The Digital Leviathan: How the India Stack Redefined State Capacity in the 21st Century

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Abstract. This paper investigates how a modern state can move from a reactive regulator to become an intentional designer of inclusive and innovation-friendly digital public infrastructure (DPI). Based on the multi-layered framework of The India Stack anchored around Aadhaar, UPI, and Account Aggregators, the paper proposes the concept of behavioural institutionalism—an analytical framework which draws on perspectives from institutional economics, platform governance, and behavioural sciences.

Using a single-case, theory-building approach underpinned by policy documentation, secondary data and process tracing, the analysis probes how India's DPI was conceptualized, governed, and adopted. This study shows that the success of India does not emanate exclusively from technological capability or administrative reach but from conscious sequencing, behavioural design, and a federated governance architecture that cultivated trust and scalability over an extremely diverse user base.

The study documents both the benefits—enhanced financial inclusion, efficient welfare delivery, and fintech expansion—and the emergent dilemmas related to privacy, exclusion, and the concentration of power. It contends that DPI constitutes a novel constitutional domain that shapes the interface among citizens, markets, and the state. Finally, The India Stack is presented not as a prescriptive blueprint for replication but as a conceptual framework for constructing public-purpose digital systems wherein infrastructure performs simultaneously as technical, behavioural, and institutional scaffolding.

Keywords: Digital Public Infrastructure (DPI); Behavioural Institutionalism; The India Stack; State-led Innovation; Platform Governance

1 Introduction – The State as Digital Architect

Over the last decade, India has emerged as a paradigmatic case of how the state can design and implement large-scale digital public infrastructure. Central to this transformation is The India Stack, a suite of interoperable systems that comprises Aadhaar (identity), UPI (payments), Account Aggregators (data portability), along with complementary components such as DigiLocker, FASTag, and DigiYatra. All these elements

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put together constitute one of the most ambitious state-engineered frameworks anywhere in the world for expanding access to identity, financial services, and data services.

It occured within a broader international context marked by three salient trends. First, persistent digital exclusion where billions remain poorly served with reliable identity, with banking, or via secure digital channels (World Bank, 2021). Second, it is increasingly recognized that private sector innovation alone often falls short in terms of foundational inclusion when profit motives conflict with social objectives (Mazzucato, 2013). Third, a renewed emphasis on the role of the state in digital governance, especially in the emerging economies seeking to transcend constraints linked to physical infrastructure via open, interoperable systems (IMF, 2023).

India's experience stands out not only because of its technical sophistication but, more important, because the outcomes are demonstrable and quantifiable. By 2023, Aadhaar-enabled e-KYC had facilitated more than 480 million Jan Dhan bank accounts, yielding fiscal savings estimated at over 1 percent of GDP. UPI, processing more than 17 billion transactions per month, had reduced frictions across formal and informal markets and fostered a strong ecosystem for fintech innovation. These achievements are thus emblematic of a more profound institutional transformation: The Indian state has started its journey toward moving from bureaucratic service delivery to real-time, programmable governance.

In simple terms, the central question driving this inquiry is: How might a state transition from being reactive, and oversight-focused to being proactive, and design-led to develop digital infrastructure in a manner that is not only inclusive but also supportive of innovation?

The argument put forward here is that the effectiveness of The India Stack does not accrue from either its digital structure or government patronage but rather from its ability to combine institutional design with behavioural acumen. In formulating this, the paper puts forward a framework of behavioral institutionalism—a synthesis of institutional economics, behavioral sciences, and platform governance—that explains how public systems attain scale by structuring incentives and user experience.

Three core propositions emerge: (i) that sequenced policy design—established identity infrastructure prior to payments and payments prior to data exchange—facilitated an iterative building of trust; (ii) that behavioral nudges through biometric verification, default enrollment, and intuitive interfaces lowered the cognitive barriers for first-time users; and (iii) that hybrid governance—as manifested in institutions like NPCI—brought state authority with active ecosystem participation, balancing oversight with innovation.

However, these same features that enable effectiveness also invite critique. The concerns primarily rise over data centralization, algorithmic exclusion, and the sustainability of the zero-MDR[1] model, among others. Dattani (2020) and Zuboff (2019) argue

[1] Merchant Discount Rate (MDR) refers to the fee charged to merchants for processing digital payment transactions. Under the UPI framework, MDR has been set at zero, rendering UPI transactions costless for both payers and merchants to date.

that digital infrastructure is not a solely techno-logical issue, rather it has constitutional dimensions that reframe the relationships among the state, market, and citizen.

This research relates to three interrelated questions:

1. *Institutional Design*: How has the layered and hybrid governance of The India Stack balanced public oversight with private innovation?
2. *Adoption and Trust*: Which behavioral and contextual dynamics explain its rapid, deep diffusion across heterogeneous populations?
3. *Global Relevance and Risk*: What are the lessons and cautions arising for countries trying to emulate the model?

The rest of the paper is organized as follows: Section 2 sets out the conceptual underpinnings of the entrepreneurial state and develops the behavioural institutionalist lens; Section 3 describes the institutional architecture comprising the core of the India Stack; Section 4 examines behavioural design and user uptake; Section 5 assesses impacts and trade-offs; Section 6 extracts policy lessons; and Section 7 concludes with reflections and directions for future research.

Methodological Orientation

1. Single-case, theory-building design: In the single-case, theory-building design, The India Stack represents a paradigmatic example of state-driven digital infrastructure in a developing economy. Multiple streams of evidence are combined:

   - Material studied includes policy documents, white papers, and legislative debates from UIDAI, NPCI, RBI, and parliamentary sources.
   - Secondary data synthesis based on datasets from the World Bank, IMF, and official transactions.
   - Chronological tracing of key milestones, such as the demonetization in 2016 and the staggered implementation of the Account Aggregator framework, to map institutional sequencing and points of inflection in behaviors.

Thematic coding of academic and grey literature in order to conceptualize the intersection of institutional design, behavioral dynamics, and governance practice.

2. The mixed-method approach used tests the concept of behavioral institutionalism put forward here and shows how institutional structures, behavioral cues, and governance mechanisms co-evolve to achieve scale and legitimacy in digital public systems.

2 Theoretical Framework: Rethinking the State's Role in Digital Transformation

The Indian experience of The India Stack calls for an essential rethink of the role of the state in digital transformation. Traditional accounts in governance and economics typically describe the state as either a referee who intervenes to cure market failures or a passive facilitator of private innovation. In contrast, the Indian experience exemplifies a more ambitious possibility: the state as an architect; through the construction of foundational platforms, shaping of behavioral contexts, and guiding innovation toward collective objectives.

This section integrates three intellectual strands, entrepreneurial-state theory, new institutional economics, and behavioral science, in order to develop the framework of behavioural institutionalism.

2.1 Entrepreneurial State and Mission-Oriented Innovation.

While the concept of the state as a driver of innovation is not new, it finds fresh relevance in the context of ongoing digital transitions across the Global South. Indeed, as Mazzucato (2013) herself argues, most of the key technological breakthroughs—from GPS to the internet—came not from private enterprise, but from publicly financed, mission-oriented programs that were willing and able to assume high uncertainty and long development horizons. According to this vision, the state acts less as a gap-filler than as a market shaper; one that takes early-stage risks to drive innovation toward socially valuable directions.

This is indeed the exact philosophy that the India Stack represents, adapted to a development-oriented agenda. In as much as private innovators were pursuing proprietary advantages, the Indian government aimed at developmental objectives: to eliminate the deep-seated frictions in access related to identity, payments, and data. Aadhaar provided for the lack of verifiable identity; UPI resolved the high-cost transaction channels; while Account Aggregators aimed at overcoming data asymmetry for credit access.

More than the use of technology, it is institutional imagination that makes this strategy "entrepreneurial." Creating UIDAI and NPCI as quasi-autonomous public-purpose organizations marked a shift in bureaucratic boundaries. Neither was tasked with direct service provision but rather the design and stewardship of open protocols. According to BIS (2024), the open-loop structure devised by NPCI spurred innovation under conditions of competition while adhering to inclusion principles.

This model is congruent with Evans's (1995) concept of embedded autonomy, where state agencies maintain close ties with private actors to ensure learning can take place while sustaining the extent of autonomy relevant to guide outcomes. The modular nature of India Stack-designing first for identity, then payments, and finally data-is illustrative of an institutional architecture that first establishes trust before attempting to address complexity.

Thus, the entrepreneurial character of the Indian state does not inhere in mimicking venture-capital logic but in curating public digital ecosystems that bring design foresight in harmony with mission clarity. As Mazzucato 2021 highlights, the proof of an entrepreneurial state lies in its ability to define problem spaces and orchestrate solutions rather than merely subsidizing innovation. The India Stack embodies this ethos: innovation conducted in service of the public purpose, wherein governance itself functions as a design instrument.

2.2 Institutional Innovation and State Capacity

From the perspective of new institutional economics, digitization succeeds inasmuch as it lowers transaction costs, secures credible commitments, and overcomes historical path dependence (North 1990; Williamson 1985). Institutions are the rules of the game, which not only constrain behaviour, but more than that, they also provide an enabling framework for new forms of cooperation.

This logic was operationalised by The India Stack by addressing frictions in these transactions structurally. Aadhaar brought down KYC costs from around ₹1,000 to less than ₹20 (UIDAI 2022), while UPI removed MDR on small-value payments. Each layer was designed not as a standalone service but as an enabling platform for the next set of innovations.

The sequencing of identity, payments, and data reflects a path-dependent trajectory in North's sense, where institutional durability follows incremental legitimacy. The 2016 demonetisation episode functioned as a *critical juncture* (Pierson, 2004), temporarily disrupted the existing equilibria, reshaped expectations, and furthermore accelerated the adoption of digital payments, through behavioural normalization, within India's institutional framework.

2.3 Platform Governance and the Public-Protocol Model

The governance architecture of The India Stack diverges fundamentally from the traditional model of state-owned, vertically integrated service provision. Rather than operate monolithic platforms, the state has pursued a public-protocol approach—one that establishes common technical and legal standards for authentication, payments, and data exchange. This design, therefore, reconfigures state power away from direct provision toward rule-setting and ecosystem orchestration. It enables private actors to create value at the application layer while the state retains control over the core infrastructural rails. Institutionally, this arrangement re-conceptualises state capacity as the ability to market structure through protocols rather than ownership, thereby integrating public stewardship with decentralized innovation.

This hybrid model is epitomized in NPCI. According to BIS (2024), it is a non-profit, bank-owned organization supervised by the Reserve Bank of India. In other words, it is neither fully governmental nor is it a purely market-driven frameworks. While it defines APIs, certifies compliance, and anchors interoperability, it leaves user-facing innovation to third-party developers such as Google Pay or PhonePe. Consequently, while there is competitiveness at the periphery the core remains stable.

This governance arrangement is reminiscent of the polycentric governance framework described by Elinor Ostrom (1990, 2005), in which authority and accountability are distributed across multiple overlapping institutions at varied scales, rather than centralized within any single hierarchical center. It also reflects Weyl (2022) view of public protocols as digital commons: open, standardized infrastructures that provide the basis for decentralized innovation while providing collective oversight and public control. Conceptually, this perspective aligns with Bhattacharya's (2023) framing of digital public infrastructure as a distinct institutional form—neither market nor hierarchy—designed to structure coordination, reduce transaction costs, and enable distributed innovation under public oversight.

At the same time, this hybrid model creates new governance problems. According to Dattani (2020), early development of the Aadhaar system blurred state–market boundaries, where private contractors were deeply involved in shaping system architecture and policy choices. These dynamics show the need for strong and constantly changing mechanisms of oversight in order to keep technical expertise within the boundaries of public accountability.

2.4 Behavioral Foundations of Public-System Design

Technical functionality is not enough to guarantee usage. Success or failure in a low-trust, low-literacy environment is determined by behavioral frictions. Consequently, the architects of The India Stack incorporates behavioral insights directly into its design. Building on Thaler and Sunstein (2008), key elements include biometric login, default enrollment, and intuitive user interfaces that reduce cognitive load. Kahneman's System 1 reasoning (2011), fast, intuitive decision-making, explains why simplicity fosters adoption among first-time participants. Social diffusion effects are at least as important. QR codes that are highly visible and demonstrations of the service by peers create what Centola (2021) calls complex contagion-behavioral adoption through repeated social exposure. Designing for scarcity: Mullainathan and Shafir (2013) make the case that interventions for the poor should assume a basic shortage in time and attention. The India Stack internalized this constraint by making biometric identity and low-friction payment tools match real-world cognitive bandwidth.

2.5 Toward a Framework of Behavioral Institutionalism

To help explain how such systems build momentum, the authors advance the concept of behavioral institutionalism—a synthesis that ties institutional structure to behavioral response. Traditional institutional economics focuses on rules and incentives (North 1990); behavioral science, on individual biases and heuristics (Thaler & Sunstein 2008; Mullainathan & Shafir 2013). The new framework cuts across the two, considering institutions as behavioral environments-apparatuses shaping not only the contours of action but also perception and trust.

Four propositions underpin this approach:

1. *The cognitive assumptions are embedded in the institutions.* Every design reflects a view on human capability: Aadhaar assumes low literacy and variable identity stability; UPI presumes trust grows through feedback loops and uniform design.
2. *Trust is behaviorally constructed.* Legality alone is not enough; trust is a consequence of repeated and predictable interactions (Centola 2021; Mayer et al. 1995). The India Stack fostered this through visible confirmation cues—SMS alerts, biometric feedback, and consistent branding.
3. *Infrastructure operates at the behavioral margin*: where users encounter the greatest friction, such as the elderly, first-time smartphone users, or those with intermittent connectivity, systems succeed or fail. Designing for the edge defines system legitimacy.
4. *Diffusion depends on normative internalization*. Once adopted behaviors become socially embedded, they become irreversible. Cultural anchoring of infrastructure arises when QR-based payments are customary.

According to the core idea of behavioral institutionalism, durable digital infrastructure is better conceptualized as:

- Technically coherent: sequenced and modular;
- Behaviorally aligned: low-friction and trust-oriented;
- Socially embedded: norm-reinforcing and equitable

Taken together, this composite lens provides an explanation for why the India Stack scaled in contexts where many state-operated platforms have failed to take off. It also shows new research directions, such as strategies to restore legitimacy after trust failures and how to expand inclusion without compromising autonomy.

3 Institutional Architecture: The Scaffolding of Digital Transformation

The achievements of The India Stack cannot be understood by focusing solely on technology. Its effectiveness arises from a complex institutional scaffolding—a particular configuration of public agencies, policy innovations, and governance mechanisms that together made possible coordination, experimentation, and scale. Less a monolithic digital platform, The India Stack is better thought of as an evolving institutional stack, each layer addressing a specific constraint, but also supporting successive layers.

3.1 Aadhaar: Identity as Infrastructure

Launched in 2009, Aadhaar sought to overcome one of the most fundamental barriers to welfare access and financial inclusion in India: the absence of verifiable identity for a large portion of the population. Grounded in biometric authentication—fingerprints and iris scans—the present system has, therefore, been a low-document and low-discretion alternative to traditional verification regimes. Indeed, at its core, the Aadhaar

was an inclusionary project that aimed to render the "invisible" citizen legible within mainstream institutions.

The organizational innovation underpinning Aadhaar resided in the Unique Identification Authority of India (UIDAI), deliberately positioned outside the conventional bureaucratic hierarchy. UIDAI enjoyed technical autonomy, recruiting expertise from both the public and private sectors. It acted under an executive mandate for almost seven years, until legal backing was provided by the Aadhaar Act of 2016. This configuration reflects Sabel and Zeitlin's (2012) concept of experimentalist governance: institutions that evolve through practice before codification.

As Raghavan et al. (2019) point out, Aadhaar was envisioned as a protocol, not a database; a digital identity layer for authentication, not for the storage of entitlements. In effect, this choice of architecture placed the system in a position to play multiple roles: from welfare disbursement to SIM-card verification to e-KYC for banking services.

However, the hybrid architecture of Aadhaar created accountability tensions. The involvement of private enrollment agencies along with subcontracted biometric vendors blurred lines of responsibility. According to Dattani (2020), such arrangements raised a host of questions on privacy and avenues of redress, particularly in the early years when robust data-protection frameworks were missing.

3.2 UPI and the Protocol Model of Payments

UPI went live in 2016 and represented a fundamental shift from state-provided services to protocol governance. Rather than offering a product for payments, UPI laid out a single rulebook or, more accurately, a common API and standards on which banks and fintech companies could innovate.

At its center lies the non-profit National Payments Corporation of India, jointly owned by banks and controlled by the Reserve Bank of India. The NPCI falls into an intermediate position in terms of governance—neither fully public nor conventionally private—pairing regulatory oversight with operational agility (BIS 2024).

This institutional architecture confers several systemic advantages:

- *Interoperability*: All stakeholders will follow one standard, with smooth transactions between institutions being guaranteed.
- *Open innovation*: The “thin protocol, thick competition” model directs innovation to the edges—applications and user interfaces—while the core rails remain standardized.
- *Cost inclusion*: The no MDR policy for low-value transactions has further opened ways for micro-merchants and low-income users, resulting in a faster pace of adoption.

These design choices help explain the rapid growth of UPI, with over 17 billion monthly transactions by the end of 2024. They also illustrate a platform-state logic: the government curates the ecosystem and sets the rules while enabling market dynamism without monopolizing it.

3.3 Account Aggregator: The Consent Layer

The Account Aggregator (AA) framework, launched in 2021, extended the stack from identity and payments to data portability—the next frontier of digital empowerment. It sought to remove a persistent bottleneck in credit markets: the lack of credible, structured financial data on the economic constituents, namely individuals and small enterprises. Through the AA system, users can share data across entities that fall within the scope of regulations—bank records, tax filings, insurance histories—via secure APIs, with explicit and defined consent mechanisms. Importantly, AAs themselves do not store or monetize any data; they act solely as consent managers. This "consent-at-the-core" design therefore fits Ostrom's (2005) principles for the governance of commons: federated access with clear user control[2]. The Financial Stability and Development Council provides oversight, bringing together, for the first time, several regulators—RBI, SEBI, IRDAI, and PFRDA—on a single platform. The result is polycentric governance with shared accountability and without centralized overreach. This architecture also aligns with global data-privacy norms, embedding protection within system design rather than retrospective compliance documentation.

3.4 Sequencing and Stackability: Institutional Logic of Layered Design

The strength of the Stack lies in its sequenced modularity. Every layer addressed the most binding constraint of its time: Aadhaar reduced authentication costs; UPI removed frictions in payments; and AAs have opened the door to data-driven credit.

The architecture of the India Stack reflects a sequential and cumulative reform logic. With each initiative, there was no attempt at comprehensive digital transformation; rather, each layer targeted the most binding constraint of its time, allowed institutions and users to learn and adapt and build trust before building further. Again, this is quite consistent with Rodrik's (2022) growth-diagnostics framework, which emphasizes the sequential targeting of dominant bottlenecks, rather than the fruitless pursuit of comprehensive, undifferentiated reform agendas. Perhaps most importantly, the modular design of the Stack enabled what the IMF has called *combinatorial innovation*[3]: the suc-

[2] Ostrom (2005) demolishes the “tragedy of the commons” fatalism. Effective governance is not binary (state vs. market); it is institutional, contextual, and participatory. In contemporary applications—digital infrastructure, data governance, platform ecosystems—these principles translate directly into scalable, legitimacy-preserving design.

[3] In the IMF’s (2022) digital public infrastructure (DPI) framework, “combinatorial innovation” refers to the capacity of interoperable public digital building blocks—such as digital identity, fast payments, and consent-based data sharing—to be recombined across use cases and sectors. As new layers are added, the marginal cost of innovation falls while system-wide value increases, generating non-linear gains through reuse, interoperability, and network effects rather than through isolated technological advances.

cessive layers did not just add new capabilities but made existing ones much more valuable through interoperability and network effects, displaying increasing returns over time.

Its broader significance lies in its institutional form. As ECDPM (2022) has pointed out, India's digital public infrastructure does not match either statist command-and-control models or laissez-faire platform capitalism. It epitomizes a negotiated institutional equilibrium in which the state functions as a policy entrepreneur—providing open, interoperable public rails—while private actors compete and innovate at the application layer. It is this state-led yet market-enabled configuration that has gained prominence precisely because it addresses a central development challenge: how to scale digital systems rapidly while preserving legitimacy, contestability, and adaptability in heterogeneous emerging economies.

3.5 Frictions and Fragilities

No architecture is without fault lines. A number of tensions remain intrinsic to the India Stack:

- *Function creep*: Though voluntary at its inception, the embedding of Aadhaar into essential services makes opting out nearly impossible.
- *Economic sustainability*: Zero-MDR, while promoting inclusion, may undermine long-term viability for the payment service providers.
- *Intermediated access*: Many citizens, especially rural or elderly users, use informal agents to use digital services; this in a sense reintroduces gatekeepers.
- *Market concentration*: Now, a few dominant applications process the bulk of transactions via UPI, raising some serious antitrust and data-access concerns.

These are not anomalies but structural consequences of scaling. The challenge, like any infrastructure, is to manage its evolution responsibly.

In a nutshell, The India Stack illustrates how layered institutional design—integrating mission orientation, federated governance, and iterative sequencing-can achieve scale without monopoly. Its widespread adoption hinged as much on psychological and social learning as on policy engineering. The next section considers this behavioural dimension in more detail.

4 Behavioural Foundations: The Human Architecture of Adoption

Even the most technically robust systems fail to deliver impact if users do not internalize and routinely adopt them. In a low-trust, socially heterogeneous context such as India, behavioral design becomes central to making infrastructure not only usable, but also perceived as safe and legitimate. Accordingly, the architects of the India Stack embedded behavioral insights—around trust, default choice, friction reduction, and grievance redress—directly into system design, treating behavioral economics as a core infrastructural principle rather than an auxiliary consideration.

4.1 Building for Cognitive Simplicity

The principal barrier to adoption in emerging markets often lies in cognitive load rather than in physical access. Systems with multiple passwords or voluminous documentation discourage participation. Where Aadhaar reduced barriers of entry with biometrics, UPI reduced cognitive load by embracing minimalist design: core actions like Send, Receive, or Check Balance were foregrounded according to progressive disclosure principles. This aligns with Kahneman's idea of the usability of System 1-facilitating intuitive, rapid decisions with limited deliberation. Raghavan et al. (2019) observe that this simplicity was intentional-digital infrastructure for large populations must be cognitively light.

4.2 Crisis as Behavioral Catalyst

The 2016 demonetization served as an unplanned behavioral shock. The sudden lack of cash forced buyers and sellers to try digital modes of paying for goods and services. Data from the IMF in 2023 shows that the adoption of UPIs grew in this period, especially amongst informal and small actors. A nascent literature on behavioral policy describes such events as focusing moments (Birkland 2006)-shocks that reset habits and open windows of opportunity. After digital transactions proved successful, users were set on a path dependence. A public narrative of digital payments being "clean" enabled the switch, turning necessity into norm.

4.3 Trust by Design

In a society habituated with bureaucratic opacity, trust could not be commanded; it had to be engineered. Multiple trust-building features were part of the India Stack:

- Institutional credibility through government oversight by UIDAI and NPCI; standardized user experience across apps reduces uncertainty.
- Real-time confirmations, texts, receipts, and voice cues that make every transaction more tangible.

Muir's 1994 theory of perceived controllability is instructive here: people trust systems when they can verify outcomes and recover from errors. These feedback loops turned infrastructure from an abstraction into lived experience.

4.4 QR Codes and Local Contagion

UPI's QR codes became ubiquitous, constituting a set of widely recognized visual anchors of digital legitimacy, from tea stalls to buses and kiosks. As Schelling (1978) pointed out, focal points reduce ambiguity about collective behavior. The concept of complex contagion by Centola (2021) further explains how diffusion occurs: users adopt after multiple trusted cues rather than a single exposure. Repetition across physical and social spaces normalized the use of QRs as a mundane act, reinforced by small

incentives and social validation, like "payment received" messages or merchant stickers.

4.5 Behavioral Coercion and the Edge of Consent

Not all nudges were benign; some bordered on coercion. Linking Aadhaar to welfare benefits or SIM cards reduced meaningful options available for opting out. Documented cases have shown biometric mismatches causing exclusion from entitlements (Dattani, 2020). These examples show how behavioral facilitation and coercion can sometimes fall within a thin line separating them. Efficiency that compromises on the tenets of autonomy risks undermining the trust that it seeks to build. Indeed, subsequent developments, like Account Aggregators, have moved toward explicit consent, but these early trade-offs revealed ethical tensions inherent in scaling behavioral design.

4.6 Designing for Scarcity

The behavioral sophistication of the India Stack was in designing for scarcity, not against it. As Mullainathan and Shafir (2013) underline, systems for low-income users need to economize time, attention, and literacy. Biometric KYC or audio confirmations were not just technical demonstrations but reflected considerations of cognitive and infrastructural constraints.

4.7 From Architecture to Uptake

The features of simplicity, feedback, social reinforcement, and constraint-sensitive design combined provide an explanation for why the India Stack moved from pilots to countrywide adoption. The task was not one of digitization of services but a reimagining of routine expectations regarding the interaction of the citizen with the state and the market. As the Stack scales into health, education, and mobility, the maintenance of behavioural trust will be as important as scaling technology. In brief, India's digital public infrastructure works on the basis of a fascinating paradox: infrastructure works because it is felt to be human.

5 Outcomes and Impacts: Evaluating the Digital Transformation

The India Stack has been widely celebrated as a paradigmatic example of inclusive digital infrastructure. However, critical evaluation requires more than indicators of adoption; it demands a structured examination of the impact such infrastructure has on access, agency, and accountability. The sections below examine its impact across five dimensions: financial inclusion, public service delivery, private innovation, equity and access, and data governance.

5.1 Financial Inclusion: Infrastructure as Onboarding

The most striking result of the India Stack has been the increase in formal financial access. From 2011 to 2024, more than 531 million Jan Dhan accounts were opened through Aadhaar-enabled eKYC. This pushed formal account ownership up to about 78% of adults. (World Bank 2021). According to the IMF estimates for 2023, the coming together of Aadhaar, Jan Dhan, and rapid mobile penetration decreased onboarding cost by over 90%. For concreteness:

- Deposits of more than ₹2.3 lakh crore under basic savings accounts by mid-2024;
- Direct Benefit Transfer (DBT) involving billions of transactions per year, at estimated fiscal savings close to 1.1% of GDP;
- Greater access for women, although use-equity gaps persist.

The more recent Account Aggregator framework extends this inclusion to credit markets through data portability and verifiable credit histories. Initial pilots suggest greater access by first-time borrowers and MSMEs, but any diffusion is still in its early days.

5.2 Public Delivery: Precision and Friction Reduction

Aadhaar-enabled DBT has reshaped welfare delivery by linking verified identities directly to bank accounts. Subsidies for rations, pensions, LPG, and MGNREGA wages now disburse with fewer intermediaries and reduced leakage. BIS (2024) reports substantial reductions in duplication and ghost beneficiaries across multiple schemes. However, the precision afforded by digital systems introduces dependency risks. Biometric mismatches, connectivity failures, or ageing fingerprints have occasionally resulted in exclusion from essential benefits. As Dattani (2020) observes, Aadhaar's de facto mandatory use in welfare introduces conditionality that challenges the principle of universal entitlement. While efficiency gains are evident, they coexist with new vulnerabilities.

5.3 Private Innovation: Rise of Stack-Native Ecosystems

By preferring open protocols over closed platforms, the India Stack has triggered a dynamism in the fintech and service ecosystem. Firms from various sectors—from digital lending to logistics—use Aadhaar-based KYC, UPI rails, and DigiLocker verification.

- In 2023, the Indian fintech sector reached more than $150 billion in market value.
- The UPI facilitates more than 16.7 billion monthly transactions by end of 2024 across all components: peer-to-peer, retail, and public-service payments.

Raghavan et al (2019) attributes this success to permissionless innovation: developers can experiment at the application layer without duplicating core infrastructure. However, shortcomings are also apparent. The zero-MDR policy has put pressure on the economics of payment providers and the UPI frontend is dominated by two players with more than 70% of the traffic. While interoperability prevents anti-competitive hardware

configurations, it does not ensure that strategic data aggregation and value extraction are curtailed.

5.4 Equity, Access and the Limits of Inclusion

Participation remains uneven despite substantial scale. Rural users show slower digital adoption; women often use male intermediaries to operate accounts; and elderly or disabled people face biometric and design barriers (RBI, 2023; Goggin, 2021; Neves, 2021). This suggests a shift from formal exclusion towards functional exclusion: people may be technically included but lack the autonomy or capability to benefit meaningfully. The related notion developed by Sen (1999) is substantive freedom; access is meaningful only if it increases real choice and control. Intermediation endures as a practical workaround-local agents help users with apps or withdrawals, effectively reintroducing human gatekeepers within a digital system.

5.5 Data Governance and the Surveillance Question

The scale and pervasiveness of the India Stack raise concerns with regard to data control and surveillance. The design of Aadhaar allows for possible cross-linking across welfare, financial, and identity databases. The Personal Data Protection Act of 2023 institutionalizes consent standards while retaining wide state exemptions. The Account Aggregator framework represents progress through its consent-by-design approach; however, gaps persist in auditability and user recourse. Zuboff (2019) warns that unless checked, such systems are at risk of mutating into surveillance capitalism in which efficiency and oversight come together at the expense of transparency. Dattani (2020) further contends that India's DPI might epitomise a technocratic social contract: efficiency gained at the expense of opacity.

5.6 Global Influence and the Replication Frontier

Components of the India Stack are increasingly studied or adapted internationally, from Brazil's Pix to Ethiopia's MOSIP-based identity system. The recent ECDPM report (2022) highlights how India has successfully positioned DPI as a sovereign alternative to corporate digital ecosystems. Replication, however, is not a matter of exact imitation. Conditions in India were uniquely favorable: robust political will, embedded technical capabilities, and legacies of developmental-state institutions. In this context, other countries are under threat of either bureaucratic overreach or shallow inclusion.

5.7 Summary Gains and Gaps

Undeniably, the India Stack has produced results: increased financial inclusion, efficiency in welfare delivery, and even a spurt of innovation. At the same time, though, it brought new dependencies-connectivity, devices, intermediaries, custodians—to the ta-

ble. Inclusion went up, but equality of experience did not follow. One big lesson, therefore, from this story is nuanced: infrastructure can redistribute opportunity only if its governance evolves as fast as its technology.

6 Policy Lessons and the Future of Digital Public Infrastructure

The India Stack represents a new kind of governance—a platform state able to integrate inclusion, innovation, and trust at scale, nationally. For the countries considering similar trajectories, a set of design and governance implications emerge.

6.1 Design for Trust, Not Just for Scale

Scale follows trust, not the other way around. Biometric simplicity of Aadhaar, consistent interfaces of UPI, and real-time confirmations were important for adoption. IMF (2023) highlights how user confidence is as crucial as policy support. Behavioural institutionalism positions that trust needs to be designed via intuitive interfaces, transparency in feedback, and consistency in institutions.

6.2 Modular Sequencing and Stackable Innovation

India's sequential development-identity first, payments second, data last-created self-reinforcing momentum. Each layer was self-reinforcing of the next one (BIS, 2024). Such sequencing turned path dependence from constraint into capability. The implication for other countries could not be clearer: avoid simultaneous rollout of multiple DPI layers; phase implementation to allow trust and usability to mature before expanding scope.

6.3 Federated Governance over Centralised Control

UIDAI, NPCI, and Sahamati also represent a practical intermediary approach that is technically independent, publicly accountable, and interconnected within a regulatory framework. This polycentric architecture (Ostrom, 2005) distributes power, fosters innovation, and protects against capture. Without this institutional depth, the replication of DPI will be fragile.

6.4 The Architecture of Consent

Consent needs to transcend a checkbox exercise. For systems holding sensitive financial and identity data, consent needs to be meaningful-verifiable, revocable, and comprehensible. The Account Aggregator model improves the theory of consent, but global frameworks need to approach consent as infrastructure, not just paperwork. Privacy needs to be designed, not declared.

6.5 Experimental Governance and Adaptive Legality

Similarly, the India Stack evolved incrementally through experimentation—Aadhaar predated legislation; UPI predated full regulatory codification. In fact, this "learn before you legislate" mindset captures Sabel and Zeitlin's 2012 idea of experimentalist governance: flexibility with feedback and ex post accountability. Pilot-driven evolution by countries should be in judicious combination with the availability of avenues for appeal and roll back. Excessive insistence on perfection in rule-making can impede innovation; when done transparently, informed learning-by-doing can improve it.

6.6 From Adoption to Social Anchoring

Widespread adoption achieved durability through normative embedding—digital payments and DBT became social expectations. QR codes and digital confirmations are now seen to be a sign of reliability. It is this cultural internalization, not compulsion, that sustains systems over time. For policymakers, the implication is to inculcate habit formation through visible cues, peer learning, and tangible feedback loops that render digital behaviour self-reinforcing.

6.7 Global Replicability: Principles over Protocols

Although India Stack informs international debate, its transferability rests on principles rather than direct code replication. Quoting ECDPM (2022), success stemmed from contextual strengths: policy entrepreneurship, institutional capacity, and fiscal commitment. Diagnosis should be a better starting point for future DPI initiatives: what are the most consequential frictions, who governs the rails, and how is legitimacy earned?

6.8 Designing Infrastructure with Intent

Ultimately, the central question is not if states should build digital infrastructure, but how. Well-designed DPI can democratize opportunity while poor design can lock in surveillance and dependence. Infrastructure is inherently value-laden.

Behavioural institutionalism reminds us that for infrastructure to be effective, it needs to be taken up as well as trusted, comprehensible and lived. This is the real bottom line for success in the digital era.

7 Conclusion and Directions for Future Research

The India Stack is a defining experiment in the emerging era of digital state capacity. It exemplifies how the combination of modular, open, and behaviourally informed infrastructure may help bring about greater inclusion, reform governance, and relocate the state towards the role of a platform builder.

This paper argues that the India Stack works by bringing together institutional design, behavioural insight, and governance pluralism. Its lessons are not limited to technology: institutions thrive when they are not just rule-bound but experientially trusted.

The following insights emerge from the perspective of behavioural institutionalism:
- Modular sequencing creates legitimacy; -design and repetition, not decree, are the roots of trust;
- Behavioural cues and peer learning maintain adoption;
- True inclusion requires autonomy, not simply access.

The tensions that stem from the project-data centralisation, exclusion errors, and market concentration-underline the fact that governance has to evolve along with the infrastructure. These frictions serve as feedback signals within a living institutional ecosystem.

At its core, the India Stack raises a broader question: What sort of digital infrastructure should a democracy build-and what vision of citizenship does such building presuppose?

Future Research Directions

1. *Longitudinal Impact*: Determine if digital inclusion produces long-term economic and social resilience.
2. *Comparative DPI Models*: Assess cross-country adaptations in search of governance patterns that work across contexts.
3. *Behavioural Integrity*: Analyze how nudges and defaults impact user autonomy, with special attention to vulnerable populations.
4. *Platform Concentration*: Examine regulatory mechanisms for preserving competition within ecosystems of public protocols.
5. *Digital Constitutionalism*: Explore data portability rights, redress, and opt-out under constitutional ethics frameworks.

Where digital infrastructure increasingly underpins citizenship, commerce, and rights, the question is no longer if states will govern it, but how. The India Stack offers both a road map and caution: power embedded in code must be matched by institutions conceived for accountability as much as efficiency.

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