Lessons from India's Digital Public Infrastructure Transformation

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In today's rapidly evolving digital landscape, many countries are striving to establish and strengthen digital public infrastructure (DPI) to harness the transformative power of technology to benefit citizens. India has emerged as a noteworthy example by successfully using technological advancements to create robust DPI. It has implemented various initiatives that mobilise technology for inclusive growth, economic development, and improved governance. Countries around the world can learn from India's experience and achievements to initiate similar digital transformations.

Through the Digital India programme, India is seeking to digitally equip citizens with access to all government services by improving internet connectivity and developing online infrastructure. This encompasses three key areas: (a) establishing a secure digital infrastructure; (b) successfully delivering digital services; and (c) ensuring that every citizen has access to the internet. India has also seen an increase in the number of digital technology users, with an estimated 750 million smartphone users, and a projected one billion users by 2025.[1] This increase has generated demand for a centralised digital architecture that functions as a single enterprise.

In 2018, the Ministry of Electronics and Information Technology (MeitY) created the India Enterprise Architecture (IndEA) framework[1] for the adoption of a whole-of-government enterprise architecture by central ministries, state departments, and public sector enterprises. Built with a focus on performance, IndEA offers open standards to promote interoperability and supports decentralisation. At the same time, it supports both new (greenfield) and legacy (brownfield) e-governance initiatives. The emphasis of the IndEA initiative is to enable "One Government – a government that is least visible but is effective" by implementing the concept of "virtualisation of departments" to activate synergy.[2]

Growing digitalisation will lead to the increased generation of data, and consequently, data protection and ownership must be addressed at the outset. The Data Empowerment and Protection Architecture (DEPA) framework, introduced in 2020, seeks to ensure user control over data. DEPA suggests measures for consent-governed and secure data-sharing with third-party institutions. Controlled by consent managers, only relevant user data is plugged in to any private ecosystem and there is no need to set up bilateral databases.[3] This empowers citizens with ownership and control over their own data and how it is shared.

While DEPA has been flexibly applied in multiple sectors, it has been particularly well-used as a techno-legal solution in the finance sector. Since DEPA empowers individuals to securely share their financial data with banks, insurers, investors, and other stakeholders, its first immediate benefit has been to encourage competition among private players. Individuals and small businesses are now able to get loans, insurance, and other financial products at competitive rates, just by using their digital footprint. In practice, DEPA works closely with the many layers of India Stack[4]—Aadhaar-based e-KYC, Unified Payments Interface (UPI) for cashless payments, and Aadhaar-based eSign) and uses the Open Credit Enablement Network to facilitate lending. India Stack has enabled the country to build its digital infrastructure, especially in establishing a design to improve private sector service delivery, and has served as India's digital library, housing several digital global goods and offering learnings to the world.

Over the last decade, India has taken landmark steps to set in motion its vision of becoming an inclusive digital economy. This includes establishing

robust DPI and the facilitation of digital governance by streamlining roles, accountability, and change management. This encompasses various components, including digital identification systems, digital payments systems, and digital service delivery platforms.

Pillars of Digital Public Infrastructure in India

The foundation: Aadhaar[5]

India's Aadhaar programme, a biometric and face authentication-based digital identification system, has revolutionised identity verification and service delivery in the country. Aadhaar has provided a unique identification number to over 1.3 billion residents of India, enabling access to essential services such as government subsidies, bank accounts, and mobile connections. It has enabled the government to streamline service delivery and eliminate duplication by providing a single digital identity across multiple sectors. The world can learn from India's approach in implementing a centralised, secure, and inclusive identification system, that has facilitated interoperability across service delivery platforms, both public and private.

Driving financial inclusion: Unified Payments Interface[6]

India's push to digitise payments has transformed the way financial transactions are conducted in the country. The implementation of UPI has created a platform that enables instant money transfers between bank accounts. It offers a smartphone-based interface to support seamless, interoperable, and real-time payments, available on the go. UPI has not only transformed the way individuals transact but has also provided a significant boost to the growth of the digital economy. Countries can gather important lessons from India's experience in fostering a competitive and interoperable payment ecosystem, which has led to increased financial inclusion, reduced reliance on cash, and enhanced transparency in transactions.

The number of digital transactions increased by more than three times from 3 billion in November 2019 to 10 billion by January 2023.[7] A 2019

MeitY study noted that under a 'business as usual' scenario, India's digital economy will grow to US$500 billion by 2025, with the potential to increase to US$1 trillion.[8] In 2021, India had 48.6 billion real-time payments, as compared to 18.5 billion in China and 8.7 billion in Brazil.[9] This is indicative of the ease with which the Indian population has adopted digital platforms for making payments even if the average value of such payments may be rather low.

Efficient welfare delivery: Direct Benefit Transfer[10]

India's Direct Benefit Transfer (DBT) programme is aimed at eliminating potential leakages in the physical delivery of financial benefits and ensuring an efficient transfer of welfare to the right beneficiaries. By leveraging digital payment systems, benefits are directly credited to the beneficiaries' bank accounts, reducing corruption, eliminating middlemen, and improving transparency in the transfer of subsidies.[11] The enablers for DBT in India are the Pradhan Mantri Jan-Dhan Yojana, the Jan Dhan-Aadhaar-Mobile Yojana, and nearly 312 other schemes from 53 ministries across all states and union territories. More than INR 24,800 billion has been transferred through the DBT programme since 2013, with INR 6,300 billion transferred in FY 2021-22 alone. On average, more than 9 million DBT payments were processed daily in FY 2021-22.[12]

Citizen-centric services: E-governance[13]

India has leveraged technology to enhance governance and service delivery through initiatives like Digital India and other e-governance platforms. The use of digital platforms (or information and communication technologies) has facilitated efficient and transparent administration, improved the accessibility of government services, and reduced bureaucratic inefficiencies. The MyGov platform[14] has been a crucial contributor to transforming citizen-government interactions. India's approach to digital governance emphasises citizen-centricity, where technology acts as an enabler to bridge the gap between the government and its citizens. By adopting similar approaches, countries can enhance government services, promote transparency, and strengthen democratic participation.

Creating a digital ecosystem: Technology access and innovation

India has created a vibrant digital ecosystem that fosters innovation and entrepreneurship. Initiatives like Startup India[15] and Make in India[16] have encouraged the growth of technology start-ups and attracted global investments. India has nurtured a conducive environment for technology and innovation through policy reforms, access to funding, and incubation support. Managed by the Department for Promotion of Industry and Internal Trade under the commerce ministry, the Startup India initiative has helped introduce various programmes that support entrepreneurs and create a healthy start-up ecosystem. Similarly, the 'Make in India' initiative has incentivised the development, manufacture, and assembly of products in the country, and has thus boosted partnerships, investments, and innovations.

Growing digital literacy and inclusion in harnessing the benefits of technology has also been crucial achievements for the country. India's experience underscores the importance of widespread access to affordable internet connectivity, digital skills training, and tailored initiatives for marginalised communities. Initiatives like BharatNet,[17] which aims to connect over 250,000 local rural bodies with high-speed internet, and the Common Service Centers,[18] which provide access to government services in remote areas, have been instrumental in extending the benefits of India's digital infrastructure to rural communities. In addition to the digital training programmes offered through government-supported bodies like the National Skills Development Centre[19] and the National Institute for Entrepreneurship and Small Business Development,[20] other private training institutes and online platforms have significantly contributed to digital skill building among citizens, both in urban and rural settings. By prioritising digital literacy and inclusion, countries can bridge the digital divide and empower their citizens to participate fully in the digital age.

Key Drivers of India's Digital Transformation

India's achievements in implementing DPI demonstrate the transformative power of technology when combined with inclusivity, scalability, regulation, and collaboration. The key factors that equipped the country to achieve this digital revolution include:

Ecosystem collaboration

India's success in digital service delivery can be attributed to strong collaboration between government agencies, industry leaders, startups, academia, and civil society organisations. This collaborative approach has fostered innovation, shared expertise, and effective implementation. India's G20 presidency has further drawn attention to the importance of collaboration, with initiatives like the Global DPI Summit[21] allowing a close agreement between partners (and non-partners alike) on the common principles and design aspects of DPIs. By bringing together all the stakeholders, the Indian government has created a collaborative environment for developing and implementing digital public infrastructure projects.

Industry players have contributed their expertise, resources, and technological innovations to build and maintain the required infrastructure. Similarly, collaborations with academic institutions and research organisations have aided innovation and helped address technical and policy challenges. Public-private partnerships and international collaborations have further supported knowledge exchange, best practice sharing, and access to resources and funding.

The Indian government has been able to promote such an ecosystem collaboration by establishing platforms (such as, India Stack), forums (for example, India Stack Knowledge Exchange Forum, 2022[22]), and regulatory frameworks (IndEA and DEPA) that encourage active participation, information sharing, and coordination between different stakeholders. These collaborations prioritise interoperability, data privacy, security, and scalability to build a robust and sustainable DPI in the country.

Scalability and inclusion

India's experience in scaling up its DPI demonstrates the significance of inclusivity, with the most successful case being that of its digital identification system. MeitY, in response to an unstarred question in the upper house of Parliament (in July 2022), said that out of the approximate projected population of 1.37 billion, around 1.27 billion held a live Aadhaar number.[23] By ensuring accessibility and ease of enrollment for all citizens,

including marginalised communities, India has achieved a notable level of inclusivity. While there are gaps in digital inclusion across demographic locations (55 percent share of urban telephone subscribers, as of December 2022[24]) and gender (11 percent gender gap in mobile ownership, 2023[25]), the country is consistently invested in closing this difference.

India's digital infrastructure has been created keeping in mind future needs and potential growth. With a quantum increase in users connected to the internet, the emergence of multiple types of intermediaries (digital media, e-commerce, and others), and the possible use of connectivity to cause harm or commit crimes cannot be ignored. Comprehensive measures need to be taken to prepare for the future. To check a potential DPI's scalability even before introduction, significant emphasis has been placed on considerations like robust technology frameworks, interoperability, open Application Programming Interfaces, data management, and addressing infrastructure gaps.

India's journey is an example of how scalability and inclusion work together in building a resilient and equitable digital public infrastructure. Key strategies that have helped the country's efforts to establish its infrastructure at scale are ensuring accessibility, promoting digital literacy and skill development, focus on last-mile connectivity, multilingual support in technological solutions, participatory implementation, and regulations to ensure affordability.

Balancing regulation and innovation

India's digital payments ecosystem demonstrates the need to strike a balance between regulation and innovation. While fostering competition and innovation, the country has implemented robust regulatory measures to ensure the security and integrity of transactions.

Putting in place provisions like regulatory sandboxes, which provide a controlled environment for testing innovative technologies and business models, has allowed experimentation and innovation, while ensuring consumer protection and risk mitigation. At the same time, taking a

collaborative approach by establishing forums and platforms for stakeholders to engage in policy discussions and regulatory consultations has helped in understanding their needs and concerns, thus informing the adoption of balanced regulatory policies. Recognising the fast-paced nature of the digital landscape, Indian regulators have also shown agility in updating and adapting regulations. Recent policy measures like the introduction of the Digital Personal Data Protection Bill 2022,[26] which restricts the processing of personal data until after the individual's consent has been recorded, and the presentation of the Digital India Act 2023,[27] to set up global standard cyber laws, have demonstrated a willingness to understand and respond to consumer needs, emerging technologies, and market trends.

While India has made strides in regulation and innovation, challenges remain. Striking the right balance between the two requires continuous monitoring, assessment, and adaptation of regulatory frameworks to keep pace with evolving technologies and market dynamics. Employing these efforts at the desired scale in the country would require infrastructure, investment, and a strong commitment. Ongoing collaboration between regulators, industry players, and other stakeholders will be crucial to maintaining an innovation-friendly environment while upholding consumer protection and addressing emerging risks.

Conclusion

India's DPI provides valuable lessons on the advantages of harnessing technology for inclusive growth, economic development, and improved governance. Through initiatives like Aadhaar, UPI, digital health infrastructure, DBT, e-governance, regulatory frameworks, and creating an enabling digital ecosystem, India has been able to unlock the transformative potential of DPI. By focusing on the key lessons from India's experience, other countries can implement similar DPIs to address their unique challenges and leverage the potential of technology for the benefit of their citizens.

These countries must consider their contextual differences based on population size, level of technological development, political priorities, and policy outlooks to customise their learnings to suit their specific needs and challenges. As the world embraces the digital era, India's DPI experience can serve as inspiration and guide for building robust digital systems that could foster inclusive societies and drive sustainable development in the 21st century.

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