Stack is the New Black?: Access, Adoption and 'Stackification' in Digital India

Smriti Parsheera

Abstract

India is going through a transformative phase in its digital journey, characterized by an expanding Internet user base, extensive reliance on digital technologies in service delivery and the creation of new layers of digital infrastructure. Set against this context, this paper deals with two interrelated questions. First, what are the key components of India's digital transformation strategy, particularly as reflected in the vision of the Digital India programme and the India Stack framework. Second, how is the country faring in terms of translating its visions of digital transformation against the ground realities of implementation and governance. The paper draws upon the OECD's Good Practice Principles for Public Service Design and Delivery to highlight some of the gaps relating to diversity of user needs, participative decision-making, data governance and accountability that still exist in India's path to holistic digital transformation.

1. Introduction

India is going through a transformative phase in its digital journey. This is reflected in the expanding size of its digital population and the myriad ways in which information and communication technologies (ICTs) have permeated across economic activities, social interactions, and governance activities. To illustrate, the country is currently estimated to have over 830 million Internet subscriptions,[1] 1.3 billion residents have been enrolled in its digital identity programme, Aadhaar,[2] and an aggregate of over 7.8 billion digital payment transactions have taken place using the Unified Payments Interface (UPI)[3]. The growing reliance on digital technologies is also evident in the design of government programmes. For instance, the digital flow of information and funds under the Direct Benefit Transfer scheme has become the mainstay for delivery of cash subsidies.[4] The determination of an individual's eligibility for most welfare benefits is in turn premised on the verification of their identity using the Aadhaar infrastructure.

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[1] Telecom Regulatory Authority of India, The Indian Telecom Services Performance Indicators April – June, 2022 <https://www.trai.gov.in/sites/default/files/QPIR_23112022.pdf> accessed 22 December 2022.

[2] Unique Identification Authority of India. Enrolment Dashboard <https://uidai.gov.in/aadhaar_dashboard/india.php> accessed 13 January 2023.

[3] National Payments Corporation of India <https://www.npci.org.in/what-we-do/upi/product-statistics> accessed 13 January 2023.

[4] Direct Benefit Transfer - About Us <https://dbtbharat.gov.in/page/frontcontentview/?id=MTc=> accessed 24 January 2023.

Many have highlighted the link between the current trends in India's digital transformation[5] and the rise in prominence of the 'India Stack' ecosystem.[6] This refers to a cluster of digital solutions centered around the use of technology for development and governance at population scale.[7] Different layers of India Stack have come to be implemented through a public-private collaboration model in the form of projects like the Aadhaar-based electronic know your customer check (for authentication using digital identity), UPI (for digital payments), DigiLocker (for online document management), and the Data Empowerment and Protection Architecture (for electronic consent management). At a 2022 event designed to showcase India Stack, India's Ministry of Electronics and Information Technology (MeitY) described it as 'a unified software platform to bring India's 1.4 billion population into the Digital Age' and 'India's most significant contribution to the digital world'.[8] Showcasing India Stack to the world is also known to be on top of India's mind at other international events, including its ongoing G20 presidency this year.[9]

The concept of India Stack was originally developed by an industry think tank called the Indian Software Industry Roundtable (iSPIRT) to describe an ecosystem of technologies that would rely

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[5] Mergel et al. describe digital transformation as 'a continuum of transition from analog to digital to a full stack review of policies, current processes, and user needs and results in a complete revision of the existing and the creation of new digital services'. See Ines Mergel, Noella Edelmann and Nathalie Haug, Defining digital transformation: Results from expert interviews, Government Information Quarterly, Volume 36, Issue 4, October 2019 <https://www.sciencedirect.com/science/article/pii/S0740624X18304131> accessed 17 December 2022. The paper focuses mainly on the views of experts based in Europe and does not include BRICS countries or other developing nations in its methodology.

[6] Rahul Matthan and Shreya Ramann, India's Approach to Data Governance, in How India and Korea Can Drive New Thinking About Data, Eds. Evan A. Feigenbaum and Michael R. Nelson, Carnegie Endowment for International Peace, August 31, 2022 <https://carnegieendowment.org/2022/08/31/how-india-and-korea-can-drive-new-thinking-about-data-pub-87766> accessed 13 January 2023; Vivek Raghavan, Sanjay Jain, Pramod Varma, India stack-digital infrastructure as public good, Communications of the ACM, Volume 62, Issue 11, November 2019 pp 76–81 <https://doi.org/10.1145/3355625> accessed 24 January 2023; Yan Carrière-Swallow, Manasa Patnam and Vikram Haksar, Stacking up Financial Inclusion Gains in India, International Monetary Fund Blog, July 2021 <https://www.imf.org/external/pubs/ft/fandd/2021/07/india-stack-financial-access-and-digital-inclusion.htm> accessed 13 January 2023; Razorpay Blog, What is IndiaStack & How is it Set to Change India?, May 2017 <https://razorpay.com/blog/what-is-indiastack-and-how-is-it-set-to-change-india/> accessed 13 January 2023; Deepa Krishnan, What the world can learn from the India Stack, Strategy + Business, PWC, Spring 2022 / Issue 106 <https://www.strategy-business.com/article/What-the-world-can-learn-from-the-India-Stack> accessed 13 January 2023.

[7] Ministry of Electronics and Information Technology, The First Ever India Stack Developer Conference to be organized in New Delhi tomorrow, Press Information Bureau, 24 January 2023 <https://pib.gov.in/PressReleasePage.aspx?PRID=1893299> accessed 25 January 2023.

[8] Ministry of Electronics and Information Technology, Government of India, India Stack Knowledge Exchange 2022 (Press Information Bureau, 8 July 2022) <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1840024> accessed 22 December 2022.

[9] MeitY, The First Ever India Stack Developer Conference; Prime Minister's Office, English translation of Prime Minister Shri Narendra Modi's address at the G-20 Summit in Bali, Session III: Digital Transformation, Press Information Bureau, 16 November 2022 <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1876347> accessed 25 January 2023; John Reed and Benjamin Parkin, India plots digital diplomacy push during G20 presidency, The Financial Times, 21 January 2023, <https://www.ft.com/content/46760429-a246-4dca-892f-d9a627ea80d7> accessed 25 January 2023.

on the use of application programming interfaces (APIs) to achieve presence-less, paperless, cashless and consent-based digital transactions. But the contours of this ecosystem have gradually expanded much beyond its original scope, in at least three ways. First, the footprint of India Stack has gone beyond the four specific layers or applications that were first articulated by iSPIRT. Drawing upon official narratives and policy documents, the paper points to how India Stack has emerged as the dominant model of digital transformation in sector after sector. Second, there has been a noticeable transition in the ownership of the India Stack brand, with the Indian government now staking a clear claim over the same. Third, the geographical focus of India Stack has also evolved to reflect its global ambitions, as evidenced by India's attempts to export the India Stack model of digital infrastructure building to other parts of the world.

But the India Stack story is only one, albeit increasingly prominent, part of India's journey towards digital transformation. The country's overall strategy for digital transformation is reflected in the Digital India programme, its focal programme on digital development since 2015. Digital India emphasizes the 'transformation' and not 'translation' of old systems into new.[10] It also seems to recognize that holistic digital transformation needs to speak to the overall readiness and competence of the ecosystem to imbibe digital technologies for socio-economic development. In addition to digital adoption by the government, this includes readiness at the level of citizens and users–in terms of connectivity, access and awareness–and at the level of the public as well as private sector, to innovate and offer socially valuable digital outputs. This broader vision of transformation is reflected in many of the components of the Digital India programme.

Set against this background, this paper deals with two interrelated questions. First, what are the key components of India's digital transformation strategy, particularly as reflected in the vision of the Digital India programme and the India Stack framework. Second, how is the country faring in terms of translating its visions of digital transformation against the ground realities of implementation and governance. Relying on a review of the relevant literature, official reports and other policy documents, the paper highlights some of India's recent digital achievements while also pointing to challenges in India's path of digital transformation. The paper contextualizes these challenges against the backdrop of the Organisation for Economic Co-operation and Development (OECD) Good Practice Principles for Public Service Design and Delivery in the Digital Age.[11]

The observed challenges are, first, the country's persisting digital divide, which although narrowing over time still remains significant, particularly in the context of mandatory or quasi-mandatory digital adoption. Second, despite some positive trends, there are several barriers to effective participation in the formulation of digital policies. Third, there remains a mismatch

[10] Digital India- Introduction <https://digitalindia.gov.in/introduction/> accessed on 24 January 2023.

[11] OECD Good Practice Principles for Public Service Design and Delivery in the Digital Age, OECD Public Governance Policy Papers No. 23, 2022, <https://www.oecd-ilibrary.org/docserver/2ade500b-en.pdf?expires=1674511976&id=id&accname=guest&checksum=1FFF5C379E278314AADB89E66D7A2A99> accessed 23 January 2023.

between the pace of data-centric digitalization initiatives and necessary legal and institutional safeguards in the area of data governance. Fourth, there are accountability and oversight deficits in the workings of many of the new technical systems adopted in India, particularly under the India Stack ecosystem.

The rest of the paper is organized as follows. Section 2 explains the vision of Digital India, as articulated by the Indian government and endorsed by various other stakeholders. Section 3 focuses on the pillar of digital adoption, looking at the current state of digital access in India and outlining some of the contours of India's digital divide. Section 4 moves on to discuss the manner in which digital technologies have been adopted in different fields of governance, followed by an elaboration of the India Stack framework in Section 5. Section 6 argues for the need to calibrate India's digital visions and achievements against the ground realities of access, participation, legal and institutional safeguards, and accountability gaps. Section 7 concludes with a brief summary of the discussions.

2. The Vision of a Digital India

In their study of international policy narratives on nuclear power, Jasanoff and Kim, 2009 used the term 'socio-technical imaginaries' to refer to '*collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects*'.[12] In India's case, the socio-technical imaginaries around digital transformation are most prominently articulated under the Digital India programme. This refers to the Indian Government's flagship programme that was launched in July, 2015 with a '*vision to transform India into a digitally empowered society and knowledge economy*'.[13]

Digital India is centered around three focus areas – provision of digital infrastructure to citizens, governance and services on demand, and digital empowerment of citizens. The programme consists of nine pillars, which include the creation of broadband highways, universal mobile connectivity, e-governance reforms and creating an open data platform. Further, Digital India's scope extends beyond the adoption of ICT in the delivery of government services to cover a number of allied agendas like building capacity in electronics manufacturing and creating job opportunities in the IT sector.[14] This corresponds with the overall vision of giving digital technologies a more central role in the way social life, economic activities and governance functions are conducted.

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[12] Sheila Jasanoff and Sang-Hyun Kim, Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea, Minerva, Vol. 47, No. 2 (June 2009), pp. 119-146.

[13] Digital India <https://www.digitalindia.gov.in/> accessed 24 January 2023.

[14] Press Information Bureau, Government of India, Digital India – A programme to transform India into digital empowered society and knowledge economy, 20 August 2014 <https://pib.gov.in/newsite/printrelease.aspx?relid=108926> accessed 24 January 2023.

Speaking at a technology summit in 2020, India's Prime Minister Narendra Modi noted that Digital India should not be seen as a routine government initiative—it had evolved much beyond that to become 'a way of life'. He noted that this was particularly the case for the poor and marginalized segments of society and for users within the government.[15] In the subsequent sections of the paper, I discuss some of the most cited manifestations of this vision, which include the ubiquitous and mandatory adoption of India's digital identity system, Aadhaar, for welfare delivery and promotion of the UPI system for real-time digital payments. Both these projects are key to the socio-technical imaginary of Digital India that is fashioned around the digital and economic empowerment of individuals propelled by digital technologies.

Beyond empowerment, the commentary on Digital India also suggests the emergence of what Gurumurthy et. al. describe as a 'grand narrative of India' where technology serves as a means to 'overcome the barriers of ignorance, corruption, and poverty'.[16] For instance, e-Kranti, which translates to mean electronic revolution, is a sub-component of the Digital India programme focused on electronic service delivery by government agencies. Its vision of 'Transforming e-Governance for Transforming Governance' represents a faith in the electronification of governance systems as the key to overcome the country's governance and capacity barriers. Similarly, reducing the malaise of corruption has routinely been invoked both as a justification and outcome of Digital India. Notably, much of the narrative around the need for a digital identity system in India was structured around the problem of leakages in the delivery of government benefits on account of corruption and fraud.[17] Correspondingly, the benefits of the project have also been described in terms of the savings to the government and plugging corruption.[18] These claims have, however, been contested by others who question the savings figures[19] and describe

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[15] MyGov India, Digital India has become a way of life - PM Narendra Modi, 20 November 2020 <https://www.youtube.com/watch?v=rCyP-pPPwkc> accessed 17 December 2022.

[16] Anita Gurumurthy, Nandini Chami and Sanjana Thomas, Unpacking Digital India: A Feminist Commentary on Policy Agendas in the Digital Moment, Journal of Information Policy, Vol. 6 (2016), p. 371-402.

[17] Nanadan Nilekani, Data to the People, Foreign Affairs, September/ October 2018 issue, <https://www.foreignaffairs.com/articles/asia/2018-08-13/data-people> accessed 21 January 2023.

[18] Aadhaar Has Led To ₹ 2.25 Lakh Crore Savings To Exchequer, Says Its Chief: Report, NDTV, 16 December 2021 <https://www.ndtv.com/india-news/aadhaar-has-led-to-rs-2-25-lakh-crore-savings-to-exchequer-says-uidai-ceo-report-2654862> accessed 21 January 2023; Shweta Banerjee, Aadhaar: Digital Inclusion and Public Services in India, Background [papr for the World Development Report 2016 Digital Dividends, The World Bank, December 2015, <https://thedocs.worldbank.org/en/doc/655801461250682317-0050022016/original/WDR16BPAadhaarPaperBanerjee.pdf> accessed 21 January 2023.

[19] Jean Drèze and Reetika Khera, Aadhaar's $11-bn question: The numbers being touted by govt have no solid basis, The Economic Times, 8 February 2018 <https://economictimes.indiatimes.com/news/economy/policy/aadhaars-11-bn-question-the-numbers-being-touted-by-govt-have-no-solid-basis/articleshow/62830705.cms> accessed 21 January 2023.; Anand Venkatanarayanan, The Curious Case of the World Bank and Aadhaar Savings, The Wire, 3 October 2017 <https://thewire.in/economy/the-curious-case-of-the-world-bank-and-aadhaar-savings> accessed 21 January 2023.

such mandatory digitization efforts as a source of disenfranchisement and exclusion for the marginalized.[20]

While one part of the Indian government's mission has been on bringing about a technology first model of governance within the country, more recently it has also set its sights on being seen as an exporter of 'digital global goods'. In July, 2021, the government declared that its digital vaccination management platform, Co-Win, would be made open-source and could be adopted by other countries looking to establish similar systems.[21] This was followed by the creation of a dedicated portal called indiastack.global to showcase India's experience of implementing 'digital transformation projects at population scale' and offering similar technologies to the world.[22]

The private sector has also played its part in championing the vision of Digital India. For instance, the country's largest telecommunication service provider, Reliance Jio, has time and again invoked its commitment to the vision of Digital India in its press releases.[23] Global tech giants have done the same while announcing initiatives like Google's India Digitization Fund[24] and Microsoft's Digital Governance Tech Tour for imparting digital training to government officials.[25] The growing band of tech unicorns in India is also suggested to be a sign of the success of Digital India—government functionaries have described Indian startups and unicorns as 'reflecting the spirit of new India'[26] and 'new engines of the digital economy'[27]. Several institutional collaborations between government stakeholders and the private sector have also emerged to promote digitisation initiatives, such as the national artificial intelligence (AI) portal created by

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[20] Nikhil Dey and Aruna Roy, Excluded by Aadhaar, The Indian Express, 5 June, 2017, <https://indianexpress.com/article/opinion/columns/excluded-by-aadhaar-4689083/> accessed 17 December 2022; Ashwini Deshpande, Aadhaar and My Brush With Digital Exclusion, The Wire, 3 January 2022 <https://thewire.in/government/aadhaar-and-my-brush-with-digital-exclusion> accessed 17 December 2022.

[21] Ministry of External Affairs, Government of India, Prime Minister addresses CoWIN Global Conclave 2021, 5 July 2021, <https://mea.gov.in/press-releases.htm?dtl/33980/Prime_Minister_addresses_CoWIN_Global_Conclave_2021> accessed 17 December 2022.

[22] India Stack Global, <https://www.indiastack.global/india-stack-global/> accessed 17 December 2022.

[23] Reliance Jio Infocomm Limited, Jio keeps consumers at the center of digital revolution in India: Continues to be committed towards collectively driving the Digital India Mission, Press release dated 19 November 2019 <https://jep-asset.akamaized.net/jio/press-release/Media%20Release%20-%20JIO%20-%2019112019.pdf> accessed 17 December 2022.

[24] Sundar Pichai, Investing in India's digital future, Google Company Announcements, 13 July 2020 <https://blog.google/inside-google/company-announcements/investing-in-indias-digital-future/> accessed 17 December 2022.

[25] Microsoft News Center India, Microsoft announces Digital Governance Tech Tour to help accelerate Digital India, 27 August 2019, https://news.microsoft.com/en-in/microsoft-digital-governance-tech-tour-accelerate-digital-india/

[26] ANI, PM Modi lauds growth of unicorns, says trend reflects spirit of 'new India', The Print, 29 May, 2022 <https://theprint.in/india/pm-modi-lauds-growth-of-unicorns-says-trend-reflects-spirit-of-new-india/975411/> accessed 17 December 2022.

[27] FPJ Web Desk, Startups, unicorns new drivers of India's digital economy: Rajeev Chandrasekhar, The Free Press Journal, 5 July 2022 <https://www.freepressjournal.in/business/startups-unicorns-new-drivers-of-indias-digital-economy-rajeev-chandrasekhar> accessed 17 December 2022.

Industry association NASSCOM and the MeitY.[28] Finally, the later sections of the paper will demonstrate how the public-private partnership model has also been central to the implementation of the different layers of the India Stack.

3. Building a Digital Population

The foundation of India's digital society rests on the strength of its digital population, individuals who sustain the ecosystem with their time, labor, attention, data and other resources. Bringing more and more people online and pushing for the adoption of digital goods and services by them has, therefore, been a focus area for the government and the private sector alike. While access to the Internet cannot be regarded as being synonymous with digital access, it constitutes an important building block. Accordingly, this section of the paper focuses on some of the key trends in Internet adoption in India.

India currently houses the second largest Internet user base in the world.[29] As per one study, it had an active Internet user base of over 600 million in 2020 and this figure was estimated to go up to 900 million by 2025.[30] The official data released by the Telecommunication Regulatory Authority of India (TRAI), however, suggests that the number of Internet subscribers in mid 2022 had already crossed 830 million.[31] TRAI's data also shows that the majority of users in India rely on wireless connectivity to access the Internet. To put this in context, out of the total number of Internet subscribers, almost 97 percent are users of wireless services. This market is largely controlled by the country's three main telecommunication service providers (TSPs) – Reliance Jio, Bharti Airtel and Vodafone Idea Ltd.[32]

Further, 95 percent of the Internet subscribers in India are users of broadband services, which represents a radical improvement over the 2G dominated markets a few years back. While Indian regulations set a fairly low bar for the definition of broadband service—download speeds of over 512 Kbps — it is clear that the quality of data access has improved over time. This has been accompanied by a reduction in the cost of data services–India is known to have among the lowest

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[28] India AI <https://indiaai.gov.in/> accessed 23 January 2023.

[29] Statista, Countries with the highest number of internet users as of February 2022 <https://www.statista.com/statistics/262966/number-of-internet-users-in-selected-countries/> accessed 17 December 2022.

[30] Kantar and iCube, Internet Adoption in India, June 2021 <https://images.assettype.com/afaqs/2021-06/b9a3220f-ae2f-43db-a0b4-36a372b243c4/KANTAR_ICUBE_2020_Report_C1.pdf> accessed 17 December 2022.

[31] TRAI, Indian Telecom Services Performance Indicators April – June, 2022. It is worth noting that TRAI's data does not represent the actual number of unique and active Internet subscribers, which is likely to be lower than the published subscriber figures. Yet, the information put out by the telecommunication authority is important in terms of offering the most regular account of the trends in Internet adoption in the country.

[32] Id.

tariffs of wireless Internet access in the world.[33]

Growing penetration and low costs have led to a significant uptake in the use of Internet-based services. Consumer surveys reveal that much of this Internet use is concentrated in areas such as social media usage, entertainment, and e-commerce.[34] Besides varying applications, there are significant variations in the duration and nature of usage among different user groups. This makes it erroneous to automatically equate Internet access with universal digital inclusion or empowerment.[35] For instance, successive editions of the GSMA's Mobile Gender Gap report have found handset costs, literacy, and skills to be some of the main barriers to mobile internet use in India, particularly among women.[36] This complements the findings of other researcher studies that have found India's mobile gender gap to be driven by a mix of economic factors and normative barriers arising from social norms, customs, and perceived gender roles.[37]

While the gender gap in Internet usage still remains significant, it is encouraging to find that this gap has been narrowing over time. As per GSMA's reports, India's gender-based mobile Internet usage gap narrowed down from 68 percent in 2017 to 33 percent in 2020. The most recent version of the GSMA report, however, found that the gap had once again widened to 41 percent in 2022. This was noted to be because of an increase in the mobile internet usage by men while the use by women remained flat.[38] According to the GSMA, the progress in female participation could be attributed to factors like the decline in the cost of internet-enabled handsets, fuelled by Jio's smart feature phones, and an uptake in demand driven by children's education and connectivity needs during the pandemic.[39]

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[33] Worldwide mobile data pricing 2021 <https://www.cable.co.uk/mobiles/worldwide-data-pricing/> accessed 17 December 2022. The study carried out a survey of 5,554 mobile data plans in 228 countries by Cable.co.uk to compare the cost of one gigabyte (1GB) of mobile data across the world.

[34] Ashish Agarwal, Nielsen's Bharat 2.0 Study reveals a 45% growth in Active Internet Users in rural India since 2019, May 2022, <https://global.nielsen.com/news-center/2022/nielsens-bharat-2-0-study-reveals-a-45-growth-in-active-internet-users-in-rural-india-since-2019/> accessed 17 December 2022.

[35] Smriti Parsheera, Understanding state-level variations in India's digital transformation. The African Journal of Information and Communication, 30, 1-9, 2022 <https://doi.org/10.23962/ajic.i30.15082> accessed 23 January 2023.

[36] GSMA, Mobile Gender Gap Report 2022, June, 2022, <https://www.gsma.com/r/wp-content/uploads/2022/06/The-Mobile-Gender-Gap-Report-2022.pdf?utm_source=website&utm_medium=download-button&utm_campaign=gender-gap-2022> accessed 17 December 2022; GSMA, Mobile Gender Gap Report 2020, March, 2020, <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2020/05/GSMA-The-Mobile-Gender-Gap-Report-2020.pdf> accessed 17 December 2022..

[37] Giorgia Barboni, Erica Field, Rohini Pande, Natalia Rigol, Simone Schaner, Charity Troyer Moore, A Tough Call: Understanding barriers to and impacts of women's mobile phone adoption in India, Harvard Kennedy School, October, 2018 <https://epod.cid.harvard.edu/sites/default/files/2018-10/A_Tough_Call.pdf> accessed 17 December 2022.

[38] GSMA, Mobile Gender Gap Report 2022.

[39] GSMA, Mobile Gender Gap Report 2020, p. 42.

In addition to factors like gender, social norms, and affordability of devices, India also reports significant regional disparities in the state of Internet adoption. For instance, the number of internet subscribers per 100 people in the population stands at 198 percent in Delhi but only 35 percent in the state of Bihar. Some other states like Jharkhand, Uttar Pradesh, Assam, Tripura and Meghalaya, also fared relatively poorly on this parameter.[40] Urbanicity is another major determinant of access. India currently has about 60 Internet subscribers per 100 people in the population with a significant divergence between urban and rural areas. The urban Internet subscribers density was 103 per 100 population while the density for rural Internet subscribers was only 38 per 100.[41] This illustrates that any kind of broad generalizations about the state of access in India can be deceptive as there are several layers of inclusion and exclusion embedded within those aggregate figures.

Boosting connectivity in rural and remote areas, which often do not present a viable market from a commercial perspective, has therefore been the focus of several policy initiatives. The government's actions on this front can be categorized under two heads. First, policy actions that incentivize TSPs and other actors to enhance rural connectivity; and second, where the government itself plays a direct role in the design and delivery of connectivity initiatives. The terms governing the allocation of spectrum bands to TSPs would fall under the first category. As per these conditions, which the Department of Telecommunications (DoT) may vary across different technologies and bands, TSPs need to meet specified minimum roll-out obligations and a schedule of deployment that should include rural areas.[42] Other initiatives that may fall under this category include a new category of licenses for virtual network operators (VNOs)[43]–entities that can resell Internet services procured through other networks without setting up their own infrastructure– and efforts at strengthening public Wi-Fi access services for increased broadband access.[44]

Telecom regulations in India also contain a universal access mandate requiring TSPs to contribute a portion of their revenue towards the Universal Service Obligation Fund (USOF). The USOF was created under the Indian Telegraph (Amendment) Act, 2003 with the goal of providing access to basic telegraph services to people in rural and remote areas at affordable prices. In 2006, the scope of universal service obligations was extended to also cover the provision of Internet access and broadband services. The selection of the universal service provider for any connectivity project is

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[40] TRAI, The Indian Telecom Services Performance Indicators April – June, 2022, p. 44.

[41] Id.

[42] Rekha Jain and Rishabh Dara, Framework for evolving spectrum management regimes: Lessons from India, Telecommunications Policy, Volume 41, Issues 5–6, June 2017 <https://www.sciencedirect.com/science/article/pii/S030859611730126X>

[43] TRAI, Recommendations on 'Introducing Virtual Network Operators in telecom sector', 1 May, 2015, <https://trai.gov.in/sites/default/files/Recommendations_VNO_01_05_2015.pdf> accessed 23 January 2023.

[44] DOT, National Digital Communications Policy 2018, <https://dot.gov.in/sites/default/files/EnglishPolicy-NDCP.pdf> accessed 23 January 2023; Press Information Bureau, Cabinet approves setting up of Public Wi-Fi Networks by Public Data Office Aggregators, 9 December 2020 <https://pib.gov.in/PressReleasePage.aspx?PRID=1679342> accessed 23 January 2023.

done based on a bidding process, which is open to all eligible operators.[45] However, the DoT has the discretion to not follow this process and opt for a specific provider based on factors such as the remoteness of the area, commercial non-viability and national security considerations.[46]

In an example of the government directly taking on the mandate of improved connectivity, one of the largest applications of USOF has been for the Bharatnet Project, which was formerly referred to as the National Optic Fiber Network. The project was launched in 2011 with the goal of providing broadband connectivity to 250 thousand Gram Panchayats—village level units of governance in India. As per the latest statistics, about 188 thousand of the 250 thousand Gram Panchayats have become service ready through the roll out of optic fiber cable.[47] The project has seen multiple extensions on account of the delays by Bharat Broadband Nigam Limited, a public sector undertaking created for this purpose in meeting its targets. The project's latest completion deadline has been set for 2025.[48] While progress on this project remains slow, and its eventual impact will depend on last mile connectivity initiatives, it holds the potential to serve as the next frontier for rural connectivity in India.

The above discussions reveal that there has been a significant expansion in the size of India's Internet user base in the last few years. Yet the availability and quality of digital engagement continues to vary drastically, shaped by factors such as income, gender, skills and education, and geographical location. In overall terms, India still performs rather modestly in terms of its overall state of telecommunications infrastructure development. The United Nations E-Government Survey of 2020 allotted it a score of 0.35 on this metric, which was below the world average of 0.54.[49] However, the reality of India's persisting digital divide has not deterred the push for digitalization of welfare delivery, public services and processes in India. The next sections discusse some of the key developments pertaining to digital adoption in the context of government services and the creation of public digital infrastructure.

4. Digital Adoption by the Government

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[45] Rule 526, Indian Telegraph Rules, 1951.

[46] Indian Telegraph (Amendment) Rules, 2015, DoT notification dated August 25, 2015, https://dot.gov.in/sites/default/files/2016_09_29%20AMD-I%20Restructuring.PDF?download=1.

[47] Bharat Broadband Network Limited. (2022). *BharatNet Status as on November 28, 2022*. http://www.bbnl.nic.in/BharatNet.pdf, accessed 23 January 2023.

[48] Amit Chaturvedi, Union Budget 2022: BharatNet broadband to be ready by 2025, says Nirmala Sitharaman, The Hindustan Times, 1 Feb 2022, <https://www.hindustantimes.com/budget/union-budget-2022-bharatnet-broadband-to-be-ready-by-2025-says-sitharaman-101643697448624.html> accessed 23 January 2023.

[49] United Nations Department of Economic and Social Welfare, E-Government Survey 2020: Digital Government in the Decade of Action for Sustainable Development, 2021 <https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf> accessed 23 January 2023. This is calculated taking into account factors like estimated Internet users and mobile subscribers per 100 inhabitants, active mobile-broadband subscription, and fixed broadband subscriptions per 100 inhabitants.

Over the last few years policy interventions in India have seen a growing emphasis on the adoption of ICTs in governance systems. Digitalization initiatives are seen across multiple sectors and are being implemented by different ministries and departments, both at the central and state levels.[50] Most of these initiatives are brought together under the Indian Government's flagship Digital India programme. This includes e-governance initiatives focused on ICT-enabled process re-engineering to improve transactions and processes and the e-Kranti scheme for electronic delivery of services.[51] e-Kranti consists of 44 Mission Mode Projects (MMPs) that are grouped into Central, State and Integrated projects. Each MMP is focused on strengthening e-governance in one particular area, such as banking, income tax, land records modernisation, e-courts and e-procurement.[52] e-Kranti serves as the successor of the National e-Governance Plan that was launched in 2006 as an umbrella project to adopt ICT initiatives across areas like education, health and public distribution system to make the services more accessible to citizens.[53]

The e-governance apparatus set up under the National e-Governance Plan and later the Digital India programme consists of a range of digital platforms and services coupled with certain infrastructural facilities to enable their utilization. The breadth of projects covered under these umbrella frameworks can be illustrated with a few examples. The MCA21 system that automated the enforcement and compliance of legal requirements under company law[54] and Passport Seva[55] services for managing the passport issuance process are two high impact examples. The Digital India Land Records Modernisation Programme is another long running project for the modernization of the land records system in India.[56] The activities under this programme include computerization of records, digitization of cadastral maps, land surveys, modernization of record rooms, computerization of registration systems, and connectivity between land records offices. Next, the e-Courts project is another important initiative that has been under progress since 2007.

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[50] See <https://digitalindia.gov.in/di-initiatives> for a detailed list of such initiatives at the Central Government level classified under the heads of infrastructure, services and empowerment.

[51] Ministry of Communications and Information Technology, Government of India, Office Memorandum – Approval of Approach and Key Components of eKranti, 8 May 2015, <https://www.meity.gov.in/writereaddata/files/Office%20Memorandum%20on%20e-Kranti.pdf>

[52] Ministry of Electronics and Information Technology, Government of India, <https://www.meity.gov.in/content/mission-mode-projects> accessed 23 January 2023

[53] Ministry of Electronics and Information Technology, Government of India, <https://www.meity.gov.in/divisions/national-e-governance-plan> 23 January 2023

[54] Ministry of Corporate Affairs, MCA21 Application - Online Help <https://www.mca.gov.in/Ministry/pdf/MCAV2Release2_Help.pdf> accessed 23 January 2023

[55] Ministry of External Affairs, Government of India, About Passport Seva <https://www.passportindia.gov.in/AppOnlineProject/online/knowPassportSeva> accessed 23 January 2023

[56] Digital Land Records Modernization Plan, <https://dolr.gov.in/sites/default/files/Final%20%20Guideline%20of%20DILRMP%2002-01-2019.pdf> accessed 23 January 2023

Its components include the computerization of subordinate courts, electronic information facilitation and simplified service delivery to litigants.[57]

Further, a network of local access points called Common Service Centres have been established across the country to facilitate access to electronic services for the rural population.[58] The use of ICT systems has also permeated the government's own management systems and processes. The Government eMarketplace (GeM) portal to facilitate online procurement of goods and services by government agencies falls under this category.[59] One of the applications of GeM has been for the procurement of cloud computing services in line with the Government of India's Meghraj policy to promote cloud services among government users.[60]

However, it is India's unique digital identity system, Aadhaar, that can be regarded as the government's most cited example of its ability to execute scalable digital infrastructure projects. Aadhaar refers to a 12 digit identity number that is issued to the country's residents pursuant to the collection of their demographic and biometric information. Its purpose is to ensure the 'uniqueness' of a person which then forms the basis for the subsequent verification of their identity for a range of purposes. Aadhaar now constitutes the mandatory means of identity verification for accessing government welfare and benefits across multiple schemes. At the end of June 2021, it had been made mandatory under 312 schemes offered by different Ministries of the Central Government.[61] This included schemes relating to scholarships, employment benefits, old age pensions, public distribution of food supplies, health treatments and insurance benefits provided by the government. In addition, various State Governments have also mandated Aadhaar linkages for the schemes and benefits offered by them. Aadhaar has also been linked with the tax identification number required to be held by all taxpayers and more recently with voter identification cards.[62] The possession of an Aadhaar number and ability to demonstrate one's identity using it has, therefore, become an inescapable part of daily life for most of India's residents.

Ever since its inception the Aadhaar project has raised many concerns, on account of deficiencies in its legal processes, privacy and surveillance concerns, denial of benefits due to mandatory

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[57] e-Committee, Supreme Court of India, E-Courts Mission Mode Project, <https://ecommitteesci.gov.in/project/brief-overview-of-e-courts-project/> accessed 23 January 2023

[58] Common Service Centres Scheme <https://csc.gov.in/> accessed 23 January 2023

[59] Government e-marketplace <https://gem.gov.in/> accessed 23 January 2023

[60] GI Cloud (Meghraj) <https://www.meity.gov.in/content/gi-cloud-meghraj> accessed 23 January 2023

[61] Rajeev Chandrasekhar, Minister of State for Electronics and Information Technology, Rajya Sabha, Unstarred Question No. 1189 to be answered on 29 July 2021, Aadhaar card linkages with voter ID cards <https://www.uidai.gov.in/images/Rajya_Sabha_Unstarred_Qn_No_1189_answered_on_29_7_2021.pdf>

[62] Indian Express Explained Desk, Why a plea in SC is challenging the Aadhaar-Voter ID card linkage, The Indian Express, 2 November 2022 <https://indianexpress.com/article/explained/why-a-petition-in-the-supreme-court-is-challenging-the-aadhaar-voter-id-card-linkage-8243283/> accessed 23 January 2023

linkage of Aadhaar with social benefits, and the lack of participative decision making.[63] In a 2018 decision, the Supreme Court heard these challenges but found the Aadhaar scheme to be constitutionally valid.[64] The Court noted that the government could make Aadhaar mandatory for the delivery of benefits and welfare schemes financed by it while imposing certain restrictions and legal changes, including a restriction on the use of the Aadhaar authentication system by private entities. Subsequent amendments have, however, allowed entities like banks, mutual funds, and telecom companies to continue with the voluntary use of Aadhaar.[65] Following this, in 2020, the government issued a new set of rules allowing Aadhaar authentication to be used on a voluntary basis for ensuring good governance, prevention of dissipation of social welfare benefits, and enablement of innovation and the spread of knowledge.[66] These changes have been called out by civil society actors for amounting to a violation of the Supreme Court's restrictions on private sector use of the Aadhaar system.[67]

The Aadhaar project has served as the trigger for India's new model of platformization of governance and service delivery. This refers to a setup where the adoption of digital technologies has moved beyond targeted digitalization initiatives to a model where the government sees more of a role for itself as a platform builder. Businesses, citizens, and other public sector actors are then meant to build and utilize services riding upon this platform. A white paper released by MeitY in 2020 explained this shift by classifying the adoption of ICT by the Indian government into three generations.[68]

It described the first generation of e-governance, labeled GovTech 1.0, as a phase of automation in governance solutions – the service delivery remained largely offline but some parts of the user experience shifted online. The document cited the digitization of government records as an example of this phase. Next, GovTech 2.0 was focused on end-to-end digitization of public service delivery, often reflected in the availability of all information and services offered by a particular department through a single portal. Finally, the white paper described the current generation of GovTech 3.0 as India's strategy of building National Open Digital Ecosystems (NODEs) that use

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[63] Dissent on Aadhaar: Big Brother Meets Big Data, Reetika Khera (Ed), Orient BlakSwan, 2019; The Social Protection Initiative, Dvara Research, State of Exclusion: Delivery of Government-to-Citizen Cash Transfers in India, June 2022 <https://www.dvara.com/research/wp-content/uploads/2022/06/State-of-Exclusion-Delivery-of-Government-to-Citizen-Cash-Transfers-in-India.pdf> accessed 23 January 2023

[64] Justice Puttaswamy (Retd.) and others. v. Union of India and Ors, Supreme Court of India decision dated 26 September, 2018 <https://indiankanoon.org/doc/127517806/> accessed 23 January 2023

[65] Aadhaar and Other Laws (Amendment) Act, 2019

[66] https://uidai.gov.in/images/Aadhaar_Authentication_for_Good_Governance_Rules_2020.pdf

[67] Internet Freedom Foundation <https://internetfreedom.in/bad-rules-for-good-governance/> accessed 23 January 2023

[68] Ministry of Electronics and Information Technology, White Paper on a strategy for National Open Digital Ecosystems, 2020 <https://static.mygov.in/rest/s3fs-public/mygov_158219311451553221.pdf> accessed 23 January 2023

open APIs and interoperable platforms to connect different parts of the government system while allowing private players to build services on top of them.[69]

These ideas are already reflected in several initiatives that are referred to as India's public digital infrastructure. Examples are seen in areas like digital payments (the UPI), tax management (the Goods and Services Tax Network), and electronic health data management (Ayushmaan Bharat Digital Mission). All of these projects reflect a public-private model of collaboration that has permeated across the adoption of technology driven projects in India, a model that can broadly be traced back to the Aadhaar project and the India Stack framework that is discussed further in the next section.

5. The Stackification of Digital India

The term "tech stack" is generally used to imply the combination of software, languages, platforms and tools that are required to build and run a particular product.[70] The concept of India Stack seems to extend this logic to a country level to describe a cluster of technologies and layers that are supposed to help build and run a digital India. The components of India Stack rely on the use of APIs to support a scalable and interoperable digital ecosystem across different use cases. Its original idea was developed by the industry think tank iSPIRT as consisting of four layers – the presence less layer, paperless layer, cashless layer and consent layer.[71] These layers were meant to work together to achieve efficiency, interoperability, and innovation in digital transactions.[72] A brief description of each of the layers is as follows.

i) *Presenceless layer* – This refers to the use of Aadhaar based authentication to remotely verify a person's identity based on their demographic and biometric data collected at the time of enrolment. The Unique Identification Authority of India (UIDAI), the agency that manages India's digital identity system, authorizes various users to gain API access to the Aadhaar authentication architecture. In addition to government departments and agencies, its users include private actors like financial services providers and TSPs who use the eKYC function for satisfying customer due diligence requirements. For instance,

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[69] Id.

[70] What is a tech stack? Technology stack in a nutshell, 21 March 2022, <https://dac.digital/what-is-a-tech-stack-technology-stack-in-a-nutshell/> accessed 23 January 2023

[71] iSPIRT, India stack - A detailed presentation, 15 November, 2016 <https://www.slideshare.net/indiastack/india-stack-a-detailed-presentation> accessed 23 January 2023.

[72] India Stack - Towards Presence-less, paperless and cashless service delivery - an iSPIRT initiative, 1 March 2016 <https://www.slideshare.net/ProductNation/india-stack-towards-presenceless-paperless-and-cashless-service-delivery-an-ispirt-initiative>.

India's largest TSP, Reliance Jio, relied extensively on Aadhaar based eKYC for the rapid onboarding of new users while launching its services in 2016.[73]

ii) *Paperless layer* – The idea behind the paperless layer is to minimize the use of physical documents and replace them with electronic transactions and records. The two main products launched as part of this layer are an electronic signature service called eSign and an electronic document wallet called DigiLocker. In both cases, the validation of the identity of the user for availing these services is done based on their Aadhaar credentials. At present, over two thousand official document issuing authorities, such as the transport department for driving licenses and car registration, insurance companies for insurance policies and educational bodies for degrees and diplomas, have adopted the DigiLocker system.[74]

iii) *Cashless layer* – The cashless layer seeks to push for greater adoption of digital payments hence moving away from a primarily cash-based economy. This has been implemented through the UPI, a real-time payments system that can be used for payments among users or for merchant transactions. The key players in this system include the National Payments Corporation of India (NPCI), which owns and manages UPI, banks and various front-end payment applications responsible for onboarding and serving customers. The UPI system has seen tremendous growth since its launch in 2016 and is now reported to be the world's 5th largest payment network by volume.[75]

iv) *Consent layer* – The consent layer relies on the use of an electronic consent management system, called the Data Empowerment and Management Architecture (DEPA), to facilitate consent-based sharing of user data.[76] The system's design is meant to enable interoperability between data collectors and users and maintenance of an auditable trail of consent records by specialized consent managers. As of now, DEPA has been adopted in specific sectors like banking[77] and digital health records management[78] with plans to extend it in many other areas.

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[73] India Today, If you want Jio SIM, first get Aadhaar card, 12 September 2016, <https://www.indiatoday.in/technology/news/story/if-you-want-jio-sim-first-get-aadhaar-card-342624-2016-09-22> accessed 23 January 2023

[74] National E-Governance Division, Ministry of Electronics And Information Technology, DigiLocker National Statistics <https://www.digilocker.gov.in/statistics> accessed 23 January 2023

[75] India Stack, <https://indiastack.org/payments.html> accessed 23 January 2023

[76] NITI Aayog, Data Empowerment And Protection Architecture Draft for Discussion, August, 2020, <https://www.niti.gov.in/sites/default/files/2020-09/DEPA-Book.pdf> accessed 23 January 2023.

[77] Master Direction- Non-Banking Financial Company - Account Aggregator (Reserve Bank) Directions, 2016, <https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=10598&Mode=0> accessed 23 January 2023

[78] National Digital Health Blueprint, Ministry of Health & Family Welfare, 2019, <https://abdm.gov.in/home/ndhb> accessed 23 January 2023

The implementation of each of the layers discussed above has been carried out as a collaboration between different government agencies and other public and private actors. Notably, the team involved in the setting up of Aadhaar included several participants from outside the formal state machinery.[79] Many of them were (or later became) iSPIRT's volunteers after having worked alongside the UIDAI to develop APIs to enable Aadhaar-based eKYC. The iSPIRT community also admits to having played a *'leading role in catalyzing the technological sea change'* across all the other layers of India Stack.[80] This group is known to be championing the ideas behind India Stack at a global level also, including as a member of the Digital Public Goods Alliance.[81] But, interestingly, the iSPIRT group does not hold legal ownership of any of the India Stack products. This ownership vests either in the relevant government agencies, like the UIDAI in case of Aadhaar and MeitY's National E-Governance Division in case of DigiLocker, or with industry-owned not for profit entities like the banking and payments industry owned NPCI that operates the UPI system.

Given its original conceptualisation by a software products industry group, one of the key objectives of India Stack has been to enable developers and startups to build businesses around its layers of digital infrastructure.[82] At the same time emphasis has also been placed on the inclusion and empowerment capabilities of India Stack's layers, in order to highlight the public interest functionality of the different layers. This ties in with a perceptible shift in the government's assertion of ownership over the India Stack brand and its layers in the public domain. For instance, the website of the National E-Governance Division notes that the government has identified the cashless, paperless and presenceless layers as part of its philosophy toward 'Minimum Government and Maximum Governance'.[83] The direct and indirect role of iSPIRT in formulating this vision and brand is, however, rarely acknowledged in the official commentary.[84]

Over time, the footprint of India Stack has expanded much beyond the four layers in the iSPIRT's original conceptualisation. This is demonstrated by the indiastack.global portal inaugurated by the Indian Prime Minister at the Digital India Week, 2022. As noted previously, the goal of this portal is to demonstrate India's prowess in developing technical architectures for the delivery of digital public goods and marketing these skills to the world. Table 1 details the different technical architectures that have been brought together under this portal as part of the India Stack portfolio.

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[79] Ram Sevak Sharma, The Making of Aadhaar: World's Largest Identity Platform, Rupa Publications, 2020.

[80] Aaryaman Vir and Rahul Sanghi, The Internet Country, How India created a digital blueprint for the economies of the future15 January, 2021 <https://tigerfeathers.substack.com/p/the-internet-country> accessed 23 January 2023

[81] The other members on the governing board of the alliance are the German Federal Ministry for Economic Cooperation and Development (BMZ), the Norwegian Agency for Development Cooperation (Norad), Sierra Leone Directorate of Science, Technology and Innovation (DSTI), UNDP and UNICEF.

[82] iSPIRT, IndiaStack <https://ispirt.in/our-industry/indiastack/>

[83] National E-Governance Division, Ministry of Electronics And Information Technology, DigiLocker <https://negd.gov.in/node/84>

[84] In an exception to this, the government's official think tank, the NITI Aayog, acknowledged that its discussion paper on the DPEA framework had been prepared by the team at iSPIRT. Supra note 67.

Besides products like Aadhaar eKYC, UPI and DigiLocker, it includes platforms developed for Covid vaccination monitoring (CoWin) and contact tracing (Aarogya Setu) and digital solutions for workplace workplace management and cloud-based telemedicine services. All of these are new additions to the India Stack's original suite of products and services.

Table 1: Components of the India Stack Framework

Product	Description	Key entities	Governing framework
Aadhaar	Biometric digital identity project. Its electronic know your customer (eKYC) identity verification represents the presence-less layer of India Stack.	Unique Identification Authority of India, a statutory body constituted under the Aadhaar Act	Aadhaar (Targeted Delivery of Financial and Other Subsidies, Benefits and Services) Act, 2016
Unified Payments Interface (UPI)	Digital payment platform that enables real-time transactions across multiple bank accounts using a virtual ID. It represents the cash-less layer of India Stack.	National Payments Corporation of India (NPCI), a non profit entity owned largely by banks	NPCI is authorized to operate under the Payments and Settlements Act, 1997. It sets the standards and governing framework for UPI through its circulars.
CoWin	Platform for tracking and managing Covid vaccination doses and generating vaccination certificates. It is now being repurposed to accommodate other vaccinations, blood donations, etc.	National Health Authority, a non-statutory executive agency constituted by the Ministry of Health and Family Welfare	No statutory framework. Governed by guidelines issued by the Health Ministry.

DigiLocker	Platform for issuance and verification of documents and certificates digitally. Represents the paper-less layer of India Stack.	National E-Governance Division, Ministry of Electronics And Information Technology	Information Technology (Preservation & Retention of Information by Intermediaries Providing Digital Locker Facilities) Rules, 2016 granted legal recognition to DigiLocker
Arogya Setu	Mobile app for contact tracing and self-assessment for Covid-19	Developed under a public private partnership. The National Informatics Centre is designated as the contact point for it	No statutory framework. Aarogya Setu Data Access and Knowledge Sharing Protocol, 2020 laid down guidelines for the app's data processing.
Digital Infrastructure for Knowledge Sharing (Diksha)	School education platform to digitally enable students and teachers	National Council of Educational Research and Training, Ministry of Education	No specific governing framework. The Department of School Education & Literacy, has issued Guidelines for Digital Education.
Umang	Mobile app that enables citizens to access pan India eGovernance services	National E-Governance Division	No specific governing framework.
eSanjeevani	Cloud-based telemedicine platform with facility for audio-video consultations with doctors and generation of ePrescriptions	Centre for Development of Advanced Computing, a R&D organization of the Ministry of Electronics and Information Technology	No specific governing framework

Government eMarketplace (GeM)	eMarketplace for public procurement of goods and services	The GeM portal is operated by a special purpose vehicle incorporated as a not for profit entity. It falls under the Department of Commerce, Ministry of Commerce and Industry	Development and operation of GeM was recognised under the Government of India (Allocation of Business) Rules, 1961 in 2017.
API Setu	A platform to facilitate the implementation of the government's Open API Policy. Currently houses over 1600 APIs	National E-Governance Division	No specific governing framework. Its objectives stem from the Open API Policy notified by the MeitY in July 2015
eOffice	A digital workplace solution to aid decision making and paperless transactions in government offices	National Informatics Centre	No specific governing framework. Its working has been explained in an eOffice Book released in 2020.
eHospital	A digital platform to connect patients and government hospitals. Enables patient registration, billing and information management. 759 hospitals have been onboarded.	National Informatics Centre	No specific governing framework.

In addition to the products and platforms listed above, the process of stackification is also taking place in several other sectors. For instance, the National Urban Innovation Stack is a framework for ICT enabled urban governance relying on the creation of registries and data infrastructure. This is set to be accompanied by core services like authentication, billing, geo-location, and various solutions built upon the infrastructure and core services layers.[85] In the agriculture sector, the

[85] National Institute of Urban Affairs, Ministry of Housing and Urban Affairs and Smart Cities Mission, National Urban Innovation Stack: Strategy and Approach, <https://smartnet.niua.org/sites/default/files/resources/national_urban_innovation_stack_web_version.pdf> accessed 23 January 2023

Ministry of Agriculture & Farmers Welfare has commenced the process for creating an AgriStack to promote innovative solutions leveraging emerging technologies. As a first step in this direction, a federated farmers' database that would serve as the core of the AgriStack is being built.[86] The common thread of reliance on open APIs, emphasis on interoperability, and a data-centric approach runs though most such new technical architectures that are being discussed in India. Many of these ideas were brought together by the MeitY in its India Enterprise Architecture (IndEA) Framework that presents a toolkit to support ICT enabled transformation across various layers and units of the government.[87] These discussions illuminate the importance being placed on digital transformation in India's governance strategy and how the India Stack model of digital governance has gradually permeated across multiple sectors and use cases.

6. An Exercise in Calibration

A study of India's digital trajectory would, however, be incomplete without calibrating how its digital visions and programmes stack up against the ground realities of implementation and governance. One way to do this could be through a review of how India fares on international indices focused on assessment of digital adoption, particularly in the domain of e-governance.

India was among the 43 countries classified under the Group A (GovTech leaders) in the World Bank's 2021 GovTech Maturity Index[88], which is supposed to be a measure of digital transformation in the public sector. Yet, despite the positive trends in increased digital access, the country has fared more modestly in some of the other digital performance indices. For instance, it scored 0.51/1 on World Bank's Digital Adoption Index, 2016. A more granular review of its performance on this index shows that although the country performed well on the parameter of service delivery by the government (0.8/1) it fared much worse on expanding opportunities and improving welfare for people (0.22/1).[89]

More recently, the United Nations E-Government Survey of 2020 ranked India at 100th position out of the 193 countries covered in the survey. Among the different sub-components of the index, telecommunications infrastructure was among the country's weakest points and adoption of online

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[86] Ministry of Agriculture and Farmers Welfare, Government of India, Government is in the process of finalizing 'India Digital Ecosystem of Agriculture (IDEA)' which will lay down a framework for Agristack, Press Information Bureau, 3 August 2021 <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1741995> accessed 23 January 2023

[87] India Enterprise Architecture Framework, <https://www.meity.gov.in/writereaddata/files/IndEA_Framework_1.0.pdf> accessed 23 January 2023.

[88] World Bank, GovTech Maturity Index 2021 <https://openknowledge.worldbank.org/handle/10986/36233> accessed 23 January 2023

[89] World Bank, Digital Adoption Index 2016 <https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index> accessed 23 January 2023

services the strongest.[90] A broad observation that emerges is that although India has made considerable progress on creating systems of e-governance and seen a spike in the adoption of online services, gaps still remain in terms of basic infrastructure and welfare impact for citizens.

In addition to these international rankings and indices, bodies such as the OECD and Gartner have put out suggested principles and maturity models for measuring digital transformation in the government sector.[91] The OECD's Good Practice Principles for Public Service Design and Delivery in the Digital Age contain nine principles organized under three key pillars.[92] These pillars are (i) building accessible, ethical and equitable public services that prioritize user needs; (ii) delivering services with impact, at scale and with pace; and (iii) being accountable and transparent in the design and delivery of public services.

As indicated by the discussions in Sections 4 and 5 of the paper, India has laid significant emphasis on building population-scale digital infrastructure over the last few years. This includes the use of private-partnership collaboration models, application of a similar digital architecture design to multiple sectors, and the initiation of discussions on enabling data sharing across government bodies. These developments speak favorably to some of the OECD's good practice principles, particularly under the second pillar on pace and scale of services. However, an important criticism of digital governance evaluation indices and strategies has been that such studies generally tend to focus on positive effects of digital transformation without paying sufficient attention to the risks that may arise in the process.[93] Taking this into account, the remaining part of this section uses the OECD's good practices principles as a framing device to examine how the digital developments in India stack up against some of the other important values and recommended good practices of digital transformation.

The OECD's first principle speaks of understanding users and their needs, engaging closely with

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[90] United Nations Department of Economic and Social Affairs, E-Government Survey 2020 Digital Government in the Decade of Action for Sustainable Development, 2020 <https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf> accessed 23 January 2023.

[91] OECD Good Practice Principles for Public Service Design and Delivery in the Digital Age, OECD Public Governance Policy Papers No. 23, 2022, <https://www.oecd-ilibrary.org/docserver/2ade500b-en.pdf?expires=1674511976&id=id&accname=guest&checksum=1FFF5C379E278314AADB89E66D7A2A99> accessed 23 January 2023; Andrea Di Maio, Rick Howard, Glenn Archer, Introducing the Gartner Digital Government Maturity Model, Gartner, 22 September 2015 <https://libguides.kaist.ac.kr/ld.php?content_id=39283439> accessed 23 January 2023. Also see Sushil Prakash, Empirical framework to determine maturity of digital transformation of a service to citizens through enhancements on existing assessment methods – Case Study India, Proceedings of the 15th International Conference on Theory and Practice of Electronic Governance, October 2022, p 301–308 <https://dl.acm.org/doi/pdf/10.1145/3560107.3560154> accessed 23 January 2023

[92] OECD, and Delivery in the Digital Age.

[93] Elena Dobrolyubova, Measuring Outcomes of Digital Transformation in Public Administration: Literature Review and Possible Steps Forward, NISPAcee Journal of Public Administration and Policy Volume 14, Issue 1 (June 2021), p 61 - 86, <https://doi.org/10.2478/nispa-2021-0003> accessed 25 January 2023.

them and increasing access for all user groups. As discussed in Section 3, despite the sharp increase in the size of India's digitally connected population, the availability and quality of digital engagement varies drastically across different user groups. For instance, the adoption of digital payments in the country, particularly through UPI, is regarded as one of the biggest success stories of Digital India. But a survey conducted by Nielsen found that the users of online banking and digital payments services were mainly from the urban and affluent segment with two thirds of them belonging to the age bracket of 20 to 39 years with a male to female divide of 69:31.[94] This situation may gradually come to change as more rural users become comfortable with digital payments or services like the UPI's feature phone version gain scale.[95]

However, as things stand, varying levels of digital access and skills remain an important reality for India, but one that can sometimes be ignored amongst assumptions about ubiquitous and fast spreading digital access in the country. This becomes particularly problematic when policy instruments mandatory thrust the adoption of digital products and services on the public. For instance, the Indian Supreme Court drew attention to this in the early days of the COVID-19 vaccine roll out, which required the use of a digital interface—the CoWin portal—to access vaccination appointments. As per the government, mandatory appointments using CoWin were meant to regulate the limited supply of vaccines and prevent overcrowding at centers. But the Supreme Court observed in this context that the government had failed to keep its ear to the ground in terms of awareness of the digital access and digital literacy gap in the country that was leading to the denial of vaccinations.[96]

The OECD's second principle emphasizes the importance of participatory and inclusive processes in the design and delivery of public services. In the absence of any legal requirements on participatory design, there is a lack of consistency in the practices followed by different government stakeholders on this front. In 2014, India's Ministry of Law and Justice put out a pre-legislative consultation policy document setting out the process to be followed by government departments while formulating any laws or subordinate legislations.[97] The government has also created a dedicated portal called mygov.in to seek public opinion and facilitate citizen engagement on policy issues.

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[94] Agarwal, Nielsen's Bharat 2.0 Study

[95] Gunja Sharan, UPI's Digital Payment For Feature Phones Receives Over 37K Users, 21K Transactions, inc42, 30 March 2022 <https://inc42.com/buzz/upis-digital-payment-for-feature-phone-receives-over-37k-users-21k-transactions/> accessed 25 January 2023

[96] Ananthakrishnan G, Supreme Court tells Government: Wake up and smell the coffee, let vaccine policy be flexible, The Indian Express, 1 June, 2021 <https://indianexpress.com/article/india/policy-must-change-as-per-ground-situation-sc-on-mandatory-cowin-registration-for-covid-19-vaccine-7337921/> accessed 25 January 2023

[97] The process includes publishing a draft in the public domain, disclosing a summary of feedback/comments received from the public, and holding consultations at the option of the concerned department.

However, in practice, each department continues to exercise the discretion to determine whether and how participatory their public engagement processes should be.[98] For instance, in some recent cases, such as the consultation on the Digital Personal Data Bill and the Draft National Data Governance Policy, MeitY decided to hold consultation meetings to garner feedback from stakeholders in the industry, civil society and academia.[99] This is a welcome yet insufficient development as the conduct, composition and frequency of such meetings depends entirely on the will of the relevant public functionaries. Further, the reliance on written responses and closed door meetings constitutes an incomplete mode of consultation in a country with digital, language, literacy, and awareness disparities of the kind that are seen in India.

In addition to the nature of the consultation processes, the type of policy instrument being used to bring about a digital initiative also influences the legitimacy, inclusiveness, enforceability and accountability of digital policies. A number of digital governance measures in India are found to be introduced through documents like national policies, protocols, strategy documents, and blueprints.[100] These instruments do not have the binding force of laws even though they may have certain governance and implementation structures embedded in the form of executive decisions. This was most starkly demonstrated in the content of the digital identity project, Aadhaar. The digital identity enrolment and authentication system under this project were in operation since 2010 but the enabling statutory framework for it came about only in 2016.[101] Before this, the operation of the project was carried out solely on the basis of an executive authorisation. Even when the law was eventually passed it was in the form of a money bill, which meant that the legislative passage of the Aadhaar Act did not go through the rigor of Parliamentary debate and revisions merited by a project of its nature. These examples highlight the gaps in participatory and consultative design of digital projects in the country.

Next, the OECD's document contains some important guidelines relating to data governance. It speaks of recognizing "security and privacy as foundational to the design of a service and not

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[98] The document, however, also states that the department can choose to dispense with such consultative procedures if it is found to be infeasible or undesirable under the circumstances.

[99] Ministry of Electronics and Information Technology, MoS Shri Rajeev Chandrasekhar holds public consultation with over 200 Stakeholders on DPDP Bill 2022, Press Information Bureau, 23 December 2022 <https://pib.gov.in/PressReleasePage.aspx?PRID=1886126> accessed 25 January 2023.

[100] Examples include the National Digital Health Blueprint, 2019, the Aarogya Setu Data Access and Knowledge Sharing Protocol, 2020 and the National Data Sharing and Accessibility Policy, 2012. See Ministry of Health and Family Welfare, Government of India, National Digital Health Blueprint, 2019, November 2019, <https://main.mohfw.gov.in/sites/default/files/Final%20Report%20-%20Lite%20Version.pdf> accessed 25 January 2023; Aarogya Setu Data Access and Knowledge Sharing Protocol, 2020 <https://www.meity.gov.in/writereaddata/files/Aarogya_Setu_data_access_knowledge_Protocol.pdf> accessed 25 January 2023; Ministry of Science and Technology, Government of India, National Data Sharing and Accessibility Policy, 2012, <https://geoportal.mp.gov.in/geoportal/Content/Policies/NDSAP_2012.pdf> accessed 25 January 2023.

[101] Aadhaar (Targeted Delivery of Financial And Other Subsidies, Benefits and Services) Act, 2016 <https://uidai.gov.in/images/Aadhaar_Act_2016_as_amended.pdf> accessed 25 January 2023.

something overlaid at the end"[102] and ensuring "users' ability to manage their personal data"[103]. There are two main strands of policy discussions on data governance that are currently going on in India – the draft Digital Personal Data Bill, 2022[104] and the recommendations made by an expert committee set up by the government on creating a separate statutory framework for the governance of non-personal data.[105] In addition, MeitY has put out a draft National Data Governance Framework Policy proposing the standardization and pooling together of all non-personal datasets held by government agencies under a new National Data Management Office.[106]

While all of the above proposals are still at a discussion stage, limited protections for personal data already exist under Section 43A of the Information Technology Act, 2000 (IT Act). The section provides for the payment of compensation to individuals for any wrongful loss suffered due to a body corporate's failure to maintain reasonable security practices while dealing with sensitive personal data. Further details regarding the implementation of this requirement have been laid down under rules formulated by the government.[107] However, it is important to note that the current scope of data protection in India does not cover government agencies although they do fall under the ambit of certain sector-specific laws. For instance, the Aadhaar Act and rules under it regulate the collection, use and sharing of Aadhaar data which applies to the UIDAI as well as other actors. In addition, legislations such as the IT Act and the Telegraph Act, 1885 contain certain protections for the privacy of communications and restrictions on unauthorized interception of messages by law enforcement agencies. However, the existence of these rules cannot be equated with their sufficiency. These provisions have, in fact, been widely criticized for their failure to meet the standards laid down by the Supreme Court while upholding the right to privacy in the *Puttaswamy* case[108] and petitions challenging them are currently pending before the Supreme Court.[109]

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[102] Principle 8, OECD, Good Practice Principles for Public Service Design and Delivery in the Digital Age.

[103] Principle 1, OECD, Good Practice Principles for Public Service Design and Delivery in the Digital Age.

[104] Draft Digital Personal Data Protection Bill, 2022 <https://www.meity.gov.in/writereaddata/files/The%20Digital%20Personal%20Data%20Potection%20Bill%2C%202022_0.pdf> accessed 22 January 2023. Also see Soumyarendra Barik, Explained: Why the Govt has withdrawn the Personal Data Protection Bill, and what happens now, Indian Express, 6 August 2022, https://indianexpress.com/article/explained/explained-sci-tech/personal-data-protection-bill-withdrawal-reason-impact-explained-8070495/ accessed 22 January 2023.

[105] Kris Gopalakrishnan et al., Report by the Committee of Experts on Non-Personal Data Governance Framework, 16 December 2020 <https://static.mygov.in/rest/s3fs-public/mygov_160922880751553221.pdf> accessed 22 January 2023.

[106] Ministry of Electronics and Information Technology, Draft National data Governance Framework Policy, 2022 <https://www.meity.gov.in/writereaddata/files/National-Data-Governance-Framework-Policy.pdf> accessed 25 January 2023.

[107] Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011.

[108] Justice K.S. Puttaswamy v. Union of India, (2017) 10 SCC 1.

[109] The Wire Staff, Why Five Petitions Are Challenging the Constitutional Validity of India's Surveillance State, The Wire, 14 January 2019, <https://thewire.in/law/supreme-court-pil-centre-snooping> accessed 24 January 2023; Rishab Bailey, Vrinda Bhandari, Smriti Parsheera, and Faiza Rahman, "Use of Personal Data by Intelligence and Law Enforcement Agencies," National Institute of Public Finance and Policy, 1 August 2018,

In the Indian state's quest of creating a digital society, everything from public service delivery to agricultural productivity has been linked to the foundations of data. Policies are being designed to encourage more and more data collection and aggregation, both by the government and private parties. For instance, the entire scheme of the DEPA architecture, which represents the consent layer of India Stack, is based on a presumption of empowerment through control over consent in collection and sharing of personal data. One of its applications is in the health sector where medical practitioners, labs, clinics are being encouraged to digitize and enable easier sharing of health data records. But, as I have argued elsewhere, having a smaller digital footprint, which logically means lesser exposure to profiling and data breach, could also be a form of empowerment.[110] A state-endorsed technical architecture that nudges businesses toward greater data processing, however, obliviates this possibility. These concerns are compounded by the fact that India's legal process on data protection and governance has not kept pace with the continuous push for data-driven actions.

Finally, the OECD principles speak of the need to implement clear and transparent governance mechanisms covering, among other features, the accountability of public services. A discussion on accountability aspects is particularly relevant in the context of the design and roll out of some of the new technical architectures in India. As discussed previously, several of these projects have relied on a model of having private volunteers working alongside government departments, which enables access to technical expertise that might otherwise not have been easily available in a traditional government set up. However, such informal collaborations also give rise to concerns of accountability, incentives and potential conflicts of interest on the part of private actors.[111] For instance, Aarogya Setu, the government's COVID contact tracing app, was designed through a public-private model of collaboration. But, curiously, the National Informatics Centre, which has been officially designated as the app's developer, denied having any information about how the app had come into existence.[112] Although this issue was later clarified by the government, the incident brought to light the disproportionate claim that some private actors may have in the designing of such technical systems.

<https://macrofinance.nipfp.org.in/PDF/BBPR2018-Use-of-personal-data.pdf>; SFLC.in, India's Surveillance State: Communications Surveillance in India, 2014, <https://sflc.in/sites/default/files/wp-content/uploads/2014/09/SFLC-FINAL-SURVEILLANCE-REPORT.pdf> accessed 24 January 2023.

[110] Smriti Parsheera, An analysis of India's new data empowerment architecture, in Emerging Trends in Data Governance, Centre for Communication Governance, National Law University Delhi, 2023 <https://ccgdelhi.s3.ap-south-1.amazonaws.com/uploads/ccg-edited-volume-emerging-trends-in-data-governance-343.pdf> accessed 24 January 2023.

[111] Krishn Kaushik, Aadhaar officials part of private firms that use Aadhaar services for profit, The Indian Express, 5 October 2017 <https://indianexpress.com/article/india/aadhaar-officials-part-of-private-firms-that-use-aadhaar-services-for-profit-4874824/> accessed 23 January 2023.

[112] No confusion on who created Aarogya Setu app: MyGov CEO, The Times of India, 28 October 2020, <https://timesofindia.indiatimes.com/india/no-confusion-on-who-created-aarogya-setu-app-mygov-ceo/articleshow/78914166.cms> accessed 23 January 2023

There is also an accountability deficit problem in the design of the industry-owned non-profit entities that are in charge of setting the standards for various technical architectures being adopted in India.[113] Examples include the NPCI in case of digital payments and the DigiSahmati Foundation in case of the implementation of the DEPA architecture in the financial sector. These entities effectively exercise quasi-regulatory powers over the participants in their respective ecosystems but without being bound by the accountability standards and restrictions on arbitrariness that would have been applicable to a public body. For instance, in 2019, India's Central Information Commission rejected a request to treat the NPCI as public authority under the Right to Information Act, 2005 thereby exempting it from public disclosures and scrutiny.[114] The emergence of these state-endorsed technical architectures requires deeper thinking in terms of building clear accountability and governance mechanisms for the private individuals and entities involved in the process.

7. Conclusion

This paper described how reliance on digital technologies and infrastructures has become the mainstay of governance in India, being positioned as the pathway to efficiency, inclusion, empowerment, and innovation. The government's willingness to pursue digital transformation is well demonstrated by the multiple schemes and platforms that have been brought together under the umbrella of the Digital India programme. This is accompanied by a new model of 'India Stack(ification)' that relies on the use of open APIs, an emphasis on interoperability, platform-like role of the government, and a data-centric approach in the deployment of new technical architectures.

However, effective digital transformation is shaped not just by the visions and designs of policymakers but the true readiness of the ecosystem to imbibe digital technologies for socio-economic development. This includes readiness at the level of citizens and users, in terms of connectivity, access and awareness, at the level of the public and private sector to offer socially valuable digital outputs, and at the level of governance frameworks to deal appropriately with the opportunities and challenges of the digital ecosystem.

The paper notes that India has seen a significant expansion in the availability, quality, and affordability of Internet access services in the last few years. This has spurred greater utilization of digital goods and services offered by the government as well as the private sector. But, despite this positive trend, it would be erroneous to equate improving digital access with the ecosystem's readiness for digital-only or digital-first solutions. This is because the availability and quality of

[113] Smriti Parsheera, India's policy responses to big tech: And an eye on the rise of 'alt big tech', Indian Journal of Law and Technology, Volume 18, Issue 1, 2022 <https://www.ijlt.in/journal/india%E2%80%99s-policy-responses-to-big-tech%3A-and-an-eye-on-the-rise-of-%E2%80%98alt-big-tech%E2%80%99> accessed 23 January 2023.

[114] Neeraj Sharma v. Bank Of Baroda, Central Information Commission order dated 10 December 2019 <https://indiankanoon.org/doc/40809441/> accessed 2 February 2022.

digital engagement continues to vary drastically across different user groups, shaped by factors such as income, gender, skills, education, and geographical location.

Further, the design and implementation of digital initiatives inevitably involves the balancing of multiple interests, including individual rights, state aims, business freedoms and incentives to innovate. This supports the case for better participation in digital governance processes through meaningful discussions, collaborative frameworks for developing technical standards and implementation of appropriate governance and accountability structures. Using the OECD's Good Practice Principles for Public Service Design as a framing device, the paper points to some of the gaps that exist in India's current digital transformation strategy on these fronts.

To sum up, the paper finds that India has built an elaborate suite of ideas and products to facilitate its digital transformation, including in the form of the India Stack products. But its visions of holistic digital transformation can be realized only by calibrating its digital design ideals against the ground realities of implementation and governance in the country. Stepping away from digital coercion, active engagement with critical perspectives and building suitable institutional structures for governance and accountability are some of the necessary steps in this process.