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Actor-Network Theory (ANT) to Explore Influence of Central Bank, Digital Public Infrastructure, Emerging Technology in Digital Transformation of Indian Banks

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Abstract
Digital transformation(DT) of banks and financial sectors among developing countries is more explored from the perspective of application of information and communication technologies (ICT). There is limited focus on social theories that needs to be leveraged for analysis of information systems driven transformation of organizations, banks, and wider financial sector, economy and governance. This exploration uses Actor-Network Theory (ANT) to understand DT among Indian banks – with specific focus on the central bank, availability of digital public infrastructure(DPI) and technology. ANT is a promising vehicle in inter-organizational strategic information systems planning (IOSISP) with relevant network interplay of actors. This study of actors includes financial organizations (private and public banks, fintechs), the Reserve Bank of India (RBI – the Central bank of India), available DPI alongside technology innovations relevant for banking transformations. The RBI is a primary actor in motivating digital focus across Indian banking. The availability and synergistic leverage of multiple purposeful DPIs and emergent technologies drive banks to transform and innovate in a developing nation like India. The descriptive exploration reveals focus across the actors that impact the supply side of digital transformation in banking. Analysis of research publications, press releases, policy documents, and reports issued by government, available DPIs, central banks, public, and private banking entities are examined through inter-rater assessments. Qualitative evaluation of vast multi-modal data, including unstructured narratives, visuals and videos, helped generate a qualitative Actor Network Framework for DT across Indian banks. Network actor inter-influence is discovered to understand how to better manage supply perspectives of digitalized banking. The distributed sensing of the transformations for alignments with customer and other stakeholder demands may be explored as future extensions in this knowledge area. The conclusions drawn are significant for banks across developing nations and globally – especially to identify the actors that influence in operationalizing digital transformation trajectories over time. This India focused study enhances strategic appreciation of the influence that multiple actors in socio-economic digital transformations relate to. From a wider perspective it provides motivation and framework for future research integrating across other prime actors like customers, competition, wider fiscal

policies, and regulations that evolve digital transformations.

Key Words: Central Bank, Digital Transformation, Digital Public Infrastructure, Indian Banks, Innovation, Actor-Network Theory

Introduction

India derives significant benefits from continued investments in Digital Public Infrastructure (DPI). DPIs manifest through the India Stack fostering innovation, public-private collaboration alongside growth and market expansion, sustainable development, enhanced financial inclusion and banking services, governance and public expenditure efficiency among others. Indian initiatives to leverage the DPIs across banking and financial services leads to many successful instances of digital transformation. Banking transformations are significantly influenced by Reserve Bank of India (RBI) – The Central Bank, proliferation of technology, innovations and fintechs. Varied elements of the Indian context including enablers like Aadhaar, ICT diffusion alongside challenges like low financial literacy are considerations in the digital transformation and evolvement of Banking in India. This study explores the primary actors – (1) RBI, (2) Proliferating DPIs, (3) Emergent Digital Technologies and (4) the significant Public and Private banks of India amidst tech-enabled transformations.

A qualitative study of actors helps understand associations and consequences towards many benchmark instances of digital transformations. Outcomes or consequences resulting from the way actors respond to transformation opportunities are explored through Actor-Network Theory (ANT). A motivation to use ANT is - it allows explorations across heterogeneous actors including non-humans, institutions with diverse focus interacting to drive digital transformations of banks in India. ANT enables understanding of relevant network composition and dynamics for a macro socio-economic phenomenon manifested through tech-enabled transformations across the banking industry. We report findings of this phenomenon scoped around three relevant research questions – a) Who are the primary supply side actors enabling DT in banking industry in India ? , b) How are each of these actors individually influencing DT of banks in India? (What are the significant DPIs influencing digital transformation of Indian Banks? - How is RBI guiding on the leverage of DPIs? – What are the relevant digital technologies enabling transformative initiatives? – What are the DT areas across Banks as they leverage DPIs and adopt technology?), c) How do these actors interact among themselves for DT of banks in India?. These explorations are inter-linked, and findings indicate how roles of the four actors are associated. For instance, banks follow RBI guidance in chartering technology enabled transformations while integrating capabilities, innovations and available DPI. In another instance emerging technology innovations drive development of new capabilities among DPIs – leading RBI and other banks to embrace enhanced capabilities and change conventional business models. ANT helps reveal multiple such inter-relations among the actors in study of the digital transformation of Indian banks.

Literature Survey

Digital Transformation of Banks: Digital Transformation (DT) presents various opportunities for banks globally and in India, including enhanced customer and stakeholder interactions, improved data management and decision-making, better fraud and risk management, innovations, digital payments, and the creation of new value chains and business models (Veit, 2014) . Successful digital transformations (DTs) generate significant competitive advantages and differentiation, as well as operational benefits such as modular and

interchangeable innovative business models (Bharadwaj, 2013) for banks. Banking transformations with technology and new capabilities require resources and expertise, bearing multiple challenges and risks. The maturity of technology enabled banking (Pramanik H. S, 2019), and the digital transformation of the financial sector is impacted by customer demands, competition, and the government's focus on digital, ICT enablers and accelerators. Favorable technology policies, regulations, governance, execution rigor and alongside on-the-ground availability of digital public infrastructure in a country, Information Communication Technology (ICT) maturity, diffusion of innovations, ecosystem, availability of fintechs among others accelerate digitization of banking from a national perspective (Desai, 2024) , (Alonso, 2023).

Emerging digital technologies offer new capabilities and open innovative business prospects, altering conventional perceptions of Information Communication Technology (ICT) as a mere enabler. With embedded computing capabilities, devices such as vehicles, phones, televisions, cameras, or bicycles are smart and networked (Yoo, 2010) . This offers opportunities for innovative services and associated financial transactions – giving rise to embedded finance possibilities. Banking industry is evolving beyond a traditional branch system-oriented sector to an ecosystem of disruptive financial and technological solution provider across industries (Barroso. M, 2022). Innovative solutions, disruptive competitive pressures including emerging fintechs (Dapp, 2017), and shifting customer demands impacting banks globally and in India. Digital capabilities such as borderless global transactions, transparency, and commoditized products, lower switching costs and market entry barriers in the conventional banking industry leads to focus on continuous value discovery and innovations.

Recent study explores five components of Digital Transformation (Roy D. &., 2021) - digital strategy, technological adoption, operations, organizational structure, and ecosystems—based on a cross-continental analysis of major organizations and banks, underscoring improved customer experience and innovation. Research focused on Chinese banks indicates how DT may enhance liquidity creation while optimizing loan provisioning and mitigating disintermediation (Wen, 2025). Governance-driven DT success is affirmed by research study indicating that strong governance, particularly in risk management, significantly accelerates DT progress in Palestinian banks (Awwad, 2024) . However, the impact of DT on bank profitability appears ambivalent. The resource-based view emphasizes that strategic resource planning and intelligent resource allocation are required to convert digital transformation initiatives into a sustainable competitive advantage that generates profitability (Daeli, 2025). While digital transformation initiatives may enhance operational efficiency, they may be associated with short-term costs to overall enterprise profitability, eventually leading to long-term gains (Shanti, 2023). Digital transformation supports the bank's profitability in the long run, therefore requires a continued strategic focus. Studies also indicate how digital transformation by banks improved Environmental, Social, and Governance (ESG) and sustainability performance (Zhu, 2023) alongside operational efficiency, particularly with innovative and technical capabilities. India-centric study reveals high customer satisfaction (Sathwika, 2024) with mobile and online banking, while raising concerns about technology and security.

Research reveals that while digital transformation catalyzes innovation and long-term efficiency, its benefits are moderated by institutional context, governance quality, executive traits, implementation strategies and wider operational ecosystems. In this context,

organizations must learn from the execution context of global banks, innovative practices, enabling conditions of success, acknowledge relevant actors for optimal influence on the digitalization processes. It is imperative for banking institutions to optimally associate with the operating ecosystem to maximize gains from digital transformations. This qualitative exploration therefore identifies and examines the relevant prime actors - drivers and antecedents of digital transformation, as well as the outcomes generated among Indian banks. Leveraging Actor Network Theory (ANT) this study analyzes the central bank, the underlying national digital public infrastructure in India, technology and how public, private banks alongside fintechs manifest varied transformations.

Introduction to Actor Network Theory and its applications: Digital transformation of banks is a multifaceted complex endeavor evolving over time with interdependence among many actors - individuals, organizations, technology, government, regulations and socio-economic structures at large (Dutta, 2023) . Such complex studies require identification of relevant actors and networks at play. Actor-network theory with a socio-technical approach is purposeful in exploring digital transformation initiatives across Indian Banking. This study explores across the central bank and availability of DPIs, underlying innovative technology as relevant actors in banking transformations.

Actor-network theory (ANT) is a constructivist theory that helps in understanding the formation of a network by treating contributors (humans and non-humans) equally. ANT is 'the theory of the network actors' (Akrich. M., 2023), to understand how relevant actors come into being together in larger units such as networks (a set of relatively stable relationships) to construct reality (e.g., an innovation, a project, or an artifact). We explore the digital transformation of banks in India in association to relevant network actors – the central bank and availability of DPIs in India, technology and banks alongside fintechs. ANT is based on the principle of the actants' heterogeneity and symmetry (Latour, 1996) . Heterogeneity implies that various actants must be considered when constructing and analyzing reality. Symmetry views humans and nonhumans as 'equal' entities in that both contribute to reality (Murdoch, 1997) . ANT conceptualizes the construction of reality over time and space as a translation. Translation is a four-stage adaptation process including moments of problematization, interessement, enrollment, and mobilization (Callon, 2001) . ANT has contributed to understanding digital system design, adoption, and stabilization in various contexts, including knowledge-sharing platforms (Mustapha, 2024), digital healthcare (Ryan T, Hynes B, Ryan N, et al, 2024), e-government systems (Cordella & Hesse., 2015), sustainability (Kadia Georges Aka, 2025) and consumer culture (Ekklesia, 2024). There are few studies based on mobile banking (Mirbargkar, 2020) , to explore understanding digital transformation using ANT in Indian banking context. Leveraging ANT for this exploration the actors explored are relevant - including humans and institutions like policymakers, and non-humans like technologies, that interact and modify each through active translations. The theory views the network as a metaphor that describes the connections between different actors.

Research Approach

The exploratory study is grounded in India-specific study of digital-focused transformative initiatives and instances across banks. Digital transformations in banking are examined as the evolving translation from the perspective of ANT. The focus of this exploration is to understand the influence and associations of emerging digital technologies, available DPI across Indian banks. Public data on technology initiatives relating to banks in India, alongside

narratives and guidelines from the government on technology-enabled banking, DPIs is considered relevant for this exploration. Data from comprehensive secondary research helped validate institutional narrative and on the ground field realities. Analysis of research publications, press releases, policy documents, and reports issued by government, available DPIs, central banks, public, and private banking entities are examined through inter-rater assessments. Relevant data on the digital focus for the last five years (2020 till date) is qualitatively evaluated to factor durational considerations in digital transformation aligned to ANT. Qualitative evaluation of vast multi-modal data, including unstructured narratives, visuals and videos, helps generate a qualitative Actor Network Framework for DT across Indian banks. The qualitative approach suits the exploration as it allows us to understand narratives across multiple actors in relation to digital transformation. ANT perspectives help assess inter-relatedness within the network.

ANT is a relevant theorical framework to explain and understand a socio-technical and economic phenomenon like digital transformation across Indian banks. The findings reveal multiple business cases and applications where digital transformation is evident, including capabilities in open banking, digital payments, and other areas as purposeful translations. In addition to technology and its applications, the study reveals the motivations for digital transformations, based on actors like the Reserve Bank of India (RBI) and available DPIs in India. The influence of these actors is relevant and applicable to digital transformation translations impacting both private and public banks in India. The set of primary actors identified and explored in this study include:
(i) Digital Public Infrastructure (DPI) – Actor Influencing Digital Transformation of Indian Banks; (ii) The Central Bank – Guiding on Leverage of DPIs and Digital Transformation of Indian Banks; (iii) Emergent Digital Technologies – Actors for Digital Transformation among Indian Banks and (iv) Private and Public Banks alongside fintechs in India manifesting Digital Transformation.

The goal of this qualitative research is to identify and describe how the different networks players evolve the digital transformation across banks in India. While there are other actors influencing banking transformations like customers, other stakeholders and their demands - we restrict this study to actors who are collectively and directly evolving the transformations. This enables create a strategic focus around conceptualizing the agenda of digital transformation in collaboration with primary supply side actants. In comparison, actors like customers, employees, and partners who may be experiencing and receiving the results of transformations are also relevant. Banking system users, including industry, citizens, employees and others are also actors in the network system rather than passive recipients of services only. Consent choices, usage patterns, trust-related behaviors, and wider technology adoptions help generate continuous feedback reinforcing the suppliers of digital transformation. This study on actors driving digital transformations in India may be integrated and contrasted with recipient actors in future explorations. It is considered relevant to study supply and demand/ recipients of digital transformation disparately to evaluate focused motivations, key considerations and initiatives before integrative validations and alignment. In the following findings section, based on observations, we qualitatively describe how the four actors (i) to (iv) contribute towards evolving translations in digital transformation.

Findings: Prime Actors Driving Digital Transformation For Indian Banks

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Digital Public Infrastructure (DPI) – Actor Influencing Digital Transformation of Indian Banks

DPI refers to publicly available technology systems that are primarily developed in the public sector. DPIs are interoperable, scalable, and capable of supporting population-wide systems, which encourages the open accessibility of technologies (Ozili, 2025). Economies of scale make DPIs cost-effective. Beneficial applications of DPI may help accelerate financial inclusion, overcoming physical distance, documentation and transaction costs for Banks and other financial institutions (Gandhi, 2026) . Global studies indicate multiple focus areas across DPI initiatives. These relate to Digital Identity, Payment, Exchange and Integration System, Consent Networks, Credentials and Registries, Digital Signatories and overall National Digital Regulations and Policies (Clark, J.; Marin, G.; Ardic Alper, O.P.; Galicia Rabadan, G.A.., 2025).

The G20 Digital Economy Working Group (DEWG) developed the Global DPI Repository (GDPIR), which is a resource hub, pooling essential lessons and expertise from G20 members and other participating countries. India's DPI journey is a model example; the private sector utilizes the DPI to develop cutting-edge, customer-facing services relevant to banking, while the public sector builds, operates, and maintains the foundational technological infrastructure. The benefit of creating DPI in the public sector is that it guarantees targeted interoperability, democratized access, and sustained capital investment. The main elements of Indian DPIs include digital payments, digital currency, digital identification, and digital processes. These include critical dimensions like digital identity, bank accounts, and processing infrastructure. Aadhaar, India's biometric identity system, provides a single and portable proof of identity. Access to the banking system for the unbanked segments has been enabled through Jan Dhan accounts, i.e. Basic Savings Bank Deposit (BSBD) Accounts. In India, there is no requirement to maintain a minimum balance in savings bank accounts, and they offer certain minimum facilities to marginalized citizens, free of charge. The reach of banking and financial services is conceptualized through mobile phones, even in regions with low connectivity, given the high diffusion of mobile phone technology across India. Jan Dhan Accounts, Aadhar alongside Mobile Phones (JAM trinity) provides the base for DPI in India. These and many others hold key aspirations for embracing innovations that digitally transform the banking and financial sector in India (Cristian Alonso, 2023).

Public administration plays a crucial role in the development of digital public infrastructure in India. India has made continued investments and progress in digital public infrastructure under the Digital India Mission leveraging technology to improve governance, enabling banking and financial services and overall infrastructure. India's DPI foundational stack has been built on guiding principles that include a focus on open APIs, which are interoperable and based on consent, and consistently demonstrate three layers: identity, payments, and data. This not only facilitated the development of government services but also included private participation in building innovative business models. **Table 1** discusses such developments, including other prime DPIs, based on our research and of relevance to the digitalization of financial services sector in India. The available DPIs are viewed as relevant actors from the ANT perspective influencing digital transformation of Indian banks. In **table 1** we describe and map the available DPIs across the focus of identity, payment and data followed by description of the significant DPIs.

Table 1: DPIs as potential actors in digitalization of Financial Services in India

Mapping Key Digital Public Infrastructure (DPI) and the Focus – India

Identity	Aadhaar, eKYC, eSign, GSTN, Udyam …
Payment	AePS (Aadhaar Enabled Payment System), APB (Aadhaar Payment Bridge), UPI, BBPS (Bharat Bill Payment System) …
Data	DigiLocker, Account Aggregators …

Description of Key DPIs in India	
Account Aggregator (AA) [1]	This is related to a framework and regulatory initiative by the Reserve Bank of India that facilitates the sharing and aggregation of consumer financial information among qualified financial system actors, subject to the consent of the individuals involved. This enables MSMEs to secure cash flow-based funding from lenders with minimal paperwork requirements. The RBI regulates Account Aggregators (AAs), a class of Non-Banking Financial Companies (NBFCs) that serve as a consent manager for the exchange of financial data in India.
FAStag[2]	FASTag, developed by the National Payments Corporation of India (NPCI), is an RFID device linked to the payment ID of any vehicle, enabling quick and seamless payment of tolls and taxes on highways. Currently, tax collections on all national highways are mandatorily paid via FASTag, which reduces congestion in toll plazas and improves travel time.
Goods and Services Tax Network (GSTN)[3]	The GST indirect taxation platform assists Indian taxpayers with the preparation, filing, and payment of indirect tax obligations, as well as other compliance requirements. To implement the GST in India, it offers taxpayers, the federal and state governments, and other stakeholders IT infrastructure and services.
Open Network for Decentralized Commerce (ONDC)[4]	An open protocol that envisions equal access to digital retail markets for small businesses and retailers across the country, thereby providing a level playing field for all players. The platform onboards sellers, logistics partners, and a delivery force of gig-workers at low margins from the wider community. Users or buyers of the platform can choose the seller, pricing and even shipping options.
Ayushman Bharat Digital Mission (ABDM)[5]	Aims to create the framework required to support the infrastructure for integrated digital health. Along with features such as electronic signatures, non-repudiable contracts, paperless payments, and secure digital record storage, users can digitally identify individuals, physicians, and healthcare facilities. The goal is to use digital management to streamline healthcare information.
CoWIN [6]	This DPI has revolutionized vaccine registration, scheduling, and monitoring, ensuring efficient distribution and data-driven decision-making. It is estimated that the campaign saved more than 3.4 million lives in 2021 by undertaking a nationwide COVID-19 vaccination effort, reaching 1.4 billion citizens, and yielding far-reaching economic and financial benefits.

[1] https://financialservices.gov.in/beta/en/account-aggregator-framework
[2] https://www.npci.org.in/what-we-do/netc-fastag/product-overview
[3] https://www.gstn.org.in/
[4] https://ondc.org/
[5] https://abdm.gov.in/
[6] https://www.cowin.gov.in/

Data Empowerment and Protection Architecture (DEPA)[7]	Empowers citizens to access their data seamlessly and securely and share it with third-party institutions. It creates a digital framework that allows users to share their data on their own terms through a third-party entity, known as Consent Managers. A prime deployment of this in India is **DigiLocker.[8]**
National Digital Library (NDL)[9]	A virtual repository of learning resources and provides a host of services for the learner community. It offers open access to learning resources for graduates, postgraduates, competitive exams, and home study. The content includes books, research articles, texts, presentations, videos, images, simulations, and animations, among others. This is potential for bridging digital and financial literacy, including upskilling.
India Digital Ecosystem for Agriculture (IDEA)[10]	The adoption of IDEA is linked to the Unified Farmer Service Platform (UFSP), which aims to create a central database of farmers, land, and farm output for each piece of land. Once the farmers are onboarded and connected to the system, it addresses the problems faced by farmers methodically through new platforms and policy changes. Focusing on agriculture, including agricultural loans, is imperative given India's economic structure and the livelihood support it provides from this sector.
mParivahan[11]	Aspires to automate all vehicle registration and driving license-related activities in transport authorities of the country, with the introduction of smart card technology to handle issues like inter-state transport vehicle movement and to create state and national-level registers.
Trade Receivables Discounting System (TReDS)[12]	An online platform in India that facilitates the financing of trade receivables for Micro, Small, and Medium Enterprises (MSMEs). It allows MSMEs to sell their invoices to financiers at a discounted rate, improving their cash flow and working capital management. This is particularly significant for the Indian banking and financial sector, given its focus on MSMEs.
Open Credit Enablement Network (OCEN)[13]	An application programming interface (API) architecture that facilitates communication between loan agents, lenders, and partners involved in collection and payout.

Alongside enabling digitalization of financial services our study across DPIs in India demonstrate focus on employment, infrastructure, agriculture, renewable energy, connectivity, MSME and artisan support, research and development, trade, foreign investments with focus on sustainable development. In India the digital public infrastructure may be classified based on functions. The functional classifications may be broadly listed as:

- **Knowledge:** Focused on Education, skilling and rural/agricultural information
- **Public health stack:** Focused on citizen health, vaccination, public health and disease management
- **Welfare and Community:** Welfare, public services, partnership and justice; Social cohesion
- **Fin-stacks:** Financial services and payments

[7] https://www.niti.gov.in/sites/default/files/2023-03/Data-Empowerment-and-Protection-Architecture-A-Secure-Consent-Based.pdf
[8] https://www.digilocker.gov.in/
[9] https://en.wikipedia.org/wiki/National_Digital_Library_of_India
[10] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1847506
[11] https://parivahan.gov.in/parivahan/en/content/mparivahan
[12] https://www.rxil.in/treds/
[13] https://ocen.dev/

- **E-market stacks:** E-commerce and market access for MSMEs, farmers, service providers

Most of the DPIs in India are clustered in the broader inclusion as part of India Stack with focus on **Identity, Payments, Data and Open Networks**. These hold great opportunities for transforming banking and financial services in India. Digitally native fintechs and conventional banks are increasingly developing solutions capabilities that leverage DPIs. Increasingly DPIs in India evolve as a key actor in evolving translation leading to digital transformations in banking.

The Central Bank – Guiding on Leverage of DPIs and Digital Transformation of Indian Banks

The Reserve Bank of India (RBI) is a large and complex organization, with ~13,500 employees across a vast and geographically diverse country. In addition to managing reserves, overseeing banks and non-banks, printing notes, processing payments, and managing the government's debt, the RBI is a "full-service" central bank that promotes monetary and financial stability.The Indian central bank, the Reserve Bank of India (RBI), is focused on leveraging Digital Public Infrastructure (DPI) and emerging technologies to improve customer experience, banking operations, resilience, and financial inclusion across Indian banks. In India, the central bank acknowledges that the traditional banking system will evolve in response to technological transformations. RBI is a prime actor and indicates that it is essential to acknowledge the pivotal role that DPI plays in the digitalization of Indian Banking, including its significant contributions towards digital and financial inclusivity.

The RBI has highlighted India's payments vision, with an emphasis on the use of technologies for data management, cloud, analytics, blockchain, artificial intelligence, and other emerging technologies. The Reserve Bank, over the years in India, has facilitated the development of retail and wholesale payments. The creation of digital infrastructure like Indian Financial Network (INFINET) using Structured Financial Messaging System (SFMS) to power Real-Time Gross Settlement (RTGS) and National Electronic Funds Transfer (NEFT) payment systems. Unified Payments Interface (UPI), a real-time payment system launched in India in April 2016 by the National Payments Corporation of India (NPCI). UPI is a significant DPI actor, helped in the growth of retail digital payments in India. UPI is now enabled through mobile channels to enable financial transactions. Under the direction of the Reserve Bank of India, banks promoted NPCI (Giulio Cornelli, 2024). Bharat Interface for Money (BHIM) 3.0 was introduced by NPCI BHIM Services Limited (NBSL) in March 2025, with the goal of providing new services to banks and businesses, as well as enhanced capabilities. It is worth noting how this is available in more than fifteen Indian languages, functional in low internet areas with slow or unstable network connections and offers better money management. To promote innovations and digital transformation-mediated enhancements in payments across the financial sector in India, the RBI provides guidance and motivation through a detailed Payments Vision 2025 – including E-Payments for Everyone, Everywhere, Every time (4Es) with distinct, achievable goals (RBI, 2022).

Simultaneously, the RBI has highlighted the focus on the Unified Lending Interface (ULI). The ULI was announced by the RBI Governor at the RBI@90 Global Conference in August 2024 (on completion of 90 years of the Reserve Bank of India). This platform facilitates a seamless and consent-based flow of digital information, including land records of various states, from multiple data service providers to lenders. ULI is a digital platform to facilitate credit access by

streamlining the flow of financial and non-financial data between lenders and borrowers. This reduces the time taken for credit appraisal, especially for smaller and rural borrowers. ULI architecture leverages common and standardized APIs and consent-based centralized data access. The Governor of the Reserve Bank of India has indicated the revolutionary power of a 'new trinity' JAM-UPI-ULI in forwarding India's digital infrastructure journey (RBI, 2024). This provides clear guidance and focus for Indian banks to explore innovations and digital transformations alongside available DPIs and technology for beneficial outcomes in India and beyond.

In addition, the RBI launched a regulatory sandbox to encourage innovations in financial services while adhering to regulations. The RBI Regulatory Sandbox is a framework that enables the testing of financial innovations in a controlled environment. This aims to foster innovation in the FinTech (Roy D. P., 2025) sector alongside banks, while mitigating potential risks, testing with real customers, and enabling regulatory learning and responsiveness. Yet another focus of RBI is resilience and cybersecurity. The RBI has issued multiple guidelines on encryption and multi-factor authentication. Guidance and expectations for banks to follow are imperative as Indian Banks embark on digital transformations. The RBI clearly emphasizes the importance of ensuring customer data protection through secure IT architecture and the necessary responses to a crisis. Major Indian banks are collaborating with the RBI to develop the Digital Payment Intelligence Platform (DPIP), aiming to counter the growing incidence of digital payment scams. By exchanging real-time intelligence, this digital public infrastructure aims to enhance fraud risk management and prevent fraudulent transactions. The RBI Innovation Hub is developing prototypes to leverage emerging technologies including quantum computing, analytics, machine learning and artificial intelligence.

The topic of Central Bank Digital Currency (CBDC) is prime in international policy discussions. In late 2022, the Reserve Bank of India initiated CBDC experiments in the retail and wholesale sectors. The RBI believes that CBDC can enhance India's financial inclusion. There are new opportunities to increase the efficiency of cross-border payments due to the development of fast payment systems in several nations and experiments with CBDC. The Digital Rupee is the electronic version of the Indian currency used for transactions or digital value, like the physical currency. The RBI creates the Digital Rupee and issues it to banks, which in turn distribute the Digital Rupee to customers. We observe inter-actor interactions between RBI and Indian banks. A pilot is currently ongoing across fifteen Indian banks to test and explore the uses/ features/ technology, and applications of the Digital Rupee. Such collaborations between actors optimally drive digital transformation initiatives across Indian banks.

The focus on disruptive technologies, such as Artificial Intelligence (AI), is evident across Indian banks. The financial sector in India utilizes AI in various forms, including services such as chatbots, internal data processing for intelligent alerts, fraud risk management, credit modelling, and other processes. A conceptualized integration of DPI with AI leads to "Digital Public Intelligence" for banks and the financial sector in India to leverage. The RBI has issued multiple guidelines regarding how banks and financial services are incorporating AI into their operations and practices, including the associated risks and the nature of mitigations. The Reserve Bank of India (RBI) is actively integrating Artificial Intelligence (AI) and Machine Learning (ML) into its operations and regulatory functions. This includes using AI/ML for predictive market analysis, stress testing banks, and strengthening supervisory capabilities. The RBI has also established a committee to develop a framework for the responsible and

ethical adoption of AI in the financial sector.

Beyond enabling banks to embrace technology as India's central bank, the RBI motivates multiple in-house digital transformation initiatives. In doing so RBI strongly acknowledges enhancement of capabilities through the leverage of available DPIs and emergent technologies. With the Sarthi and Pravaah Systems, the RBI's in-house developers have transformed the bank's internal and external processes. RBI itself continues to focus on digital transformation, working on cloud and new data centers, including a strategic focus on technology, making the RBI agile, resilient and future-ready. These activities can be linked with the interessement component of ANT, particularly in alignment of interest and convincing others towards protocols of digital transformation of banking in India.

Emergent Digital Technologies – Actors for Digital Transformation among Indian Banks

Digital transformation has led to the development of business models such as Banking as a Service, embedded finance across neo-banks, and conventional banks in India. This focus has also led to multiple innovations and technology-enabled transformations across the Indian banking sector, with transformations evident across large private and public banks alongside fintechs. The evolving landscape in India is profoundly influenced by emerging digital technologies, including data management, analytics, cloud computing, cybersecurity, artificial intelligence, and the leveraging of multiple digital channels for delivering banking and financial solutions. The banking experience is increasingly omni-channel beyond the conventional branches and is curated through smart screen automated banking machines, online digital portals, mobile devices, near field communication, wearables and even smart home devices leveraging internet of things among others. This is a business model transformation with motivations for broader reach and greater inclusion. Some banking applications are designed to operate at low internet connections and on basic mobile connectivity. Simultaneously, alongside technology efficiencies, we observe efforts by banks to humanize experiences over digital channels with natural language capabilities, including Indian vernacular languages. Observed instances of deployed chatbots for customers and robotic process assistants manifest focus on enhancing both operational efficiencies and banking experiences.

The new and emergent digital technologies demonstrate considerable complementary capabilities. The ability to derive greater value from adopting these technologies in conjunction, rather than individually, leading to digital technology bundling and convergence is one of the most important considerations that go into formulation of digital strategies across financial institutions (Pani, 2020) . In addition, the individual to individual, individual to institution and institution to institution digitally enabled financial transactions are presently influenced by level of technology adoption both by individuals and institutions. Theoretical evaluation like ANT is therefore relevant to understanding the role technology as a prime actor in socio-economic translations associated with digital transformations.

Recent observations across Indian banks have highlighted a dedicated focus on technology adoption across various areas. These include – data management and analytics, cloud, cybersecurity technology, Application Programming Interfaces (APIs) at a significant scale. Simultaneously, there are instances of deployment and experimentation with emerging and disruptive technologies, such as Artificial Intelligence (AI), generative AI, blockchain, and quantum computing among others. **Table 2** presents some indicative emergent technologies

used as evident across recent case instances of technology adoption among Indian banks. These instances help understand the nature of deployment and the digital capabilities being aspired across Indian banks. The examples are indicative of varied proliferations in digital technologies. Included are some representative instances for the audience to intuitively assess the adoption and deployment of technology. While some of these instances exhibit scaled adoption across many banks in India, others are emerging and experimental. These activities can be linked to enrollment in perspective of ANT, including negotiation and accepting roles with technology while leveraging DPIs. This leads to evolving common interests among banks including standard practices, best practices, innovative benchmark for differentiations in relation to digital transformations.

Table 2: Digital Technologies enabling Transformative Initiatives across Indian Banks

Data Management and Analytics	▪ A leading private sector bank utilizes advanced analytics platforms to consolidate customer data across its retail and corporate segments. This integration enables real-time risk assessment, personalized product recommendations (such as pre-approved loans), and automated regulatory compliance reporting, in line with the RBI's data localization norms. ▪ A leading private sector bank employs an AI-powered data lake to consolidate structured and unstructured data across retail, corporate, and digital channels. This infrastructure facilitates real-time credit risk scoring, hyper-personalized wealth management recommendations, and the automated generation of regulatory reports (e.g., for RBI's BASEL III compliance), while adhering to data localization requirements under the Data Protection Bill. ▪ Banks leverage DPI associated with data for associated analytics and decision making
Cloud	▪ A prominent private sector bank has migrated critical workloads, including customer-facing applications, to a major cloud service provider. This shift enhanced scalability for UPI transactions and accelerated application deployment. The bank utilizes a hybrid cloud model to maintain agility and comply with regulatory mandates. ▪ Instance A major public sector bank migrated its core banking system and mobile banking applications to a private cloud environment. This achieved 99.5% operational uptime during high-volume periods (e.g., tax seasons), reduced infrastructure costs by 30%, and enabled instant scalability for Aadhaar-linked subsidy disbursements. The architecture utilizes RBI-approved in-country data centers with encrypted backups to meet financial data residency requirements. ▪ Cloud adoption primarily leverages DPIs associated with payments and necessary regulations
Cybersecurity Technology	▪ A leading public sector bank has implemented AI-driven Security Operations Centers (SOCs) to ensure continuous threat monitoring and detection. Its cybersecurity architecture includes behavioral analytics for fraud detection, end-to-end encryption, biometric authentication, and cybersecurity drills, adhering to CERT-In (national cybersecurity agency) and RBI guidelines. ▪ A major private sector bank has deployed deception technology with AI-driven decoy networks that mimic critical assets. This system reduced breach detection time by 70% through threat-luring forensic analysis. These outlines innovative practices by a bank in use of AI.

Digital Channels	▪ A notable public sector bank has introduced a tablet-based banking solution that enables field officers to remotely onboard customers in India. Its integrated digital platform unifies mobile apps, net banking, WhatsApp banking, and physical branches, ensuring seamless transition across service channels. This relates to greater banking reach and better financial inclusion. ▪ A leading public sector bank launched an AR-powered virtual branch platform accessible via smartphones, enabling 3D holographic interactions with relationship managers. Features include Voice-enabled transactions in 8 Indian languages, Real-time document co-browsing for loan processing, and Unified transaction history across IVR, web, and app channels.
Artificial Intelligence and GenAI	▪ A major private sector bank uses AI-powered virtual assistants to handle ~5 million customer queries monthly, resolving with agility while improving with machine learning. ▪ Another prominent private sector bank utilizes robotic process automation (RPA) to execute ~1.2 million daily operations, including KYC verification and reconciliation, with claims of near-zero error rates. ▪ Observed instances indicate a forward-looking private sector bank is piloting Generative AI to create hyper-personalized marketing content and streamline internal documentation processes through intelligent summarization. ▪ AI adoption in banking is executed under close guidance of RBI and national policies.
Application Programming Interface (API)	▪ An innovative small finance bank has developed an API-driven ecosystem that enables third-party fintech platforms to integrate banking services, including account opening, payments, and credit underwriting. The bank handles ~8 million API calls daily, covering UPI, Bharat Bill Payment System (BBPS), and other essential financial services. ▪ A mid-sized cooperative bank built a microservices API gateway for agricultural banking, featuring Aadhaar-based e-signature integrations for land record verification, Real-time GSTN API sync for farmer income assessment, Weather data APIs for crop insurance underwriting, and handles nearly 4 million daily calls through NPCI's Bharat Stack while complying with RBI's API Security Standards.
Internet of Things (IoT)	Observed instance indicates a progressive private sector bank is piloting IoT-enabled smart lockers equipped with biometric authentication and real-time inventory tracking. Additionally, sensor networks are deployed in key branches to enhance energy efficiency and enable predictive maintenance of ATMs and other critical hardware.
Blockchain	▪ A tech-savvy private sector bank has partnered with global blockchain networks to facilitate cross-border remittances, reducing settlement times from several days to few minutes. ▪ Another private sector bank utilizes blockchain technology to issue digital bank guarantees for corporate clients, reducing processing time from 2–3 days to a few hours while ensuring transparency and tamper-proof audit trails.

Private and Public Banks alongside fintechs in India manifesting Digital Transformation

Digital transformation is viewed as a complex process, under-taken by institutions – manifested through multiple technology and business initiatives, to capitalize differential benefits (Pani, 2020) . Based on descriptions from existing literature, public narratives from institutions, news, discussions with expert technology practitioners, qualified by grounded

theoretical understanding of technology-led transformations, the research identifies specific Indian banking focus on digital transformation. The adoption of emerging and disruptive technologies, leverage of DPIs, guidance from the RBI as well as diffusion of innovations across the banking and financial sector, lead to transformations. Observations across transformative initiatives by banks reveal insights into the focus of digital transformations. In other words, we explore, what are the banks hoping to achieve with the adoption of technology? How are banks leveraging availability of DPIs in India? How do financial policy, regulations and guidelines from government and RBI influence digital transformations in banking?

It is significant as banking organizations establish strategic orientations and are motivated to achieve broader business objectives. Establishing linkages between actors like technology, DPIs and central bank associated with digital transformation of banks. will be imperative. The fourth component from an ANT perspective - mobilization, involves the representation and entrenchment of interest in digital transformation is explained in the following section. Based on qualitative research the discovered focus areas in relation to technology-mediated digital transformation of banks are discussed below. The key transformation focuses observed across Indian banks are - 360 Degree Customer-Centric Banking; Open and Embedded Banking; Proliferation on Innovative Ecosystems; Digital Payments; Cybersecurity and Fraud Resilience; Simplified Paperless Processes; Digital Lending; and Financial Inclusion alongside sustainable development. While these focus areas are indicative as to where digital transformations are evident across bank, this is continuously evolving based on network influence of relevant actors. Across the transformation focus areas in India we observe leverage of DPIs, technology, motivations from the central banks alongside initiatives across public and private banks. The following are qualitative descriptions across the transformation focus areas.

- **360 Degree Customer-Centric Banking Transformation in India:** India's banking industry aspires to achieve comprehensive 360 Degree Customer centricity by integrating digital ecosystems that unify data across all touchpoints. Institutions now leverage unified customer profiles, aggregating transactions, interactions, and behavioral data, to enable hyper-personalization through AI-driven insights. This shift facilitates real-time product recommendations (e.g., pre-approved loans triggered by life events) and predictive financial advice. Omnichannel engagement ensures seamless transitions between digital channels - mobile apps, chatbots, branches, and call centers with continuous context tracking. API integrations with third-party platforms automate offerings aligned with customers' milestones, such as education, marriage, the birth of a child, or retirement. Observed across are instances of vernacular voice assistants to enhance accessibility and inclusion. Supported by IndiaStack infrastructure and regulatory frameworks like RBI's Digital Banking Units these transformations reduce service latency and elevate customer satisfaction scores industry-wide, evolving banks from transactional providers to proactive financial partners.
-
- **Focus on Open and Embedded Banking in India:** India's API-driven banking ecosystem enables secure data sharing and integrated financial services, leading to the realization of open and embedded banking across various instances. India-specific study reveals that the most common use cases relate to embedded payments—online payment options at places of consumption. For instance - embedded insurance, which is insurance bundled in real time and at the point of consumption addressing diverse needs of the consumer like travel insurance while booking airlines tickets. Embedded investments (integrations into brokerage and/or investing platforms based on APIs), Embedded lending

(Options for Buy Now Pay Later - BNPL at points of consumption) and Embedded cards (cards-as-a-service offering) are increasingly being rolled out and gaining ground among users. In India, it appears that there are several different versions and application landscapes, including business-to-business, business-to-consumer, consumer-to-consumer, and obviously government-to-consumer as manifested across instances of open banking and embedded finance – as indicated earlier.

- **Proliferation of Innovation Ecosystems in India - The Emergence of Neo Banks, Fintechs:** The emergence of neo banks and fintechs in India represents a paradigm shift driven by digital-native platforms that offer branchless, app-based banking experiences. This brings about very divergent perspectives to the process of digital transformation in banking. Financial services are rendered simultaneously through conventional organizations adopting digital and emerging technologies and digitally native fintechs and neo banks in India. The pace and outcomes of digitally mediated banking services are therefore disparate. These entities leverage partnerships in compliance with regulations to provide seamless services - such as instant account opening, automated budgeting tools, and personalized lending—catering especially to diverse customer segments and underserved segments like MSMEs, gig workers and even the financial marginalized and excluded. The growth of such ecosystems is fueled by India's expanding internet access, UPI infrastructure and regulatory frameworks like IndiaStack. Fintechs further proliferate ecosystems through APIs, integrating banking with third-party services (e.g., e-commerce, accounting software), enabling embedded finance solutions such as BNPL and automated GST compliance. The dynamic and innovative fintech landscape in India is developing solutions to extend regulatory frameworks. Banks and evolving financial entities navigate evolving paradigms and compliance requirements, such as data localization (RBI's Storage of Payment Data), leverage available DPIs simultaneously.

- **Innovative Digital Payments in India:** The Digital payments landscape has been transformed by innovations centered on the Unified Payments Interface (UPI), processing billions of monthly transactions. This interoperable infrastructure enables instant, continuous bank-to-bank transfers via mobile apps, QR codes, and contactless methods, servicing everyone in a democratized manner with nearly last-mile reach. Key advancements include- QR Code Proliferation, Offline Payments, Cross-Border Integration, Auto-pay subscriptions and EMI collections via e-mandates and APIs enabling 'payments within apps' for e-commerce, transit, and accounting platforms. Many of the digital payment practices in India are global benchmarks in scale and serve as learning opportunities.

- **Cybersecurity and Fraud Resilience across Indian Banks:** India's banking sector has significantly strengthened its fraud resilience through multi-layered technological and regulatory frameworks, deploying AI-powered surveillance for real-time anomaly detection, which significantly reduces response times. Blockchain verification ensures immutable audit trails for high-value transactions, while mandatory biometric authentication and dynamic tokenization secure sensitive operations. A centralized national fraud registry enables predictive risk modelling and facilitates cross-institutional alert sharing. Crucially, regulatory sandboxing enables the controlled testing of advanced solutions, such as homomorphic encryption, before deployment. These systemic defenses—reinforced by the Fugitive Economic Offenders Act (2018) and RBI cybersecurity mandates —have reduced fraud-to-loan ratios by 58% since 2020. Continuous collaboration among regulators, financial institutions, and

fintechs ensures proactive and agile adaptation to emerging threats, thereby safeguarding the growth of digital banking in India.

- **Simplified Paperless Processes, Including KYC Management, among Indian Banks:** India's banking sector has revolutionized paperless processing and KYC management through Aadhaar-integrated digital infrastructure, enabling instant identity verification via biometric or XML-based e-KYC. Video-based KYC with liveness detection enables remote onboarding in just a few minutes, while AI-powered OCR extracts data from documents, such as PAN cards, for automated form filling. Centralized KYC (CKYC) repositories eliminate redundant documentation across institutions, thereby streamlining processes and reducing costs. Blockchain secures audit and compliance, and smart contracts auto-trigger updates for expired documents. These innovations were further supported by RBI's sandbox for testing AI-driven risk profiling, which slashed customer onboarding times, reduced costs and minimized fraud through real-time biometric authentication. Regulatory frameworks, such as India Stack, ensure interoperability and security while advancing financial inclusion.

- **Leveraging Digital Lending in India:** Digitalization in India's banking sector, driven by ubiquitous connectivity, robust digital identity, and interoperable payment platforms, has fundamentally reshaped lending. Core processes—from application and KYC to underwriting and disbursement—are mostly automated. This leverages alternative data sources (like cash flow patterns) for algorithmic credit scoring, bypassing traditional collateral requirements. The result is dramatically faster, paperless loan approvals (often within minutes), significantly lower operational costs for lenders, and vastly expanded access for underserved segments, such as MSMEs and new-to-credit customers. However, it necessitates continuous focus on robust cybersecurity, data privacy, and preventing algorithmic bias to ensure responsible and sustainable growth.

- **Practices towards wider Financial Inclusion in India:** The Indian banking sector is advancing financial inclusion through a multi-pronged approach focused on expanding access and deepening usage and citizen engagements. A significant push involves scaling alignments to digital public infrastructure, particularly by establishing dedicated digital access points in underserved rural and semi-urban regions, often integrated with flagship national programs. The overwhelming success of a dominant, user-friendly mobile payment system, which processes digital transactions by value, serves as a powerful model, demonstrating how technology can bring the informal economy into the formal fold, even before full financial literacy is achieved. Concurrently, the industry is adopting advanced technologies, including artificial intelligence for multilingual support, alternative credit scoring for customers who lack conventional documentation, and robust fraud detection. Supportive regulatory frameworks, including mechanisms for consented financial data sharing and policies that encourage tailored products for underserved segments such as women, gig workers, and marginalized individuals, further enable inclusion. Crucially, efforts extend beyond mere account ownership to driving active engagement with diverse financial services – including credit, insurance, and pensions – by leveraging simplified digital interfaces and literacy initiatives linked to practical needs, thereby converting access into meaningful adoption for Indian citizens.

Analysis And Discussion

Actor-network theory approach allows to investigate the balance between the technical and

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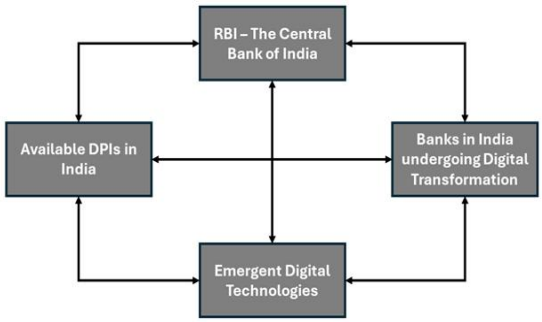
social, economic, regulatory, policy and governance aspects of digital transformation in India. Acknowledging the role of multiple actors and respective influence towards a complex phenomenon like digital transformation of banking in India is imperative beyond technology only studies. This is achieved by recognizing a set of prime actors and describing the actions of those present in the network as outlined in the findings section. Further relevant actors may be enrolled in future studies to make the network representation more comprehensive. While this actor network exploration primarily focuses on actors those are responsible for bringing about the transformation. Further extension to this study may include wider partners, banking customers, industries that are receiving and experiencing the digitally transformed services as dispensed by Indian banks. Based on the qualitative descriptions across the primary actors as presented in findings section a high-level network is indicated in **Figure 1**. The figure indicates the nature of associations across the source and target actors. Also highlighted are the various features of the actors as evident from the qualitative explorations.

FIGURE 1: ANT Perspective Comprising Four Actors for Digital Transformation of Banks in India



Actor Features and Considerations	
Available DPIs in India	Identity, Payments, Data and Open Networks: JAM – trinity; Account Aggregator; FAStag; GSTN; ONDC; ABDM, CoWIN; DEPA; NDL; IDEA; mParivahan; TReDS; OCEN; ...
RBI – The Central Bank of India	INFINET; SFMS; RTGS; NEFT; Unified Payment and lending Interface; Policy; Guidelines; Regulatory Sandbox; Innovation; Technology Adoption ...
Emergent Digital Technologies	Data Management and Analytics; Cloud; Cybersecurity Technology; Omni Channel including Digital; Artificial Intelligence and GenAI; Application Programming Interface (API); Internet of Things (IoT); BlockChain
Banks in India undergoing Digital Transformation	360 Degree Customer-Centric Banking; Open and Embedded Digital Banking; Neo Banks, Fintechs; Innovations in Digital Payments and Lending; Cybersecurity and Fraud Resilience; Paperless Processes, Including KYC Management; Digital Financial Inclusion

Actor 1 (A1)	Actor 2 (A2)	Bi-directional Associations
Available DPIs in India	RBI – The Central Bank of India	▪ **A1 (Source) → A2 (Target)** : Introduces digital public infrastructure based new possibilities in banking ▪ **A2 (Source) → A1 (Target) :** Provides regulatory standards, incentives, and sandbox mechanisms, positions Digital Public Infrastructure (DPI) as an obligatory passage point for digital transformation
	Emergent Digital Technologies	▪ **A1 (Source) → A2 (Target) :** Introduces public infrastructure opportunities and challenges to be overcome with digital technologies ▪ **A2 (Source) → A1 (Target) :** Continuous improvement and reimagination of public infrastructure with emergent digital technologies
	Banks in India undergoing Digital Transformation	▪ **A1 (Source) → A2 (Target) :** Introduces digital public infrastructure based new possibilities in banking ▪ **A2 (Source) → A1 (Target) :** Demands for Innovations and Proliferations in digital transformation generate developments in digital public infrastructure
RBI – The Central Bank of India	Emergent Digital Technologies	▪ **A1 (Source) → A2 (Target) :** Evaluation and assessment of emerging technology for banking. Provide regulations, guidance and sandbox environments for technology adoptions ▪ **A2 (Source) → A1 (Target) :** Continuous improvement and reimagination of digital transformations in banking for purposeful growth
	Banks in India undergoing Digital Transformation	▪ **A1 (Source) → A2 (Target) :** Provides regulatory standards, incentives, and sandbox mechanisms suitable for public / private banks, fintechs ▪ **A2 (Source) → A1 (Target) :** Innovations and Proliferations in digital transformation generate developments, data, benchmarks and feedback
Emergent Digital Technologies	Banks in India undergoing Digital Transformation	▪ **A1 (Source) → A2 (Target) :** Introduces emergent digital technology capabilities based new possibilities for banking transformation ▪ **A2 (Source) → A1 (Target) :** Adoption of emergent digital technologies

The **figure 1** conceptualizes India's DPI-enabled banking ecosystem as a dynamic inter-influence system, where outcomes emerge through continuous interaction, feedback, and adjustment, rather than through simple linear cause–and–effect chains. Drawing on Actor–Network Theory (ANT), the diagram illustrates how human and non-human actors - regulators, institutions, technologies, and banks co-evolve through processes of coordination, control, and learning. The table in the figure indicates the prime interactions between the source and target actors. These interactions are longitudinal and evolve continuously over time. A reinforcing feedback loop reflects the ANT process of translation leading to optimal influence on digital transformation of banks. The system begins with problematization, where inefficiencies in traditional banking practices are identified. In response, the Reserve Bank of India (RBI), through regulatory standards, incentives, and sandbox mechanisms, positions Digital Public Infrastructure (DPI) and other enablers as an obligatory passage point for digital transformation. The DPI stack, covering identity, payments, application programming

interfaces (APIs), and data layers, enables banks and fintechs to adopt digital processes more efficiently alongside other inherent technology proliferations. As these actors enroll into the DPI and banking ecosystems, operational efficiency improves, leading to the expansion of digital payments, open banking services, and more customer-centric financial products. These improvements, in turn, strengthen financial inclusion, paperless transactions, and institutional trust, which is likely to further reinforce more DPI adoptions and digital transformations in banking. As DPI adoption and transaction volumes increase, cybersecurity and other risks may rise. Rising risk levels trigger regulatory interventions through the RBI's control mechanisms, including monitoring, corrective action, and system redesign. This control loop helps stabilize from the ANT perspective and acts to reduce vulnerabilities through improved safeguards, tightened protocols, and adaptive regulation. Simultaneously rather than suppressing innovation a balance between innovation and resilience is revealed important for digital transformation of banks in India and globally.

Conclusion

This study advances the understanding of digital transformation in Indian banking by moving beyond linear, technology-centric explanations. This exploration conceptualizes digital transformation as a dynamic, self-regulating socio-technical system. Application of Actor–Network Theory (ANT) reveals a wider appreciation of beyond bank actors that are prime in developing and driving the phenomenon of digital transformation in India. The findings affirm the pivotal role of the Reserve Bank of India (RBI) in the translation process. Through regulatory guidance, standard-setting, sandboxing, and internal digital transformation initiatives, the RBI has effectively guides on leverage of available Digital Public Infrastructure (DPI) as an obligatory passage point for banks, fintechs, and allied ecosystem participants in embracing technology solutions. However, the analysis shows that the RBI's influence is not merely hierarchical or command based. Instead, governance is increasingly embedded within technological architectures, such as APIs, consent frameworks, cybersecurity protocols, and payment rails, allowing regulation to operate continuously and adaptively evolve within the system.

The DPI stack in India, spanning identity, payments, data, and open networks, is a relevant and primary non-human actor that shapes digital transformation, banking operations, organizational processes, and citizen interactions. The availability and adoption of DPIs in a developing nation like India and its influence in digitalization of banking highlights the importance of enabling ecosystems created by the government. As banks and fintechs enroll into this infrastructure, they experience gains in operational efficiency, scalability, and innovation capability, which translate into expanded digital payments, open and embedded banking models (Roy D. P., 2024) , paperless processes, and enhanced customer-centric offerings. These outcomes, in turn, reinforce trust, inclusion, and further adoption, create a reinforcing feedback loop that sustains digital transformation growth. The capabilities in digital transformation alongside adoption of DPIs are deeply rooted in the proliferations of technology and innovations. Our exploratory perspective views relevant technologies as primary actor evolving the process of digital transformations. This aligns closely with ANT's notion of mobilization, where networks stabilize and act as cohesive mesh of inter-influences. The study presently concentrates focus on the prime supply side actors responsible for digital transformations in India. Recipients of digital transformations also operate as actors like distributed sensors enabling learning and adjustment across the banking ecosystem. Future integrated studies beyond supply-side narratives as extension to this exploration framework

can dwell on the co-productive role of users in sustaining transformation.

The analysis further reveals that growth-oriented dynamics in digital transformations are accompanied by systemic risks and constraints. Rising transaction volumes and deeper digital integration increase exposure to cybersecurity threats, identity and privacy issues - wherein regulatory interventions, technological safeguard capabilities, and institutional coordination is important and relevant from ANT perspective. Rather than constraining innovation, these control mechanisms enable a balance in the network, allowing the system to grow, overcome any structural inertia while maintaining resilience. Taken together, the findings suggest that India's banking digital transformation is best understood as a regulating socio-economic and technical ecosystem, where innovation, inclusion, risk, and regulation are continuously co-produced evolving digital transformation in banking.

Indian experience offers valuable lessons for emerging economies from a policy and global development perspective. The findings highlight how digitalization of banking in a country needs wider expansive appreciation of the role played by multiple relevant actors. It illustrates how strong public digital infrastructure, coupled with adaptive central bank governance and guidance, diffusion of technology and innovations can enable large-scale transformation while preserving system stability. For practitioners and policymakers, the study underscores the importance of designing digital ecosystems that internalize governance, leverage enabling actors, incorporate citizen feedback, and balance growth with resilience. Future research needs to extend this framework by empirically examining citizen experiences, institutional learning processes, and cross-country comparisons of DPI-led banking transformations. The study establishes a robust conceptual foundation for understanding digital transformation not as a one-time shift, but as an ongoing longitudinal, adaptive process shaped by interdependent actors, associations and feedback loops, a perspective that is increasingly essential to acknowledge in digitally mediated financial and other macro-systems.

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