Discussion Paper

Impact of Inadequate Digital Infrastructure on Ease of Doing Digital Business in India

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Overview

To identify the bottlenecks in Ease of Doing Digital Business (EoDDB), CUTS has been publishing a *Discussion Paper Series* on issues that impact digital businesses in India. The role of digital infrastructure in facilitating a conducive environment for doing digital business is one of them. Economists have repeatedly demonstrated that infrastructure plays a critical role in providing supporting components to businesses as it reduces the cost of production and services and strengthens economic growth.[1]

The role of infrastructure in digital business has a similar impact on facilitating digital businesses. This paper unpacks the digital infrastructural constraints that hinder the digital economy's growth and the digital business ecosystem. In its analysis, the paper goes beyond 'connecting the unconnected' framework, in the spirit that connectivity does not necessarily translate into positionality to use services and business opportunities offered by digital technologies.

Further, the paper breaks the entire gamut of digital infrastructure into two parts – soft and hard digital infrastructures. Throughout this paper, an attempt is made to ascertain the role of digital infrastructure and related challenges in EoDDB that can inform policymakers, business leaders and investors. Towards this end, recommendations on the future strategy are made for facilitating EoDDB to protect and expand the commercial ecosystem.

Introduction

India aims to elevate the digital business ecosystem and increase the digital economy by US$1tn by 2025.[2] This vision was fuelled in 2015 when the Digital India programme was launched.[3] The flagship programme is directed to transform India into an empowered digital economy, capturing the potential of technology in the Indian economy. Digital India is an umbrella programme that includes multiple efforts around connectivity, skilling and capacity building, amongst others.[4] For the scope of the paper, only the infrastructural aspects of Digital India will be focussed upon. In this paper, digital infrastructure is the assemblage and interconnectedness of hard and soft infrastructures that facilitate the foundation for digital businesses' operations.

Digital infrastructure can be divided into soft and hard digital infrastructure. The hard digital infrastructure, such as digital connectivity and data centres provides the necessary foundation for digital businesses to function. On the other hand, soft digital infrastructure, such as cybersecurity and public digital infrastructure – India Stack, National Open Digital Ecosystem, Unified Payments Interface, Open Network for Digital Commerce – facilitates a conducive environment for the ecosystem of digital business. Further, digital literacy, language, culture also are critical factors.

Infrastructural constraints (discussed throughout the paper) have been a bottleneck for digital businesses. Digital infrastructure provides the foundation for the digital business ecosystem and creates necessary grounds for the layers of digital business prospects. It helps in improving coordination and outsourcing of workers, services and optimising targeted advertising. Soft and hard digital infrastructures have multiple direct and indirect impacts on the digital economy. Indirect impact includes increasing the consumer base and easiness in accessing digital services that contribute to digital businesses' growth.

In this Discussion Paper series that focuses on the EoDDB in India, authors have highlighted the direct impacts relating to different issues of *Criminalising Provisions[5]* and *Regulatory Uncertainty[6]* on digital businesses. However, in the context of this paper, which focuses on the role of digital infrastructure in digital businesses, indirect impacts cannot be excluded as it significantly impacts digital businesses.

An efficient digital infrastructure is critical to support digital businesses, economic growth and improving quality of life as it expands the diversity in choosing goods and services. Lending momentum to the aspiration of Digital India and enhancing the infrastructures for the digital businesses, the Government of India (GoI) allocated around Rs100bn in 2022 for the Digital India programme, up from Rs60mn last year.[7]

Countries around the globe are attempting to leverage the opportunities to gain the economic benefits that digital technologies offer. Still, challenges related to digital infrastructures that support digital business remain one of the significant constraints, particularly in a developing country like India.

Understanding and anticipating infrastructural challenges is essential when formulating the policies and legislative framework for digital businesses, as it helps in rapidly building products and services and delivering them at scale.

Implication of Inadequate Hard Infrastructure on EoDDB

A substantial body of empirical evidence now suggests that hard digital infrastructure factors such as increased internet penetration and connectivity are positively associated with EoDDB and growth in Gross Domestic Product (GDP).[8] However, the mission of digitising the Indian society and economy has met with considerable infrastructure challenges such as lack of connectivity and data centres. This also impacts GoI's aim of enabling digital services for commerce, education, healthcare and finance.[9]

These services have unmanageable dependencies upon hard digital infrastructure. India's hard digital infrastructure is not adequate to exploit the maximum potential of the digital ecosystem. This section will unpack the role of the hard digital infrastructures that include connectivity, and data centres in EoDDB.

Lack of Digital Connectivity constraints doing Digital Business

Despite all the promises and magnitude to transform the economy, the digital economy's full potential is yet to be unlocked as more than half of the population in India still lacks access to digital connectivity.[10]

Digital connectivity is at the intersection of the digital business with the physical world which means that it is a critical factor within the ecosystem of digital business. The data of economic contribution around the globe

demonstrates that a 10 percent increase in broadband penetration yielded an additional 1.25 percent in GDP growth in developed economies.[11] In comparison, the same increase in middle-income countries yielded only an additional 0.85 percent in GDP growth and much lesser growth in low-income countries.[12]

The evidence from China suggests that the contribution of digital connectivity and integration to the development of China's digital economy has led to an increment of 163.18 percent in 2019 as compared to 101 percent in 2015.[13] In enhancing the digital economy in China, access to connectivity which includes access to the internet, mobile phones and computers/laptops have been instrumental.[14]

This signifies that the development of digital connectivity has a critical role, which further facilitates ease of doing business for digital players. Having access to digital technologies and devices such as mobile/computer and internet is instrumental and has multiple direct and indirect impacts.

The relation between penetration of broadband connection and economic growth reflects the importance of connectivity in promoting digital businesses. Smooth connectivity reduces the cost of production, coordination, dissemination and collection of information and services for business players.

Digital connectivity reduces barriers to entry and opens doors for a new generation of entrepreneurs and innovators as it facilitates knowledge and tools to build business and maximise the growth potential. By bringing market barriers down, digital connectivity can be a great leveller. It can enable the smaller firms to reach out to relevant consumers despite the limited capacities of investing resources to attract new consumers.

India's broadband speed is among the slowest in the world and limited accessibility to the internet remains one of the major constraints of digital business in India.[15] Lack of access to digital connectivity harms the scope for the digital business at multiple layers, such as expanding the access to market, particularly for smaller businesses. Bridging the gaps in accessing digital connectivity for small businesses requires more than just gaining high-speed internet access, smartphones and laptops/computers.

For instance, for business owners in remote locations, new internet-based applications enable them to reach potential new customers, grow their businesses and create new jobs, but that is highly dependent on the access to digital connectivity in the region. Consumers' access to digital technologies can support them in selling goods and services online, marketing and advertising, customer service and support, communications and brand loyalty programmes.

For example, in 2016, to enhance rural mobility a start-up was founded in Bihar's Saharsa district – *AryaGo*.[16] Due to the lack of digital connectivity in rural Bihar, the platform has to rely heavily on interactive voice response by setting up call centres. However, despite the platform investing huge resources in developing digitally-mediated infrastructure, it has not been able to receive bookings through the mobile-based application.[17] The reason is poor internet access in Bihar, which stands at 37 percent.[18]

The offline operation of *AryaGo* makes it difficult to maintain and manage customer relations to enhance users' experience hassle free booking of cabs and rather adds extra financial burden which is hard to sustain in the long run for the platform.[19] The lack of digital connectivity constrains the aggressive promotion of their services through online platforms, as they do not have resources for traditional promotional activities. The case of *AryaGo* reflects larger challenges in starting a digitally-mediated business in India, which is not having access to basic digital infrastructure such as connectivity for a major chunk of the population. Although the rural population makes up a major chunk of India, not having enough online consumers in rural areas discourages budding entrepreneurs from innovating and ideating anything based in rural locations.

In Jammu and Kashmir, start-ups are struggling to overcome internet connectivity challenges. Ubair Shah, the co-founder of *e-fruitmandi*, a start-up that aims to connect small and marginal farmers to the market, said that internet connectivity is one of the biggest challenges in Jammu and Kashmir.[20] Many small and medium businesses do not own mobile phones and live in areas where access to high-speed internet is not available, limiting the platform's growth.

Despite significant improvement in connectivity, India's digital businesses' landscape is still struggling to overcome challenges related to access to digital connectivity.[21] India currently does not have adequate mobile data subscription and broadband connections that has multiple direct and indirect impacts on doing digital business. Examples of Bihar and Jammu and Kashmir reflect the challenges of doing digitally mediated business across the country due to poor digital connectivity, particularly in rural locations as they cannot find enough consumers and unstable internet connectivity increases their operational cost.[22]

Further, limited access to digital technologies such as internet connectivity and smartphone/computers limits the business community's adoption and expansion of innovative technology. For instance, only 53 percent of Micro, Small & Medium Enterprises (MSMEs) have adopted digital technologies in India due to the lack of access to digital connectivity.[23]

The Indian economy heavily relies on MSMEs for employment generation but faces greater challenges of external markets due to limited access to digital infrastructure.[24] The economic opportunities generated by these technologies, such as websites, e-commerce, digital marketing and advertising, and social media for enterprises, have not provided critical indirect and/or direct support in expanding their business, particularly to MSMEs, due to the inaccessibility of digital connectivity such as the internet and mobile/laptop. During COVID-19 induced lockdowns, MSMEs who were in position and/or were integrated into the digital ecosystem could sustain their business. Some of them even increased their sales.[25]

However, businesses operating in locations where access to digital connectivity is limited suffered hugely.[26] Access to digital technologies plays a critical role in determining the future of EoDDB. Without adequate digital connectivity across the country, the digital gap will widen, decreasing digital businesses' penetration and negatively impacting EoDDB.

Accelerating Digital Connectivity

Digital India has attempted to provide new energy to India's ambitious expansion of the digital economy by promising greater connectivity.[27] The mission of digitising socio-economic aspects of the country is an umbrella effort that incorporated and/or rebranded earlier policies and programmes such as National Optical Fibre Network (2011).[28]

However, programmes under Digital India have been poorly implemented, sometimes due to the lack of a backing legislation, but often owing to poor planning and foresight.[29] For instance, National Optical Fibre Network was rebranded in 2014 as BharatNet, to extend the existing optical cable fibre network from the Block Headquarters to 2.5 lakh Gram Panchayats (GP). Phase 1 of the programme missed the deadlines and fell apart.[30] Till June 2021, only 60 percent of GPs had been made service-ready and just 34 percent of these panchayats had been provided with a Fibre to the Home (FTTH) connection.[31]

Access to digital connectivity depends on multiple factors, such as geographical location. Similarly, internet penetration in rural areas is only 29 percent against a national average of 51 percent.[32] There is a persistent income-based digital divide among households as well.[33]

In July 2021, the Union government approved a revised strategy for the BharatNet project, with expenditure leading to Rs40mn.[34] This would be implemented through the Public-Private Partnership (PPP) model in 16 states.[35]

A 2020 report by the Standing Committee on Information Technology remarked on the absence of measures to deliver internet services to end-users and bureaucratic delays in granting tenders.[36] The Comptroller and Auditor General of India on the BharatNet also underlined similar reasons for the poor project implementation.[37]

Excessive downtime of Optical Network Termination that converts fibre signals into digestible information in the form that the devices can understand, hurting the smooth and stable internet connectivity.[38] Fibre networks/connectivity are critical for businesses as they provide symmetrical – upload and download – and stable high-speed connectivity. There are also severe disparities between states, with the Northeast faring the worst, partly because of challenging terrain, rain and floods, all of which should have been part of contingency planning. The terrain and the climate in the region are not classified information.[39]

Further, India has also been left behind in deploying 5G Internet connectivity compared to its global counterparts such as South Korea, China and the United States of America. 5G is expected to cover one-third of the global population by 2025, but India has not even started auctioning 5G spectrum.[40] If India aims to boost the digital economy and EoDDB, it should migrate from 3G and 4G internet connectivity to 5G at the earliest, as slow rollout is a bottleneck in doing digital businesses.

Sectoral regulator Telecom Regulatory Authority of India (TRAI) has been trying to minimise the infrastructural constraints in rolling out 5G. In this regard, TRAI had released a consultation paper stating that street furniture and public structures can be instrumentalised for deploying small cells and aerial fibre.[41] This might help India roll out 5G at scale as it will reduce the capital expenditure. However, an auction of 5G spectrum was expected to be held in 2021, but it has been postponed to 2022. There are multiple reasons for delaying the

auction including network providers asking for more time to test the technology. At the same time,[42] some reports claim that the government needs to do a lot of work on making the necessary spectrum available.[43] The cold response in rolling out 5G networks will hurt the economy and digital business, allowing faster and smooth connectivity for everyone.

In an attempt to bridge the gaps in accessing the internet, Prime Minister Wi-Fi Access Network Interface (PM-WANI) was initiated by the Indian government in 2021. The scheme aims to deploy large-scale public Wi-Fi hotspots and access points at the local stores and neighbourhood shops as availed by the Public Data Offices (PDO) without any licence, fee or registration. PDOs will be set up on similar lines as the old-school Public Call Offices (PCOs).[44]

PM-WANI aims to be a low-cost internet option for the underserved populations of the country, subsequently enhancing the ecosystem of the digital business across the length and breadth of the country. Still, its success in providing meaningful connectivity remains to be seen. Enhancing connectivity through PM-WANI might not directly facilitate doing digital business, but it will certainly have multiple indirect impacts. Increasing the connectivity will expand the consumers' base and help onboard small and medium enterprises into the digital business ecosystem such as e-commerce.

However, public WI-FI networks have not been unfamiliar to the data breach and privacy related concerns. Accessing any website that is not HTTPS certified through public WI-FI can increase vulnerability related to data security.[45] The governing framework of PM-WANI falls short in specifying robust information security mechanisms in order to ensure secure connections.[46] For instance, any actor can become a PDO as it has removed the registration process to become a PDO but there are limited checks and balances in terms of security and privacy. [47] Further, as there are no registration, verification and authentication requirements for a PDO, any PDO can be a rogue network more susceptible for hacking and attack on personal and non-personal data of the users.[48] Anyone can access the internet services under PM-WANI by just completing KYC process which is not an adequate security mechanism either,[49] thereby it creates an opportunity for the hacker to get unfettered access to unsecured devices of legitimate users on the same PDO network. As India is yet to mandate data protection legislation, it poses risks for both users' data and any personal or sensitive information entered for the purpose of authentication.[50] There should be a periodic audit mechanism to keep a check on the rouge networks acting as PDO, it will enhance the security and trust of the user within the PM-WANI scheme.

Furthermore, PM-WANI mandates that users' data must be stored for a year for compliance and legal provisions, the rule states, "PDOA shall make necessary provisions for storage of user data for one year to ensure compliance with legal provisions, as required."[51] The framework further states "subject to terms and conditions of the Registration, the App Provider, PDOA and Central Registry Provider will take all necessary steps to safeguard the privacy and confidentiality of any information about a third party to whom it provides the service."[52]

However, aforementioned rules do not clearly spell out the data security measures and how the collected data will be managed. The

storage of the users' data raises concerns of privacy and surveillance despite the government stating that all stored data under PM-WANI will be safe and secure. The PM-WANI framework does not define whether this data will be accessed or not by the government and its agencies.[53] If accessed, then the grounds of such access are not provided and in the absence of a data protection law and surveillance framework there are no checks on the powers of the government and its agencies.[54] Any executive orders or legislation which accesses user's data, infringe upon the right to privacy, should be required to adhere to the principles of legality, necessity, and proportionality established in the *K.S. Puttaswamy judgement*.[55] In light of the above and in absence of a robust data protection mandate and adequate surveillance framework, the concerns of data security around the PM-WANI scheme will remain unaddressed.

Along with the GoI, multiple state governments are also navigating ways to provide internet connectivity to foster digital businesses. For example, in Rajasthan, the L-route server has been operationalised at Bhamashah State Data Centre to provide smooth digital connectivity to facilitate digital businesses.[56] The server has been established in association with the Internet Corporation for Assigned Names and Numbers (ICANN).[57] The server is independent of any Domain Name System (DNS), which means that internet services in the state will not be interrupted even in the case of natural calamities.[58] Further, the Uttar Pradesh government has promised free Wi-Fi in villages to enhance connectivity and integrate the society into the digital ecosystem under the '*smart village*' mission.[59]

Kerala was among the first states to declare internet as citizen's basic right.[60] The Kerala government has recently promised to provide free internet connectivity to the people living at the socio-economic margin under the Kerala Optical Fibre Network (K-OFN) project.[61] Other states are following similar models to provide stable and faster digital connectivity that will be critical in expanding the scope of digital businesses in remote and semi-urban locations.[62]

Internet Shutdown – Disrupting Digital Business

The Supreme Court of India, in Anuradha Bhasin & Ors v. Union of India has stated that the right to carry on any trade or business using the internet is protected under the Indian constitution.[63] The Kerala High Court also delivered a verdict by arguing that access to the internet is a basic right and cannot be denied on social and moral policing.[64]

However, despite the Supreme Court's order, internet shutdowns have become a pathological response to maintaining law and order situations in India by central and state governments.[65] Internet shutdowns crush businesses and enterprises that heavily rely on digital connectivity to function. The Indian Council for Research on International Economic Relations (ICRIER) published a report in 2018 noting that India lost more than Rs220.3bn due to internet shutdowns during 2012-2017.[66] According to the UK-based privacy and security research firm, Top10VPN, India suffered the biggest economic loss in the world in 2020 due

to internet shutdowns, adding up to 8,927 hours and US$2.8bn losses.[67]

Internet shutdowns hurt small entrepreneurs more severely and to the extent that they have to close down their business operations and find a job to survive. Alam Gul, an entrepreneur from Jammu and Kashmir, started a software firm by investing his savings in 2018.[68] In 2019, the GoI shutdown the internet in Jammu and Kashmir for the longest time in any democratic country. Gul's venture was unable to function due to the unavailability of the internet, subsequently failing to deliver the services promised to the clients.[69] Internet shutdown broke his spirit and now he is wary of starting another venture.[70] Entrepreneurs cannot find any investors as they fear that internet services will continue to be disrupted in Jammu and Kashmir.[71]

According to the *Kashmir Chamber of Commerce and Industry (KCCI)* estimates, Kashmir's economy alone suffered a loss of Rs 17,000cr (1,70,000 million) due to the communication lockdown in the wake of the abrogation of Article 370.[72] *The Cellular Operators Association of India (COAI)* has evaluated an estimated Rs 2.4 crores (24 million) per hour of revenue loss to members during internet shutdowns.[73]

Fast Beetle, an online logistic venture, was nascent when the internet service was suspended in Jammu and Kashmir. Until August 2019, *Fast Beetle* delivered 15000 orders across Jammu and Kashmir and regularly provided employment to 11 people. However, the shutdown broke down the whole business chain of Fast Beetle, forcing it to shut its operation for almost eight months.[74] Its co-founder said that disruption of internet shakes stakeholders' confidence, including investors. Despite liking the e-business model, investors are not willing

to invest in a start-up based in a region where connectivity is not stable.[75]

Negative impacts on digital businesses, livelihood and innovations are evident as India continues to top the chart in shutting down the internet globally.[76] It has been challenged in court multiple times. The due process of shutting down the internet was laid down in *Anuradha Bhasin v. Union of India,* challenging the prolonged internet blockade in Jammu and Kashmir.[77]

The Supreme Court stated that it was illegal to shut down the internet indefinitely under Indian law. The court further stated that the order for internet shutdown must satisfy the requirements of necessity and proportionality.[78] Further, it placed requirements on the government to make internet shutdown orders public and subject to judicial review.[79] The court also mandated that such shutdowns need to be temporary and reviewed regularly.[80] The frequent and protracted shutdown of the internet has long been in contest with international and constitutionally guaranteed civil, political, social, and economic rights. Its implication on EoDDB is deep as it shakes the business community's confidence.

However, despite Supreme Court's ruling, India continues to shut down the internet. Recently, Rajasthan government shutdown internet in Jhunjhunu in view of Holi Procession in March 2022.[81] Similarly, West Bengal Government also shut down the internet in several districts of the state to prevent cheating in exams in March 2022.[82] The High Court in West Bengal stayed the government's order of suspension because it did not disclose the necessity for the shutdown.[83]

More recently, in Jodhpur, a district in Rajasthan, internet was suspended for an

undetermined period, violating the Supreme Court's order in which it said internet services could not be suspended for an undefined period.[84]

> *On shutting down the internet, the government's position of national security and public order continues to dominate the discourse. However, the losses in EoDDB include missed opportunities, jobs, livelihoods, access to health and education, and government services which need to be considered.[85]*

Suspension of internet and EoDDB do not go together. If India aims to boost the digital economy and provide a conducive business environment, it needs to recalibrate the frequent suspension of the internet that is being frequently done on the grounds of public order and national security.

Development of Data Centres

Digital businesses need to store data to enhance services, consumers' experience and minimise the cost of production. This requires data centres to host, process, analyse and access their data directly or indirectly. Digitally-enabled business enterprises, such as cloud service providers, fintech, health tech, and edtech would require comprehensive backend digital infrastructure in the form of data centres to cover users' demands. The convergence technologies and other factors offer a new set of economic avenues such as data centres. Quality, availability and accessibility of data centres are critical in promoting the digital business ecosystem.

Demand for data centres would grow exponentially in India due to the growing use of Information and Communication Technology (ICT)-enabled services. Particularly, the need for data centres is paramount in the context of the proposed data localisation mandates and Reserve Bank of India's (RBI) rules[86] that require data storage within national boundaries. Meeting the demand for data centres will be critical in facilitating the digital business ecosystem, but there are infrastructural challenges in setting up the data centres in India. There are 749 million active internet users in India[87], but the country has an abnormally low, 80 data centres[88], compared to Europe's 1978 data centres[89] for 372.43 million internet users.[90]

Further, the traditional data centres cannot support the increasing complexities of digital business such as cloud computing and social media.[91] Digital businesses require hyper-scale data centres that would ensure better access and analysis of large volumes of data which will add value to their supply chain and enhance customer experience by more significant levels of personalisation.[92]

In this context, it is important to talk about the challenges such as the absence of legislative backing in establishing data centres, uncertainty around data storage, clearly spelled out standards and hard infrastructures that include power supply, land for setting-up data centres in India, which might have a negative impact on doing digital businesses in India.

Constraints present here challenge setting up data centres. For instance, land and power, high speed and stable internet connectivity are necessary to establish the data centres, and such infrastructural requirements are not present in smaller cities. The average power supply required is between 15-100 MW and 3-12 acre land with high bandwidth to develop the data centres.[93] These requirements also mean that

developing data centres is a high capital investment task and needs governments' support to facilitate infrastructure and investment.

> *Riding on the increasing penetration of ICT-enabled services such as smartphones, social media, e-commerce and entertainment platforms, India aims to take advantage of data centres services due to the country's exponential growth of data creation and consumption. The Finance Minister, Nirmala Sitharaman, in her 2022 budget, extended the infrastructure status to data centres to avail credit and manage resources.[94]*

India's Data Centre Policy, 2020 states, "drive necessary regulatory, structural and procedural interventions for enabling ease of doing business in the sector, attracting investments and accelerating the existing pace of Data Centre growth in the country."[95] Different state governments also propose their own data centre policies to attract investment. For instance, the Telangana government in 2016 published a document that aimed to attract investments in data centres, and the Tamil Nadu government also published a similar data centre policy.[96]

Along with the infrastructural challenges, Data Centre Policy, 2020 aims to simplify the complex clearance policy for setting up data centres in India, but no clear mechanism has been laid down in the draft.[97] The draft policy states that Data Centre Economic Zones (DCEZ) will be set up to promote data centres in India. However, India's experience rolling out similar schemes has not brought intended success. For instance, Special Economic Zones (SEZ)[98] and Mega Food Park[99] suffer from multiple challenges such as unpredictable taxation and limited incentives to expand, need to be taken into account.

In addition to these, Data Centre Policy 2020 does not talk about issues related to cybersecurity which are essential to ensuring sustainable growth of data centres in India. Cyberthreats will continue to hunt business, consumers, and government without establishing safe and secure data centres, and India has already been performing poorly in risks related to cyber security. Building desired data centres for business and end consumers will be critical to ensuring a safe, transparent, and sustainable ecosystem for digital business.

Implication of Soft Digital Infrastructure on EoDDB

Access to hard digital infrastructure – uninterrupted and faster internet connectivity, smartphone, laptop/computer and data centres – cannot be seen in isolation from soft digital infrastructures that comprise digital literacy, culture and language. Empowering the underserved population and facilitating digital business involves the availability of digital connectivity and affordability, positionality that can allow them access to a wide range of potential that technological development offers.

Access to the hard digital infrastructure requires understanding what digitalisation means in its widest possible sense and imagining alternatives to the traditional digital business approach and participation in commercial activities. This section will unfold the issues related to digital literacy, language and cultural barriers in EoDDB.

The section will also unpack India's public digital infrastructure, including India Stack, Digital Payment Infrastructure, Open Network for Digital Commerce, and National Open Digital Ecosystem. Public digital infrastructure is an attempt to democratise the access of technology that can be reprogrammed for small businesses, start-ups and budding entrepreneurs to utilise.[100]

A digital ID card has lowered the cost of confirming an individual's identity, and open access software standards facilitate digital payments between banks, fintech firms and digital wallets. All these initiatives have provided better mechanisms for doing digital businesses in India. However, there are multiple challenges related to open digital technologies. Along with these, issues related to cybersecurity will be discussed as safe and secure cyberspace has a positive association with EoDDB.

Digital Literacy, Language and Culture

Digital literacy is defined as the ability of individuals and communities to understand and use digital technologies for meaningful actions within life situations, including operating a computer, laptop, tablet and smartphone.[101] If at least one person within a household can operate the devices, the household is considered digitally literate.[102] Only 38 percent of the households in India are digitally literate, whereas about 61 percent of households in urban and only 25 percent of households in rural are digitally literate.

Online commercial activities in India have gained significant momentum in the recent past, but consumers have not put total confidence in the digital ecosystem.[103] Along with meaningful access to digital infrastructure, digital literacy is critical in establishing confidence among stakeholders.

The lack of digital literacy in Indian households is a barrier for digital businesses to penetrate rural and urban households.[104] This highlights that, digital businesses are yet to fully realise the market potential of increasing digital adoption in India. In EoDDB terms, access to digital connectivity brings together businesses and consumers through digital connectivity and applications but it cannot be separated from their required skill and knowledge.

The GoI initiated the National Digital Literacy Mission (NDLM), Digital Saksharta Abhiyan and Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) with the vision to empower at least one person per household with digital literacy skills by 2020 to integrate the people in the digital ecosystem. Subsequently improving EoDDB. NDLM is an attempt to complement the Digital India mission to transform each household into digitally literate.

However, the programme fell short on multiple fronts due to lacking funds, resulting in poor implementation and execution.[105] INR 2,350 crore was required for 2017-19, only INR 536 crore has been allotted to the scheme.[106] Additionally, GoI used a method that was expensive and flawed, training people through computers that require high investment infrastructure and broadband internet connectivity, while largely Indian people have been using internet through smartphones.[107]

Overcoming these inequalities is critical for EoDDB and requires an equal emphasis on digital infrastructures and skills development. Limited digital literacy in rural areas impacts the EoDDB, as MSMEs find it challenging to attract skilful individuals who can instrumentalise the

digital ecosystem to drive economic growth. A large pool of skilful and digitally literate individuals is concentrated in urban pockets due to better educational opportunities and thus have higher chances of getting employment. These factors also negatively impact the ecosystem of digital business in rural areas.

> *Like digital literacy, cultural and linguistic barriers also affect the ability of the people to access and avail products of digital businesses. Limited access to different regional languages and dialects on the internet hinders digital business growth as consumers are wary in case of a dispute. Online commercial platforms provide the redressal mechanism. The process such as bots and emails are often not easy to navigate.*

For instance, most businesses and consumers prefer to operate and interact with their consumers in their regional languages. A Common-Sense Advisory Survey with 8709 online consumers in the Business to Consumers (B2C) segment in 29 countries reported that 75 percent of respondents preferred to do online transactions if the information was in their native language.[108] About 60 percent confirmed that they rarely or never bought from an English-only website because they cannot read.[109] The 956 business-to-business (B2B) survey shows a similar sentiment toward doing business in their native language.[110]

Whether B2B or B2C, consumers prefer to do online transactions in their native language.[111] This reflects the importance of language in enabling digital commercial activities. In India, leading e-commerce companies like Amazon and Flipkart have invested and expanded the subsequent 100 million users by providing text and voice-based consumer support in regional languages.[112]

However, it would be difficult for smaller businesses to provide multilingual content due to limited resources and capacities. Compared to conventional offline consumers, increasing digital technologies and associated risks related to quality and online financial fraud have also emerged. Generating awareness is critical to harnessing maximum potential digital business. EoDDB demands more digital interactions between consumer and business platforms and creating the infrastructure and an environment – literacy, culture and trust – that is conducive to commercial activities is critical.

Increasing Cases of Cybercrime

With increasing adoption of digital technologies but associated lack of understanding about the importance of cyber security, businesses and consumers are increasingly falling prey to cybercrimes. Cybercrimes are an emerging and increasing concern for businesses and people vis-a-vis disruption of services, privacy and security concerns, including data breaches, ransom attacks, and loss of commercial reputation, negatively impacting the digital business ecosystem.

Cyber-attacks in India were reported to have increased by about 300 percent in 2020 compared to the previous year, which had cost Small and Medium Businesses (SMB) in India more than Rs 3.5 crore.[113] According to a survey, 52 percent of people do not know how to protect themselves from cybercrime, and even more, 68 percent say it is difficult for them to determine the credibility of their information. In a period of just 12 months, over 27 million

Indian adults experienced identity theft. More importantly, three out of four MSMEs in India witnessed a cyber-attack in 2020. It is critical to note that the cost of a cyberattack is not just material.[114] The loss is colossal in reputation, loss of consumers and damage to profit margins. Globally, the cost of cybercrimes is high and rising as well.[115]

Since India is the second-largest online market globally with over 749 million internet users and aims to instrumentalise the user's database to boost the digital economy by enhancing EoDDB, safe cyberspace will be critical for the intended aim.[116] Cybercrimes in India have implications for commercial activities across the globe because of the sheer size and volume. Many data files and online activity important to the world are being generated and consumed in India, so the rising crimes here and its ability to tackle growing cybercrimes concern EoDDB.[117]

> *MSMEs are more prone to cybercrimes due to a lack of awareness and/or knowledge, lack of skilled personnel, and limited capacity to invest resources in building capabilities that will protect them. For instance, MSMEs do not always know if they have been attacked or breached.[118]*

Similarly, business owners may not know how much and what type of data has been leaked.[119] Additionally, MSMEs may also hesitate to report cyberattacks to law enforcement agencies as these businesses fear a loss of reputation by exposing their vulnerabilities.[120]

Minister of State for Electronics and Information and Technology (IT) Rajeev Chandrasekhar said, "the government is committed to ensuring that the internet in India is open, safe, trusted and accountable for all users".[121]

Currently, the response to cyber security threats can be taken under the Information Technology Act, such as hacking, denial-of-service attacks, phishing, malware attacks, identity fraud and electronic theft, and the Indian Penal Code punishes criminal offences in cyberspace defamation, cheating, criminal intimation and obscenity.[122]

In accordance with IT laws, the Indian Computer Emergency Response Team (CERT-In) was created in 2004 to take care of incident response, and the National Critical Information Infrastructure Protection Centre (NCIIPC) was created in 2008 to look after critical infrastructure from the threat of cybersecurity.[123] Recently, GoI mandated that Indian companies report any cybercrime within six hours under CERT-in.[124]

Additionally, The Indian Computer Emergency Response Team and Manner of Performing Functions and Duties Rules 2013 (CERT Rules) has been established as the nodal agency responsible for collecting, analysing, and disseminating information on cyber incidents and taking emergency measures to contain such incidents. India also enforces Companies Management and Administration Rules 2014 (CAM Rules) framed under the Companies Act 2013, which mandates companies to ensure that electronic records and security systems are secure from unauthorised access and tampering.

CERT-in demands real-time data from service providers such as intermediaries and data centres in India. However, there are multiple layers in cyber fraud and/or cybercrimes and disclosing information within

six hours and without any oversight, access to the data in nearly real-time might be tricky and raises the question of surveillance.[125] These mandates will negatively impact EoDDB, as NordVPN, a leading VPN provider, may pull out of India due to proposed changes in CERT-in, which mandates storing users' data for five years.[126]

Along with flawed implementation, these mechanisms cannot adequately address the dynamic nature of cybercrime due to the lack of coordinated approach.[127] There is no uniform cybersecurity architecture that unifies the efforts of all these agencies to be able to assess the nature of the threat and tackle them effectively.[128] Lack of inter-agency coordination and unclear demarcation of roles and responsibilities weaken the efficiency and effectiveness of cybersecurity.[129] To this end, the government is expected to introduce a national cyber security strategy to provide guidelines and build capacities in tackling emerging cyber threats. Still, the process needs to be accelerated as effective cybersecurity mechanisms positively impact the digital business environment.[130]

Public Digital Infrastructure – India Stack

India Stack is a project of creating a unified software platform that will facilitate India's digital business ecosystem. "India Stack is a set of Application Programming Interfaces (APIs) that allows governments, businesses, start-ups and developers to utilise a unique digital Infrastructure to solve India's hard problems towards presence-less, paperless, and cashless service delivery".[131]

The stack consists of four layers of infrastructure and standards: (i) digital identity, which features the Aadhaar digital ID system

that allows for identity verification and the mapping of information across datasets; (ii) an interoperable payments interface which is Unified Payment Interface (UPI); (iii) digitalisation of documentation and verification which can be instrumental in the verification of digital documents that can replace traditional paper analogs; and (iv) a consent layer that will involve the operation of data fiduciaries that act as intermediaries between individuals and financial companies.[132]

Pillars of India Stack have been introduced gradually in the last decade in India, except for the consent layer. The first two, Aadhaar and UPI will be discussed in the next section of this paper. In this section, the consent layer is discussed.

Consent layers have not been fully developed and operationalised in India but probably it would be based on MIT Media Lab's Open Personal Data Store (OpenPDS) system, allowing users to collect, store, and give fine-grained access to their data while protecting their privacy.[133] It enables the user to view and reason about the data collected. The user would own secured space, PDS acting as a centralised location where their data resides.[134]

The user can then control the data flow and manage fine-grained authorisations for accessing his data. The individual data ownership model would fundamentally impact the digital business ecosystem from a business standpoint. The business would have to largely reprogram its digital architecture based on the individual's data.

Digital business would be dictated by the users' justification of services and data, and services can be rated and evaluated, accordingly. Interestingly, India Stack can revoke the access of the data from any business

platforms if the concerned person expresses their withdrawal.

> *Currently, data is being collected and stored by hundreds of different goods and service providers. Data, particularly, metadata is yet to realise its full potential due to fragmentation that makes the data inaccessible to innovative services and often even to the individual who generated it in the first place. Additionally, the lack of access and control over the data is fuelling growing concerns about associated risks. The data ownership model enabled by OpenPDS can potentially foster alternatives to the current data-selling and advertising-based business model.*

India Stack potentially aims to unlock the economic values of the data that includes digital business opportunities to provide hardware for data collection, storage for metadata, or algorithms for better-using metadata by keeping software for data collection and data management open-source.

Subsequently, removing the barriers to entry for new businesses allows the most innovative algorithmic companies to provide better data-powered services. This will facilitate EoDDB for new entrants.

However, the technologies used in the OpenPDS are complex and would not be easily available in India.[135] Moreover, there is still a lack of clarity on how this would be operationalised, limiting the understanding around it.

Online Payment Infrastructure

New-age digital payment modes, such as UPI, Aadhaar-Enabled Payment System (AePS) and Bharat Bill Payment System (BBPS) are crucial to India's cashless economy.[136] Riding on Open Banking such as UPI, launched by the National Payment Corporation of India (NCPI), digital payment infrastructure has seen an exponential boom in India.[137]

This has allowed fintech platforms to innovate and create a strong foundation for digitalisation and cross-selling other financial products and services such as GooglePay, PhonePe and BharatPe. Interoperability enabled by public sector API has been critical in the wide acceptance of application-based online financial transactions as well as it has generated competition among the fintech players.[138]

Cheap internet data, increasing penetration of smartphones and India's biometric identity card provided the fertile ground for digital payment in India.[139] India's biometric identity Aadhaar – built on a unique 12-digit identification number for each Indian resident – has become a critical component in boosting digital payments.[140]

Aadhaar has been India's most ambitious public digital infrastructure project to provide a single identity card to Indian people. It allows seamless integration of cash transfer between consumer-to-consumer and consumer-to-merchant through mobile applications. It does so by bringing e-KYC (Know Your Customer), turning an Aadhaar number into financial address, e-signature and UPI.[141]

While using UPI does not require an Aadhaar ID, Aadhaar has facilitated e-KYC compliance for opening bank accounts needed to access the UPI system.[142] Further, Aadhaar has enabled the digital ecosystem involving several APIs.

These APIs allow public and private service providers to authenticate identity using the data biometrics, demographics, and links to individual phones registered with Aadhaar to facilitate authentication using a One Time Password (OTP).

The Reserve Bank of India (RBI) has also started Payments Infrastructure Development Fund (PIDF). The fund will be spent to subsidise deployment of Points of Sale (PoS) infrastructure (both physical and digital modes) in tier-3 to tier-6 centres and north-eastern states.[143]

In 2020, India was among the top countries globally, with 25.5 billion online financial transactions.[144] Although there are challenges relating to dispute resolution that fintech platforms are facing, it demands attention to enhance EoDDB. Most fintech players approach dispute management through phone calls or digital channels like WhatsApp and Email.

Determining the root cause behind any dispute is time-consuming and complex. Online financial transactions involve multiple players: a bank that accepts the transaction; a network such as Visa, Master, Rupay; and the bank where consumers hold their account. These complexities have been a bottleneck in facilitating digital business, leading to a pile-up of credit reversal failures.[145]

Other concerns related to privacy and security continue to be a challenge for fintech platforms.[146] In digital payments architecture, vulnerabilities related to privacy are at many layers, including poor technical mechanisms and unethical data collection practices. For example, the front end is a biometric capture device in a digitally enabled payment system. The backend comprises consumer Aadhaar data linked to the bank account and in between these two, data transmission systems function.[147] The authentication is done through passwords. However, data breaches in the digital payment ecosystem, unethical data collection have not been uncommon. One of the major fintech platforms has repeatedly faced massive data breaches that diminish users' confidence in the digital payment ecosystem.[148]

The absence of data protection mandates also reduces confidence in the digital ecosystem. In addition to this, digital payment also excludes people living at the socio-economic margins. The success of a cashless economy will heavily rely on how much it will enhance inclusiveness and secureness in online financial transactions. This will lead to a better ecosystem for doing digital payment business in the country.

National Open Digital Ecosystem

India is deliberating the implementation of another open public digital infrastructure – the National Open Digital Ecosystem (NODE). The Ministry of Electronics and Information and Technology released a white paper in 2020 and laid down the broader principle of the NODE.[149]

The white paper states that NODE will consist of a three-layer mechanism: a delivery platform which is the technological aspect; a governance framework that will anchor the technological component; and a community that will develop and new on top of it to deliver shared values. The open digital ecosystem aims to encourage competition by breaking the entry barriers and spur innovation and investments, thus facilitating a business-friendly digital environment.

Delivery platforms, consisting of entrepreneurs, business and public agencies, will facilitate the delivery of services and solutions to the end-users. This will be modular/reusable, scalable and interoperable to unlock maximum benefits. Moreover, it can be flexibly integrated with other applications through open APIs, e.g. Aadhaar authentication, e-KYC. Personal and community information/ records, will be provided by 'single source of truth' e.g. financial data, identification data, civil registries, land registries, and Exchanges which facilitate flow of data being generated by governments, businesses and individuals, e.g. Indian Urban Data Exchange (IUDX), Account Aggregators.

The governing framework for NODE would consist of multiple stakeholders such as institutions that own the delivery platform, builders who develop solutions on it, and end-users who consume services and/or participate in designing solutions. Since openness in data sharing increases the vulnerabilities of the associated risk of misuse and manipulation of the data, NODE would have a strong governance mechanism to ensure fair value sharing while keeping stakeholder behaviours in check, with both preventive and corrective measures.[150] A vibrant community of partners will drive NODE to unlock its values. The community consists of government, foundations, think tanks, businesses and entrepreneurs who will transact and collaborate via the NODE to create new user-centric solutions.[151]

NODE will enable business communities and entrepreneurs to innovate and ideate new technology-centric solutions, subsequently providing an alternative vision of digital ecosystems to the dominant big tech-controlled digital ecosystems. It will be critical in supporting budding entrepreneurs and smaller businesses as they can ideate and build innovative ways of doing digital businesses. However, this is just one of the potentials of the NODE, but to achieve the stated objective, it needs careful implementation.[152]

NODE, an open digital ecosystem, will potentially break the wall of the current platform-centric model where everyone has to use the same platform/application to enable transactions between them — subsequently promoting interoperability and EoDDB, particularly for smaller players.[153]

India has experience developing an open digital ecosystem and it must use its experience to enhance the inclusivity of small businesses, start-ups and budding entrepreneurs. If it is not designed and incorporated while developing the NODE, it might lead to monopolisation and concentration of resources among a few hands. The top-down approach in developing these ecosystems that aim to democratise public digital infrastructure access might be counterproductive.[154]

There is a lesson to learn from past experience. For instance, under the 'Bulk Data Sharing Policy' the GoI intended to monetise the database of vehicle registration certificates, citing benefits to the 'transport and automobile industry'. The government reserved Rs 3 crore for accessing the data, which would have become an entry barrier for small businesses.[155] In the context of NODE, the government needs to be careful about entry points that are critical in fostering innovation and fairer digital business.

The white paper also raises some concerns about objective and scope of NODE, including integration with existing architecture, policies and regulations. The scope is broad as it

assumes, throughout the paper, that operationalisation of NODE will improve the overall functioning of the sector. The broader objective and scope of the NODE also raise concerns about the harm such as functioning creep, surveillance and other data-related risks as the white paper does not clearly spell out the stakeholders within the NODE.

There is almost no clarity on who can access the NODE and its purpose. In addition to this, the white paper paid limited attention to harmonisation of existing public digital infrastructure, policies and regulations. It mentions initiatives such as National Digital Health Blueprint (NDHB), National Urban Information System (NUIS), Digital Infrastructure for Knowledge Sharing (DIKSHA), and India Enterprise Architecture (IndEA). However, how these initiatives that require different ministerial coordination, will be integrated or built off these initiatives when implemented remains to be seen. If they are not seamlessly integrated might create friction, negatively affecting the EoDDB.

Open Network for Digital Commerce

The Department for Promotion of Industry and Internal Trade (DPIIT) went live with its Open Network for Digital Commerce (ONDC) project on a limited scale.[156] The ONDC aims to democratise the digital commerce ecosystem by shifting from platform-centric models to an open network.[157] This would enable small businesses to access processes and technologies largely deployed by large e-commerce platforms such as Amazon and Flipkart.

Operationalisation of ONDC that includes onboarding of sellers, vendor discovery, price discovery and product cataloguing could be made open source on the lines of the UPI. ONDC will work on two ends — the seller and the buyer sides.[158]

On the seller side, players such as *GoFrugal*, an enterprise resource planning company, and *Digiit*, a digital business platform, are engaged. While on the buyer side, the interface is being built on *Paytm* and will be expanded when the ONDC is rolled out to its full potential.[159]

ONDC will help enhance the visibility of the service delivery platforms and/or sellers that help MSMEs reach out to a greater consumer base with limited resources. This will be done through operational mechanisms of ONDC that will facilitate interoperability and buyers and sellers can transact no matter what platform/application they use. ONDC is intended to ensure that sellers and buyers do not need to be on the same platform, as has been done in the fintech ecosystem.

Lack of interoperability brings multiple problems for digital business, such as portability of trust. E-commerce allows businesses as well as consumers to build a reputation through the transaction enabled by the platforms, which has a critical value in doing business in recent times. However, if a business is keen to port to another platform in a platform-centric model, they lose all the hard-earned reputation and trust. They have to start the business from scratch again even though the data and reputation belong to them. The lack of portability among e-commerce platforms disincentives the business as they can neither transpose nor migrate. The loss is significant mainly for smaller businesses as they have limited capacity to repeatedly build their reputation.

Additionally, if anyone hopes to do business on multiple platforms, they must maintain separate processes, which adds the financial burden on the platform as each e-commerce platform has its terms and conditions. This constrains participation in the digital business ecosystem. The ONDC intends to go beyond the B2C and cover any digital commerce domains, including wholesale, mobility, food delivery, logistics, travel and urban services. The open network, ONDC is being developed, will have multiple effects on businesses, consumers, application developers, governments, and other relevant participants by enabling an interoperable and open playground for various sections to function and compete.

ONDC aims to unlock innovation and scale within digital commerce by democratising the ecosystem. Unlocking will also open up new digital business opportunities for budding entrepreneurs to ideate and innovate in multiple areas such as logistics and warehousing and provide specialised services to buyers and sellers as ONDC will be accessible in multiple languages and dialects. However, like UPI, ONDC has some challenges, such as financial fraud, security risk, and duplication of products. The strategic paper on ONDC does not have enough privacy and security safeguards information which demands attention.[160]

Recommendations

Access to Meaningful Connectivity

Digital divide in India is stark and demands urgent attention. From a digital business standpoint, stable and faster connectivity is critical as it has layers of direct and indirect impacts, as demonstrated above. Empowering the underserved population involves the availability of internet connectivity, affordability

and positionality that can allow them access to a wide range of potential digital business opportunities. To this end, India needs to close two gaps in accessing the digital connectivity: firstly, those living in dark telecom settings and cannot access the internet; and secondly, those who have access to the internet but their socio-economic situation deprives them of this access.

The policymakers need to focus on specific assessment standards for different user groups, based on which assessment can be made of the type of digital skills required for them. It will help in creating tailored mechanism programmes accordingly. India needs to reprogram its approach to fill the gaps in accessing digital connectivity, such as redesigning broadband policy where particular attention on geographical locations is given, crafting effective public-private partnerships, and promoting infrastructure sharing models that will lessen the financial burden of internet operators, subsequently increasing the integration of digital businesses.

Recalibrate Internet Shutdown

India needs to learn from developed nations on how they are minimising the internet shutdown to avoid disruption in doing digital businesses.[161] Canada declared access to the internet as an essential component in participating in economic activities and quality of life.[162] The German court ruled that the internet is an essential part of life and customers have the right to compensation if the service is interrupted.[163] Finland declared access to the internet a legal right.[164]

If India aims to enhance the digital business ecosystem, access to the uninterrupted access to internet needs to be seen in a framework of essentiality. Evidence suggests that cost of internet shutdowns is too high, particularly for

digitally mediated businesses. As the Supreme Court stated, India must recalibrate based on proportionality and necessity. Internet shutdown for an indefinite time hurts the prospects of digital businesses. Internet shutdown mechanisms need to be carefully deliberated and recalibrated to foster confidence among digital businesses, consumers and investors.

Enhancing Cybersecurity

Rise in the adoption of technology has opened a fault line in terms of cyber threat, crime and fraud. The breach in cybersecurity has seen an alarming rise in recent times in India and the cost is not just material, but it impacts the overall ecosystem of digital business activities. If India wants to attract investors and entrepreneurs and sustain the exponential growth of the digital economy, it must strengthen its cybersecurity.

Currently, India's approach is disparate and different actors are working in different directions that need an overhaul where coordinated and robust effort is made to strategise and tackle the cyberthreat. In addition to this, investment in developing safe and secure data storage and skilful individuals who can maintain the security of such ecosystems. Policymakers and the industry should engage more deeply with international cyber security practices, collaborate on improving cybersecurity mechanisms with like-minded countries and actively work on building more robust cybersecurity mechanisms for the country. Providing a digitally safe and secure environment is necessary for digital businesses to function effectively.

Public Digital Infrastructure

Open-source approaches to technologies in India have leaped and it can be instrumental in efficiently developing tailored solutions and opportunities for digital business. In developing open-source digital ecosystems such as UPI, ONDC, NODE, the process should be more participatory and include different stakeholders such as small and medium businesses, budding entrepreneurs, and civil society organisations to minimise unintended consequences such as exclusion, digital monopolisation and risk related to data. Transparent and consultative processes will help inequitable access to the public digital infrastructure with built-in philosophy to reduce entry barriers and frictions.

Public digital infrastructure can be designed to be interoperable and modular structures, on top of which reprogrammed interfaces and databases can operate using APIs. Anyone can reprogram these architectures according to their needs, which can only be done through participatory and consultative processes. The open digital infrastructure that envisions democratising the access of public digital infrastructure must avoid centralisation, which can lead to monopolisation of powers with limited accountability, which is critical for enabling innovation, competition, partnership and user-friendliness.

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