] (graph shown in Figure 2.14)

Figure 2.14: Growth of transactions in AA (in crores)



Authors' representation. Source: https://financialservices.gov.in/beta/sites/default/files/2025-05/Annual-Report-2024-25.pdf, accessed 23 Sep 25.

The role of the AA framework was even recognised in the G20 India Presidency 2023. It was recognised as the foundational DPI serving the data exchange layer and complementing the identity (Aadhaar) and payments (UPI) layers. The role and impact of AA have been acknowledged in key G20 documents, including the "*Policy Recommendations for Advancing Financial Inclusion and Productivity Gains through Digital Public Infrastructure" (2023)*. Its significance is also detailed in *the "Report of India's G20 Task Force on Digital Public Infrastructure" (July 2024)"*[94].

Way Forward: The DEPA and AA ecosystem has grown rapidly and brought in new members and participants. The adoption is fast paced and is across multiple sectors like banking, securities, insurance and pension sector. The ecosystem boasts of a high number of FIUs and FIPs and over 2.2 billion financial accounts for consent-based data sharing, and over 112.34 million users having linked their accounts. This shows the adoption, trust and scale of the AA framework. Going forward, the AA framework is expected to expand the horizons of credit access, especially for the MSME sector and a rise in personal credit sector.

[93] https://financialservices.gov.in/beta/sites/default/files/2025-05/Annual-Report-2024-25.pdf, accessed 18 Sep 25.
[94] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2162953, accessed 18 Sep 25.

OCEN and ONDC Finance

The open networks for providing affordable credit are basically a common language for lenders and marketplaces to build scalable financial products. They provide a set of standard APIs and enable a 'plug and play' approach for all participants[95]. This approach has enabled banks and NBFCs to use the data sitting in siloes across India's digital ecosystem to create new lending products. While the presence of digital payment systems has brought in comfort and awareness among the Indian citizens, the open networks for credit are benefiting from the prevailing digital literacy and are using digital transactional data being generated by every MSME as collateral to provide them with the much-needed small-ticket-size loans[96]. This has started solving for the big credit gap which exists in the market for the MSME segment. OCEN allows for MSMEs to build their credit profiles based on their digital transaction and business history. This data enables the open networks to assess MSME credit worthiness more accurately and is able to offer tailormade solutions for them[97]. This drives MSME growth and also helps the sector to drive further employment. Since ONDC enables the MSME to digitise their offerings through digital platforms, it drives digital enablement and thereby formalization. ONDC offers multiple services like payment and logistics support to MSME, thereby helping them improve their standing and business transactions. This in turn gets reflected in their digital history and creditworthiness, thereby improving their chances of affordable online credit.

Way Forward: The MSME segment may be the biggest beneficiary since they are currently in the midst of a huge credit crunch. With more liquidity in hand, the MSME segment will not only improve performance but also grow in terms of size and scope. There is also a huge opportunity for employment creation through this segment once their credit needs are met. Additionally, OCEN also has tremendous scope to improve the lending process and make short term lending profitable. The cost of servicing loans decreases through these networks which also enables the lenders to service remote areas. Going forward, these open networks have the power to streamline the lending process, and provide benefits to new and smaller lenders in form of enhanced transparency and low cost[98]. Large lenders too may benefit from the networks when they can avail the benefits of Lending Agents. Thus, there are potential benefits for all participants involved, which can drive a smoother and more transparent process.

[95] https://sahamati.org.in/ondc-financial-services-ocen-protocol-account-aggregators-will-change-digital-lending-in-india/, accessed 18 Sep 25.
[96] https://ocen.dev/blog/importance-of-lending-for-India/, accessed 18 Sep 25.
[97] https://www.financialexpress.com/business/sme-msme-tech-how-ondc-and-ocen-can-push-digitisation-drive-among-msmes-3140669/?ref=ondc.org, accessed 18 Sep 25.
[98] https://pn.ispirt.in/beyond-the-clutter-how-ocen-is-unlocking-msme-credit-market-in-india/, accessed 18 Sep 25.

STATE OF DPI IN HEALTHCARE

Mapping the ecosystem

The key ecosystem players in healthcare in India are as follows:

Private Healthcare Providers

- **Hospitals**: tertiary/quaternary multispecialty hospitals; secondary care hospitals; day-care centres; specialty institutes (cardiac, cancer, neuro, mother & child, eye, ortho, etc.).
- **Nursing Homes**: small/midsize inpatient facilities (often family-run) with basic specialties.
- **Clinics & OPD**: single-doctor clinics, group practices, polyclinics, dental clinics, eye clinics, fertility centres, dialysis centres.
- **Quasi-Medical / Allied Professionals**: physiotherapists, occupational therapists, nutritionists/dietitians, psychologists, counsellors, speech & hearing therapists, optometrists, dentists, dental hygienists, prosthetists/orthotists, pharmacists.
- **Home-based Care**: home nursing, palliative & hospice care, home ICU setups, remote monitoring.

Public Healthcare Providers

- **Sub-centre & Health & Wellness Centre (HWC)**: community-level primary care, maternal & child health, Non-Communicable Disease screening, basic diagnostics, teleconsulting linkage.
- **Primary Health Centre (PHC)**: medical officer-led primary care; OPD, basic lab, immunization, referrals.
- **Rural/Community Health Centre (RHC/CHC), Sub-District Hospital**: first-referral units (FRU) with basic surgical/obstetric capability; limited specialties.
- **District Hospital / District Health Centre**: secondary/tertiary care hub for the district; multi-specialty services, blood bank, imaging.
- **Medical Colleges & Teaching Hospitals**: tertiary/quaternary care, specialty & super specialty departments, research & training.
- **Autonomous National and state Institutes**: AIIMS and similar institutes (e.g., NIMHANS, PGIMER, JIPMER) offering advanced care & research.

- **Vertical National/State Programs**: TB, HIV, NCDs, mental health, blindness control, etc., with dedicated facilities/centres.

Non-Clinical / Technical & Supporting Services

- **Medical Instruments & Devices**: OEMs, importers, distributors; biomedical engineering vendors; calibration & maintenance services.
- **Pharmacy & Medical Supplies**: retail pharmacies (organized chains, independent chemists), wholesale distributors, online pharmacies; consumables (PPE, syringes, reagents).
- **Waste Management**: bio-medical waste collection, treatment & disposal agencies; sharps management; e-waste (equipment) handlers.
- **Medical Transport**: emergency ambulances (108/102/112, private, hospital-run), non-emergency patient transport; air ambulance.
- **Laboratories & Diagnostic Centres**: (NABL-accredited labs)
    - Organized: national/regional chains for labs and radiology diagnostic Centers; hospital labs
    - Unorganized: standalone labs, (acting as collection centres national/regional chains), radiology centres (Standalone).
- **Insurance & TPA (Health Financing)**: government schemes (e.g., publicly financed health insurance), private health insurers, standalone health insurers, third-party administrators, insurance brokers, empanelment networks.
- **IT & Digital Health**: HIS/EMR/EHR vendors, LIMS/RIS/PACS, telemedicine platforms, e-pharmacy, appointment & practice management, health information exchanges, payments & fintech, ABDM consent managers & health lockers.
- **Facilities & Operations**: facility management, sterilization (CSSD), linen & laundry, catering, security, building services.
- **Education, Training & HR**: medical colleges, nursing & allied health colleges, paramedical training centres, CPD/CME providers, staffing agencies, locum networks.
- **Quality, Compliance & Accreditation**: NABH accreditation, infection control audits, biomedical waste compliance, radiation safety, Central Drugs Standards Control Organization (CDSCO)/State FDA liaison, ethics committees, NABL, Pollution control, Fire audit, electrical audit, oxygen plant.
- **Public Health & Community Support**: NGOs, community-based organizations, wellness/AYUSH centres, occupational health services.

Insurance Agencies

Insurance provides risk protection for individuals and businesses. Key segments in this category are:

- **Life Insurers (selected)**

LIC, HDFC Life, SBI Life, ICICI Prudential Life, Max Life, Bajaj Allianz Life, Kotak Life, Tata AIA Life, PNB MetLife, Canara HSBC Life, Edelweiss Tokio Life, Aviva Life, Ageas Federal Life, Birla Sun Life (ABS Life), IndiaFirst Life.

- **General/Non-life Insurers (selected)**

New India Assurance, United India, National Insurance, Oriental Insurance; ICICI Lombard, HDFC ERGO, Bajaj Allianz General, SBI General, Reliance General, TATA AIG, Kotak General, Future Generali, Royal Sundaram, Cholamandalam MS, Universal Sompo, Digit Insurance, Acko General, Go Digit, Navi General (transitioning).

- **Standalone Health Insurers (SAHI)**

Star Health, Niva Bupa, Care Health (Religare), ManipalCigna, Aditya Birla Health, HDFC Ergo Health (ex-Apollo Munich, folded into HDFC ERGO), Kotak Health (as applicable).

Governance & Ecosystem Players

- **Public Institutions**
  - AIIMS, PGIMER, state medical colleges (departments of forensic medicine)
  - State/District forensic science labs (FSLs)
  - Police & judiciary as demand-side users
- **Private/Independent**
  - Private forensic labs (accredited by NABL/ISO)
  - Independent forensic experts (ballistics, cyber forensics, medical legal advisors)
- **Regulators & Legal Bodies**
  - Ministry of Home Affairs (MHA) for FSLs
  - MoHFW (for forensic medicine education standards under NMC)
  - Courts (evidence admissibility under Indian Evidence Act)
  - NABL for lab accreditation

Veterinary Healthcare

- Veterinary Healthcare Provider:
  - Public: State veterinary hospitals, district clinics, veterinary colleges/teaching hospitals.
  - Private: Small animal clinics, farm vets, specialist vets, pet hospitals.

    - Support Staff: Para-vets, AI technicians, animal attendants.
- Support Services:
    - Diagnostic labs (pathology, microbiology, PCR).
    - Vaccine manufacturers, cold chain & distribution.
    - Feed & nutrition suppliers, pharmacies, farm input shops.
    - Insurance & credit schemes for livestock.

Telemedicine

- **Primary Care**
    - Tele-triage (first consultation, minor illnesses, prescription renewal)
    - AYUSH + general practice consultations
    - ASHA/ANM using telemedicine apps for linking PHC doctors
- **Secondary Care**
    - Tele-radiology, tele-pathology (lab reporting from hub to spoke hospitals)
    - Specialist consultation in district hospitals via video link
    - eSanjeevani OPD (state-to-state load balancing of specialists)
- **Tertiary & Super specialty**
    - Tele-ICU monitoring
    - Tele-oncology (tumour boards, follow-up chemo counselling)
    - Post-surgical follow-ups, chronic disease management
- **Public Health**
    - COVID-19 teleconsults, mental health helplines
    - Digital platforms for TB, HIV, NCD follow-ups

DPIs in use

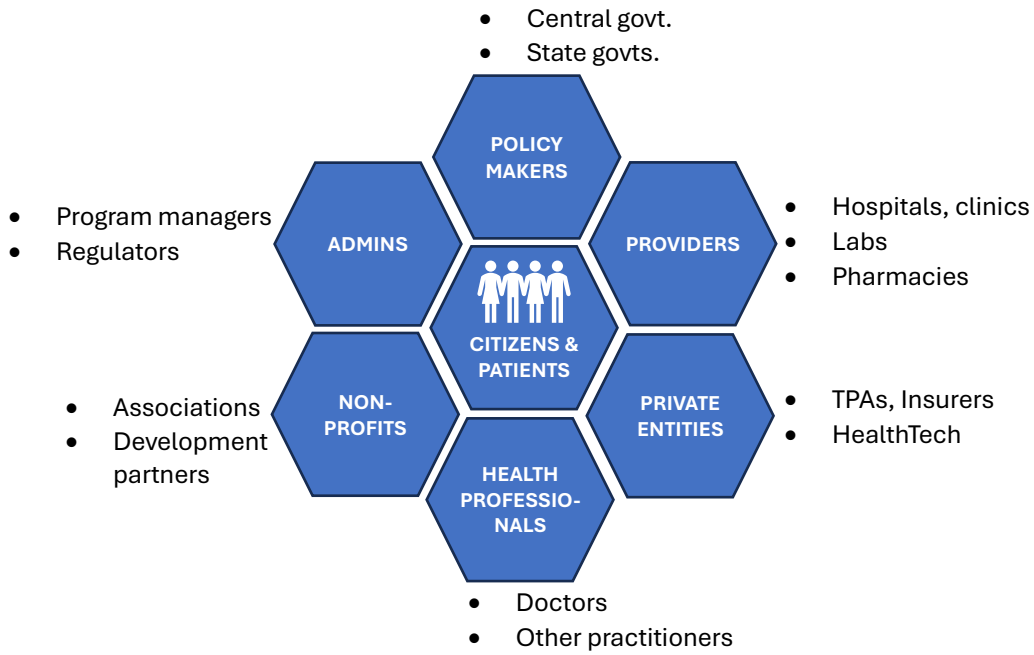
India's healthcare ecosystem has been fragmented. Medical records have been scattered throughout government hospitals, private hospitals, independent laboratories, pharmacies, and insurance databases. Patients typically face repetition of diagnostic tests, lack of care continuity, and challenges in confirming healthcare practitioner's credentialing and legitimacy. At the same time, policymakers and authorities have restricted access to health-related data at population scale which impacts monitoring and resource allocation.

India introduced the Ayushman Bharat Digital Mission (ABDM) under the Ministry of Health and Family Welfare (MoHFW) to address these institutional challenges. ABDM takes the Digital Public Infrastructure (DPI) approach, building on the success of foundational digital rails like Aadhaar, UPI, and eKYC. ABDM proposes a federated,

consent-based, and standards-driven architecture instead of consolidating all health records.

The healthcare DPI is assembled around three core registries: patients, practitioners, and health facilities and records which are functionally interoperable as a stack. These registries are accompanied by digital rails of interoperable standards, consent management, and data privacy and security protocol. It offers gateway APIs which enables health ecosystem participants to interconnect. Various digital healthcare services such as telemedicine, remote vitals, digital prescriptions, claim settlement and health-related data sharing can be built and provided on this foundation.

Figure 3.1: ABDM Ecosystem



Authors' representation. Source https://abdm.gov.in/abdm/, accessed 17 Sep 25

The Stack: The Trinity of Core Registries

Patient Registry: ABHA (Ayushman Bharat Health Account)

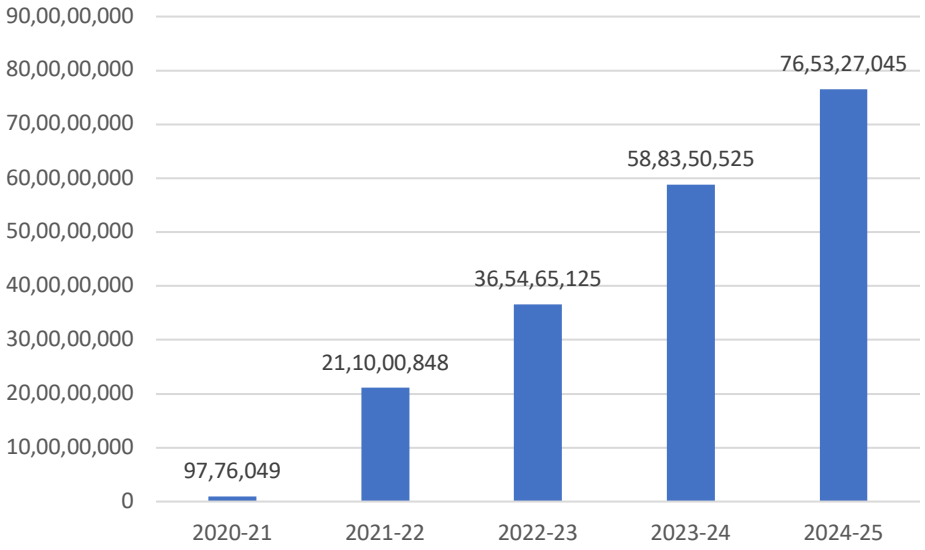
The ABHA (Ayushman Bharat Health Account)[99] number is a uniquely assigned digital health identity assigned to citizen. This functions as the patient registry of ABDM which is one of the building blocks. By linking health records generated across facilities and over time, ABHA enables creation of a longitudinal medical record. Each ABHA is portable, interoperable, and linked to consent flows. ABHA enables the establishments of

[99] https://abha.abdm.gov.in/abha/v3/, accessed 17 Sep 25

longitudinal medical records which can be created and accessed across the healthcare facilities. This registry is designed to be portable and interoperable[100].

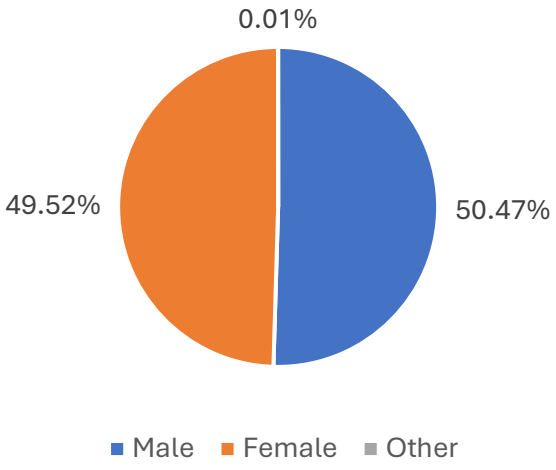
The ABHA ID addresses the prevalent problem of redundant and inconsistent patient profiles in healthcare facilities and insurance databases. ABHA has embedded telemedicine apps, pharmacies, and diagnostic data management systems into it while connecting with uniquely identified patient's ID. ABHA is enabling India in creating the foundation for patient-centric health data ownership.

Figure 3.2: ABHA creation trend (Cumulative)



Authors' representation. Source: https://dashboard.abdm.gov.in/abdm/abdminsight_1, accessed 23 Sep 25

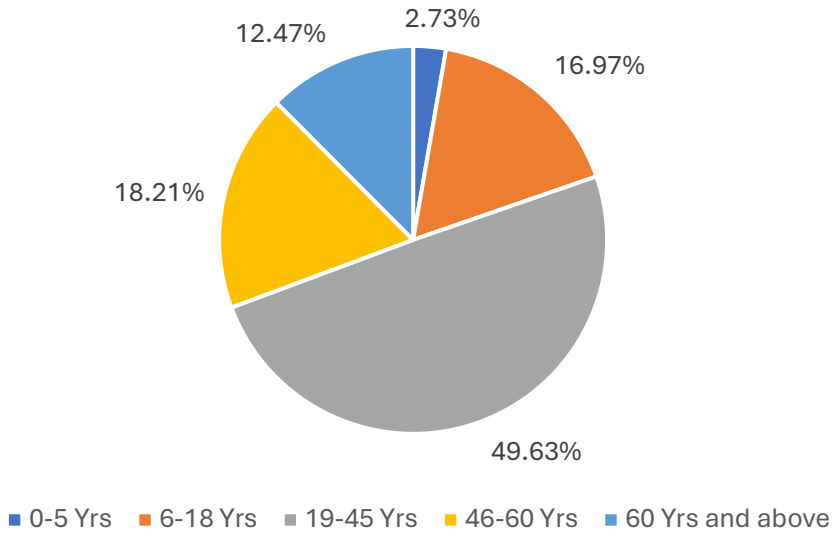
Figure 3.3: ABHA creation by gender (Trend as on 23 Sep 25)



Authors' representation. Source: https://dashboard.abdm.gov.in/abdm/, accessed 23 Sep 25

[100] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2017129, accessed 17 Sep 25

Figure 3.4: ABHA creation by age (Trend as on 23 Sep 25)



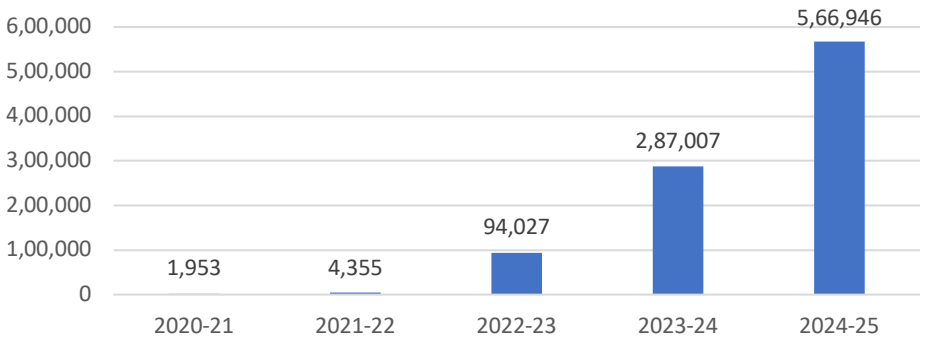
Authors' representation. Source: https://dashboard.abdm.gov.in/abdm/, accessed 23 Sep 25

Practitioner Registry: HPR (Healthcare Professionals Registry)

The (HPR) is the Healthcare Professionals Registry under ABDM. This Practitioner registry maintains verified records of doctors, nurses, paramedics, and AYUSH healthcare professionals[101]. Each practitioner's credentials are authenticated through their respective State Medical Councils or professional boards.

Patients can verify the legitimacy of practitioners with HPR[102]. This enables trust and discovery of authorised practitioners for provision of healthcare services. This makes telemedicine platforms more credible with authorized professionals provide services. The HPR facilitates authorities in mapping the practitioner distribution across regions.

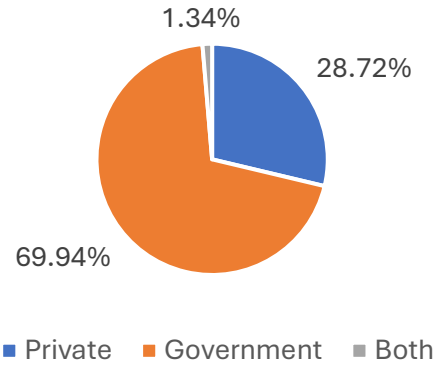
Figure 3.5: Verified Healthcare Professionals Trends (Cumulative)



Authors' representation. Source: https://dashboard.abdm.gov.in/abdm/abdminsight_1, accessed 17 Sep 25

[101] https://nhpr.abdm.gov.in/home, accessed 17 Sep 25
[102] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1839609, accessed 17 Sep 25

Figure 3.6: HPR registered by employment type (as on 23 Sep 25)



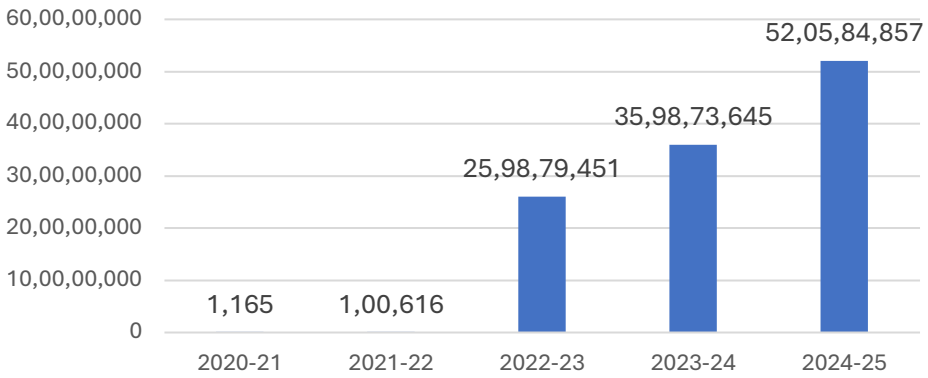
Authors' representation. Source: https://dashboard.abdm.gov.in/abdm/, accessed 23 Sep 25

Facility & Health Records Registry (Federated EHR/PHR)

The third component of the stack is the Health Facility Registry (HFR)[103] combined with the federated personal health records (PHR) architecture. ABDM distinguishes between HIP (Health Information Providers), HIUs (Health Information Users) and HRPs (Health Repository Providers)[104].

- HIPs (Health Information Providers): are the healthcare facilities where the personal health records are generated which can be provided to users. HIPSs are hospitals, labs, clinics that generate records.
- HIUs (Health Information Users): are the entities who need patient's health related data and can seek this information from HIPs. These HIUs can be Practitioners, insurers, or other entities requesting records.
- HRPs (Health Repository Providers): are the entities which offer consent-based digital lockers where patients may choose to store their records.

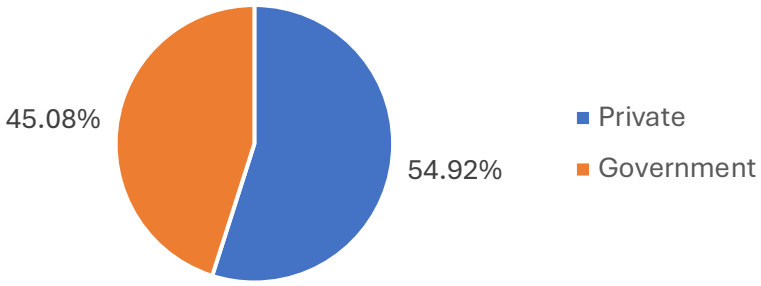
Figure 3.7: Health Records Linked Trend (Cumulative)



Authors' representation. Source: https://dashboard.abdm.gov.in/abdm/abdminsight_1, accessed 23 Sep 25

[103] https://nhpr.abdm.gov.in/home, accessed 17 Sep 25
[104] https://abdm.gov.in:8081/uploads/HIP_HIU_Guidelines_f85df336ec.pdf, accessed 17 Sep 25

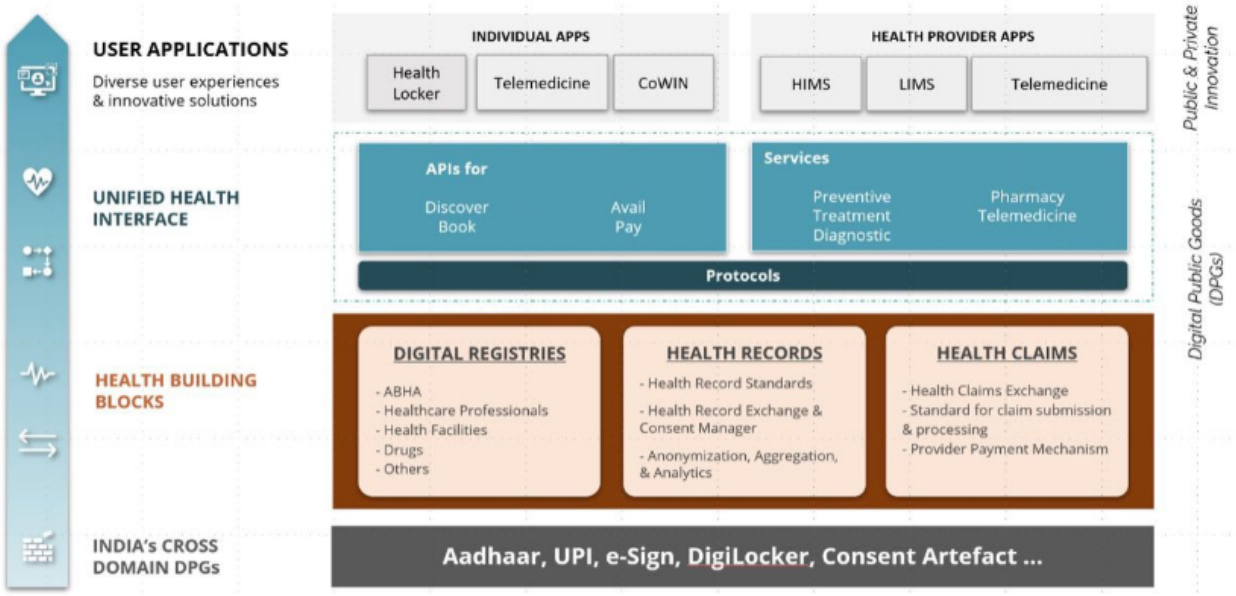
Figure 3.8: Healthcare Facilities by ownership type (as on 23 Sep 25)



Source: https://dashboard.abdm.gov.in/abdm/, accessed 17 Sep 25

The NRCeS FHIR Framework is the Indian National Resource Centre for EHR Standards (NRCeS)'s implementation framework for Fast Healthcare Interoperability Resources (FHIR), designed specific to the Ayushman Bharat Digital Mission (ABDM)[105]. It provides standardized FHIR[106] profiles, implementation guides, and resources to ensure interoperability within India's national digital health ecosystem, supporting applications like patient health records, clinical documents, and insurance claim processing using open standards. This framework ensures that records can flow securely across HIPs and HIUs via the ABDM Gateway, governed by patient consent.

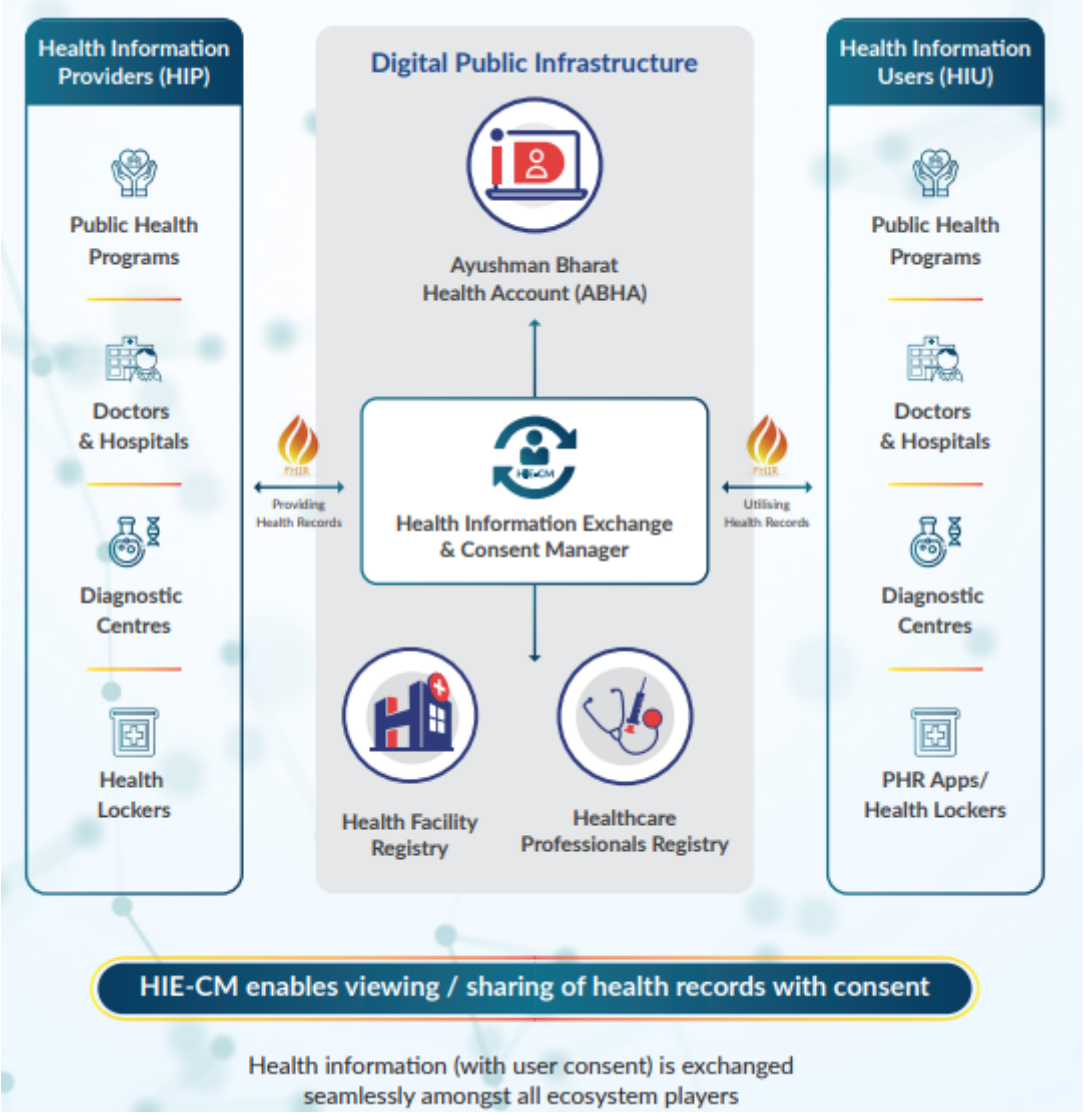
Figure 3.9: ABDM Architecture



Source: https://abdm.gov.in/abdm/, accessed 17 Sep 25

[105]https://www.nrces.in/download/files/pdf/Implementation_Guide_for_Adoption_of_FHIR_in_ABDM_and_NHCX.pdf, accessed 17 Sep 25
[106] https://nrces.in/ndhm/fhir/r4/3.0.1/, accessed 17 Sep 25

Figure 3.10: Illustration depicting generation and sharing of records on ABDM



Source: https://abdm.gov.in/abdm/; https://abdm.gov.in:8081/uploads/ABDM_HIE_CM_ea5d4c0559.pdf, accessed 17 Sep 25

The Rails: Consent, Interoperability, and Governance

While the ABDM registries can be defined as the "stack," their interconnected rails enable these diverse systems made of building blocks of health data and identity can communicate securely, seamlessly and reliably.

Consent Manager

ABDM adopts patient-centric consent management framework[107]. The Consent Manager provides standardized APIs through which patients approve or revoke sharing of their

[107] https://abdm.gov.in:8081/uploads/HIP_HIU_Guidelines_f85df336ec.pdf, accessed 17 Sep 25

records[108]. This consent is digitally logged and auditable also provide grievance Redressal Mechanism. This ensures compliance with data protection principles while enabling data portability. This strengthens patient's trust in health data management policy under ABDM.

ABDM Gateway for Interoperability

The ABDM Gateway[109] serves as the interface for HIP-HIU communication. All data exchanges occur via standardized APIs that enforce FHIR data framework, encryption mechanisms, and metadata norms. This ensures that a health-related data exchange seamless and readable for relevant healthcare practitioner or facility, or by an insurer evaluating a claim.

Nation Health Authority has provided ABDM Sandbox[110] which is capable of hosting building blocks like ABHA number service, consent manager and gateway, Sandbox ABHA Mobile Application for android, Sandbox for HIUs, Sandbox for DigiDoctor, Sandbox for health Facility within its sandbox environment.

Institutional Governance

ABDM has multi-layered governance which ensures both national coherence and state-level adaptability. It has National Health Authority (NHA) implements ABDM Policy and oversee orchestration of the registries. MoHFW provides policy direction to NHA for Policy making and implementation around ABDM. State government and UT administration with their Health departments oversee state-level adoption of ABDM and its regulatory compliance. District administration led by District magistrate with District Health Officer will be the point of influence for the ABDM adoption at healthcare facilities and practitioners in their region[111].

Services Enabled by the ABDM Stack

The DPI trinity consists of patient registry (ABHA), practitioner registry (HPR), and federated health records through HIP, HIU, HRP enable service delivery without creating silo and fragmentation. These services streamline clinical workflows along with creating efficient governance and health program management.

Patient Identification & Longitudinal Records

The Ayushman Bharat Health Account (ABHA) provides every patient with a unique digital identity. This enables patient with ability to provide explicit consent for sharing of health-related data for query linked health records stored with Health Information Providers

[108] https://abdm.gov.in:8081/uploads/ABDM_HIE_CM_ea5d4c0559.pdf, accessed 17 Sep 25
[109] https://abdm.gov.in:8081/uploads/HIP_HIU_Guidelines_f85df336ec.pdf, accessed 17 Sep 25
[110] https://sandbox.abdm.gov.in/sandbox/v3/documentation?doc=building_blocks, accessed 17 Sep 25
[111]https://abdm.gov.in:8081/uploads/ABDM_Building_Blocks_v8_3_External_Version_eabbc5c0f3_4_a96f40c645_5716a684de_b344369144.pdf, accessed 17 Sep 25

(HIPs) or Health Repository Providers (HRPs)[112]. These may include past prescriptions, laboratory reports, diagnostic imaging, and hospital discharge summaries[113].

This mechanism facilitates continuity of care across multiple nodes. For instance, if a patient is treated in a district hospital and later admitted to a tertiary hospital, doctors at the second facility can retrieve the patient's history without repeating the tests. For insurers, ABHA reduces ambiguity in patient identification and enables claims processing with greater accuracy.

Provider Discovery & Trust

The Healthcare Professionals Registry (HPR) and Health Facility Registry (HFR) together create a verified database of practitioners and facilities. Patients and insurers can confirm that credential and legitimacy of the providers[114]. This service critically addresses the challenges with unqualified practitioners and unregistered facilities. It facilitates state departments and central authorities to monitor and map provider density and distribution. This enables Government in planning action plan for underserved geographies resource allocation. In the insurance ecosystem, empanelment decisions rely on Health Facility Record data which can ensure only accredited facilities can be part of public or private reimbursement schemes.

Telemedicine Integration (eSanjeevani)

The eSanjeevani national telemedicine platform[115] has been integrated with ABHA, demonstrating how ABDM operationalize remote care. The records of teleconsultation such as the practitioner's notes, prescriptions, and diagnostic recommendations are linked to the patient's ABHA ID and securely stored in health lockers. This enable teleconsultation records to be easily accessed for follow-up visits at physical hospitals. It highlights that telemedicine is important part of the patient's longitudinal health journey. Teleconsultation service's Integration with ABDM underlines the interoperability of state-run telemedicine programs and private platforms within the same ecosystem.

Interoperable Prescriptions, Labs, and Referrals

With ABDM Health Information Providers (HIPs) (hospitals, clinics) can generate electronic prescriptions and lab reports in FHIR-compliant formats[116]. These records can be accessed by Health Information Users (HIUs) such as other doctors, insurers, or diagnostic centres after patient grants explicit consent for the access. This streamlines the referral mechanism. For instance, a general physician is able to electronically refer a

[112]https://abdm.gov.in:8081/uploads/ABDM_Building_Blocks_v8_3_External_Version_eabbc5c0f3_4_a96f40c645_5716a684de_b344369144.pdf, accessed 17 Sep 25
[113] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2017129, accessed 17 Sep 25
[114]https://nhpr.abdm.gov.in/home, accessed 17 Sep 25
[115] https://esanjeevani.mohfw.gov.in/#/, accessed 17 Sep 25
[116] https://www.nrces.in/ndhm/fhir/r4/index.html, accessed 17 Sep 25

patient to a cardiologist, who can access past health records and lab reports. Likewise, labs can upload results directly into the patient's record ecosystem improving clinical efficiency[117].

Program Management, Empanelment, and Claims

Insurance schemes like Pradhan Mantri Jan Arogya Yojana (PM-JAY)[118] use the ABDM stack for end-to-end program management. It facilitates key functions such as Beneficiary identification, Empanelment of hospitals, and Claims verification and fraud detection. Patients are uniquely verified with ABHA; Health facilities are verified by HFR which helps in simpler Claims verification and fraud detection. These linkages minimize leakages, improve settlement times for claims, and make process transparent for both government and private payers.

Public Health Surveillance and Research

ABDM enables seamless flow of aggregated and anonymized[119] health data from Health Information Providers into platforms such as DHIS2 (District Health Information System 2)[120] which is widely used in India for health program data management. This facilitates departments with state and national level tracking of Immunization; real-time surveillance through diagnosis and clinical records for epidemic; and monitoring Chronic disease registries for resource allocation[121]. This service can provide access of public health data to researchers and authorities with well-defined purpose limited consent framework.

Open Source /Digital Public Goods in Healthcare

India's healthcare DPI leverages several open-source Digital Public Goods (DPGs) to ensure interoperability, cost-efficiency, and scalability across the ecosystem:

- **Bahmni [122]/ OpenMRS** – These are widely used Electronic Medical Record (EMR) and Hospital Information Systems (HMIS)[123] certified under ABDM as per Indian contexts. They function as HIPs/HUIs, enabling low resource environments, clinics, NGOs and governments with generation and sharing of patient records in standardized formats[124].

[117]https://abdm.gov.in:8081/uploads/ABDM_Building_Blocks_v8_3_External_Version_eabbc5c0f3_4_a96f40c645_5716a684de_b344369144.pdf, accessed 17 Sep 25
[118] https://nha.gov.in/PM-JAY#, accessed 17 Sep 25
[119] https://abdm.gov.in:8081/uploads/HIP_HIU_Guidelines_f85df336ec.pdf, accessed 17 Sep 25
[120] https://dhis2.org/, accessed 17 Sep 25
[121]https://abdm.gov.in:8081/uploads/ABDM_Building_Blocks_v8_3_External_Version_eabbc5c0f3_4_a96f40c645_5716a684de_b344369144.pdf, accessed 17 Sep 25
[122] https://www.bahmni.org/, accessed 17 Sep 25
[123] https://www.cmchistn.com/ABDM_Pdf/HMIS_IEC.pdf, accessed 17 Sep 25
[124] https://abdm.gov.in/partner-offers-details/Mg==, accessed 17 Sep 25

- **DHIS2** – District Health Information System 2 (DHIS2)[125] is a web-based, open-source data management platform used globally, including in India, to collect, analyse, and visualize health data from facility and community levels for program monitoring and decision-making. In India, it is utilised for immunization tracking and public health reporting
- **eSanjeevani**[126] – The national telemedicine platform, integrated with ABHA Health IDs to ensure that teleconsultation notes, prescriptions, and follow-ups are linked to a patient's longitudinal record.
- **TeleMANAS:** Tele MANAS[127] offers 24/7, free mental health support through phone-based services, ensuring that individuals across India can easily access the help they need. The service is structured in a two-tier system to optimize care delivery and enhance support. Tier 1 has Tele-counselling (Assistance with psychological distress) and Tele-consultation(for specialized care and assistance). Tier 2 has specialists from District Mental Health Program (DMHP) facilities and medical colleges, offering additional resources for physical consultations and audiovisual consultations via e-Sanjeevani[128].
- **PHR / Health Locker Apps and HMIS**[129] **Modules** – An evolving ecosystem of ABDM-compliant health locker applications, hospital MIS systems that facilitate HIP/HIU/HRP functions, this enables patients with storing, sharing, and managing their health data securely[130].

Building Rails for the Future

The ABDM stack comprising of ABHA, HPR, HFR records is the backbone of healthcare DPI in India. The rails of consent, gateways, and institutional governance enable trust and interoperability within healthcare DPI ecosystem. India is offering digital healthcare services from telemedicine to claims management built on this foundation. As ABDM adoption accelerates, this DPI will lead to shaping the next frontier of global digital health diplomacy. The Indian healthcare DPI is not merely a digital project; it is the institutional and technical blueprint for world to adopt.

CoWIN (COVID Vaccine Intelligence Network)

The COVID Vaccine Intelligence Network (CoWIN)[131] platform represents one of India's most remarkable health-sector digital public infrastructures[132]. It was built during the

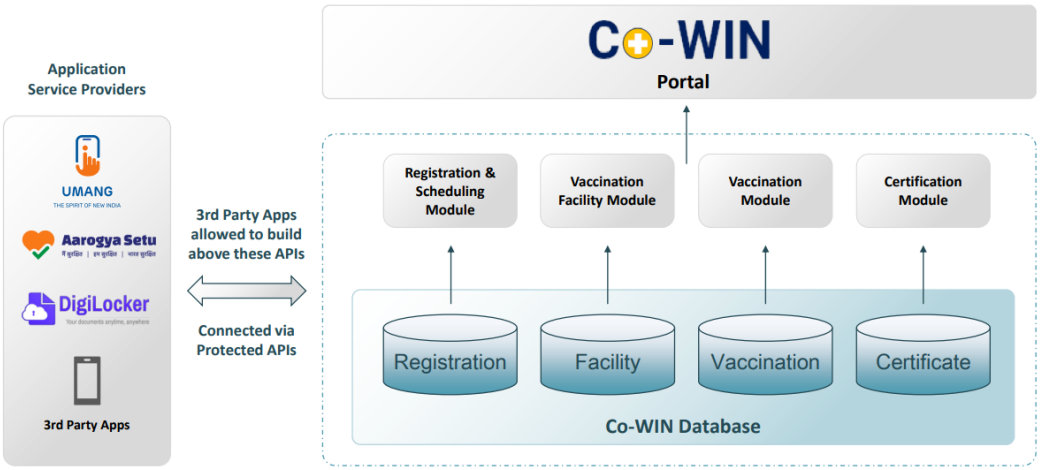
[125] https://www.digitalpublicgoods.net/r/dhis2, accessed 17 Sep 25
[126] https://esanjeevani.mohfw.gov.in/#/, accessed 17 Sep 25
[127] https://telemanas.mohfw.gov.in/home, accessed 17 Sep 25
[128] https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=153277&ModuleId=3, accessed 17 Sep 25
[129] https://hmis.mohfw.gov.in/#!/, accessed 17 Sep 25
[130] https://abdm.gov.in:8081/uploads/HIP_HIU_Guidelines_f85df336ec.pdf, accessed 17 Sep 25
[131] https://health.vikaspedia.in/viewcontent/health/health-campaigns/all-about-covid-vaccines/covid-vaccine-intelligence-network-cowin?lgn=en, accessed 17 Sep 25
[132] https://www.cowin.gov.in/, accessed 17 Sep 25

COVID-19 pandemic under the Ministry of Health and Family Welfare (MoHFW). CoWIN provided the digital rails for planning, registration, delivery, and certification of vaccinations[133]. It was designed on top of India stack, embedding Aadhaar-based authentication, QR-enabled certificates, and scalable APIs.

The architecture of CoWIN comprised four functional layers[134]. First layer was Beneficiary Management enabled self-registration, appointment scheduling for vaccination and generating downloadable digital vaccination certificate for citizens. Second layer was for Vaccinator and Session Management which enabled state health departments to plan vaccination sessions, allocate vaccines, and assign staff. Third layer was for Inventory and Logistics which provided real-time tracking of vaccine supply and cold chain movements. Fourth layer was for Reporting and Analytics which generated dashboards for the Union and state governments for micro-planning and monitoring.

CoWIN integrated with DigiLocker for certificate storage, Aarogya Setu for user access, and the ABHA ecosystem for linking health identifiers. The platform issued vaccination certificates in WHO-compliant formats, which were globally recognized. As of 2025, CoWIN has administered over two billion[135] vaccine doses. Beyond COVID-19, its architecture is being repurposed under the UWIN[136] (Universal Immunisation Network) initiative to support the digitization of India's routine immunisation programme. CoWIN thus exemplifies how a crisis-driven DPI can transition into a permanent, national public health digital asset.

Figure 3.11: Co-WIN Architecture



Source: http://prod-cdn.preprod.co-vin.in/assets/pdf/CoWIN_Overview.pdf, accessed 17 Sep 25

[133] https://health.vikaspedia.in/viewcontent/health/health-campaigns/all-about-covid-vaccines/covid-vaccine-intelligence-network-cowin?lgn=en, accessed 17 Sep 25
[134] https://prod-cdn.preprod.co-vin.in/assets/pdf/CoWIN_Overview.pdf, accessed 17 Sep 25
[135] https://dashboard.cowin.gov.in/, accessed 17 Sep 25
[136] https://uwin.mohfw.gov.in/home, accessed 17 Sep 25

eSanjeevani (National Telemedicine Service)

eSanjeevani[137] is India's flagship national telemedicine platform, launched by the Ministry of Health and Family Welfare (MoHFW) and implemented by the Centre for Development of Advanced Computing (C-DAC). It bridges gaps in healthcare accessibility across rural and urban India by facilitating remote consultations at scale.

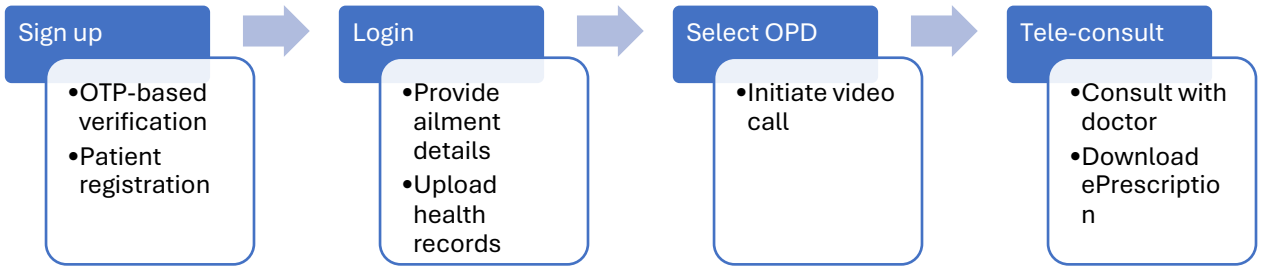
The platform runs on two models: eSanjeevaniAB-HWC (doctor-to-doctor) and eSanjeevaniOPD (patient-to-doctor)[138]. The AB-HWC model connect community health officers and primary doctors with district or state-level specialists. The OPD model allows citizens to directly book teleconsultations with verified practitioners. Both models are integrated with the ABHA (Health ID), enabling patient records, prescriptions, and follow-up notes to be linked to longitudinal health records.

eSanjeevani functions on ABDM's digital rails for authentication, consent, and portability of health record. Prescriptions generated in eSanjeevani are digitally signed and are accepted by pharmacies or uploaded into health lockers. Teleconsultation workflows are integrated with referral pathways, ensuring seamless transitions from general physicians to specialists[139]. This part of eSanjeevani functions as a Digital Public Good (DPG) enabling platforms like eSanjeevaniAB-HWC (doctor-to-doctor) and eSanjeevaniOPD (patient-to-doctor).

The eSanjeevani is governed by MoHFW. Its open API structure enables private telemedicine service providers to sync with ABDM standards. As of 2025, eSanjeevani has facilitated over 150 million[140] consultations, which makes it the world's largest publicly funded telemedicine service.

By integrating it within the ABDM ecosystem, eSanjeevani a durable DPI asset. It is excellent example of India's excellence in supporting continuity of care, balancing imbalances in practitioner distribution, while scaling DPI for remote health services.

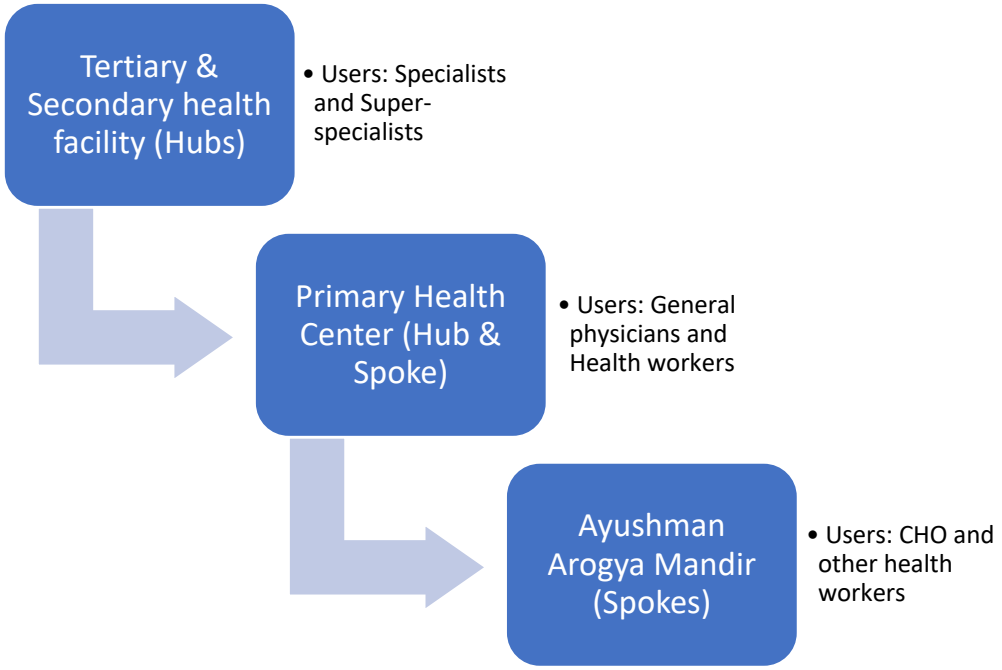
Figure 3.12: eSanjeevani OPD Process Flow



Authors' representation. Source: https://mohfw.gov.in/sites/default/files/san.pdf, accessed 17 Sep 25

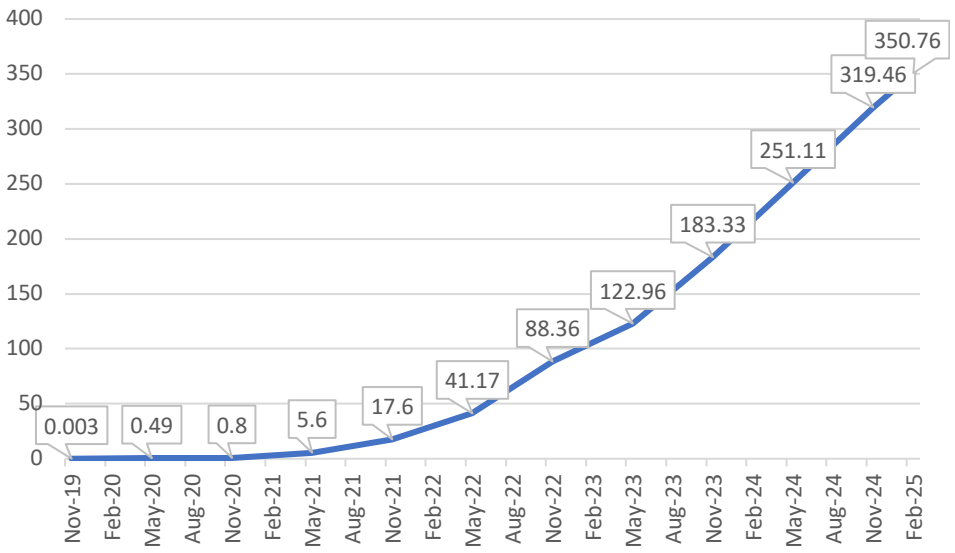
[137] https://stg.esanjeevani.in/#/, accessed 17 Sep 25
[138] https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1670952, accessed 17 Sep 25
[139] https://mohfw.gov.in/sites/default/files/san.pdf, accessed 17 Sep 25
[140] https://esanjeevani.mohfw.gov.in/#/, accessed 18 Sep 25

Figure 3.13: Architecture of eSanjeevani (Hub-and-Spoke model)



Source: https://mohfw.gov.in/sites/default/files/san.pdf, accessed 17 Sep 25

Figure 3.14: Adoption of eSanjeevani in terms of patients served (in millions)



Source: https://mohfw.gov.in/sites/default/files/san.pdf, accessed 17 Sep 25

Makkalai Thedi Maruthuvam (MTM) – Tamil Nadu

Makkalai Thedi Maruthuvam (MTM)[141], is a state-level initiative launched by the Government of Tamil Nadu in 2021 which provide healthcare at doorstep as per its

[141] https://spc.tn.gov.in/makkalai-thedi-maruthuvam/, accessed 17 Sep 25

translation. It is not a DPI, but an excellent demonstration of utilization of states' digital and physical infrastructure to expand service delivery within the ABDM framework.

The programme is designed to provide home-based healthcare services specifically for non-communicable diseases (NCDs) such as hypertension, diabetes, and chronic kidney disease[142]. It is a decentralized model comprising of teams of nurses, health volunteers, and physiotherapists visit households, for screenings, medicine delivery, and record patient data digitally. This collected data is linked with state health management systems for surveillance and planning.

MTM integrates with ABDM by using ABHA identifiers for patient records and aligning with state facility registries, telemedicine consultations. The programme leverages digital tools for supply chain management of medicines, diagnostic kits and workforce deployment.

From an institutional perspective, MTM is an important state-level DPI innovation complementing national systems like eSanjeevani ensuring last-mile delivery into community settings.

Impact of DPIs in Healthcare

India's healthcare system is undergoing a digital transformation, driven by the Ayushman Bharat Digital Mission (ABDM), a flagship initiative under the National Health Authority (NHA). As a Digital Public Infrastructure (DPI), ABDM aims to create a unified digital health ecosystem that ensures accessibility, transparency, and interoperability across the healthcare value chain. This chapter analyzes key trends in the adoption of ABDM—specifically the trinity of patient registry (ABHA cards), health professionals registry (HPR) or registration of healthcare providers and facilities, and the linking of health records or electronic health registry/ personal health records (EHR/ PHR) —and evaluates their impact on healthcare providers, the government, and citizens.

Key Trends in ABDM Implementation

Surge in ABHA Card Issuance:

As of July 28, 2025, India has issued 79.71 crore Ayushman Bharat Health (ABHA) cards. This represents a massive scale of digital identity adoption in healthcare, covering a large proportion of the country's population[143]. The ABHA card enables individuals to store and share their health records securely, facilitating seamless access to medical history

[142] https://interstatecouncil.gov.in/wp-content/uploads/2023/08/Tamil_Nadu2.pdf, accessed 17 Sep 25
[143] Source: https://medicarepharmabusiness.com/india-issues-79-71-crore-abha-ids-links-65-09-crore-health-records/

across healthcare providers. This foundational layer of digital identity is critical for enabling longitudinal health records and personalized care.

Growth in Verified Healthcare Providers:

The Healthcare Professionals Registry (HPR) has seen a significant rise in verified professionals. As of early 2025, 6.76 lakh healthcare professionals—including doctors, nurses, and allied health workers—have been registered and verified under ABDM[144]. This registry ensures that only authenticated and qualified professionals are part of the digital ecosystem, enhancing trust and accountability in healthcare delivery.

The Health Facility Registry (HFR) now includes 4.17 lakh health facilities, encompassing hospitals, clinics, diagnostic labs, and pharmacies. Of these, 3.20 lakh facilities actively use ABDM-enabled software, indicating a high level of digital integration[145].This widespread registration ensures that citizens can discover and access verified healthcare services across both public and private sectors.

Linking of Health Records

A major milestone has been the linking of 65.09 crore health records to ABHA IDs. This enables the creation of longitudinal electronic health records (EHRs), which are accessible to patients and providers through Personal Health Record (PHR) apps[146]. This trend marks a shift from fragmented, paper-based records to a unified, digital-first approach to health data management. Such shifts provides patients unlimited portability and continuity of care.

Impact on Stakeholders

Healthcare Providers

- **Improved Efficiency and Continuity of Care**
  With access to patients' digital health records, providers can make faster, more informed decisions. This reduces duplication of tests, minimizes errors, and enhances treatment outcomes.
- **Streamlined Patient Management:**
  Tools like the "Scan and Share" service allow patients to register instantly at OPDs using QR codes. As of December 2023, Over 1.5 crore patients had used this service, reducing administrative burden and wait times[147].

[144] Source: https://medicarepharmabusiness.com/india-issues-79-71-crore-abha-ids-links-65-09-crore-health-records/
[145] Source: https://medicarepharmabusiness.com/india-issues-79-71-crore-abha-ids-links-65-09-crore-health-records/
[146] Source: https://medicarepharmabusiness.com/india-issues-79-71-crore-abha-ids-links-65-09-crore-health-records/
[147] Source: https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1989763

- **Incentivized Digital Adoption:**
  Through the Digital Health Incentive Scheme (DHIS), providers receive financial incentives for generating ABHA-linked records. This has encouraged even small clinics and labs to adopt digital workflows.
- **Enhanced Discoverability and Trust:**
  Being listed in the HFR gives providers a verified digital identity, increasing their visibility and credibility among patients.

Karnataka's HPR Success
Karnataka leads in HPR adoption with 35,908 healthcare professionals registered and 89.3% verified. The state achieved this through structured onboarding, training, and integration with the Karnataka Private Medical Establishment Act, which mandated HP IDs for license renewals[148].

Citizens

- **Empowered Health Management:**
  Citizens can now access and control their health data through apps like the ABHA app and Aarogya Setu. This empowers them to make informed decisions and manage chronic conditions more effectively. Digitized and accessible health records also enables significant portability, empowering patients with access to a variety of healthcare providers, seeking second opinions, and managing their entire care programmes and insurance flows seamlessly.
- **Reduced Costs and Time:**
  With digital records, patients avoid redundant tests and consultations. Instant OPD registration and telemedicine services (through eSanjeevani) save time and travel costs, especially for those in remote areas.
- **Improved Access to Quality Care:**
  The ability to discover verified providers and facilities enhances trust and access. Citizens can now choose providers based on credentials and services offered. With enhanced portability, the access to multiple healthcare providers are also seamless.
- **Privacy and Consent-Based Sharing:**
  ABDM ensures that health data is shared only with patient consent, reinforcing data privacy and security.

Nurse Registration in Bihar
Karuna Fellow Chandani Kumari registered 1500 nurses in public facilities under HPR. This not only empowered the nurses with digital identities but also improved public access to qualified professionals[149].

[148] Source: https://abdm.gov.in:8081/uploads/HPR_Case_Study_Karnataka_1_f0a22e545e.pdf
[149] Source: https://digitalbharatcollaborative.org/wp-content/uploads/2024/12/DBC-KFs-Impact-Stories.pdf

Government

- **Data-Driven Policy Making**
  The aggregation of health data at scale enables the government to monitor disease trends, allocate resources efficiently, and design targeted interventions.
- **Universal Health Coverage (UHC)**
  By integrating ABHA with schemes like PM-JAY and eSanjeevani, the government is moving closer to its goal of UHC. Over 39 crore teleconsultations have been conducted via eSanjeevani, many in rural and underserved areas.
- **Digital Inclusion and Equity**
  The government has ensured that ABHA creation is possible through assisted and offline modes, addressing the digital divide. Multilingual apps and simplified interfaces further promote inclusivity.
- **Regulatory Oversight and Quality Assurance**
  The HPR and HFR allow the government to maintain oversight over healthcare quality and compliance, ensuring that only accredited entities participate in the ecosystem.

Bihar's CCC Initiative
In Bihar, Karuna Fellow Nirupama Devi contacted over 900 private facilities, collecting data on 4000 doctors and nurses. Her efforts helped the state identify gaps and expedite professional registrations, improving healthcare access[150].

Digital Health Incentive Scheme (DHIS)

Launched in January 2023, DHIS has been a catalyst for digital adoption. With an initial outlay of ₹50 crore, the scheme incentivizes (a) health facilities for generating ABHA-linked records; (b) digital solution companies for providing ABDM-compliant software; and (c) labs and pharmacies for integrating with ABDM. The scheme has led to a 50% increase in ABDM adoption among small providers within 18 months[151].

Challenges and the Road Ahead

Despite the impressive progress, several challenges remain:

- Digital Literacy: Many citizens, especially the elderly and rural populations, still lack the digital skills to fully utilize ABDM services. Most of the users targeted by these public health systems are from the rural/ disadvantaged sections of the society, and operate in low digital fluency environments. Added to digital literacy, most of these systems include technical terms, especially in English language (not the local language), and that would present significant challenges to surmount in deepening penetration.

[150] Source: https://digitalbharatcollaborative.org/wp-content/uploads/2024/12/DBC-KFs-Impact-Stories.pdf
[151] Source: https://allhealthtech.com/digital-health-incentive-scheme-dhis/

- Interoperability: Ensuring seamless data exchange across diverse health IT systems remains a technical challenge. Large private sector healthcare providers have invested in their own legacy systems, and that presents significant resistance to align with the ABDM standards, often requiring adoption of open source software and standards.
- Data Security: As health data becomes digitized, robust cybersecurity frameworks are essential to prevent breaches. With patients and care providers sceptical about data security and privacy preservation, especially as it involves personal data, the adoption remains low.

To address these, the government and the National Health Authority (NHA) must continue investing in capacity building, public awareness, and infrastructure development.

- Establish a National Drug Registry to standardize prescriptions, track medicines, and reduce counterfeit risks.
- Scale UWIN (Universal Immunization Network) by extending CoWIN architecture for routine vaccination linked to ABHA.
- Develop disease-specific registries (e.g., cancer, TB, diabetes) to strengthen patient doctor interaction and research, continuity of care.
- Expand the Health Facility Registry (HFR) with service availability, specialization, and equipment data for real-time discovery.
- Define clear rules for health data monetization, ensuring only anonymized, consent-based use for research and surveillance.
- Build structured PPP models to integrate private hospitals, insurers, diagnostics, and startups into ABDM.
- Define incentives for private players—such as faster claims, ABDM compliance badges, and access to innovation sandboxes.
- Promote Digital Public Goods (DPGs) like Beckn, Bhashini, encouraging private contributions and extensions. DPGs from DPG Alliance registry
- Strengthen the open API ecosystem, offering innovation grants and testbeds for ABDM-compliant health solutions.
- Invest in developing and deploying AI supported decision models

Conclusion

The Ayushman Bharat Digital Mission exemplifies how Digital Public Infrastructures can transform healthcare delivery at scale. By enabling digital identity, verified provider registries, and interoperable health records, ABDM is creating a more efficient, inclusive, and patient-centric healthcare system. For healthcare providers, it offers operational efficiency and greater reach. For the government, it provides a foundation for data-driven governance and universal health coverage. For citizens, it ensures better access, control, and quality of care. As India continues to scale ABDM, it sets a global precedent for how digital infrastructure can revolutionize public health systems in emerging economies.

INTEGRATION AND THE WAY FORWARD

India's journey in building Digital Public Infrastructure (DPI) has been marked by bold experimentation, rapid scaling, and a commitment to inclusive innovation. Among the sectors that have embraced DPI most effectively, financial services stand out as a mature and vibrant ecosystem. The foundational layer of this ecosystem is Aadhaar, India's biometric identity system, which has enabled secure authentication for millions. Building on Aadhaar, the Unified Payments Interface (UPI) revolutionized digital payments by offering real-time, interoperable transactions across banks and platforms. UPI's success is not merely technological—it reflects a design philosophy rooted in openness, modularity, and user-centricity.

Complementing UPI are other critical DPIs such as eKYC, which simplifies customer onboarding; DigiLocker, which allows citizens to store and share verified documents; and the Account Aggregator (AA) framework, which facilitates consent-based financial data sharing. The Data Empowerment and Protection Architecture (DEPA) underpins AA and other data-sharing protocols, ensuring that users retain control over their personal data. These infrastructures have enabled among other things, schemes like Direct Benefit Transfers (DBT) leveraging Jan Dhan Yojana (universal zero-balance bank accounts), leading to broad financial inclusion and ensuring that welfare payments reach beneficiaries efficiently and transparently.

In contrast, the Indian healthcare sector is still in the early stages of DPI implementation. The Ayushman Bharat Digital Mission (ABDM) aims to create a federated health information architecture, anchored by the ABHA ID—a unique health identifier for individuals. Platforms like eSanjeevani offer telemedicine services, while CoWIN demonstrated the power of digital coordination during the COVID-19 vaccination drive. The Aarogya Setu platform, though short-lived, showcased the potential of mobile-based health advisories and contact tracing. However, these initiatives are yet to achieve the scale, interoperability, and ecosystem maturity seen in financial services. The healthcare DPI landscape remains fragmented, with limited integration across providers, insurers, and regulators.

To understand the differential progress across sectors, we adopted a maturity framework inspired by global institutions such as the UNDP, World Bank, and OECD. See Table 4.1 (extracted from Table 1.6)

Table 4.1: DPI maturity (authors' analysis)

Maturity Stage	Key Indicators
Implementation	Pilot projects, legal foundations, early users
Adoption	User uptake, penetration, service integration, measurable impact
Leverage	Multiple use-cases, widespread adoption, private sector building, ecosystem maturity

The financial services sector in India has clearly entered the leverage stage. This is evidenced by the proliferation of use-cases built atop core DPIs, the active participation of private sector innovators, and the extant reuse of infrastructure across domains. UPI, for instance, is now used not just for peer-to-peer payments but also for merchant transactions, insurance premium payments, and even donations. The Account Aggregator framework is being extended to sectors like wealth management and lending, showcasing the versatility of the DPI.

Healthcare, on the other hand, is in the implementation stage. This stage is characterized by pilot projects, legal and institutional groundwork, and early user engagement. ABDM is still onboarding hospitals and clinics, while ABHA IDs are yet to achieve widespread penetration. The challenge lies not just in technological deployment but in building trust, ensuring interoperability, and aligning incentives across a diverse set of stakeholders. The transition from implementation to adoption will require concerted efforts in capacity building, data governance, and citizen engagement.

What does the future hold for DPIs in India?

The future of DPIs transitioning from implementation to adoption to leverage stages is dependent on four major themes: technology leverage; integrating the incentives of *samaj, sarkar, and bazaar* (citizens, governments, and markets); data governance; and the push towards digital sovereignty.

The Role of AI and other Emerging Technologies in DPI Adoption

As DPI ecosystems evolve, the integration of Artificial Intelligence (AI) and other exponential technologies is poised to accelerate both adoption and leverage. AI offers transformative potential across sectors by enabling data-driven decision-making, predictive analytics, and product/ service personalization (superior user experience). In financial services, AI is already being used for credit scoring, fraud detection, and customer segmentation. These applications enhance efficiency, reduce risk, and improve user experience. For instance, fintech startups are using AI models trained on Account Aggregator data to offer tailored loan products to underserved segments, thereby expanding financial inclusion.

In healthcare, AI can play a pivotal role in diagnostics, treatment planning, and public health surveillance. Machine learning algorithms trained on anonymized health records can identify patterns in disease progression, recommend interventions, and even predict outbreaks. However, the deployment of AI in healthcare DPI must be accompanied by robust safeguards to ensure privacy, fairness, and accountability. Federated learning—a technique that allows models to be trained across decentralized datasets without sharing raw data—offers a promising approach to privacy-preserving AI.

Beyond AI, other emerging technologies are also shaping the DPI landscape. Blockchain can enhance data integrity and traceability, particularly in health records and supply chains. Internet of Things (IoT) devices, when integrated with DPI, can enable real-time

monitoring in logistics and remote healthcare. Edge computing allows data processing closer to the source, reducing latency and enhancing responsiveness. These technologies, when combined with DPI, create a powerful stack that can support complex, scalable, and citizen-centric services.

The key to harnessing these technologies lies in ecosystem readiness. As more stakeholders – governments, startups, civil society organizations – embrace data-driven approaches, the demand for interoperable, secure, and ethical DPI will grow. AI and exponential technologies will not replace DPI; rather, they will amplify its impact, enabling smarter, faster, and more inclusive public services.

Integrating *Samaj, Sarkar, and Bazaar*

A successful DPI strategy must go beyond technology—it must reflect a deep understanding of societal needs, institutional capacities, and market dynamics. Rohini Nilekani's framework of *Samaj, Sarkar, Bazaar* offers a compelling lens for this integration[152]. *Samaj* represents the citizens and civil society; *Sarkar* denotes the government and its institutions; and *Bazaar* encompasses the private sector and markets. DPI must be designed to serve all three, balancing their interests and fostering collaboration.

In the financial sector, UPI exemplifies this integration. Developed by the National Payments Corporation of India (NPCI), UPI was built with government support, private sector innovation, and civil society advocacy. Its open API architecture allowed startups and banks to build diverse applications, while its inclusive design ensured that even small merchants and rural users could participate. The private sector payment apps – both large incumbents and startups – contributed to evangelizing DPI adoption by the smallest of merchants through the provisioning of static QR codes and frugal point-of-sale (POS) solutions. Innovations like the Soundbox[153], that vocalizes payment receipts through UPI at the merchants POS further enhanced adoption and continued leverage. Though the growth of the UPI ecosystem is currently driven by subsidies, it is unlikely to be reversed when the subsidies are reduced/ removed[154], with deep entrenchment and habit formation amongst merchants and citizens. UPI's success lies not just in its technical robustness but in its governance model, which aligned the incentives of *Samaj, Sarkar, and Bazaar*.

In the healthcare sector, CoWIN demonstrated the power of coordinated action. The platform integrated data from public and private hospitals, enabled real-time scheduling, and provided transparent dashboards. Civil society organizations played a crucial role in outreach and awareness, while private players contributed logistics and

[152] See: Nilekani, Rohini (2022). Samaj, Sarkar, Bazaar: A citizen first approach, Notion Press.
[153] See: https://business.paytm.com/soundbox, accessed 18 Sep 25
[154] Source: https://www.business-standard.com/specials/news/the-cost-of-free-upi-s-exponential-growth-strains-limits-of-subsidies-125082100033_1.html, accessed 18 Sep 25

infrastructure. CoWIN's rapid scaling during the pandemic was possible because it respected the roles and responsibilities of all three actors.

Education offers another example. DIKSHA, India's national platform for school education, is built on the Sunbird framework—a modular, open-source infrastructure that allows various State Councils for Education, Research and Training (SCERT – the publishers of text books for school education) to customize content while maintaining interoperability. Teachers, administrators, and ed-tech companies collaborate on DIKSHA, creating a vibrant ecosystem that reflects the diversity of India's educational landscape.

The integration of *Samaj, Sarkar, and Bazaar* is not just a governance principle—it is a design imperative. DPI must be participatory, accountable, and adaptable. It must empower citizens, enable governments, and energize markets. Only then can it fulfil its promise of inclusive digital transformation.

Data Governance and Policy Trade-offs

As DPI enters the leverage stage, the question of data governance becomes central. The success of DPI depends not just on technological innovation but on the ethical, legal, and institutional frameworks that govern data collection, sharing, and use. India's approach to data governance is shaped by two key frameworks: the Digital Personal Data Protection (DPDP) Act, 2023, and the Data Empowerment and Protection Architecture (DEPA).

The DPDP Act establishes a rights-based regime for personal data protection. It mandates informed consent, purpose limitation, and accountability for data fiduciaries. It also introduces the concept of data fiduciaries, who are subject to enhanced obligations. The Act aims to balance individual privacy with the need for innovation and public interest. However, its implementation will heavily depend on emergent clarity on enforcement mechanisms, grievance redressal, and rules/ norms around cross-border data flows.

DEPA, on the other hand, operationalizes consent-based data sharing through interoperable protocols and consent managers. It enables users to share their data securely and granularly with third parties, fostering trust and transparency. DEPA is particularly relevant for financial services, where Account Aggregators facilitate data portability across institutions. Its principles can be extended to health, education, and other sectors, creating a unified framework for data empowerment.

The CDPG-IIMB and IISc-CSP white paper on data governance[155] highlights several trade-offs. Primary trade-off is the tension between privacy and innovation. Excessive regulation may stifle experimentation, while lax governance may erode trust. Another is the choice between centralization and decentralization. Centralized systems offer

[155] See: https://www.iimb.ac.in/cdpg/images/White-paper-Guidelines.pdf, accessed 18 Sep 25

efficiency and control, but may be vulnerable to misuse; decentralized models enhance resilience and user autonomy, but require robust coordination. Data monetization is another area of concern. While commercial use of data can drive innovation, it must be balanced with public good considerations. Pricing models, data commons, and ethical guidelines are needed to ensure that data serves societal interests. The white paper advocates for a layered governance model, combining legal safeguards, technical standards, and participatory oversight.

In sum, data governance is not a peripheral issue—it is the foundation of DPI. It must be designed with care, implemented with integrity, and evolved with feedback. Only then can DPI be trusted, adopted, and leveraged at scale.

Preserving Digital Sovereignty

Digital sovereignty refers to a nation's ability to govern its digital infrastructure, data, and algorithms in a manner that aligns with its constitutional values, developmental priorities, and strategic interests. In a world where digital platforms often transcend borders and are dominated by global corporations, maintaining control over core digital assets is essential for autonomy, security, and equity.

Preserving digital sovereignty begins with the adoption of open standards. These standards ensure interoperability, prevent vendor lock-in, and promote innovation. India's DPI initiatives, such as UPI, DIKSHA, and ONDC, have embraced open APIs and modular architectures, allowing diverse stakeholders to build on shared infrastructure. This adoption of open standards and open-source software fosters competition and resilience, while enabling customization.

Another construct of digital sovereignty is the consent architecture. Users must have granular control over how their data is collected, shared, and used. DEPA's consent managers exemplify this approach, enabling secure and transparent data flows. Consent must be informed, revocable, and auditable, ensuring that users retain agency in the digital ecosystem. This is especially important in the case of countries like India where a significant proportion of the population operates in low digital fluency environments.

Data localization is also a key consideration. While global data flows are essential for trade and innovation, certain categories of data, such as personal health records, financial transactions, and government databases, must remain within national jurisdiction. Localization enhances security, facilitates regulatory oversight, and supports domestic innovation. However, it must be balanced with scale, interoperability and global collaboration.

Algorithmic transparency and accountability are another critical construct. As AI systems increasingly influence public services, their decision-making processes must be explainable, accountable, and free from bias. DPI governance must incorporate mechanisms for auditing algorithms, addressing grievances, and ensuring fairness.

To support these principles, India must create enabling conditions and incentives for ethical innovation. Public funding, regulatory sandboxes, and ecosystem support can encourage startups and institutions to build sovereign, inclusive, and trustworthy digital solutions. Digital guardrails must be embedded in DPI design, not as afterthoughts, but as foundational elements.

Digital sovereignty is not about isolation; it is about empowerment. It is about ensuring that India's digital future is shaped by its people, institutions, and values. DPI must be the vehicle for this sovereignty, enabling India to lead with confidence, integrity, and purpose. As India's DPI models are adopted by other countries through initiatives like MOSIP, it should be emphasized that the DPI ensures data sovereignty within those countries' boundaries and are not locked-in to Indian systems and data registries.

India's DPI in the immediate future

In this first edition of the report, we had specifically focused on two sectors to highlight the contrasts in DPI impact. However, the India DPI story is far from these. There are many more exciting sectors that are increasingly adopting DPIs and are at various stages of implementation and impact. For a quick reference, we highlight three sectors where DPI impact has already become visible – digital commerce, education, and logistics.

Digital Commerce

India's digital commerce landscape is undergoing a paradigm shift, driven by the Beckn Protocol and the Open Network for Digital Commerce (ONDC). Beckn[156] is an open protocol that enables decentralized discovery and transaction across services. It allows demand and supply sides to interact without relying on centralized platforms, thereby democratizing access and reducing gatekeeping. ONDC is built on the Beckn protocol and has curated a federated e-commerce network where retailers, logistics providers, payment gateways, and consumers can transact seamlessly.-Traditional ecommerce models (which we call as Closed Network Digital Commerce), favours monolithic organizations (centralized platforms) and tightly dependent networks of users (including sellers, buyers, logistics providers, and payment solutions providers) who interact with each other based on the proprietary protocols defined by the central platform. ONDC however efficiently unbundles these roles, and encourages different stakeholders to perform each of these roles adhering to open protocols.

The promise of ONDC lies in its ability to level the playing field. Small and medium enterprises (SMEs), which often struggle to compete on dominant platforms, can now participate in digital commerce without compromising margins or visibility. Consumers benefit from greater choice, transparency, and interoperability. The central orchestrator (ONDC) provides the gateway, and plays a facilitative role, setting standards and

[156] See: https://becknprotocol.io, accessed 18 Sep 25

ensuring compliance, while the ecosystem partners drive innovation and lead service delivery.

ONDC's architecture reflects DPI principles: open standards, modularity, and user-centricity. It integrates with other DPIs such as UPI for payments, DigiLocker for document verification, and DEPA for consent-based data sharing. This convergence creates a robust ecosystem that supports diverse use-cases, from grocery delivery to mobility services.

However, the success of ONDC will depend on broad adoption, trust, and governance. Stakeholders must invest in capacity building, grievance redressal, and data protection. Digital commerce, powered by ONDC, can become a catalyst for economic empowerment, especially in tier-2 and tier-3 cities.

Education

The education sector in India is witnessing a quiet revolution, enabled by Sunbird and DIKSHA. Sunbird is a modular, open-source framework that allows developers to build customizable learning solutions[157]. DIKSHA, built on Sunbird, is India's national platform for school education, offering digital content, teacher training, and administrative tools[158].

DIKSHA exemplifies the principles of federated architecture. States and SCERTs can adapt the platform to their curricula, languages, and pedagogical needs, while maintaining interoperability and data standards. Teachers can create and share content, track student progress, and access professional development resources. Students benefit from personalized learning, multimedia content, and offline access.

The integration of DPI in education addresses several systemic challenges. It reduces dependency on proprietary platforms, enhances accessibility in remote areas, and supports multilingual content. It also enables data-driven decision-making, allowing policymakers to monitor learning outcomes and allocate resources effectively.

AI and analytics are increasingly being integrated into educational DPI. Adaptive learning systems can tailor content to individual needs, while predictive models can identify students at risk of dropout. However, these innovations must be guided by ethical frameworks that protect student privacy, ensure fairness, and promote equity.

Education is not just another sector; it is a foundation for digital citizenship. DPIs in education must empower learners, support educators, and strengthen institutions. The DIKSHA platform offers a blueprint for inclusive, scalable, and sovereign digital education.

[157] See: https://www.sunbird.org, accessed 18 Sep 25
[158] See: https://diksha.gov.in/index.html, accessed 18 Sep 25

Logistics

Logistics is the backbone of commerce, industry, and services. DPI can make it smarter, faster, and more inclusive. Unified Logistics Interface Platform (ULIP)[159] and PM Gati Shakti[160] offer a vision of integrated, data-driven logistics that supports India's development goals.

India's logistics sector is being transformed by the seamless integration of ULIP and PM Gati Shakti. ULIP is a digital platform that integrates data from multiple logistics stakeholders – ports, railways, road transport, customs, and private players – in a unified interface. It enables real-time tracking, predictive analytics, and seamless coordination across various stakeholders in the supply chain. PM Gati Shakti complements ULIP by providing a master plan for multimodal infrastructure development. It aims to break silos across ministries and departments, enabling integrated planning and execution. Together, ULIP and Gati Shakti create a digital-physical convergence that enhances efficiency, reduces costs, and supports economic growth.

Conclusion

India's DPI journey is a story of ambition, innovation, and inclusion. While financial services showcase the power of scale and rapid democratic adoption by myriad stakeholders, healthcare and other sectors are still building foundational capabilities. The integration of emerging technologies, thoughtful data governance, and inclusive design principles will determine the success of DPI in delivering public value.

As we move forward, the vision must remain clear: to build digital infrastructure that is open, inclusive, and sovereign—serving the needs of *Samaj, Sarkar, and Bazaar* in equal measure. Civil society organizations contribute content and outreach; governments provide infrastructure and policy support; edtech companies drive innovation and scalability. Together, they create a vibrant ecosystem that reflects India's diversity and aspirations.

DPI is not just a technological intervention—it is a societal project. It must be built with careful design, governed with integrity, and evolved with purpose.

[159] See: https://goulip.in/home, accessed 18 Sep 25
[160] See: https://www.india.gov.in/spotlight/pm-gati-shakti-national-master-plan-multi-modal-connectivity, accessed 18 Sep 25

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