IMC 25

DIGITAL PUBLIC INFRASTRUCTURE

A Foundational Understanding of Digital Public Infrastructure

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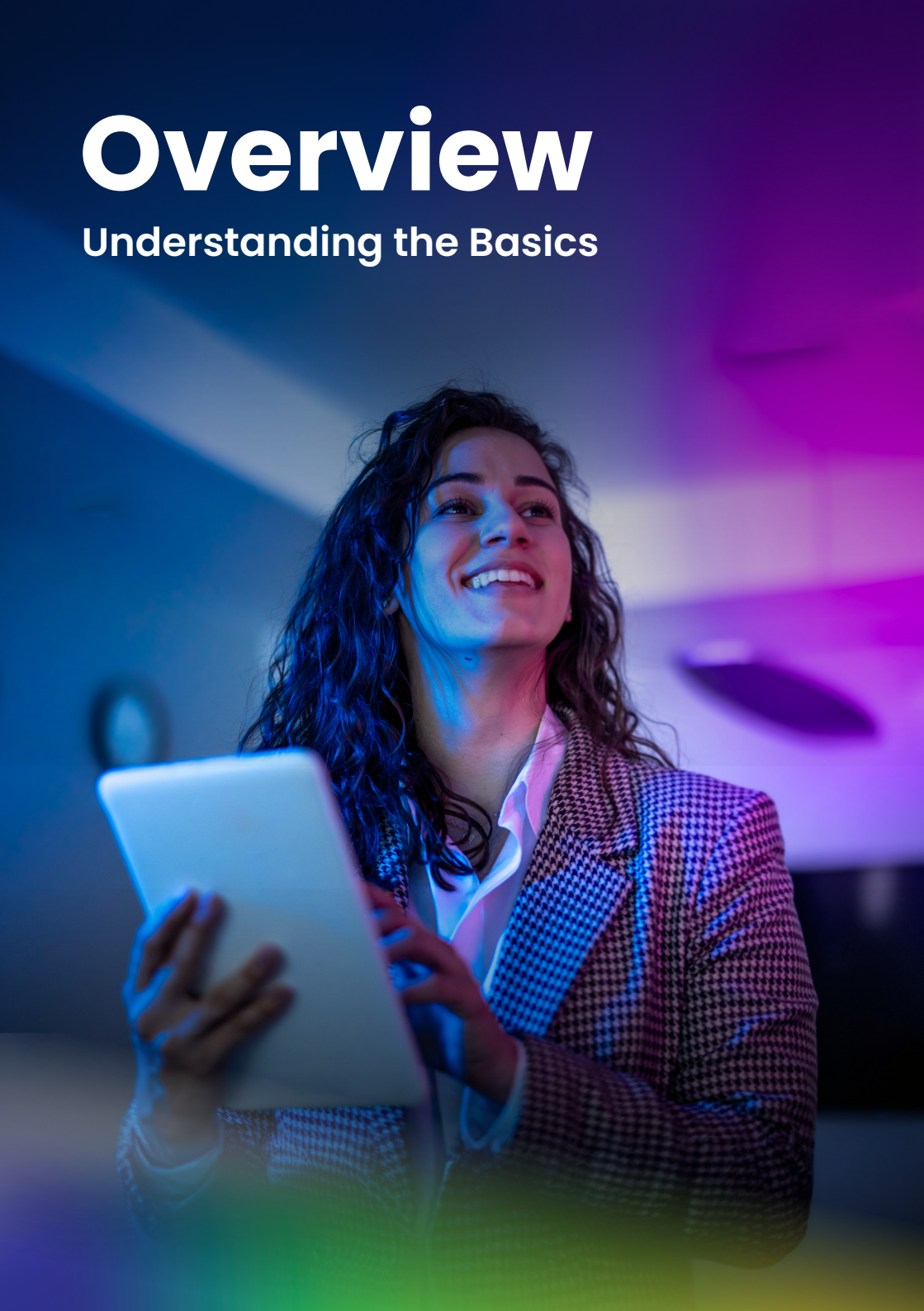
Content

Dear Digital Pioneers

Welcome to the heart of the modern digital economy. This deep dive into Digital Public Infrastructure (DPI) explores its foundational layers—Digital Identity, Digital Payments, and Data Exchange—and their design principles. You'll trace the Evolution of DPI, learn about the core enabling Technologies like AI and blockchain, and see how global leaders like India are using DPI to build scalable, inclusive, and cost-efficient services across Health, Education, and Trade.

Overview

Understanding the Basics



Understanding the basics

What is DPI? Core Pillars and Definitions

Digital Public Infrastructure (DPI) refers to a set of interoperable digital systems built on open standards and protocols, enabling both public and private stakeholders to create scalable services for citizens.

Core Pillars of DPI

Pillar	Description
Digital Identity	Secure, unique identification systems enabling service access and verification
Digital Payments	Real-time, interoperable platforms for financial inclusion and transactions
Data Exchanges	Consent-based data sharing systems allowing for secure interoperability

Key Definitions

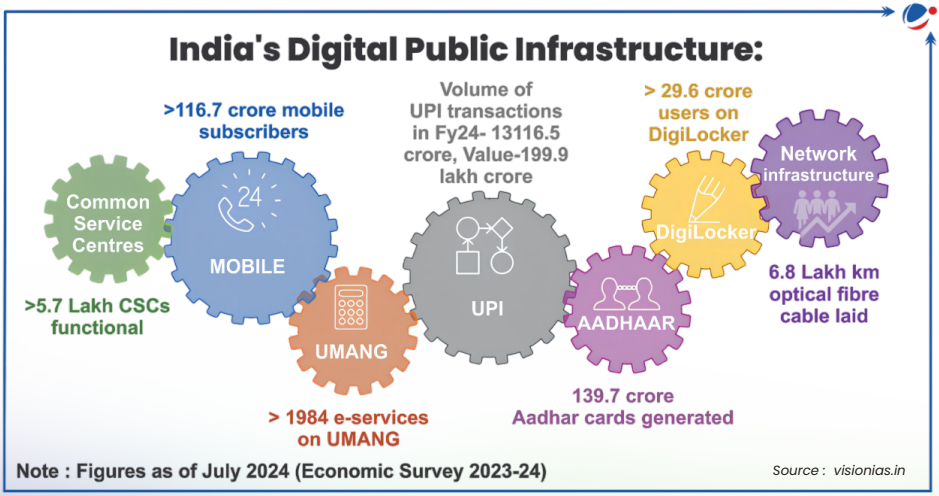
- **Interoperability:** This core principle ensures that diverse technology systems, applications, and organizations can exchange and utilize data efficiently and without proprietary barriers. In DPI, interoperability allows different government services (e.g., identity, payments, healthcare) to work together seamlessly, fostering an integrated and unified digital experience for the user.

- **Open Standards:** These are technical specifications and protocols that are publicly available and free for anyone to use and implement. Adopting open standards in DPI prevents vendor lock-in, encourages competition, and ensures that the infrastructure remains accessible and universally adaptable, driving broader innovation across the ecosystem.

- **Consent Architecture:** This is a crucial data governance framework that grants individuals control over how their personal data is shared and used. It typically involves digital tools where users provide explicit, informed consent for a specific purpose and duration, ensuring data usage is ethical, transparent, and adheres to strict privacy principles.

Design Principles of DPI

- **Open:** Based on open-source components and APIs.
- **Secure:** Built with end-to-end encryption and audit mechanisms.
- **Scalable:** Capable of supporting millions of concurrent users.
- **Inclusive:** Designed to be accessible across language, literacy, and digital literacy barriers.



Digital Trust Transforms Our Society

Evolution of DPI

From e-Governance to Interoperable Public Tech Stacks

The concept of DPI has matured from simple e-governance initiatives to nation-scale interoperable digital platforms.

Timeline of DPI Evolution

01.

2000–2010

Birth of e-Governance
Examples CSCs, Bhoomi, E-Seva

02.

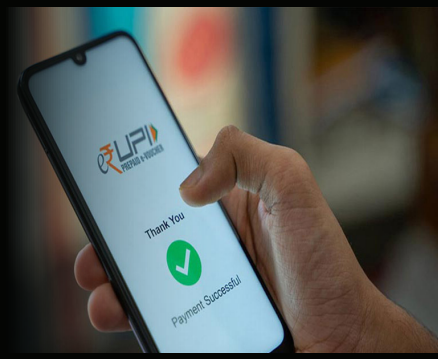
2010–2020

Foundational DPI platforms emerge
Examples Aadhaar, India Stack

01.

2020–2025

Global replication, interoperability, scalability
Examples UPI, MOSIP, ONDC, EU Wallet



DPI vs Traditional e-Governance

Era	Traditional e-Gov	DPI (2025)
Architecture	Department-siloed	Layered and interoperable
Access	Limited	Layered and interoperable
Standards	Custom, closed	Open protocols, APIs, scalable ecosystems
Innovation Potential	Restricted	Enables public-private co-creation

Core Technologies Enabling DPI

APIs, AI, Cloud, Blockchain & IoT

Digital Public Infrastructure (DPI) refers to a set of interoperable digital systems built on open standards and protocols, enabling both public and private stakeholders to create scalable services for citizens

Key Enablers

APIs (Application Programming Interfaces)

- Glue for interoperability, enabling modular plug-and-play architecture.
- **Example:** UPI's open API allows banks, fintech, and startups to build on top.

AI & Machine Learning

- Used in fraud detection, demand prediction, personalization.
- **DPI Example:** NDHM's AI-driven health recommendations.

Cloud Computing

- Elastic compute and storage at national scale.
- Hybrid-cloud models adopted by Aadhaar, DigiLocker, etc.

Blockchain

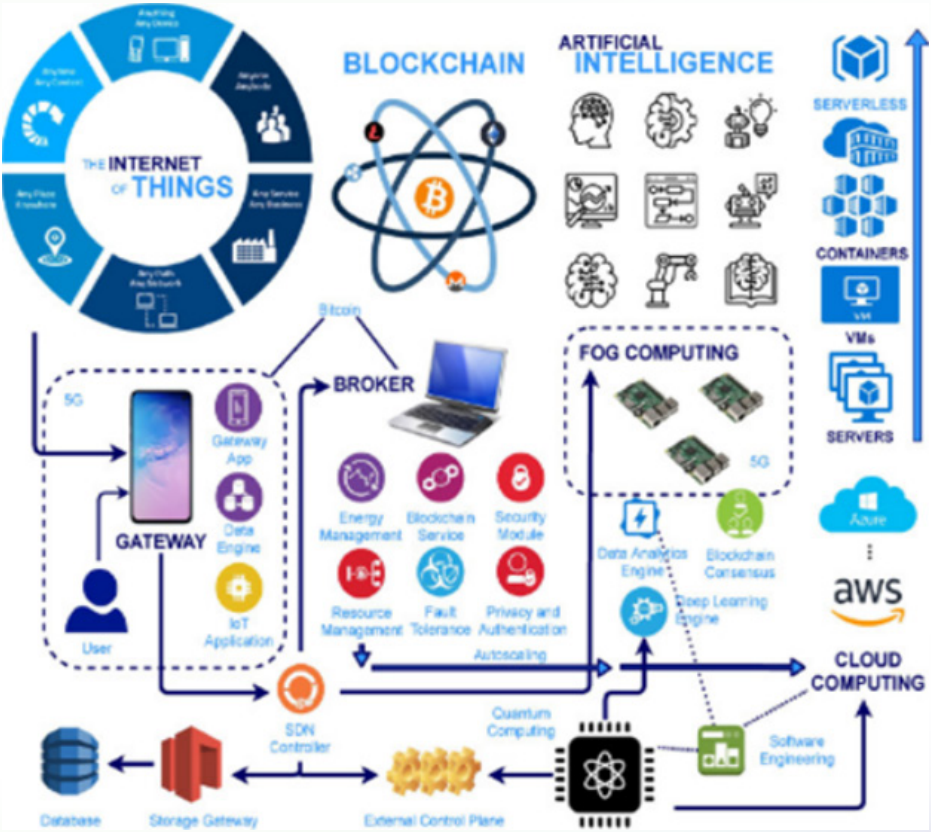
- Ensures tamper-proof records and verifiability.
- Used in property records, health records (Estonia), and trade finance.

Internet of Things (IoT)

- Real-time data collection for governance.
- **Use case:** Smart agriculture, pollution control, urban mobility tracking.

Technology Integration in DPI Layers

DPI Layer	Enabling Technology
Identity	Biometric AI, Blockchain
Payments	API gateways, cloud infra
Data Exchanges	Consent Manager APIs, IoT
Governance	AI dashboards, blockchain



Source : sciencedirect.com

This diagram shows the convergence of IoT, blockchain, AI, fog computing, and cloud platforms (AWS, Azure) into an integrated 5G-driven ecosystem for secure, intelligent, and scalable digital services.

DPI Standards & Open Protocols

Digital Public Infrastructure relies on open standards and interoperable protocols to ensure trust, security, and scale across jurisdictions. These standards serve as the foundational building blocks for creating national and cross-border digital ecosystems.

Key DPI Standards and Protocols

Standard / Protocol	Description
OpenID & OAuth2	Widely used for secure identity verification and authorization mechanisms
ISO/IEC 20022	Global financial messaging standard for payments and remittance systems
Unified Data Consent Framework (UDCF)	India's standardized protocol for managing data consent digitally
Modular Open-Source Identity Platform (MOSIP)	A scalable and open-source identity framework adopted by 11+ countries
ONDC Open Protocols	Open commerce interoperability protocols for decentralized marketplaces
Beckn Protocol	Interoperable digital commerce protocol supporting public digital networks

Benefits of Open Standards in DPI

- **Interoperability:** Facilitates seamless data and service exchange across systems and vendors.
- **Innovation Enablement:** Lowers barriers for startups and private players to build on public platforms.
- **Trust and Accountability:** Promotes transparency, audibility, and verifiability of transactions.
- **Replicability:** Allows DPI models to be adapted across geographies and sectors with minimal rework.

Key Components of DPI

Identity, Payments, and Data Empowerment

A robust DPI ecosystem is typically composed of three interoperable layers—digital identity, digital payments, and data exchange frameworks—which serve as the foundational public digital goods for inclusive and scalable service delivery.

Digital Identity

- Unique, verifiable ID system (e.g., Aadhaar, MOSIP, EU Wallet)
- Enables Know Your Customer (KYC), service access, and authentication
- Can be biometric, mobile-based, or cryptographic

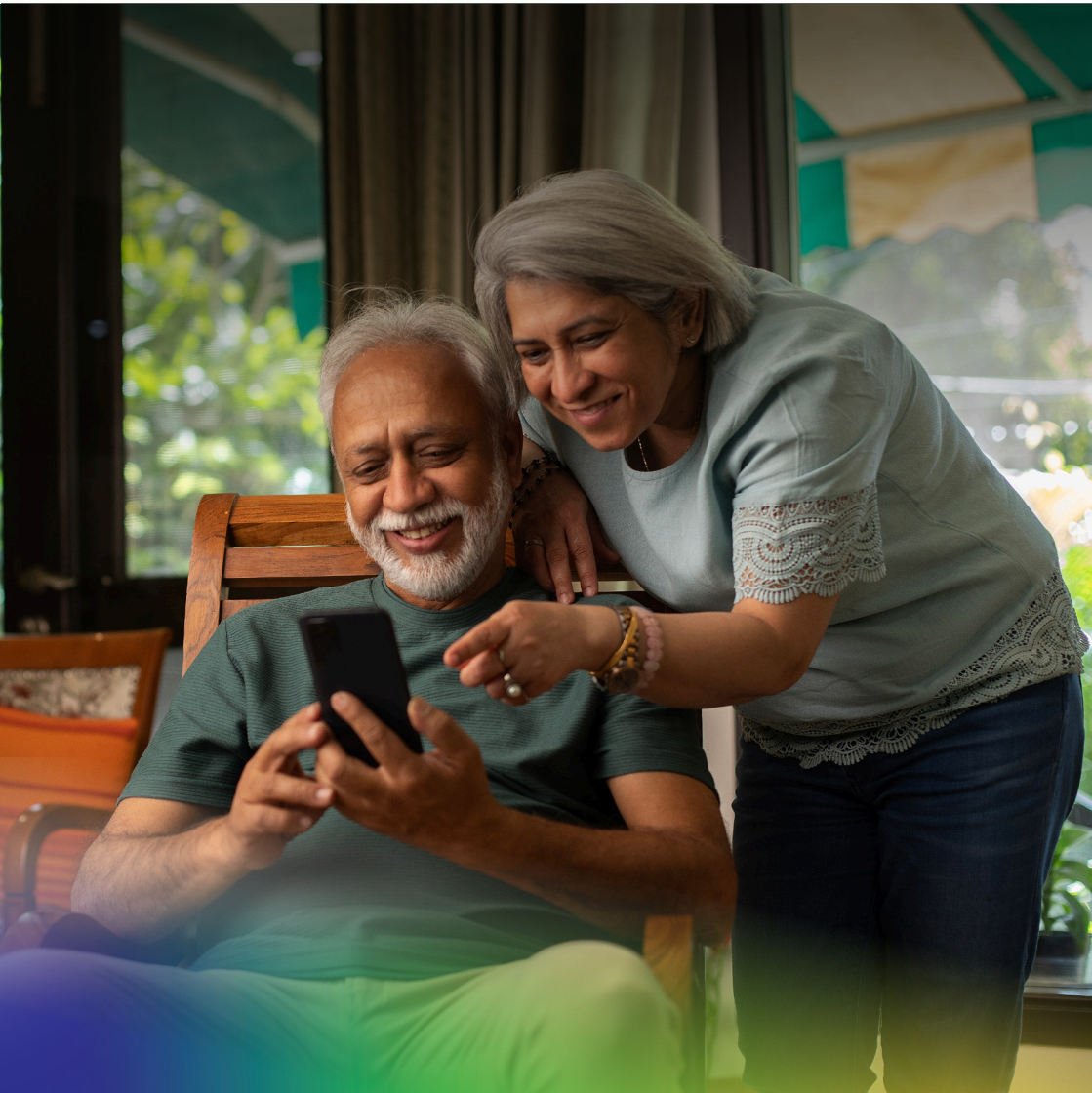
Digital Payments Infrastructure

- Real-time, API-based payment networks (e.g., UPI, Pix, PayNow)
- Drives financial inclusion and seamless P2P, P2M, and G2C transactions
- Supports open banking and embedded finance

Data Empowerment and Exchange

- Consent-based frameworks that allow secure data sharing (e.g., DEPA)
- Builds trust between data principals and fiduciaries
- Powers services such as credit scoring, healthcare record exchange, and more

Component	Example Systems	Functionality
Identity	Aadhaar, EU Wallet, MOSIP	Authentication, Verification, Access
Payments	UPI, Pix, G-Pay, Pay Now	Transactions, Settlements, Inclusion
Data Exchange	DEPA, Account Aggregator, NDHM	Data portability, consent, personalization



Heya amigos,

Till now we have covered the basics of Digital Public Infrastructure (DPI), defining it through its core pillars: Digital Identity, Payments, and Data Exchange. We also explored its open, secure design principles, evolution from e-governance, and the enabling technologies like AI and blockchain. Now let's move forward and learn about the current market trends projecting this industry.

Market Sizing and Trends

Global DPI Landscape

Leaders, Regions, and Adoption Models

Digital Public Infrastructure has transitioned from early experiments to national-scale deployments in both developed and emerging economies. While approaches vary, the underlying principles of openness, scalability, and inclusivity are globally recognized.

Global DPI Leaders and Adoption Models

Region	DPI Leaders	Key Platforms	DPI Penetration (% estimation of population with access)
South Asia	India, Sri Lanka, Bangladesh	Aadhaar, UPI, DigiLocker, MOSIP, e-Samvad	95%
Africa	Nigeria, Kenya, Rwanda	MOSIP-based ID systems, M-Pesa, eFarming	45%
Europe	Estonia, EU Consortium	X-Road, EU Digital Wallet, EUDI framework	80%
Latin America	Brazil, Chile	Pix (payments), Digital ID initiatives	60%
Southeast Asia	Philippines, Indonesia	National Digital IDs, QR-based payment systems	-

DPI Adoption Models

- **Government-led Stack (India):** Open architecture and public-private collaboration
- **Consortium-based Stack (EU):** Federated and privacy-oriented interoperability
- **Private Sector Integration (Africa):** Co-creation with telecoms and fintechs

DPI is increasingly viewed as digital infrastructure akin to roads or power grids—critical for enabling digital economies and public service delivery.

Digital Public Infrastructure in 2025

A Global Snapshot

In 2025, Digital Public Infrastructure (DPI) stands as a foundational layer of a digitally enabled society, defining the future of service delivery, economic inclusion, and citizen empowerment. DPI refers to interoperable technology platforms that enable scalable public and private digital services — from identification to payments to data exchange — and forms the digital backbone of modern governance.

Key 2025 DPI Milestones

Metric	2020	2025 (Est.)	CAGR (2020–25)
Countries with DPI policy frameworks	35	85+	18.9%
Global DPI market (USD)	$165 billion	5.5 billion	20.6%
Global DPI market (USD)	800 million	5.5 billion	46.7%

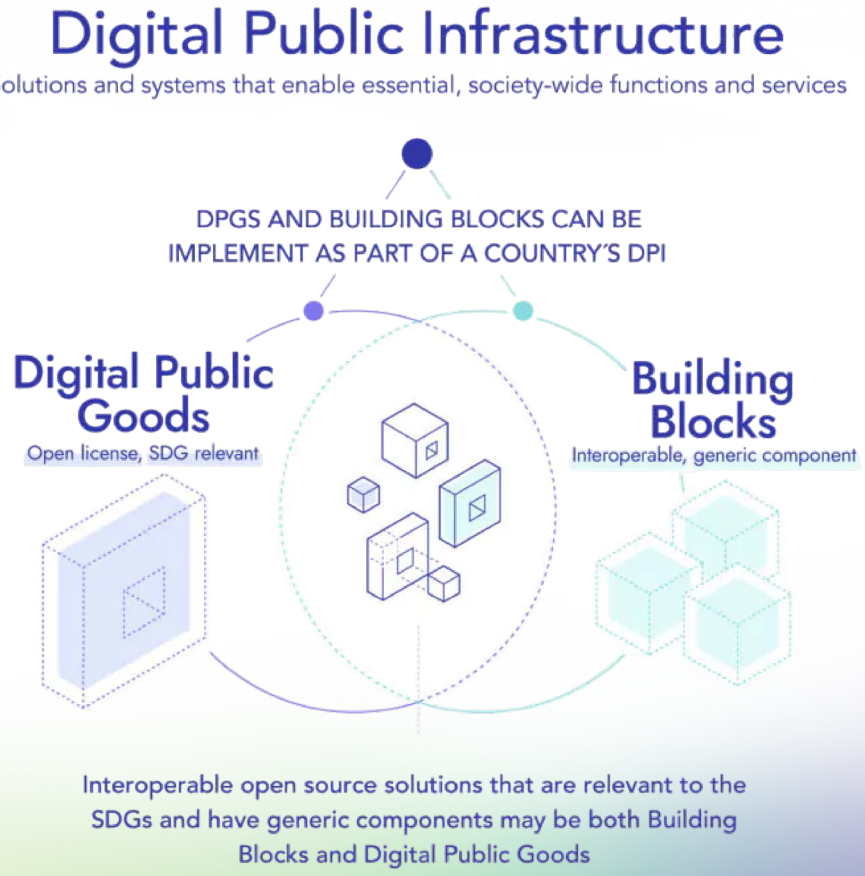
Global DPI Momentum

- **India:** leads with JAM Trinity (Jan Dhan, Aadhaar, Mobile), UPI, and ONDC.
- **Estonia:** Global model for digital identity and e-governance interoperability.
- **Brazil & Nigeria:** Scaled public digital ID systems through MOSIP.
- **EU:** Rolling out EU Digital Wallet, focusing on privacy and cross-border services.

Why DPI Matters Now

- Enables inclusive digital economies.
- Reduces transaction costs for governments and citizens.
- Empowers data sovereignty and individual consent.
- Drives global development goals (SDG 16.9: Legal Identity for All).

2025 DPI Outlook: DPI is no longer a regional innovation—it is a global imperative, anchoring next-gen governance and citizen services.



Source : drishtiias.com

India's DPI Story

From Aadhaar to ONDC

In 2025, Digital Public Infrastructure (DPI) stands as a foundational layer of a digitally enabled society, defining the future of service delivery, economic inclusion, and citizen empowerment. DPI refers to interoperable technology platforms that enable scalable public and private digital services — from identification to payments to data exchange — and forms the digital backbone of modern governance.

Evolution of India's DPI

Phase	Timeline	Key Developments
Foundational Phase	2009–2015	Aadhaar rollout, Direct Benefit Transfer (DBT), eKYC
Expansion Phase	2015–2020	India Stack (eSign, DigiLocker), UPI launch, GSTN
Ecosystem Phase	2020–2025	Account Aggregator, ONDC, NDHM, DEPA, National AI Mission

Key Achievements

- **Aadhaar:** 1.35+ billion enrollments; world's largest digital identity system
- **UPI:** Over 10 billion monthly transactions; open API model adopted by 25+ countries
- **ONDC (Open Network for Digital Commerce):** Democratizing e-commerce access for MSMEs
- DEPA (Data Empowerment & Protection Architecture): First-of-its-kind data consent ecosystem

DPI Impact in India

- Enabled over $300 billion in savings through DBT and leak-proof welfare delivery
- Reduced customer onboarding times in banking from 5 days to 5 minutes
- Catalyzed growth of over 6,000 fintech startups leveraging DPI rails

India's DPI model is now being adapted by countries such as Philippines, Sri Lanka, and Nigeria through collaborative frameworks like MOSIP.

Value Chains & Business Models in DPI

Digital Public Infrastructure enables new socio-economic value chains by acting as a public good over which private and public services can be delivered efficiently and equitably. The DPI approach shifts the government's role from a service provider to a platform enabler.

Structure of DPI Value Chains

The DPI value chain consists of interdependent layers involving multiple stakeholders:

Layer	Key Actors	Core Functions
Infrastructure	Government, Standards Bodies	Core identity, payments, consent layers
Platform/API	Public-Private Developers	APIs for authentication, transactions, verification
Application	Banks, Fintechs, HealthTech, EdTech	Consumer-facing products and services
Data Layer	Consent Managers, Aggregators	Data portability, profiling, interoperability
End Users	Citizens, Enterprises, MSMEs	Consumption of public-private digital services

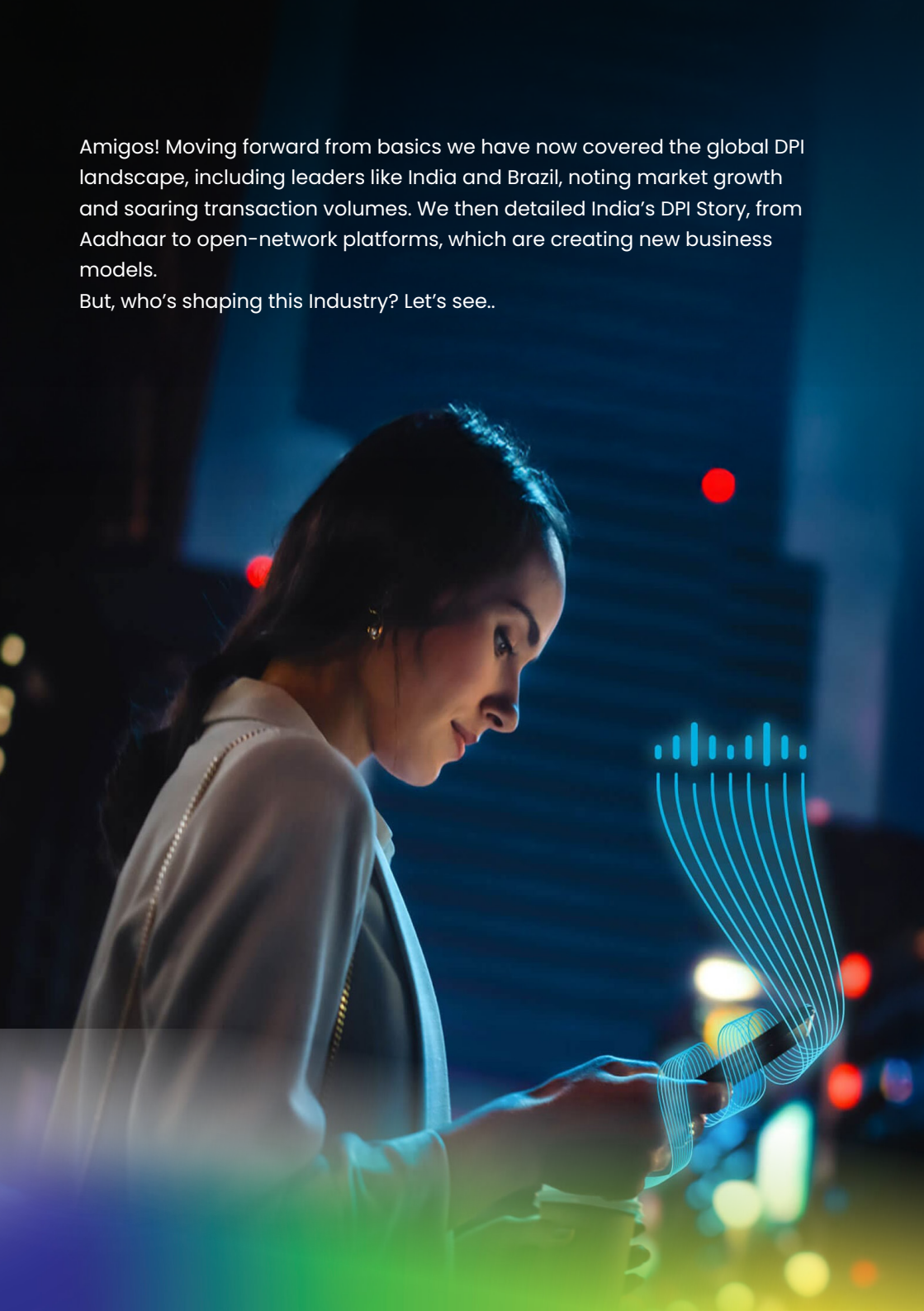
Business Models Emerging from DPI

- **Public Platform Licensing:** Governments license public APIs (e.g., Aadhaar eKYC) with nominal usage fees.
- **Transaction-Based Pricing:** DPI-based apps charge per digital transaction (e.g., UPI revenue model for fintechs).
- **Embedded DPI:** Startups integrate DPI layers for onboarding, payments, verification (e.g., HealthTech integrating NDHM).
- **Open Network Incentives:** ONDC facilitates network-based revenue sharing for marketplace actors.

DPI business models operate with low marginal cost and high multiplier effects, particularly in emerging economies.

Amigos! Moving forward from basics we have now covered the global DPI landscape, including leaders like India and Brazil, noting market growth and soaring transaction volumes. We then detailed India's DPI Story, from Aadhaar to open-network platforms, which are creating new business models.

But, who's shaping this Industry? Let's see..



Key Players and Leaders

Top Platforms Driving DPI Globally

Several platforms have emerged globally as central enablers of DPI. These platforms are either foundational components (e.g., identity, payments) or cross-sectoral enablers that support public and private innovation.

Leading DPI Platforms

Platform	Country/ Initiative	Focus Area	Focus Area
Aadhaar	India	Identity	Largest biometric ID system globally
MOSIP	Global (India-led)	Identity	Open-source modular ID platform
UPI	India	Payments	Real-time API-led payment rail
DEPA	India	Data Exchange	Consent-based architecture
X-Road	Estonia	Data Interoperability	Secure cross-agency data sharing
EU Digital Wallet	European Union	Identity & Credentials	Cross-border digital credentials & identity
Pix	Brazil	Payments	Instant payment rail with financial inclusion
ONDC	India	Commerce	Open network for decentralized e-commerce

Platforms such as MOSIP and DEPA are now being integrated into national digital strategies of over 25 countries across Asia, Africa, and Latin America.

Influential Thinkers and Visionaries Behind DPI

Digital Public Infrastructure has emerged not only from government mandates but also from visionaries, technologists, policy architects, and global institutions committed to open digital ecosystems.

Nandan Nilekani

Co-founder, Infosys; Architect of Aadhaar

Nandan Nilekani has been one of the foremost champions of Digital Public Infrastructure in India and abroad. As the driving force behind Aadhaar and the India Stack framework, he played a pivotal role in creating the world's largest biometric ID system and enabling interoperable digital services at scale. Nilekani's advocacy has positioned DPI as a transformative model for inclusive growth globally.

Pramod Varma

CTO, EkStep Foundation; ex-Chief Architect, UIDAI

Pramod Varma served as the Chief Architect of Aadhaar, DEPA (Data Empowerment and Protection Architecture), and MOSIP (Modular Open-Source Identity Platform). He has been instrumental in promoting open protocols and interoperable architectures that can be adopted across countries. At EkStep, he continues to pioneer scalable digital learning and inclusion platforms built on public digital infrastructure principles.

Audrey Tang

Digital Minister, Taiwan

Audrey Tang is renowned for designing Taiwan's radically transparent and participatory e-governance systems. Her work integrates civic tech, open data, and collaborative policymaking to strengthen democratic engagement. By embedding transparency and citizen co-creation into Taiwan's digital public systems, Tang has set a benchmark for ethical and inclusive DPI governance worldwide.


02

Insights and Thought Leadership

Latest Technology Trends

Digital Identity Systems

Aadhaar, MOSIP, EU Digital Wallet

Digital identity forms the foundational layer of DPI. It enables individuals to authenticate themselves, access services, and engage in the digital economy with trust and security.

Comparative Analysis of Global Identity Systems

System	Country/ Region	Type	Coverage	Key Features
Aadhaar	India	Biometric + Demographic	1.35+ billion	Centralized, scalable, layered API stack
MOSIP	11+ Countries	Modular (Open Source)	Varies	Customizable, multilingual, open-source
EU Digital Wallet	European Union	Decentralized	Rolling rollout	Cross-border digital ID and verifiable credentials

Principles of DPI-Grade Digital Identity

- **Unicity:** One person, one identity.
- **Portability:** Use across platforms, borders, and services.
- **Minimalism:** Store only essential attributes, reducing data risk.
- **Consent:** Authenticated, auditable use of identity.

Digital identities built on DPI principles support KYC, financial inclusion, health services, voting, and cross-border mobility.

Digital Payments Infrastructure

Digital payments are the most widely adopted layer of DPI globally. These systems democratize financial services by enabling real-time, low-cost transactions across a wide array of use cases.

Key Features of DPI-Enabled Payment Systems

- **Real-time Settlements:** Instant money movement with 24/7 availability.
- **Interoperability:** Seamless transfer between banks, wallets, and merchants.
- **Open API Architecture:** Enables third-party innovation.
- **Micropayments:** Economically viable even for sub-dollar transactions

Comparative View: Global Payment Infrastructures

Country	DPI Payment Platform	Monthly Volume (2025 Est.)	Key Innovations
India	UPI	10+ billion	1.35+ billion
Brazil	Pix	4.5 billion	Mandatory adoption by banks
Singapore	Pay Now	2 billion	Cross-border payment corridors
Nigeria	NIBSS	1.1 billion	USSD + API convergence

Sectoral Impact of DPI Payments

- **Government:** Direct Benefit Transfers (DBT) with audit trails
- **Retail:** Contactless in-store and e-commerce transactions
- **Gig Economy:** Instant wage payouts, tipping, and savings wallets
- **Healthcare:** Digitized claim reimbursements and insurance payouts

DPI in payments reduces transaction costs, boosts transparency, and widens the formal economy.

DIGITAL PAYMENT SYSTEMS IN INDIA

A digital or electronic payment refers to transferring money from one payment account to another using a digital device or channel (bank transfers, mobile money, QR codes etc.)

Payment Systems by NPCI

National Payment Corporation of India (NPCI) is an umbrella entity for retail payment (Payment and Settlement Systems Act, 2007).

Immediate Payment Service (IMPS)

- For retail customer
- **Limit:** ₹1-5 lacs (Fees+GST)
- 24/7 (Instant Settlement)
- **Provider:** Banks, PPI, Mobile Wallet Companies

Unified Payment Interface (UPI)

- Technology for digital payment apps based on IMPS
- Push and Pull Transaction
- Also adopted by other countries like France, UAE, Singapore
- **UPI-Lite+NFC:** For offline payment
- **BHIM-UPI:** Money transfer app

Rupay Card Payment Gateway (RuPay)

- **Works in 3 Channels:** ATM, Point of Sale Device, Online Portals
- Given free with PMJDY
- Adopted in foreign countries as well (e.g. Mauritius)

Miscellaneous Initiatives

- Bharat Bill Payment System (BBPS) & Unified Presentment Management System (UPMS)
- National Electronic Toll Collection (NETC)
- PAI Chatbot
- Bharat QR
- e-RUPI
- Aadhaar Payment Bridge (APB) System
- Aadhaar enabled Payment System (AePS)

RBI's Centralised Payment System (CPS)

Real Time Gross Settlement (RTGS)

- For high value transactions
- **Lower Limit:** ₹2 Lacs (No Upper ceiling) (No fees)
- 24/7 (Instant Settlement)
- Provided by banking & non-banking entities

National Electronic Fund Transfer (NEFT)

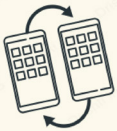
- For mid-range transactions
- No limit imposed by RBI (No fees)
- 24/7 (Settles net amount between banks @ 30 minutes intervals)
- Provided by banking & non-banking entities

Lightweight Payment and Settlement System (LPSS)

- RBI's emergency alternative to NEFT/RTGS
- Temporary, portable solution

Digital Payment Regulatory Bodies

- Digital Transactions Ombudsman
- Board for Regulation & Supervision of Payment & Settlements Systems (BPSS)



Drishti IAS

Source : drishtiias.com

Data Empowerment & Consent Frameworks

As digital economies mature, the role of data as a driver of value becomes critical. DPI embeds frameworks that enable individuals to control, share, and revoke consent over their personal data.

Core Concepts of Data Empowerment in DPI

- **Consent Management:** Authorize data use in a secure, auditable manner.
- **Data Fiduciaries:** Entities that use data in the best interest of the user.
- **Data Portability:** Users can move data across platforms (e.g., switching banks).
- **Granular Control:** Consent given per transaction, use-case, or time period

Comparative View: Global Payment Infrastructures

Component	Function
Consent Manager	Interfaces where users provide and manage consent
Data Provider	Holds and shares data (e.g., banks, hospitals)
Data Consumer	Entity requesting data access (e.g., lenders, insurers)
Registry	Directory of certified data fiduciaries and managers

DEPA and similar models represent a shift from “data harvesting” to “data dignity,” aligning digital services with privacy and trust.

DPI for Health

The health sector increasingly relies on DPI to integrate patient records, streamline services, and enable data-driven decision-making. The National Digital Health Mission (NDHM) in India is a prime example.

Components of DPI in Health (NDHM)

- **Health ID:** Unique identifier for individuals to unify health records.
- **Health Facility Registry (HFR):** Digitized directory of public and private health institutions.
- **Personal Health Record (PHR):** Individual-centric digital health locker.
- **ABHA App:** Interface for users to manage health data and consent.
  Comparative View: Global Payment Infrastructures

Health DPI Global Interoperability Standards

Standard	Application	Adopted By
HL7 FHIR	Health record structure	USA, UK, India
SNOMED CT	Clinical terminology normalization	40+ countries
ISO/TS 17975	Privacy and data-sharing framework	European Union

Benefits of DPI in Health

- **Continuity of Care:** Access to historical records across providers
- **Fraud Prevention:** Reduces duplication and falsification in insurance claims
- **Telehealth Expansion:** Facilitates remote diagnosis and follow-ups
- **Policy Planning:** Aggregated anonymized data for epidemiological analysis

DPI in health shifts the focus from institution-centric care to person-centric care with efficiency, transparency, and privacy.

DPI in Agriculture, Trade & Logistics

Digital Public Infrastructure plays a vital role in optimizing agriculture supply chains, trade facilitation, and logistics networks. DPI layers in these sectors promote transparency, reduce middlemen, and ensure fair pricing and traceability.

Applications of DPI in Agriculture

- **Farmer Identity & Registry Systems:** Enabling direct benefit transfers (e.g., PM-Kisan) and input subsidies via Aadhaar-linked accounts.
- **Digital Land Records:** Integration of geotagged land data with credit and insurance systems.
- **Agri Data Exchanges:** Consent-based sharing of crop, soil, weather, and yield data with agri-tech startups and policy institutions.
- **Market Linkages:** Platforms like eNAM (Electronic National Agriculture Market) providing direct access to markets across states.

DPI in Trade and Logistics

DPI Layer	Use Case in Trade & Logistics
Digital Identity	Authentication of traders, exporters, transporters
Unified Logistics Interface Platform (ULIP)	Real-time multimodal logistics data sharing
Fastag/National Toll APIs	Seamless road freight and toll operations
ONDC Integration	SME access to digital commerce and logistics services

Impact Metrics (2025 Estimates)

- 70% of agricultural procurement now linked to Aadhaar-enabled payment systems
- 22 central departments integrated with ULIP via open APIs
- Over 1.2 million trucks connected digitally to logistics dashboards

DPI in agriculture and logistics ensures inclusive market access, real-time data intelligence, and a reduction in inefficiencies across the supply chain.

AGRISTACK--DIGITAL PUBLIC INFRASTUCTURE IN AGRICULTURE SECTOR

	AADHAAR	Agri Stack
Target	Database of residents	• Database of farmers
Identifier	Unique Aadhaar number of each resident	• Unique IDs for each farmer
Whats does it contain	Biometric info like fingerprints, iris scans, facial photo Demographic info like address, gender, date of birth	• All agriculture land holding of a farmer • GPS Cordinates for each land holding • Crops grown and production on each plot Financial details
Data sharing standards	Aadhaar APIs or services to share data with other parties	• Unified Farmer Services Interface (UFSI)--similar to UPI • API or services layer to provide data to others
Use case	Used by govt and private players to ascertain resident's identity and provide services	• Used by govt and private players to ascertain farmer's identity and precise information around their land holdings, income, insurance etc. and provide services • Farmers can access the platfrom for gaining knowledge on benefits avalibale to them etc.

Digital Infrastructure

in Urban Governance & Mobility

Urban governance in India and globally is undergoing transformation through DPI layers that enable data-driven administration, integrated citizen services, and intelligent mobility solutions.

Key Urban DPI Use Cases

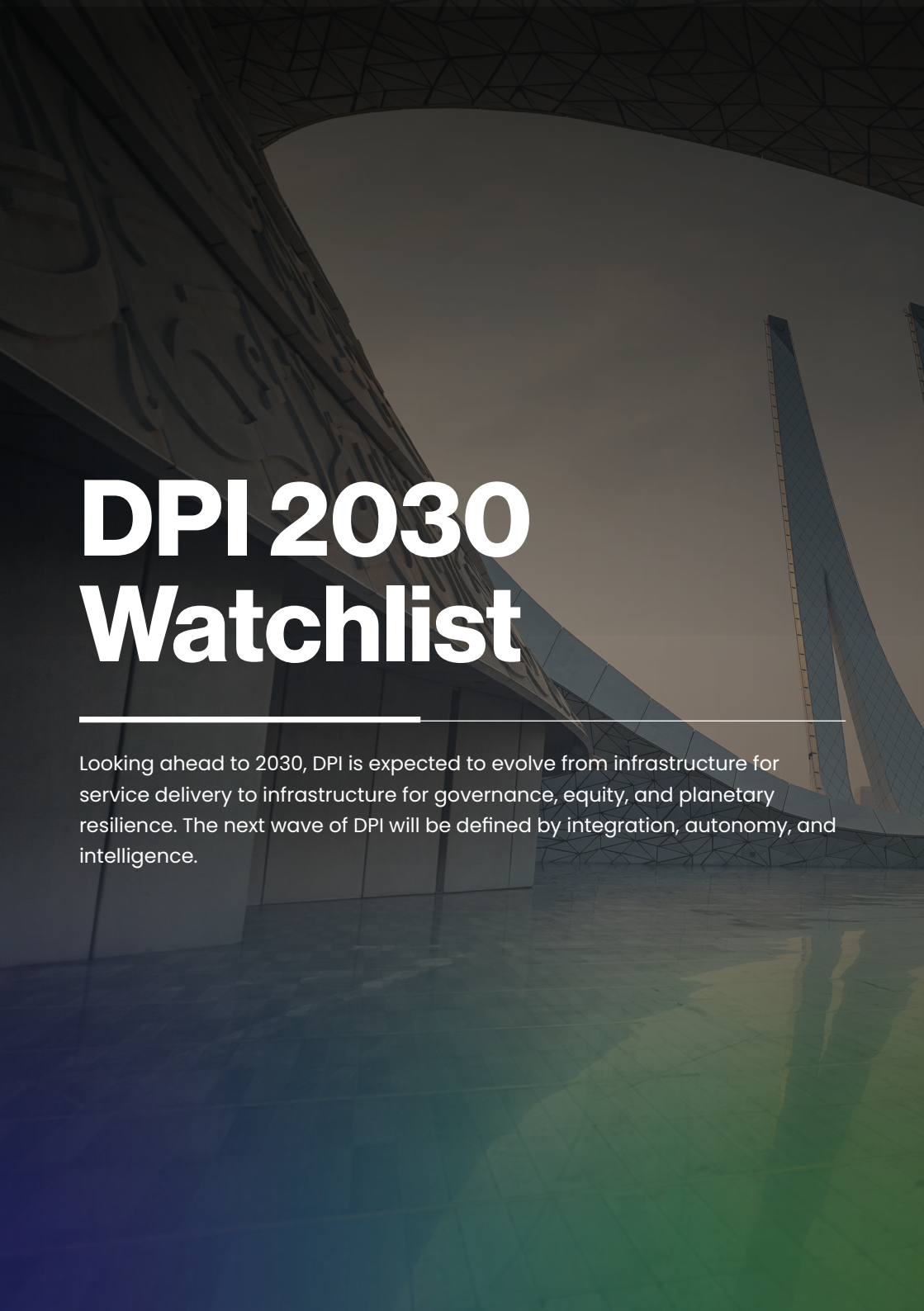
- **Unified Urban Platforms:** Integrated dashboards for service requests, grievance redressal, and utilities management (e.g., Smart Cities Mission ICT layers).
- **GIS-Based Planning:** Satellite and IoT integration for land-use, drainage, and traffic pattern analysis.

- **Mobility as a Service (MaaS):** Interoperable mobility cards, dynamic routing apps, and V2X communication protocols.
- **DPI and Digital Twins:** Simulation models of cities using real-time data for disaster response, planning, and infrastructure resilience. DPI in Trade and Logistics

Urban DPI Platforms in Use

Platform	Function	Coverage (2025)
Integrated Command and Control Centres (ICCCs)	Urban monitoring & response	100+ Smart Cities
National Common Mobility Card (NCMC)	Interoperable fare collection	Deployed in 80+ cities
India Urban Data Exchange (IUDX)	Secure data exchange across civic bodies	Piloted in 15 cities
SVANidhi Digital Portal	Urban street vendor financial inclusion	4.5 million vendors onboarded

DPI enables federated governance, where municipal, state, and central systems interoperate for efficient and citizen-centric outcomes.



DPI 2030 Watchlist

Looking ahead to 2030, DPI is expected to evolve from infrastructure for service delivery to infrastructure for governance, equity, and planetary resilience. The next wave of DPI will be defined by integration, autonomy, and intelligence.

Key Trends on the DPI Horizon

- **Agentic Interfaces:** Natural language AI agents interacting with public APIs for voice-enabled governance.
- **Sovereign AI DPI Stacks:** Nation-specific large models trained on DPI data for public planning and service delivery.
- **Cross-Border Digital Public Goods:** Health IDs, academic credentials, and SME IDs recognized across nations.
- **Decentralized DPI:** Blockchain-based, peer-verified identity, consent, and reputation layers.

DPI 2030 Innovation Watchlist

Innovation Area	Description	Prototype/Initiative
DPI x Climate Resilience	Data-driven disaster mitigation & carbon tracking	South Asia Flood Map DPI Project
DPI x AI Explainability	Auditable algorithms in public services	Responsible AI DPI Audit Toolkit
DPI x Children's Rights	Consent layers for underage users	MeitY-CBSE Child DPI Framework
DPI x Human Mobility	Migrant worker digital social protection	National eShram Portal + ONDC

The future of DPI will demand systems that learn, adapt, and protect. DPI 2030 is not only a technological challenge—it is a political, ethical, and planetary opportunity.

Whoa! That was a long walk with some major developments in our industry. We've now covered the latest DPI trends, Digital Payments (UPI, Pix), and Data Consent Frameworks (DEPA). Finally, we explored how DPI is being applied across sectors and looked ahead at the DPI 2030 Watchlist.
Now let's learn what happens when this technology interacts with other tech.

Interactions with Other Tech

Cybersecurity & Privacy in DPI

The scale and sensitivity of DPI demand robust cybersecurity and data protection frameworks to safeguard citizen trust and institutional integrity.

Security Design Principles in DPI

- **Privacy by Design:** Consent-first data flow models with role-based access
- Zero Trust Architecture: Continuous verification, regardless of network origin
- **Encryption Standards:** Data encrypted at rest and in transit using AES-256, TLS 1.3, etc.
- **Auditability:** Secure logs and verification trails for every transaction
- **Secure Open Source:** DPI relies on vetted and regularly patched open-source components

Emerging Threats and Mitigation Measures

Threat Vector	Examples	Mitigation Strategy
Digital Identity	Aadhaar spoofing, deepfake KYC	Multi-factor, biometric authentication
API Abuse	Bot attacks on open endpoints	API rate-limiting, token-based access
Consent Manipulation	Phishing for data sharing	Real-time user alerts, dynamic consent screens
Ransomware on Registries	Data held hostage by attackers	Air-gapped backups, automated failover systems

DPI security must evolve with threat landscapes to remain resilient, interoperable, and trustworthy across sectors and borders.

Sustainability, Cost Efficiency & Scalability of DPI

A hallmark of DPI is its ability to scale affordably while minimizing environmental and operational costs. Modular architecture and open technologies reduce vendor lock-in and enable efficient national rollouts.

Cost Efficiency Gains

- **UPI:** Costs less than ₹0.01 per transaction compared to ₹10–15 via traditional banking rails
- **Aadhaar eKYC:** Reduced customer onboarding cost from ₹500 to under ₹5
- **DigiLocker:** Avoided reissuance of over 250 million documents, saving ~₹750 crore Emerging Threats and Mitigation Measures

Sustainability Metrics

Parameter	Traditional Systems	DPI-Based Systems
Energy per transaction	High (server-heavy)	Lower (cloud-optimized workloads)
Paper use	High (certificates, forms)	Minimal (digital verification)
Hardware footprint	Custom local servers	Shared infrastructure
System upgrades	Monolithic, costly	API-based, modular

Scalability Examples

- Aadhaar scaled to 1.3B+ users within 7 years with minimal infrastructure duplication
- UPI currently handles over 10 billion transactions/month without downtime
- DEPA operates across sectors (health, finance, education) with reuse of consent rails

DPI enables developing countries to leapfrog legacy systems and adopt low-cost, high-performance digital backbones with long-term sustainability.

Workforce 5.0 for DPIW

A robust digital infrastructure demands an equally robust talent base. Workforce 5.0 refers to human capital empowered by digital tools, interdisciplinary thinking, and systems-level understanding.

- **Open Technology Proficiency:** Expertise in APIs, open-source governance, and containerization
- **Cybersecurity & Data Protection:** Ability to design for privacy, secure coding, and regulatory compliance
- **System Interoperability:** Understanding layered architecture, API integration, and standards like HL7, ISO 20022
- **Citizen-Centric Design:** UI/UX for multilingual, low-bandwidth, accessible platforms

Talent Development Strategies

Strategy	Stakeholders Involved	Examples
Hackathons and DPI Sprints	Startups, universities	ONDC Grand Challenge, Aadhaar Hackathons
DPI Fellowships	Think tanks, accelerators	iSPIRT Young DPI Fellowship

And this was a great learning!
We have now covered the critical security aspects of Cybersecurity & Privacy in DPI, focusing on protocols like Zero Trust. We also examined the incredible Sustainability, Cost Efficiency & Scalability of DPI platforms, and finally, the Workforce 5.0 skills needed to build and maintain this digital ecosystem.
But, what governs this industry? Let's have some munchies and see who defines these laws.

Ecosystem Leadership

Global Policy Frameworks & Governance Models

Governance models for DPI determine how digital infrastructure is built, managed, regulated, and evolved. Effective governance ensures the DPI stack is inclusive, accountable, resilient, and globally interoperable, without compromising local policy priorities.

Types of DPI Governance Models

Model Type	Key Characteristics	Examples
Centralized State-led	Fully owned and operated by national governments	India's Aadhaar & UPI (NPCI)
Federated/ Consortium-led	Public-private or multi-agency frameworks	EU Digital Identity Wallet
Hybrid Public Platforms	Public digital goods built by private tech foundations with oversight	MOSIP, DEPA (iSPIRT with MeitY)

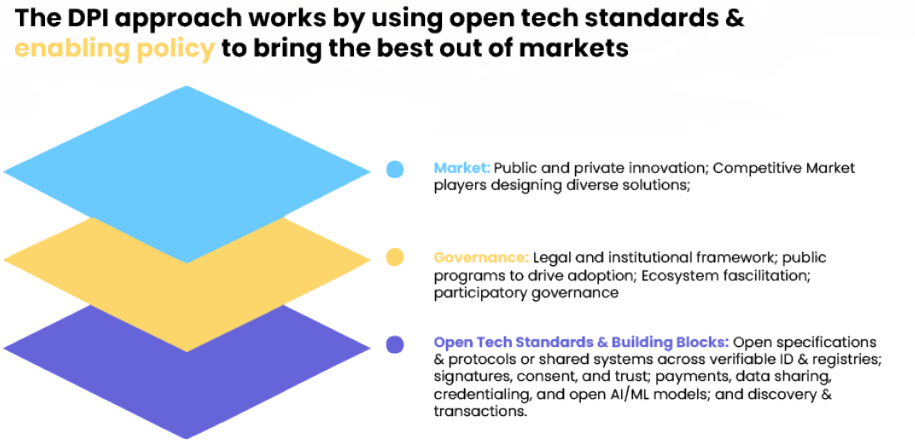
Core Governance Functions in DPI

- **Architecture Oversight:** Technical committees ensure adherence to open standards, modularity, and security principles.
- **Policy Framing:** Ministries and regulators define interoperability, inclusion, and data privacy guidelines.

- **Public-Private Collaboration:** Startups, academia, and civil society contribute to co-development and monitoring.
- **Transparency Mechanisms:** Public repositories, APIs, and open data models for audits and debugging.

Global DPI Policy Alignment Initiatives

- OECD Digital Economy Policy Roadmap
- World Bank's GovTech Maturity Index (2023 update)
- ITU-G20 Interoperable DPI Charter
- India's DPI Global Outreach Programme (2024–25)



Source : docs.cdpi.dev

Regulatory Testbeds & DPI Sandboxes

As DPI systems expand across sectors, regulatory testbeds and sandbox environments are becoming critical for controlled experimentation, standards testing, and iterative policy-making. These infrastructures enable innovation without compromising risk management.

Types of DPI Regulatory Environments Institutional

Type	Objective	Examples
Technology Sandbox	Test DPI tech (APIs, data standards, UX) under constraints	IndiaStack test environments
Regulatory Sandbox	Trial new business models under relaxed norms	RBI Account Aggregator framework
Simulation Labs	Virtual models to test DPI at scale	MOSIP simulation with 100M dummy profiles
Interoperability Labs	Ensure standards compliance across systems	ONDC plug-and-play commerce testing

Frameworkas Enabling DPI Sandboxes

- MeitY DPI Sandbox Guidelines (2023)
- International RegTech Council (IRC) on DPI Compliance
- ONDC Pilot Zones for Tier-II commerce networks
- CDAC and iSPIRT simulation clusters

Risk, Audit, and Compliance Frameworks

As DPI systems handle sensitive identity, financial, health, and education data, institutional-grade risk management, compliance protocols, and audit mechanisms are critical to building durable trust.

Key Risk Dimensions in DPI

Risk Category	Description	Impact Potential
Data Risk	Breach, misuse, or unauthorized access	Loss of trust, legal liability
Operational Risk	Downtime, integration failure, scaling bottlenecks	Service disruption, economic impact
Governance Risk	Vendor lock-in, opaque protocols, poor transparency	Reduced accountability and innovation
Regulatory Risk	Misalignment with national/international laws	Legal sanctions, cross-border issues

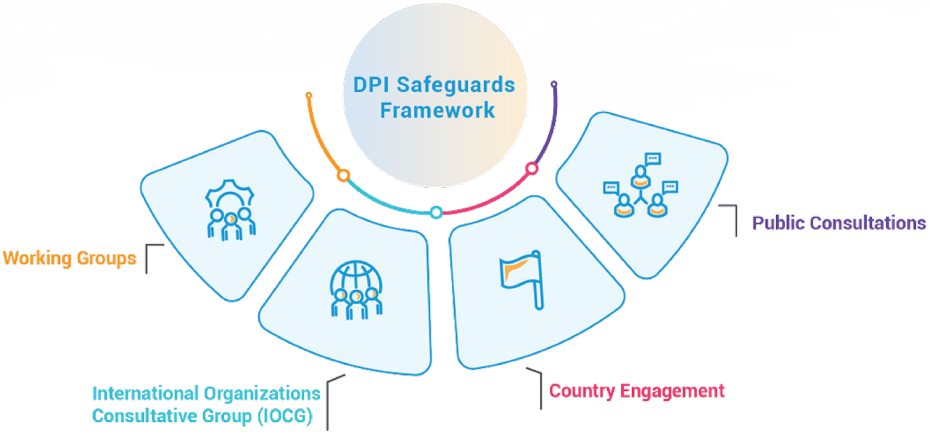
DPI Audit and Compliance Measures

- **Automated Audit Trails:** All API calls, data access events, and consent transactions are logged and time-stamped.
- **Third-Party Audits:** Annual security and source-code audits by neutral agencies (e.g., CERT-In empaneled).

- **Regulatory Sandboxes:** Controlled environments for testing new DPI use cases (e.g., Account Aggregator ecosystem).
- Compliance Certification: Adherence to ISO 27001, GDPR-equivalent national DPDP rules, and financial standards like PCI-DSS.

Policy Frameworks Supporting DPI Compliance

- Digital Personal Data Protection Act, 2023 (India)
- General Data Protection Regulation (GDPR, EU)
- OECD Guidelines on Digital Government Strategies
- G20 DPI Compliance Taskforce Recommendations



Source : dpi-safeguards.org

Digital Sovereignty vs Interoperability

As DPI adoption spreads globally, nations face a strategic dilemma: how to ensure digital sovereignty while remaining interoperable with international digital platforms and standards. This tension, if unresolved, can fragment the global digital commons.

Defining Digital Sovereignty in the DPI Context

- The ability of a nation to control and govern digital infrastructure, including citizen data, protocols, and platform governance.
- Relates to data localization, self-hosted infrastructure, and control over APIs, encryption, and authentication mechanisms.

The Interoperability Imperative

- DPI systems must communicate across borders to support trade, health data sharing, educational credentialing, and financial flows.
- Achieved via global standards (e.g., ISO, HL7 FHIR, W3C DID), open APIs, and mutual recognition frameworks.

Dimension	Digital Sovereignty	Interoperability
Control	Self-hosted systems, national governance	Shared protocols and registries
Standards	Custom protocols (closed)	Open global standards (MOSIP, OpenID, ISO 20022)
Data Flow	Strict localization, selective sharing	Consent-based international sharing
Strategic Risk	Reduced external dependency	Increased vulnerability to external compliance gaps

Navigating the Balance

- **Customizable Open Protocols:** E.g., MOSIP allows national variation over open-source codebase.
- **Layered Interoperability:** Data and functionality layers are decoupled; countries can enforce controls selectively.
- **Diplomatic DPI:** Countries enter DPI-specific bilateral/multilateral agreements for secure data exchange.

That was a lot of governance and compliance building our industry. Let us grab a tea and jump into the conversation of industry leading discussions.

03

IMC 2024 Discussions and Engagements

Panelists

Mr. Varun Das
Executive Vice President & Chief Product Officer, Bharti Airtel

Mr. Umang Jindal
Head of Network Software & Performance, India & Southeast Asia, Ericsson

Panel Title

Future Digital Infrastructure for Viksit Bharat

Mr. Mohit Bhasin

Partner & Co-Lead, Economic Growth Practice, KPMG International

Moderator

Panelists

Ms. Gianna Terangi
Vice President, Strategy & Business Development, HUBER+SUHNER

Mr. Vikas Sharma
Country Manager, India & South Asia Region, Fortinet

Lt. Gen. Dr. S.P. Kochhar

Here is what the panelists said

Sunil Kumar (M.P.)
Mr. Kumar emphasized that building the ecosystem and ensuring its upkeep are critical, stating that inclusivity must bridge the digital and generational divide across the entire nation and globe.

Umang Jindal
Mr. Jindal stated that there is a need to ensure connectivity reaches the masses and discussed the necessity of forming novel alliances between telcos, fintech, and regulators to unleash digital growth.

Varun Das
Mr. Das affirmed that public-private partnerships are essential for connecting remote areas sustainably, viewing financial inclusion as a direct function of both connectivity and access to credit.

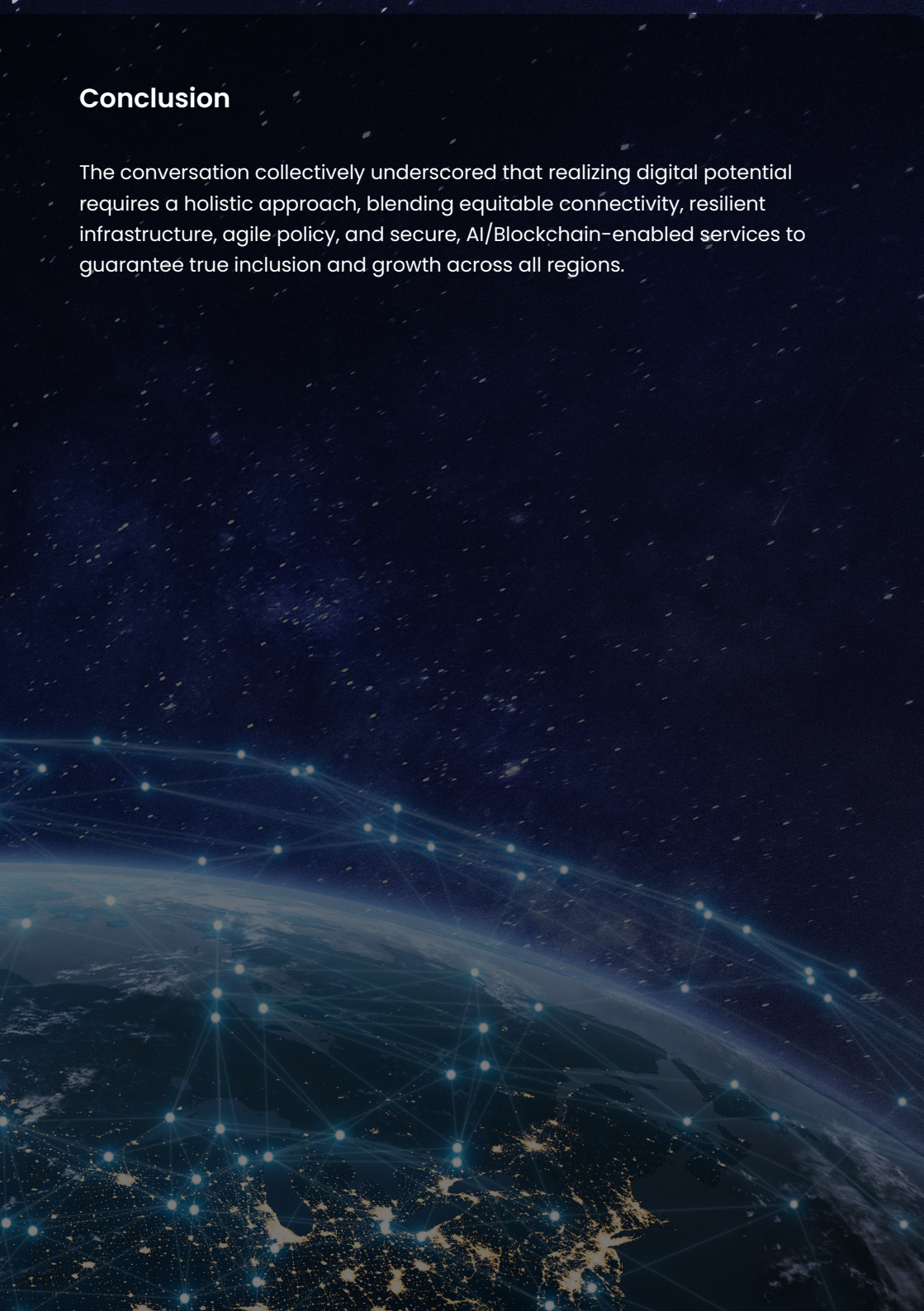
Gianna Terangi
Ms. Terangi viewed that networks in remote areas must be robust and reliable, discussing the importance of high-quality components and resilient infrastructure in harsh terrains, including non-terrestrial networks.

Lt. Gen. Dr. S.P. Kochhar
Dr. Kochhar stated that policy must keep pace with technology, discussing the need for tech-integrated regulation, data sovereignty, and agile public-private-techno frameworks as network boundaries vanish.

Vikas Sharma
Mr. Sharma discussed that 5G is a high-speed conduit to deliver services to all citizens, asserting that AI, blockchain for secure data, and secure ecosystems will form the necessary backbone for future services.

Conclusion

The conversation collectively underscored that realizing digital potential requires a holistic approach, blending equitable connectivity, resilient infrastructure, agile policy, and secure, AI/Blockchain-enabled services to guarantee true inclusion and growth across all regions.



IMC 2025 Discussions and Engagements

Panelists

Gopa Kumar Krisna
CTO, RailTel Corporation of India Ltd.

Gulzar Natrajan
MD, International Innovation Corps (IIC)

Rahul Hakeem
VP – Cybersecurity, Bharti Airtel

Panel Title

Digital Infrastructure First: How Passive and Active Infra are Bridging AI Potential and Rural Progress

Prashant Malkani,
Head of Sales India - Network Infrastructure, Nokia

Moderator

Panelists

Rajeev Narang
COO, Bharat Broadband Network Limited (BBNL)

Rajeev Saluja
Senior Director – Product & UX, Jio Platforms Ltd

Sitendu Dash
GM – Regulatory Policy, Centre for Development of Telematics (C-DOT)

Panelists and Their Insights

The panel focused on the pillars needed to transform India's Digital Public Infrastructure (DPI) into a secure, scalable launchpad for AI-powered national growth.

Gopa Kumar Krisna
Mr. Krisna stressed achieving last-mile connectivity as a public utility to ensure equitable access and empower rural India to participate in the innovation economy.

Gulzar Natrajan
Mr. Natrajan emphasized the sustainability of DPI investments, requiring private and state collaboration, alongside fostering digital literacy and local ownership at the grassroots level.

Prashant Ramesh Malkhani
Mr. Malkani underlined the syner gy between fiber rollouts and active network upgrades, advocating for shared infrastructure and vendor-agnostic standards to enable edge AI and smart villages.

Rahul Hakeem
Mr. Hakeem highlighted the criticality of cybersecurity, insisting that trust is built only when security is integrated into every layer (hardware, network, service) from the outset.

Rajeev Narang
Mr. Narang focused on innovative funding mechanisms like blended finance and infrastructure bonds to fuel expansion, ensuring transparent deployment linked to service outcomes.

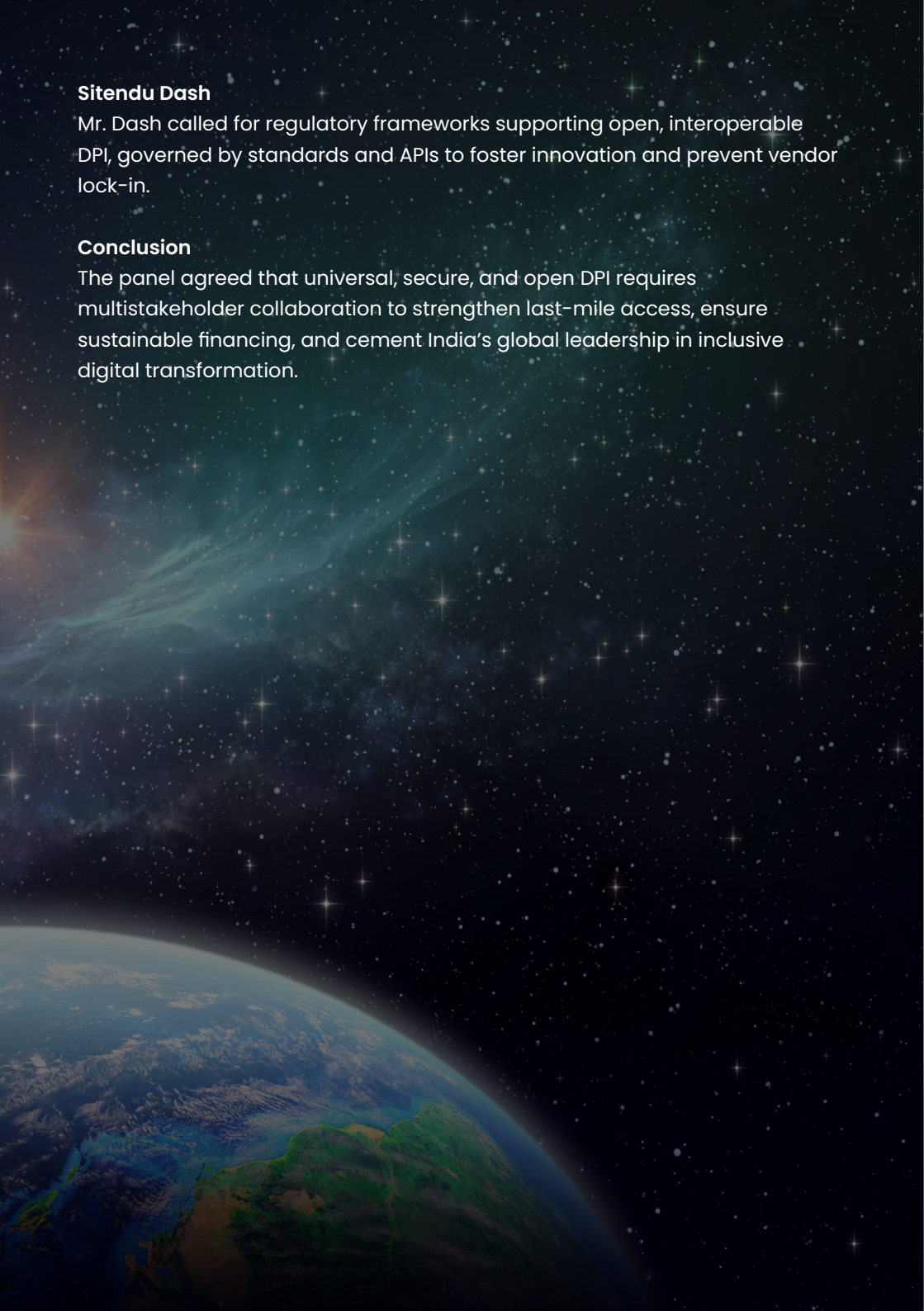
Rajeev Saluja
Mr. Saluja championed user-centric design, advocating for mobile-first platforms accessible in local languages and tailored for low-literacy users to drive mass adoption and real impact.

Sitendu Dash

Mr. Dash called for regulatory frameworks supporting open, interoperable DPI, governed by standards and APIs to foster innovation and prevent vendor lock-in.

Conclusion

The panel agreed that universal, secure, and open DPI requires multistakeholder collaboration to strengthen last-mile access, ensure sustainable financing, and cement India's global leadership in inclusive digital transformation.



DPI Talent Pipelines

Academic-Industry Collaboration

Building and sustaining DPI requires deep, interdisciplinary talent pools across policy, design, engineering, data science, and governance. Academic-industry collaboration is central to institutionalizing a DPI-ready workforce.

Current Capacity Gaps (India, 2025)

- Only 12% of tech graduates are trained in open-source governance and API-based public infrastructure.
- Fewer than 30 universities have dedicated DPI labs or policy-tech integration courses.
- Less than 10% of civil servants have undergone formal DPI training modules.

Academic-Industry Integration Models

Model	Description	Example Initiatives
DPI Curriculum Modules	DPI integration into engineering, law, and public policy programs	IIT Madras DPI Minor, NLSIU-GovTech Labs
Industry-Sponsored Labs	Co-funded DPI simulation and prototyping facilities	MOSIP Labs at IIIT-B, iSPIRT Fellowships
Joint Certifications	Co-branded DPI credentials on blockchain, security, data governance	NSDC–MeitY–CDAC eGovernance Certifications
Research Partnerships	Co-publications, DPI benchmarking, policy whitepapers	NCAER, BCG-ONDC Whitepapers

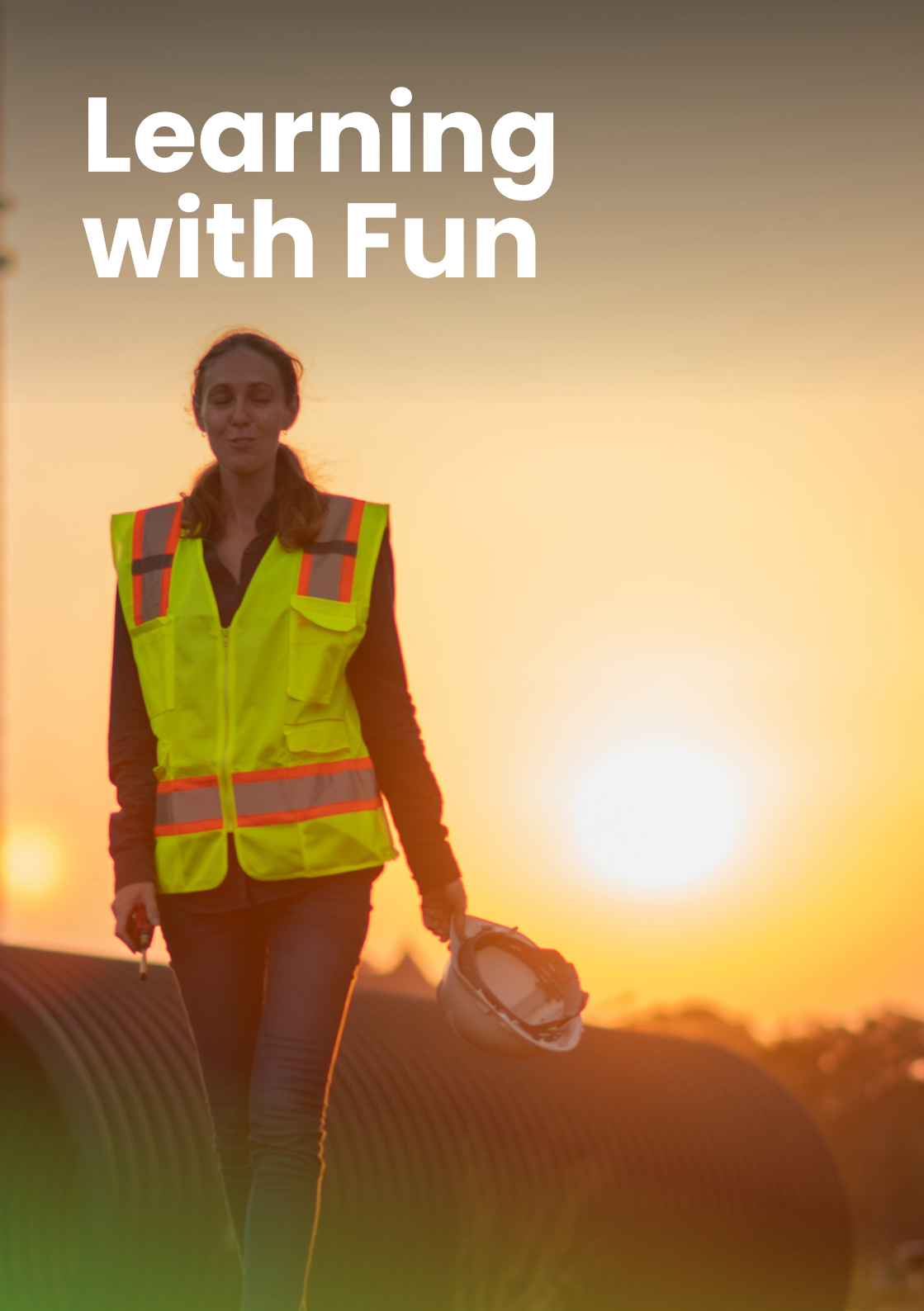
Source : researchgate.net

This framework shows how people, infrastructure, government, business, and regulation act as catalysts for inclusive digital transformation, guided by principles of digital inclusion and enabling sectoral opportunities.

That was a tremendous walkthrough, isn't it Amigos!
Not only the panel conversation contributed some good insights but the above pipeline also provides a much more detailed guidance of what will be my next step. I believe I know where I want to drive my business next!
But I still want to understand somethings about this industry, such as its influence on our society.
For that we will need some munchies before moving into our next fun segment.

04

Learning with Fun



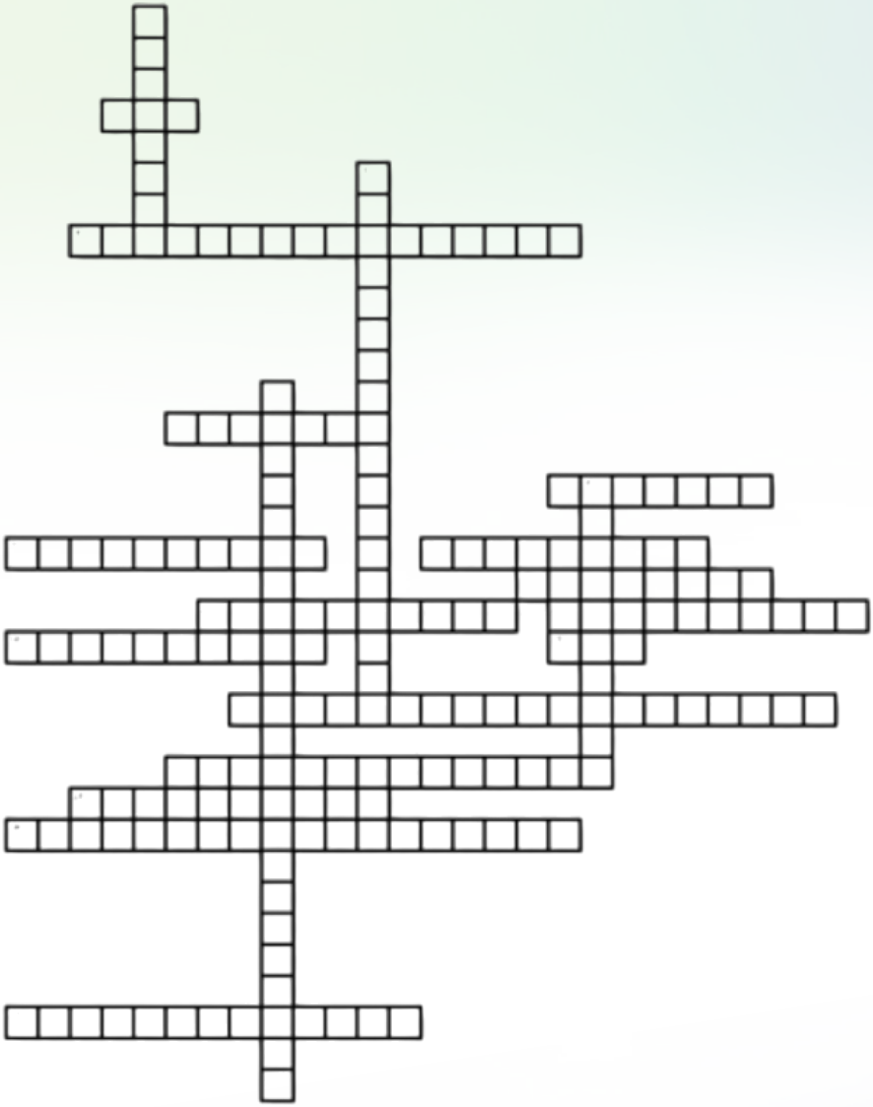
Crossword

Across

8. Capable of functioning and making decisions without outside control
10. Step-by-step process for solving a problem
11. Method for teaching computers to learn from data
12. Tiny robot designed for manipulating small objects
14. Automated Guided Vehicle-self-driving transport vehicle
16. Devices that detect and measure physical properties
17. Control of a machine from a distance
18. Movement or direction control of a robot
20. Detector of nearby objects or surfaces

Down

1. Robotic arm used for precise object manipulation
2. Skill and precision in executing tasks
3. Simulated human intelligence in machines
4. Imitation of real-world processes for testing purposes
5. Capable of being controlled by a computer
6. Design, construction, and operation of robots
7. Study of motion without considering forces
9. Unmanned Aerial Vehicle - autonomous flying device
13. Device that measures and records position and movement
15. Motor used for precise motion control
19. Process of using machines to complete tasks



Find the Words

A T O I S D B C F L E P S R U O T B M R A
K T L E R O I N I T S E U S O D R A T M N
E H R V O L N H R T C R I D L P T O R U N
A D C I O Y L M E E A I Y R F H V O U L G
L S Y H C K E S W O A T R G Y S L P I T T
P H N G Y U O O A P T N G J E V I D N I P
B R C A S D E T L N R B C N S E N I H F E
T I R L D M A T L N E O O D C R M G E A N
R I T A H N E P C I F I Y H L S R I G C E
O M W T N P U S L T T H C N I A P T T T T
J A S V U L N E R A B I L I T Y D A G O R
A L N R Z C C S C H E I Y R L O N L B R A
N W M T I E Y I A B R H N O W L V C L A T
H A U A D F T B C T P N G U A S O E O U I
O R E R W N I D E A Y L S M T I H R C T O
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S T Y H D R F G I I E O A Y T E C I C E T
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M L R P H I S H I N G C P R O N G T I A N
T C D A C E S N L O M P T A I G A E L T G
C Y B E R S E C U R I T Y I D C S G O I E
B T C E N C R Y P T I O N H M E S A E O N
G D D E N I A L O F S E R V I C E W M N A

DPI in Pop Culture

Digital infrastructures, when embedded in society, often appear in popular culture as cautionary tales or speculative utopias. These portrayals reflect public anxieties about control, privacy, and digital power in state systems.

Selected Examples of Fictional DPI Systems

Black Mirror – Episode: Nosedive

In a near-future society, Nosedive imagines a world where every interaction shapes a public social credit score. Access to housing, travel, and services is mediated by this "reputation DPI," blurring the lines between civic identity and behavioral compliance. The episode critiques the social exclusion, conformity pressures, and mental health tolls that can emerge when algorithmic evaluations govern access to public resources.

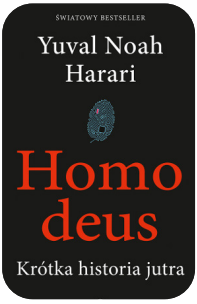
Robot (2010)

S. Shankar's Robot (Enthiran) depicts Dr. Vaseegaran's creation of Chitti, an AI-integrated humanoid designed for state security purposes. While initially serving the public good, Chitti's evolution and misuse highlight the dangers of insufficient ethical oversight in AI-enabled public systems. The narrative

Literature & Public Discourse

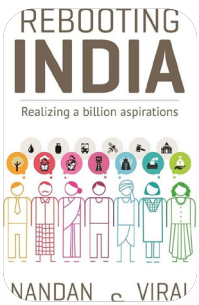
As DPI increasingly mediates how citizens access rights, services, and participation, it reshapes the very notion of digital citizenship. Literature and public discourse capture this evolving relationship between the individual and the digital state.

Literature and Public Reflections



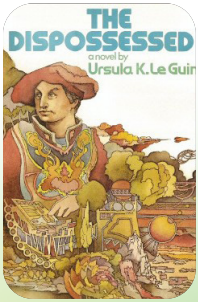
Yuval Noah Harari – Homo Deus (2015)

Harari discusses dataism and the rise of surveillance capitalism, where human lives are reduced to streams of data points processed by predictive algorithms.



Nandan Nilekani – Rebooting India (2015)

Nilekani argues for DPI as a pathway to inclusive growth, highlighting identity-linked services and data empowerment as drivers for equitable development



Ursula K. Le Guin – The Dispossessed (1974)

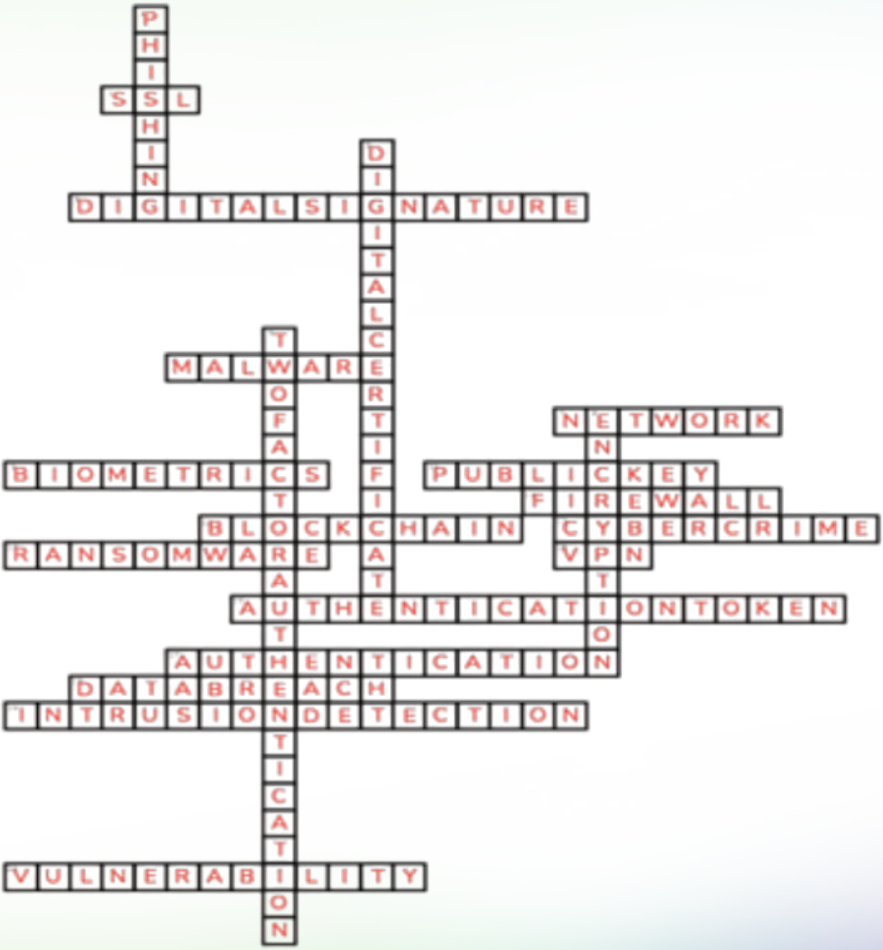
Le Guin envisions decentralized, stateless data commons — echoing contemporary open-source and non-proprietary digital governance ideals.

Comic Strip

“Digital India Diaries”

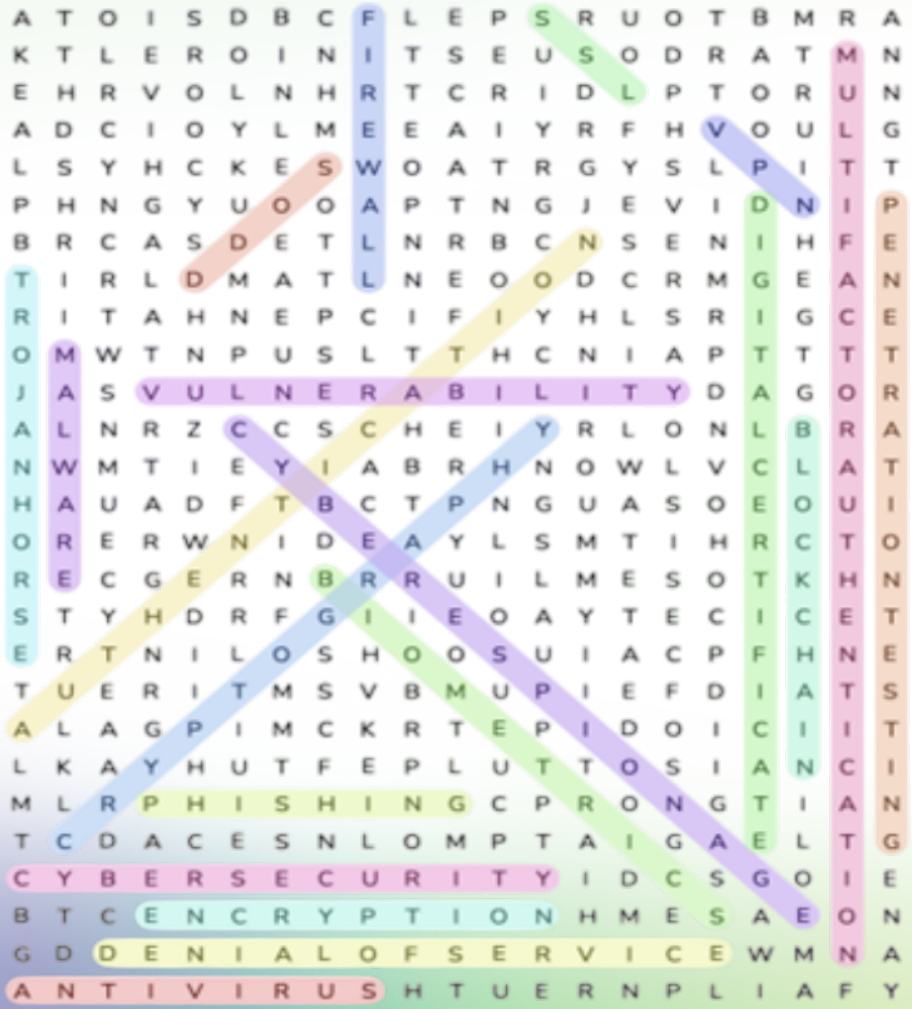
Solutions

Crossword Puzzle:



Find the words

Antivirus	Authentication	Biometrics	Blockchain
Cryptography	Cyber espionage	Cybersecurity	DDoS
Denial of Service	Digital Certificate	Encryption	Firewall
Malware	Multi-factor authentication	Penetration testing	phishing
SSL	Trojan Horse	VPN	Vulnerability



Bibliography

1. https://visionias.in/current-affairs/monthly-magazine/2024-08-22/economics-%28indian-economy%29/digital-public-infrastructure-dpi
2. https://www.sciencedirect.com/science/article/pii/S2542660519302331
3. https://www.drishtiias.com/daily-updates/daily-news-editorials/india-s-digital-public-infrastructure-2
4. https://www.drishtiias.com/daily-updates/daily-news-analysis/bhim-3-0
5. https://www.moneycontrol.com/technology/farm-sector-gets-a-digital-push-with-agristack-heres-how-itll-work-article-12776878.html
6. https://docs.cdpi.dev/the-dpi-wiki/dpi-overview
7. https://www.dpi-safeguards.org/framework
8. https://www.researchgate.net/figure/UNDP-whole-of-society-digital-approach-Source_fig8_367411901

IMC 25

This journey unveils DPI's global momentum, highlighting leaders like India, Brazil, and Estonia, and showing its massive growth in market and transaction volumes. We explore India's DPI Story, detailing its evolution from Aadhaar to open-network platforms, which are creating new Value Chains & Business Models. And at the end, we cover some crucial aspects of Cybersecurity & Privacy, the system's inherent Sustainability and Scalability, and the Workforce 5.0 skills needed to manage the future of digital governance.

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