

1.1 Extra Mile for the Last Mile: Evolution of Digital Bharat Nidhi

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Abstract

This paper explores the dynamics of the digital divide and how public policy interventions are being redesigned to achieve Universal and Meaningful Connectivity (UMC) with a special focus on the policy of Digital Bharat Nidhi (DBN) as a case study. The paper starts with analysing the multidimensional aspects of digital divide and attempts a quantitative analysis to show the nature of digital divide as a moving target. It moves on to explore the structural aspects of the Indian telecom sector through competition metrics, pricing strategies, supply-demand characteristics, and the persistence of digital gaps. It attempts to establish the fact that digital divide is a dynamic phenomenon which is leading to a stark structural paradox of aggregate successes and granular gaps. With the background of market dynamics and evidence of digital divide, this paper delves into the study of DBN, erstwhile Universal Service Obligation Fund (USOF) by tracing its origins and policy evolutions since inception to manage the disruptions in this domain. To end, the case focuses on the new avatar of DBN, reformed through the New Telecommunications Act 2023, which expanded the mandate of USOF both horizontally and vertically, empowering it to go the extra mile to connect the last mile.

Keywords

Digital Divide, Underground Monitoring Committee (UMC); Digital Bharat Nidhi (DBN); Universal Service Obligation Fund (USOF); Herfindahl–Hirschman Index (HHI); Cournot Competition

Digital Divide-The Cracks in the Design as a New Poverty Line

In the contemporary socio-economic landscape, access to telecom services and reliable internet has become a universal basic service for every individual, as well as society for development. International Telecommunication Union (ITU), a United Nations (UN) agency dealing with global telecom/Information and Communications Technology (ICT), has come up with the concept of Universal Meaningful Connectivity (UMC) which is defined as “Ability for everyone to enjoy a safe, satisfying, enriching, productive, and affordable online experience, regardless of

location or demographic”. This framework of UMC can be seen as a gauge to measure the digital divide, which is gradually becoming the new Poverty line, creating a new marginalized section in society.

This subject of digital divide is getting interesting as the telecom market shifted from a fragmented multi-player to an oligopoly industry. Remarkably, even with this highly concentrated market structure, India has one of the lowest prices for mobile services. This gives rise to thoughtful policy and academic discourses, especially from the viewpoint of equity vis-a-vis efficiency. The data reveals that India has done exceptionally well in bringing the telecom revolution which laid the foundation for the digital ecosystem. However, the major challenge lies in the fact that digital divide is a moving target that needs constant catching up due to disruptive changes in emerging technologies.

Measuring the digital divide is no longer just about counting who has access to telecom services. To map the multi-layered fractures within the digital ecosystem, the divide must be separated into three progressive dimensions: the access gap, the usage gap, and the empowerment gap.

- **First Level-The Access Gap:** This represents the foundational level of the divide, defined by the physical availability of network infrastructure. It measures whether a region has quality mobile connectivity and a reliable backhaul like Optical Fiber Cable (OFC) backbone.
- **Second Level-The Usage Gap:** This dimension underlines the gap between network accessibility and user viability. The usage gap may persist due to the socio-economic factors such as low per-capita income, absence of devices, digital illiteracy and so on.
- **Third Level-The Empowerment Gap:** This level measures the qualitative outcomes rather than just the access and usage parameters. This is linked to the impact on socio-economic parameters due to telecom usage. It attempts to capture how efficiently the users could leverage telecom for education, business, self-development, wealth creation and so on.

As we explore the above gaps, the definition of digital divide is getting a transformative disruption with the onset of Artificial Intelligence (AI), wherein telecom is the core supply chain. The digital divide is going to get into complex dimensions of AI Divide.

Macro-level evaluations of the digital divide reveal that India's telecommunications trajectory represents a structural paradox of aggregate success and granular exclusion. At the national level within India, there are geographical imbalances between urban and rural populations, as well as distinct gender disparities, as quantified in Table 1 and Table 2.

Table 1

Telecom Subscriptions- Rural & Urban

Indicator	Rural	Urban
Total Tele -density Rate (%)	59.00%	135.00%
Wireless Tele-density (%)	59.00%	127.00%
Wireline Tele-density (%)	0.55%	8.00%
Total Internet Subscribers per 100 Population	47.00	115.00

Source: *Telecom Regulatory Authority of India (TRAI) Quarterly Performance Report September 2025.*

Table 2

Digital Literacy & Usage-Rural & Urban (Gender-wise)

Digital Literacy & Usage Indicator	Rural Male (%)	Rural Female (%)	Urban Male (%)	Urban Female (%)
Mobile Usage	89.50%	76.30%	95.00%	86.80%
Mobile Device Ownership	80.70%	48.40%	90.00%	71.80%
Internet Usage	72.10%	57.60%	85.50%	74.00%
Advanced Use : Sending Messages with File Attachments	67.20%	50.90%	79.10%	65.80%

Source: *National Sample Survey Office (NSSO) Comprehensive Mobile and Technology Survey (CMTS) 2025 dataset.*

Recognizing the gravity of digital divide, the judiciary has integrated digital inclusion into the framework of fundamental constitutional rights. In several landmark judgments (*Amar Jain v. Union of India*, *Anuradha Bhasin v. Union of India*), the Supreme Court of India interpreted digital access as a vital component of Article 14 (Right to Equality), Article 21 (Right to Life), and internet accessibility is protected under Article 19, functioning as an indispensable tool for modern liberty.

Consequently, the state has a constitutional mandate to actively dismantle the digital divide, ensuring that technological progress does not create new marginalized classes.

Issues and Challenges-Strong Pillars on Shaky Foundations

The persistence of the digital divide stems from an interaction of market failures, geographic and economic barriers, social factors, and rapid technological disruptions. It can be noted from the earlier section that at an aggregate level, the telecom expansion has been phenomenal with high telecom density, huge data consumption, rapid 4G/5G roll outs, and deepening digital ecosystem, which represent the strong pillars of telecom revolution in India. At the same time, there is persistent geographic as well as demographic disparities in the telecom indicators which expose the perils of last mile exclusions. In this context, diagnosis of these digital divide symptoms reveal that the microeconomic foundations are shaky due to a combination of structural market failures, competition & pricing dynamics, and supply-demand economics.

- **Quantitative Analysis of Market Structure and Concentration:** To evaluate the competitive landscape of India's telecommunications sector, the Herfindahl-Hirschman Index (HHI) is used. A score below 1500 indicates a highly competitive market structure, between 1500 and 2500 indicates moderately concentrated structure, and score beyond 2500 represents highly concentrated oligopolistic structure (U.S. Department of Justice & Federal Trade Commission, 2023). In case of India, the HHI is beyond 2,500 (for both cases, i.e. based on revenues as well as subscriber share), which shows that the telecom market in India is highly concentrated. The HHI indices calculated using the empirical datasets released by TRAI is detailed in Table 3 below.

Table 3

Empirical HHI Market Concentration Calculations for Indian Telecom Service Providers (TSPs)

Telecom Service Provider	Gross Revenue Share	Revenue Component HHI	Active Subscriber Share	Subscriber Component HHI
Reliance Jio	42.70%	1,823	41.10%	1,689

Bharti Airtel	38.30%	1,466	33.70%	1,136
Vodafone Idea (VIL)	15.00%	225	17.50%	306
BSNL	4.00%	16	7.70%	59
Aggregate Total	100.00%	3,530	100.00%	3,190
<i>Note: The HHI is calculated by squaring the individual percentage market share of every firm operating within the market and summing the resulting values.</i>				

Contributing to the Access Gap

In this scenario, the oligopolistic market behaves like duopolistic in reality, as two players have more than 80 percent market share. Such high market concentration creates a purely commercial ecosystem to target only the high dense and high Average Revenue Per User (ARPU) urban pockets, leaving out the rural and remote areas. This leads to the Access Gap, leaving rural tele-density merely at 59 percent compared to 135 percent in urban.

- **Game-Theoretic Pricing Models and Market Transitions:** Historically, the industry operated within a Bertrand competition model, where firms compete primarily on price rather than capacity. The Bertrand model assumes that if a service is homogeneous and consumers can transition easily between providers, firms face an economic incentive to undercut competitors. This process continues until pricing drops to match the industry's marginal cost (Tirole, 1988). However, empirical data from the 2020–2026 period confirms that the market is shifting from a Bertrand trap toward a capacity-led Cournot competition model. In a Cournot framework, firms compete on capacity allocations and infrastructure investments rather than pricing metrics alone (Nicholson & Snyder, 2012). These factors have fostered a sense of structural interdependence among the surviving operators.

Driver of Usage Gap

There is a transition of the telecom market from a high-competitive price wars scenario (where prices matched marginal cost increasing consumer surplus) to capacity-led interdependent price fixing through Cournot competition model.

- **Supply and Demand Characteristics:** The supply-side economics of

telecommunications networks are shaped by high Capex and continuous re-investments, along with low operational marginal costs. On the demand side, access to mobile networks generates wider positive externalities as telecom networks connect users to diverse economic, social, and government services. This dependence shifts the demand curve for basic telecom services into a highly inelastic zone. This blend of inelastic demand and high supply-side concentration creates a significant risk of market exploitation, requiring active policy interventions to protect consumer welfare in underserved regions.

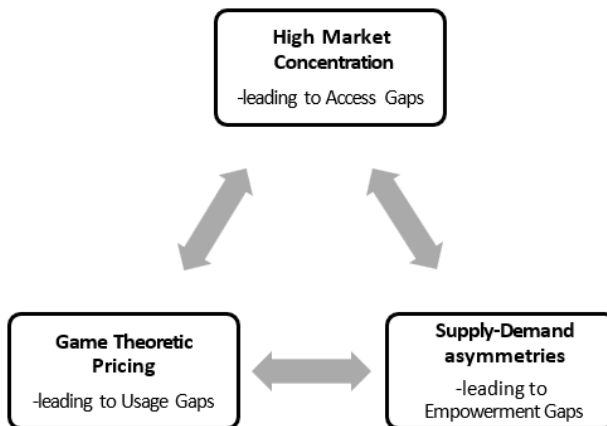
Widening the Empowerment Gap

The inelastic nature of the telecom demand combined with supply-side commercial economics of TSPs due to high market concentration and pricing strategies create a settle-with-minimum trap for marginalized sections. The market tends to provide high-speed telecom services and advanced digital tools to only the commercially viable areas. This deprives the unviable regions from accessibility to latest telecom technologies-widening the empowerment gap.

The above analysis shows that the telecom market suffers from a structural “triangular convergence” (see Figure 1)-market concentration, game theoretic pricing shifts and supply-demand asymmetries, which creates a “triangular gap”-access gap, usage gap and empowerment gap.

Figure 1

Triangular Convergence



In other words, the underlying market forces that govern the sector expose the cracks in the market-depicting that the strong pillars built by telecom revolution may have a shaky foundation which is showing up as symptoms of Digital Divide, mandating a targeted public policy response.

Digital Bharat Nidhi (DBN) as a Bridge for the Digital Divide-Its Evolution

As seen above, the digital divide is constantly changing, creating newer gaps and the same is accentuated with the structural level gaps created by market failures, technology disruptions and supply-demand dynamics. Thinking through the economics lens, this phenomenon is a classic case of efficiency vs equity conundrum. The first fundamental welfare theorem states that free markets lead to efficiency whereas the second fundamental welfare theorem states that if a specific efficient outcome is socially undesirable or inequitable, the state can achieve any desired pareto efficient outcome by redistributing initial resource endowments and allowing the market mechanism to operate freely (Varian, 2014). In the telecom industry, this second theorem provides the theoretical justification for the state to ensure universal service to achieve social equity without distorting underlying market efficiencies.

To address this, the Government of India established dedicated institutional funding mechanisms. The genesis of universal service obligation is from the new telecom policy of 1999, which contemplated on this subject and provided that a percentage of revenues from operators can be used as a source to create a dedicated 'Universal Access Levy' (UAL). This policy direction was given a statutory mandate through The Indian Telegraph (Amendment) Act, 2003 and this gave birth to the Universal Service Obligation Fund (USOF). The USOF was given the mandate of providing access to "Basic" telegraph services for remote and rural area in the country at affordable and reasonable prices. At the time of establishment of this fund, telecom services were considered as a normal market good, necessary but not essential. Therefore, the policy was restricted to providing only basic telecom service. However, as the times changed and telecom took a prominent place in communications ecosystem, the policy was lagging.

This led to the first wave of evolution in the USOF policy. Considering this catching up of digital divide, a need was felt to move beyond the basic telegraph. This prompted the amendment to the USOF provisions in the Indian Telegraph Act through an amendment in 2006. This amendment widened the scope to provide

access to mobile services, broadband connectivity and ICT infrastructure creation in rural and remote areas. In 2002, the DBN rule had only one stream of funding which was targeted towards Public Access. It was the era of community-based telecom infra projects such Village Panchayat Telephones (VPT) and the subsidized Public Call Office (PCO) which were hugely popular in the early 2000s.

Gradually, the services were shifting from a public model to a household landline phone. So, the USOF rule added a new stream. Every few years, USOF transformed itself dynamically by amending the rules to catch up with the evolving digital divide. Till 2023, the USOF had seen streams of funding, ranging from general infrastructure projects like Bharat Net OFC network, mobile tower projects, submarine OFC cable and even Research and Development (R&D) funding for innovations in this domain. The list of the streams under erstwhile USOF is as under:

- Stream-I: Public Access Service
- Stream-II: Household Telephones
- Stream-III: Mobile Services
- Stream-IV: Broadband Connectivity
- Stream-V: General Infrastructure
- Stream-VI: Induction of new technological developments
- Stream-VII: Research and Development

The above streams helped USOF bring in many projects to cover the uncovered and plug the digital divide in rural and remote areas. However, the major implementation strategy was roll-out of infrastructure and the funding model was restricted to net cost and cost-plus basis. Considering the dynamic and disruptive nature of the telecom ecosystem, there was need felt to have a more futuristic and diverse structure to the USOF.

In 2023, the Government of India took a transformative step by changing the entire game of USOF to include a broad-based and futuristic vision. This change was necessary to shift gears in the game of telecom connectivity, from being a catch-up with digital divide mode to set benchmarks in the digital empowerment. The vision was rooted in the vision of Viksit Bharat, where focus was not just about roll-out but to reach-out and empower, making telecom not just universal but meaningful. This led to the new avatar of USOF as DBN under the Telecommunications Act, 2023. The operative part of the Act states that,

DBN will exclusively use to meet any or all of the following objectives, namely:

- Support universal service through promoting access to and delivery of telecommunication services in underserved rural, remote and urban areas;
- Support research and development of telecommunication services, technologies, and product;
- Support pilot projects, consultancy assistance and advisory support towards provision of service under clause (a) of this section;
- Support introduction of telecommunication services, technologies, and products

As it can be seen from the expanded mandate above, the USOF activities in India have been widened as well as deepened to cover not just underserved rural areas but also underserved urban areas. Further, special focus is given to support R&D, pilot and new services, technologies and products, paving way for an Atmanirbhar Bharat and holistic telecom reach-out. The rules for implementing the objectives of DBN were notified in August 2024 which provides the implementation mechanism to achieve the mandate of DBN in India. To be more equitable, inclusive and meaningful, criteria were defined for taking up schemes and projects. Some noteworthy criteria are given below-

- Providing targeted access to telecommunication services for underserved groups of the society, such as, women, persons with disabilities and economically and socially weaker sections.
- To improve affordability of telecommunication services in underserved rural, remote and urban areas.
- Sharing of telecommunication networks established under DBN to promote sustainable and green technologies in telecommunications sector
- Flexible funding modalities: Flexibility is provided with regards to the funding modalities which may be determined on a case-to-case basis, including but not limited to full funding, partial funding, co-funding, market risk mitigation or risk capital.

As on date, the foundation being laid by DBN with its flagship projects like 4G mobile saturation and Bharat-Net, is expeditiously plugging the access gaps with sturdy mix of both wireless as well as wired saturation to all the villages in the country. The usage gap is being covered by subsidizing the last mile connectivity through its schemes such as Bharat Net Udyami, wherein a target to provide 1.5 crore

Fiber to the Home (FTTH) connections to rural households is set in next five years. Further, the combination of Capex and Opex support for five years in the mobile tower projects are creating a business viable situation for the telecom operators, marrying efficiency with equity. Apart from providing the telecom access to underserved areas, DBN has been contributing to nation security through its special mobile tower projects in left wing extremism areas, critical north-eastern region, border areas and connecting the strategic islands of Andaman & Nicobar and Lakshadweep with submarine OFC.

This case study of DBN showcases how the public policy can be evolved to match with the dynamic nature of the industry. Rather than just being a passive player with a reactive approach to plug the digital gaps, the new DBN policy provides a proactive approach to spearhead the universal and meaningful connectivity mandate in India.

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Author's Profile

Shri Sathish Kumar M C is Deputy Administrator, Digital Bharat Nidhi, Department of Telecommunications, Ministry of Communications. A civil engineer turned civil services officer from the Indian Posts and Telecommunications Accounts and Finance Service (IP&TAFS), he has over 11 years of experience in financial management, public policy, project management, and international standardization in the field of telecommunications. He also serves as the Vice Chair of an International Telecommunication Union (ITU) Study Group dealing with international telecom, ICT policy, and economic matters. Prior to joining the Civil Services, he spent five years in civil project execution at SAIL and three years in IT systems development at Infosys. He is currently associated with Digital Bharat Nidhi (erstwhile USOF), where he oversees the financial management of nationally significant initiatives such as BharatNet, 4G Saturation, and Submarine OFC projects, while also contributing to the digitalization of project funding and monitoring activities.