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Digital Public Infrastructure and the Road to Viksit Bharat @2047: Efficiency, Inclusion, and the Future of India's Social Sector Transformation

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Abstract

India's vision of Viksit Bharat 2047 positions Digital Public Infrastructure (DPI) as the foundational engine for inclusive social and economic development. This study examines how DPI—through components such as Aadhaar, UPI, JAM, ABDM, and digital education platforms—has transformed governance, accelerated social outcomes, and reduced poverty. Using secondary quantitative analysis of the SDG India Index (2023–24) alongside policy reviews and academic literature, the research finds strong correlations between DPI maturity and improvements in poverty reduction, financial inclusion, and service delivery efficiency. However, persistent structural inequalities—including rural–urban access gaps, gender disparities, biometric failures, and emerging algorithmic risks—limit the full realization of inclusive growth. The study highlights Digital ShramSetu as a critical next-generation policy shift aimed at empowering 490 million informal workers through AI, blockchain, and Verifiable Credentials. Policy recommendations emphasize resilience-by-design, multi-factor authentication, digital literacy expansion, and stronger data ethics governance. The findings collectively underscore that DPI has catalysed India's development trajectory, but future progress toward Viksit Bharat 2047 requires prioritizing equity, accessibility, and technological trustworthiness.

Keywords: Digital Public Infrastructure, Viksit Bharat 2047, Financial Inclusion, Digital Divide, Social Policy Transformation, Digital ShramSetu.

INTRODUCTION

Contextualizing Viksit Bharat 2047: The Developed Nation Mandate

The aspiration of Viksit Bharat (Developed India) by 2047 represents a comprehensive national mandate for achieving developed nation status by the centenary of India's independence. This vision is articulated not merely through economic growth projections but is fundamentally centered on the collective objective of a prosperous nation operating in harmony with nature, supported by modern infrastructure, and guaranteeing opportunities for all citizens (Ministry of Finance, 2024). The overarching development mantra that guides this strategic ambition is the inclusive principle of Sabka Saath, Sabka Vikas, Sabka Vishwas, underscored by the imperative of Sabka Prayas (collective effort).

Crucially, the official strategy identifies three interdependent pillars of substantive infrastructure development necessary for realizing this goal: Physical, Digital, and Social infrastructure. Within this framework, Digital Public Infrastructure (DPI) has been elevated to a foundational role. The utilization of DPI is considered paramount to achieving core social progress objectives outlined in the vision, including the elimination of poverty, ensuring farmer welfare, driving women's empowerment, enhancing healthcare access, and transforming the education sector. Consequently, the trajectory toward Viksit Bharat 2047 is inextricably linked to the success of India's ongoing digital transformation in the social sphere.

The Digital India Mission and the DPI Ecosystem

The launch of the Digital India initiative in 2015 established the governmental commitment to transforming India into a knowledge-based, digitally empowered society. This program is not a short-term project but a sustained strategic imperative, evidenced by significant investment, including INR 14,903 crore allocated between 2021 and 2026 to expand the digital framework. The Digital India mission rests on three primary pillars: creating robust digital infrastructure, ensuring universal accessibility to government services, and empowering citizens through digital literacy (World Economic Forum, 2023).

The core of this transformation is the DPI ecosystem, characterized by components like Aadhaar (identity), the Unified Payments Interface (UPI) (payments), and the Jan Dhan-Aadhaar-Mobile (JAM) Trinity (financial inclusion). These components function as scalable, resilient, and interoperable national assets. They are deliberately designed as "public goods," maintaining government oversight over critical infrastructure while enabling rapid innovation by the private sector. The design philosophy of DPI—leveraging public technology stacks for private innovation—has made India a global exemplar for developing nations pursuing digital inclusion.

Statement of the Problem

This research argues that the robust and scalable architecture of India's Digital Public Infrastructure has been a necessary, catalytic force in accelerating social sector progress, as evidenced by significant quantifiable gains in national development indices and demonstrable reductions in welfare leakage. However, the benefits accrued remain structurally uneven, requiring a crucial and deliberate policy pivot—represented by proposed missions like Digital ShramSetu—to mitigate persistent digital, gender, and socio-economic exclusion. This rectification is essential to transition the digital impact from solely protective welfare delivery to genuinely productive wealth generation, thereby fulfilling the mandate of universal and inclusive growth promised by Viksit Bharat 2047.

NEED FOR STUDY

Assessing the Transformative Character of India's Social Policy Paradigm

This study examines whether India's large-scale adoption of digital technologies has fundamentally reshaped its historically "minimalist" welfare model. The key question is whether DPI has moved India from a residual social policy regime toward a more transformative one. This requires assessing not only faster delivery of existing schemes (protective function) but also whether digital systems generate productive assets and new opportunities for the poor (productive function).

Large efficiency gains—such as digital payments contributing an estimated 1.5% to GDP (2017–23) (IMF, 2022) and Aadhaar reducing verification costs from $10–$20 to $0.27—must be meaningfully linked to improvements in human development outcomes to justify continued investment in DPI for 2047 (UIDAI, 2023).

The Inclusivity Paradox: Scale vs. Margin

Despite high-scale success, DPI introduces an "inclusivity paradox," where systems designed for efficiency can exclude vulnerable groups. High biometric authentication failures among the elderly and manual workers often lead to denial of essential entitlements, highlighting the need to evaluate not just outputs but the human impact of system errors (Singh & Bhatia, 2022). As AI-driven decision systems enter welfare delivery, risks of reinforcing historical biases related to caste or gender intensify. Ensuring constitutional commitments to equality requires strong oversight of data governance, cybersecurity, and accessibility—especially in remote regions—to maintain the legitimacy and long-term sustainability of the Viksit Bharat mission (Sharma, 2024).

OBJECTIVES AND METHODOLOGY

Objective This research investigates India's digital transformation in the social sector under the Viksit Bharat 2047 vision.

Quantitative Impact: Assess how Digital Public Infrastructure (DPI) maturity influences State/UT performance on the NITI Aayog SDG India Index 4.0 (2023–24), with a focus on poverty reduction (SDG 1).

Mechanism Analysis: Review the reach, efficiency gains, and limitations of key DPI elements—JAM trinity, ABDM, and digital education platforms (DIKSHA/SWAYAM)—across finance, health, and skilling.

Critical Assessment: Measure and interpret the extent of the digital divide (rural–urban, gender, and biometric exclusion) and its impact on inclusive growth.

Future Policy Evaluation: Evaluate proposed next-generation DPI initiatives, such as Digital ShramSetu, for their potential to formalize and empower India's informal workforce by 2047.\

Research Methodology:

Secondary Data Analysis and Policy Synthesis

This study uses a mixed-methods approach combining secondary quantitative analysis with a systematic review of national policy reports and academic literature.

Data Sources

Government Reports: Core data is drawn from NITI Aayog publications, including the SDG India Index 2023–24 and the AI for Inclusive Societal Development roadmap (Digital ShramSetu). Additional operational metrics (e.g., UMANG usage, connectivity indicators) are sourced from PIB and ministerial reports.

National Surveys: Demographic and digital access patterns are contextualized using established datasets such as NSS and NFHS (UNDP, 2023).

Academic & Institutional Studies: Research from the IMF and peer-reviewed journals supports analysis of DPI's macroeconomic impact, financial inclusion effects, and ethical concerns.

Analytical Framework: Causal Chain Analysis

The study applies a causal chain analysis to trace how DPI expansion (independent variable) contributes to changes in social outcomes such as SDG performance and poverty reduction (dependent variables). Mediating factors—technological scalability, digital literacy, and authentication robustness—are assessed to capture both system-wide gains and structural barriers that lead to exclusion.

DATA ANALYSIS AND DISCUSSION

Quantitative Evidence of Social Progress: The SDG Index and DPI Correlation

The pursuit of Viksit Bharat 2047 requires not just ambition, but measurable, sustained progress across socio-economic indicators. The NITI Aayog SDG India Index, which monitors the country's performance against the Sustainable Development Goals (SDGs), provides strong quantitative evidence of the accelerated development trajectory following the deep integration of DPI into social policy.

Correlation Between DPI Maturity and SDG Index Performance

The country's overall composite SDG score has shown a significant, continuous improvement over successive index editions. The score rose from a baseline of 57 in 2018 to 66 in 2020-21, reaching 71 in the latest 2023-24 assessment. This improvement of 14 points since the baseline indicates that systemic friction—the historical administrative barriers and leakages—has been substantially reduced, allowing government schemes to reach beneficiaries more efficiently (NITI Aayog, 2024).

Table 1: Evolution of India's Composite SDG Index Score (2018–2024)

Year/Index Edition	Composite Score	Improvement (from Baseline 2018)	Policy Context and Digital Correlate
2018 (Baseline)	57	N/A	Early DBT saturation, Pre-Aadhaar linkage scale-up
2020-21 (Index 3)	66	+9 Points	High DPI utilization (e.g., UPI, DBT), COVID-19 response via digital transfer
2023-24 (Index 4)	71	+14 Points	Viksit Bharat focus, Maturation of DPI; 32 States/UTs achieve Front Runner status

This upward trend is mirrored at the sub-national level, with 32 States and UTs achieving 'Front Runner' status (scores between 65 and 99) in the 2023-24 index, up from 22 in 2020-21. States like Assam, Manipur, Punjab, West Bengal, and Jammu and Kashmir recorded the most substantial positive change, each improving their score by 8 points since 202021.This nationwide acceleration is officially attributed to targeted government interventions—such as the Jan Dhan scheme, Ayushman Bharat-PMJAY, and Ujjwala—all of which rely heavily on the DPI for identification, disbursement, and verification. The evidence strongly suggests that the efficiency inherent in the DPI ecosystem functions as a necessary mechanism for translating policy intent into measurable development outcomes at scale.

DPI's Role in Poverty Alleviation (SDG 1)

The most compelling correlation between DPI maturity and social progress is observed in SDG Goal 1 (No Poverty). The index score for this goal improved by 12 points between the 2020-21 and 2023-24 editions, elevating the category from 'Performer' to 'Front Runner'. This quantitative improvement aligns with national data on poverty reduction, where multidimensional poverty nearly halved, decreasing from 24.8% (2015-16) to 14.96% (2019-21). It is estimated that approximately 24.8 crore people were lifted out of multidimensional poverty between 2013-14 and 2022-23.

This high correlation indicates that DPI performs a critical protective welfare function. By leveraging Aadhaar and the Direct Benefit Transfer (DBT) scheme, the government ensures timely and accurate disbursement of subsidies directly to the bank accounts of beneficiaries. This process, which creates a digital trail for every transaction, significantly reduces leakages, fraud, and duplication of benefits. The elimination of middlemen and corruption, in turn, ensures that intended resources reach the poorest households, providing financial resilience and security that directly contributes to the observed reduction in poverty (UIDAI, 2023). However, while the protective function has stabilized consumption, achieving the goal of total poverty eradication under Viksit Bharat 2047 will necessitate moving beyond protection to active wealth generation.

Sectoral Deep Dive: DPI Mechanisms and Social Outcomes

The success of DPI lies in its modular application across different social sectors. A detailed analysis reveals the operational mechanics, positive impacts, and concurrent challenges inherent in each major DPI component.

Table 2: Key Digital Public Infrastructure (DPI) Components and Social Impact

DPI Component	**Social Sector Application**	**Demonstrated Positive Impact/Metrics**	**Critical Challenge/Exclusion Metric**
Aadhaar/DBT	Welfare Transfer, Identity Authentication	Reduced subsidy leakages and fraud, Enhanced financial transparency (IMF, 2022)	High biometric failure rates (elderly, informal workers), leading to denial of critical services
UPI/Jan Dhan	Financial Inclusion, Economic Formalization	Monthly UPI transactions surpassed 10 Billion (late 2023); 1.5% GDP contribution (2017-2023)	Digital illiteracy (only 20% can operate computer/internet); Lower uptake by the poorest 40%
UMANG/DigiLocker	Unified E-Governance Access	Integration of 2,300+ government services in 23 languages; 82 million citizen users (as of 2025)	Last-mile connectivity issues in rural areas; Language/interface barriers [7]

ABDM	Interoperable Healthcare Delivery	Creation of a "single source of truth" via registries (ABHA, HFR); Improved clinical decision-making	Data security and privacy concerns; Gaps in digital health literacy and trust among users

Financial Inclusion and Economic Formalization (UPI/JAM)

The JAM trinity (Jan Dhan-Aadhaar-Mobile) serves as the backbone for financial inclusion. The integration of the bank account (Jan Dhan), the unique identity (Aadhaar), and mobile connectivity has significantly reduced the friction associated with accessing formal finance. The UPI payment layer, built upon this foundation, has achieved exponential growth, with monthly transactions surpassing 10 billion by late 2023 (Press Information Bureau, 2024).

The structural significance of UPI extends beyond transaction volume. It has markedly reduced India's dependency on cash, lowering associated systemic costs for the government and enhancing economic formalization. By providing a user-friendly and highly accessible platform, often with localized language options, UPI has successfully penetrated rural and underserved populations, enabling marginalized communities to access savings and credit facilities, thereby bolstering household incomes. This formalization process, aided by the DPI, is a key driver of GDP growth and economic resilience. The ability to integrate digital infrastructure with banking capacity, as analyzed in the context of the Jan Dhan accounts, is critical; the Jan Dhan scheme, in turn, relies on the technical capacity provided by Aadhaar and BC models to provide access to vulnerable populations (Riahi & Mathew, 2024).

Digital Health and Education Platforms

The transformative potential of DPI is also evident in social service delivery systems. The Ayushman Bharat Digital Mission (ABDM) aims to create a national digital health ecosystem, centered on the interoperable trinity of registries (ABHA, Health Professional Registry, Health Facility Registry) and gateways. By providing health providers with easy access to patient histories through paperless records, ABDM is projected to enhance clinical decision-making, improve treatment outcomes, and ultimately streamline healthcare delivery, which is essential for meeting the quality healthcare goals of Viksit Bharat. However, successful adoption hinges on addressing public concerns regarding the sensitivity of health data and ensuring trust in the data security protocols (Ministry of Health and Family Welfare, 2024).

In the education and skilling sector, platforms like DIKSHA (Digital Infrastructure for Knowledge Sharing) and FutureSkills Prime are leveraging DPI for human capital development. DIKSHA, the 'one nation; one digital platform' for school education, provides vast amounts of curriculum-linked e-content and has been instrumental in enhancing rural secondary school pass rates by 10-15% in certain states. Similarly, FutureSkills Prime, focused on next-generation professional skilling, has empowered over 2.2 million learners, including a significant 41.2% female enrollment, across 720 Tier 2 and Tier 3 cities. This scalable, targeted skilling effort demonstrates the capacity of digital platforms to foster inclusive growth by improving employability in non-metro regions (NCERT, 2023).

Critical Discussion: The Imperative of Inclusion and Resilience

Despite the impressive aggregate metrics, a critical examination reveals that the benefits of the digital transformation are not uniformly distributed, posing a significant threat to the inclusive mandate of Viksit Bharat 2047. Structural barriers translate system-level efficiency into last-mile exclusion.

The Magnitude of the Structural Digital Divide

The digital divide in India remains substantial, challenging the notion of universal opportunity. Empirical data highlights a significant access disparity: only 31% of the rural population uses the internet compared to 67% of the urban population. This chasm is compounded by inadequate infrastructure, with thousands of villages still lacking mobile and internet connectivity, and many BharatNet Wi-Fi hotspots remaining underutilized or non-functional (MeitY, 2023).

Furthermore, India faces one of the Asia-Pacific region's worst gender-based digital divides, with a wide gap of 40.4% in internet usage between men and women. This gender gap means that systems reliant on digital access inherently disadvantage female citizens, particularly women in the informal sector, limiting their access to information, market linkages, and, most critically, welfare entitlements (UNDP, 2023).

Table 3: India's Digital Divide and Structural Inequality Gaps

Indicator of Gap	**Metric/Observation**	**Disadvantaged Group**	**Consequence for Viksit Bharat 2047**
Rural Connectivity	31% Rural Internet Usage vs. 67% Urban Usage	Rural populations, Remote Cities	Hinders adoption of e-governance and skilling platforms (DIKSHA/SWAYAM)
Gender Gap	40.4% gap in internet usage (worst in Asia-Pacific)	Women, especially in the informal sector	Leads to high welfare exclusion (36% biometric failure during hospital visits) (Singh & Bhatia, 2022)
Functional Exclusion	Biometric failures increasing due to worn hands, fading ridges	Elderly, construction/daily-wage workers	Denial of basic entitlements (ration, pension, wages) ; threatens 'Zero Poverty' goal
Cognitive Barrier	Only 20% can operate a computer or use the internet	Low-literacy groups, rural populations	Digital services remain inaccessible; requires exponential investment in digital literacy

Biometric Failure and Administrative Trauma

Functional exclusion presents a critical vulnerability in the DPI architecture. The reliance on Aadhaar biometrics for verification often fails vulnerable citizens, leading to administrative trauma. Failures are widespread and affect specific demographics disproportionately: elderly individuals often experience fingerprint mismatches due to fading ridges, while daily-wage laborers whose hands are worn by construction, cement, or chemical exposure frequently face rejections. One study reported that 36% of migrant women workers faced biometric authentication failures during crucial pregnancy-related hospital visits.

When Aadhaar authentication fails, people are denied access to essential services, including ration through the Public Distribution System (PDS), pensions, LPG subsidies, and NREGA wages. This is not a trivial technical glitch; for many Indians, it represents the difference between eating or going hungry. The high rate of failure, acknowledged even by the Public Accounts Committee, indicates a structural design flaw: over-reliance on a single, sensitive mode of authentication that does not account for the physical realities of the large informal workforce. This creates a powerful, technology-based barrier to accessing state benefits, undermining the goal of achieving zero poverty.

Algorithmic Bias and Data Ethics

As India integrates AI into governance and welfare (as proposed by NITI Aayog), the risk of algorithmic bias looms large. Technology is not value-neutral; it often embodies the sociopolitical moments and historical data from which it learns. In a society with deeply entrenched historical inequalities based on caste, gender, and economic status, AI systems learning from biased historical data can systematically disadvantage marginalized communities.

Examples from other contexts, such as AI hiring tools downgrading female applicants or generative AI generating biased letters of recommendation , illustrate the real threat of technology amplifying existing injustices. The proliferation of digital platforms, while necessary, intensifies concerns over data privacy and cybersecurity. For the DPI model to remain resilient and trustworthy, the government must enforce its principle of maintaining security and cyber hygiene as public goods, ensuring user understanding of basic security practices and preventing purely commercial logic from compromising critical national assets (Sharma, 2024).

RESULTS AND FINDINGS

A synthesis of SDG data, DPI performance indicators, and exclusion evidence yields four major findings on India's digital transition toward Viksit Bharat 2047.

DPI as a Macro-level Efficiency Catalyst

DPI has significantly lowered the cost of governance and enabled formalization. Aadhaar-based verification cuts transaction costs to $0.27, and UPI-driven digital payments contributed an estimated 1.5% to GDP (2017–23). The results confirm DPI's central role in India's long-term development strategy (UIDAI, 2023).

Digital Platforms Accelerate Social Development

DPI correlates strongly with improved SDG outcomes, reflected in a 14-point rise in India's SDG score since 2018, including a 12-point gain in SDG 1 (Poverty). Digital welfare delivery via DBT has supported the exit of nearly 25 crore people from multidimensional poverty, while ABDM and digital education

platforms show measurable improvements in access and service quality across Tier 2–3 regions (NITI Aayog, 2024).

Efficiency Gains Are Offset by Persistent Inequities

Despite aggregate progress, major digital divides remain. Rural–urban internet use (31% vs. 67%) and a 40.4% gender gap create systematic exclusion. Biometric authentication failures disproportionately affect vulnerable groups such as the elderly and manual workers, leading to denied entitlements. Addressing these margin-level failures is essential for inclusive digital governance.

Digital ShramSetu Marks a Strategic Shift to the Informal Sector

NITI Aayog's Digital ShramSetu represents a pivotal move toward empowering 490 million informal workers. Using AI, blockchain, and Verifiable Credentials, the mission aims to shift from protective welfare to productive asset-building. Features such as digital work credentials, automated smart-contract payments, and credit-linked trust layers could raise average informal-sector incomes from ~$1,800 to ~$14,500 by 2047, advancing India toward a high-income economy (NITI Aayog, 2025).

CONCLUSION AND POLICY RECOMMENDATIONS

. Conclusion: The Digital Trajectory Towards Viksit Bharat 2047

The Digital India initiative has successfully laid the essential foundation for the Viksit Bharat 2047 goal, establishing a robust Digital Public Infrastructure that is globally recognized for its efficiency and scale. The DPI has served as a powerful engine for poverty reduction, accelerating social sector outcomes far beyond previous administrative capacities. However, the transformation faces an inflection point: the persistent digital divide, high rates of functional exclusion, and inherent risks of algorithmic bias threaten to marginalize the very citizens the vision intends to empower. The realization of Viksit Bharat—a prosperous nation with opportunities for all—will depend entirely on the successful implementation of the next generation of DPI policy, specifically the pivot towards comprehensive formalization and economic empowerment of the informal workforce, as envisioned by Mission Digital ShramSetu. This requires a dedicated focus on equity-by-design to ensure that technological advancement reinforces, rather than undermines, constitutional equality.

Policy Recommendations for Sustained and Inclusive Digital Growth

Fast-track Digital ShramSetu: Prioritize and adequately fund the rollout of Verifiable Credentials and smart contract systems to shift DPI's impact from protective welfare to productive asset creation for India's 490 million informal workers.

Build Resilient, Multi-Factor Authentication: Mandate technology-neutral, multi-layered authentication across all welfare schemes to prevent exclusion caused by biometric failures, aging-related issues, or weak connectivity in rural areas (Singh & Bhatia, 2022).

Launch Digital Literacy Mission 2.0: Expand targeted, vernacular digital literacy programs to address the low (≈20%) digital competency rate. Integrate AI-driven tools such as Bhashini to support intuitive, speech-based navigation of services (Sharma, 2024).

Strengthen Data Ethics and Algorithmic Accountability: Implement strict regulatory oversight to prevent algorithmic bias in welfare delivery, employment, and credit access. Ensure robust data security and cyber hygiene to protect user trust in DPI systems.

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