

A CRITICAL ANALYSIS ON ROLE OF INDIAN DIGITAL PAYMENT SECTOR IN DIGITAL FINANCIAL INCLUSION WITH SPECIAL REFERENCE TO POST COVID-19 PERIOD .

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Abstract

The Indian digital payments Sector has experienced significant growth over the past eight years, specially denormalization of currency in 2016 powered by a significant thrust due to pandemic Covid -19 towards digitalisation. The industry is projected to expand more than three times in volume, from 206 billion transactions in FY24–25 to 617 billion by FY29–30. (PwC Analysis) In terms of value of payment transactions, the market is expected to triple, from INR 299 trillion to INR 907 trillion over the same period Digital payments have significantly grown in recent decade as a result of mutual actions by the Government of India with all stakeholders. The total digital payment transactions volume increased from 2,071 crore in FY 2017-18 to 18,592 crore in FY 2023-24 at CAGR of 44%. Digital Payment Transactions has seen a tremendously increased especially after FY 2016-17 after demonetization of the currency by NDA government in Nov 2016. The digital payment transactions have grown from 220 crore in FY2013-14 to 18,592 Crore in FY2023-24. During the same period, the value of transactions has grown from ₹ 952 lakh crore to ₹ 3,658 lakh crore. UPI is an benchmark digital payment system which provides the digital interface among the payment parties of speedy and easy payments from multiple bank accounts in a single mobile application. UPI has paved a way for digital payments sector in all over the country , UPI transactions have grown from 92 crore in FY 2017-18 to 13,116 crore in FY 2023-24 at CAGR of 129%. India's indigenously developed UPI and RuPay cards are world class platforms for enabling digital payments. Government is making efforts to promote these products globally. (Reports of RBI, NPCI & Banks) As per RBI data till 31st March 2024, the number of payment acceptance infrastructure is 36.14 crore. (Reports of RBI, NPCI & Banks). The Current Paper attempts to discuss the Digital Indian Payment Sector as prime engine in digital finance inclusion in India

Keywords: Digital Inclusion, Digital Payment Sector, Digital Payment Methods, NPCI, UPIs, Digital Wallets.

Introduction

Information Technology -the word becomes magical in many ways in contemporary time as it has changed the ways of life style of the people in the allover world. ICT has its own significant impact on modes of communications, spendings, learning, entertaining, thinking, travelling, and earning of the people in general in dynamic trends. If we think about the earning aspect of the people, Information technology has changes the upside down of the scenario of the “making money” concept, from going to office physically to freelancing job based structure, work from home concept, providing home deliveries not only for FMCG Goods but also heavy electronic appliances, creating digital workplace/marketplace, involving

numerous social media platforms for marketing strategies to capture more relevant customers segments and most importantly fast, easy and secured payment methods. Apart from Information Communication Technology, pandemic COVID can also be considered as the major influential factor on trade and commerce in general, the word “E-Commerce” has leads us to another research avenue for the academicians and professionals in Industry. COVID-19 compelled the trade and commerce world to move from manually-physically to digitally in each aspect of the trade whether providing service remotely and delivering goods at your door step or generating new job opportunities and last but not the least the whole payment system-from physical cash/bank-based method to new digital payment methods using electronic device which floats ‘Paperless, faceless and Cashless” feature. The demonetization process carried out by Indian Government on Nov. 08, 2016, has open the gateways of digital payment methods not only for industrial frontline but encompasses the small-scale industries as well as end consumers. New Digital wallets, digital mobile applications for payment gateways such as Paytm, Google Pay Airtel Wallet comes into existence, new market players such as Airtel wallet Paytm, Google Pay Mobikwik, Amazon Pay comes into frontline with new variety of digital payment consumer service products such as UPI, Mobile Wallets etc. After computerization in Indian banking sector in 1996 to 1999, it has witnessed the tremendous growth in their digitally payment services and has been compelled to improve and launch new services in Internet banking, Mobile banking, and various banking cards. With all this, and with the benchmark agenda “The Digital India Program” by Government of India gave push to creation of New, advanced Digital Payment Sector in India and paved path for the government to embodied Regulatory and policy framework for such Sector

Digital Inclusion

Indian Government has launched “Digital India” program in 2015, with a motive of leading the nation towards Digital empowerment and knowledge-based ecosystem. For that Digital Inclusion must be discussed in the preview of major Eco-socio sectors, be it financial service system, Healthcare, Agriculture Education, and trade-Commerce in general. To achieve the goal, three basic Pillers must be established for smoothen out the transformation process of Digitally Empowered Nation: Digital Literacy, set up of Digital Infrastructure and Digital Inclusion. Digital Inclusion may be defined as framework where every Stakeholders has equal rights to access the Internet based Information, and also can participate in innovative usage of Information and communication Technology. Digital Inclusion refers to the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies (ICTs). This includes 5 elements: 1) affordable, robust broadband internet service; 2) internet-enabled devices that meet the needs of the user; 3) access to digital literacy training; 4) quality technical support; and 5) applications and online content designed to enable and encourage self-sufficiency, participation and collaboration. Digital Inclusion must evolve as technology advances. Digital Inclusion requires intentional strategies and investments to reduce and eliminate historical, institutional, and structural barriers to access and use technology. (NDIA)

Overview of Digital Payment Sector in India

The digital payment ecosystem in India is a ever changing framework formed by the mutual role of regulatory bodies such as RBI, government regulations, banking and non- banking financial institutions, and private market players and innovative service promoters. Each stakeholder perform a unique role in constructing a infrastructure, complying security standards, and extending accessibility to end users across diverse geographies.

Reserve Bank of India (RBI) As the apex regulatory authority in banking sector, the Reserve Bank of India has been instrumental in rolling out the legal and operational structure for digital economical transactions in India. It regulates digital payment sectors, licenses acquisition framework for payment service providers, and confirm cybersecurity compliance. Major RBI initiatives include guidelines for

Prepaid Payment Instruments (PPIs), interoperability norms for digital wallets, and the issuance of the Central Bank Digital Currency (CBDC) or Digital Rupee (RBI, 2022).

National Payments Corporation of India (NPCI) has been established in 2008, the NPCI act as an umbrella non-profit motive organization for retail payment systems in India. NPCI is not a commercial competitor but sets the rules and technical design of essential rails; its governance and fee design materially shape market incentives. It has accelerating impact on numerous digital payment transformative products and services, such as the Unified Payments Interface (UPI), Immediate Payment Service (IMPS), Bharat Interface for Money (BHIM), Bharat Bill Payment System (BBPS), and the Aadhaar Enabled Payment System (AePS) (NPCI, 2023). NPCI's initiatives have significantly paved a path for interoperability, security, and ease of access across banking and non-banking platforms.

The central Government of India through the policy framework passively act as watchguard and assist the digital inclusion programs, the Government of India has performed a key platform generating entity. The Ministry of Finance, unique public initiatives (DPI Trusts, merchant subsidy programmes), and data governance laws (emerging) shape the operating environment for payment firms. The Digital India Agenda has been launched in 2015, targets to encompass establishment of digital infrastructure, extension of digital literacy, and facilitate the financial services electronically beyond geographical diversity of the nation. The Jan Dhan Aadhaar–Mobile (JAM) combination has penetrate the electronic-biometric identity verification and financial inclusion, making digital transactions accessible even in rural and remote areas (MeitY, 2022).

All operating Commercial Banks being a Public and Private Sector Banks and Non-banking Financial Institutions are chief medium for the rolling out of digital payment services throughout the nation. They collaborate their financial service functions with NPCI platforms, issue debit/credit cards/Pre-paid cards, facilitate mobile banking applications with multiple layers safeguards standards against potential cyber frauds, and capacitate clientele for QR-based payments. Banks are showing the adaptability pf technological innovations such as AI-enabled chatbots and biometric authentication to widen user experience and security (RBI, 2023).

Fintech Companies and Payment Service Providers as well as Private fintech firms have been proven best medium in promoting innovation, convenience, and competition in the digital payments sector of India. A handful of consumer-facing platforms processed the lion's share of UPI volumes: Companies such as Paytm, PhonePe, Google Pay, Amazon Pay, and BharatPe have very effectively illustrated the easy, speedy and secured access to digital payments financial transactions with help of customer-friendly mobile applications. These platforms often integrate rewards, financial products, and utility bill payments, thereby increasing customer engagement (NASSCOM, 2022).

Telecom companies in India and new generation Technology Enablers Telecommunication providers and tech companies are emerged as the backbone of the India digital ecosystem and gained the global financial markets attention. Secured and improvised mobile connectivity and variety of budget-friendly data plans have facilitate high usage of payment apps, especially in Tier-II and Tier-III cities as per RBI Schedule. Technology enablers also support cloud infrastructure, cybersecurity solutions, and APIs for seamless integration between banks and fintech platforms.

Digital Payment Methods in India

When a payment for exchange for the goods and services is done through electronics devices with help of Information communication technology, it calls a "digital payment", the intervening the mobile technology with banking services has brought down major economic transactions of different economic sector and helps government to form a regulatory framework for said sectors. Various developments in Information technology and recent framework of Government regulations in payment system in Indian

economic sector has pushed the Indian digital Payment System towards transparency, security, and user-friendly approach. With help of new advanced smartphones technology developments, formation of National Payment Corporation of India (NCPI) to achieve greater efficiency in operations and widening the reach of payment system in India, and with providing low-cost service transactions by different market players in Digital Payment Sector, it has pushed to new abilities such as mobile wallets, smart devices, Near Field Communications (NFC) and Quick Responses codes etc. The payment partners can penetrate different customers segments for digital payment services accordingly with taken consideration for security aspect, user friendly aspect and speediness of the payment system and shaped their product for variety of economic transactions. Banking Cards- Debit/Credit / Prepaid Cards, USSD (Unstructured Supplementary Service Data), AEPS (Aadhar Enabled Payment System), UPI Mobile (Unified Payments Interface), Mobile Wallets, Bank Pre-paid Cards, POS Terminals, Internet Banking, Mobile Banking. BHIM (Bharat Interface for Money) App and other UPI apps are chief mediums through which the Indian Digital Sector is getting boomed.

Banking cards (Debit/Credit/Prepaid) cards facilitates the consumers of the banks to operate the bank accounts remotely, they work both ways online plus offline, either by swiping, tapping, or entering cards in electronic devices, and sensor based identification system. USSD is another platform provides by telecom companies to offer various talk Time/databased plans to users by dialing for instance #99, @121# and so far. To extending digital financial services to the remote and rural sector of the nation and implementing financial inclusion policies National Payment Corporation of India (NPCI) has provided Adhar Enabled Payment System where users can use their Adhar Number and Biomertic Authentications for performing banking functions like withdrawal of cash, deposit of cash, fund transfer, and balance inquiry of the Bank Accounts, unlike using the Banking cards or Pin Number for digital transactions. Bank Led Model, Adhar Authentication, Micro ATMs and No Card/No Pin Needed are four significant components of the AEPS initiative of the NPCI. Unified Payment Interface (UPIs) has proven revolutionary action provided by NPCI permitting real time money transfer with using smartphones technology, with help of linking multiple bank accounts and powered by Virtual Payment Address and QR Codes. Allowing for operating as Payment banks (PBs) and Small Finance Banks proven a major time-changing decision in Digital payment sector in India. Apart from the private sector players in Payment banks and Small Finance Banks, Government of India has launched its own Unified Payment Interface viz, BHIM UPI in 2016. The UPIs system is proven p2p that is person to person framework for payment system in digital way with more securely, with real time access and with simplified address. Apart from QR which allows quick response to the system Unified Payment Interface also generates digital payment gateways through virtual payment addresses like usernameid@bank. It can help to curtail the need of IFSC codes of the payers' bank account branch and lengthy account numbers. As the virtual payment address can be set in simplified ways and the Quick Response codes can easily be scanned, the manual mistakes of feeding wrong data regarding number of payments and considerable lengthy sum bank accounts numbers, the UPI Digital payment method in past few years becomes the chief Digital Payment Method. The International Monetary Fund has officially announced India's UPI the world's largest real time retail payment system in its report of FY 2025. New global data cleared out that UPI single handedly operates 49 percent of all instant payment transactions, giving India a unique lead in digital finance and placing its "swadeshi" system far ahead of every other nation. The revolutionary emergence of UPIs Digital Payment System has also attracted global attention toward India's fintech model. International institutions are in affirmation of UPI as the most successful example of large-scale real-time payments. Other Nations of the World are navigating partnerships opportunities Memorandum of Understanding with this unique, fast, secure, and easy digital payment method, and several are analysing how India framed a system that is fast, secure, interoperable, and most importantly free for users. This international view highlights the long-lasting impact pf UPI Digital Payment method has created beyond national borders. With UPI capturing approximately half of the world's real time transactions, India has proven its capacity to innovate at scale

and generate global standards that are now becoming benchmark to explore their Digital Payment Gateways. Another very popular method in Indian Digital Payment Sector in Indian perspective can be ranked viz, “Digital Wallets”, unlike the in UPIs Digital Payment Method where one has to link the real bank account with mobile application providing digital payment interface to the users, in Digital Wallet can be understood as prepaid account in which one has to deposit the money in advance and then users can use this “digital wallet” at time spendings. It covers the aims of financial inclusion policy of Indian Government where end users need not to have a bank account or minimum balance criteria, as the Digital Wallet can accept the from any bank account holders. Digital wallets contributed to the ease and speed of transactions. Moreover, different types of e-wallets such as Open Wallets, Closed Wallets, UPI Light Wallets, Crypto Wallets, Gift-cards Wallet, Transit Wallets assist customers to shop online/offline, book tickets, pay bills, etc. Customers are able to link their bank account or card and add money to their mobile wallets. Thereafter, they can avail of various products and services by paying through these digital wallets. Although most e-wallets are free from any fees, especially for lower amounts, however, some of them may incur some charges, perhaps after a certain permissible limit. Needless to say, with the huge revolutions in Indian Digital Payment Methods coming on frontline in this financial space, the new challenges also can be talked and measured with regulatory actions by Government. ICICI Pockets, M-Pesa, MakeMyTrip Wallet, BookMyShow Wallet, Paytm, PhonePe, MobiKwik, BHIM UPI Lite, Paytm UPI Lite, Amazon Pay Gift Card, Starbucks Card, FASTag, Delhi Metro Card, Mumbai One and CoinDCX Wallet, WazirX, Metamask are few examples of the Digital wallets in Indian digital payment sector, they are quite popular for their security framework and user friendly approach, as well as minimalizing risk factors with considerable small amount of funding requirements.

Another significantly emerging trend in Indian Digital Payment Sector in India is POS terminals-that is Point-of-sale terminals where the combinations of both physical purchasing and payment through digital mode is effectively carried out for all stakeholders in the market places. Customers can have liberty to visit, inspect, compare the product or service in manual manner or with physical visit and at the time of the payment can choose to pay with their other digital service platforms such as mobile banking, debit/credit/prepaid cards, banking mobile applications, digital wallets multiple Unified Payment Interface and quick response codes. Customers can either swipe the their banking cards into the POS terminal devices and can either scan the Quick response codes whichever fits the convenience of the customers, the vendor can receive the payment on real time basis digitally and can attract more clientele base by offering multiple digital payment methods. A research report published by Mordor Intelligence – a professional research consultant reveals that the India POS Terminals market size stood at 37.08 Billion units in 2025, and is expected to reach 63.88 Billion units by 2030, translating an average 11.49% CAGR during the forecast period. Competition therefore intensified between fintech specialists such as Pine Labs and Paytm and bank-led acquirers like HDFC, ICICI, and SBI.

The mode of payment acceptance, contact-based systems led with 55.78% of the India POS Terminals market share in 2024, while contactless solutions are forecast to post a 12.56% CAGR to 2030. The POS type, mobile and portable units accounted for 62.74% of the India POS Terminals market size in 2024 and are on track to expand at a 12.81% CAGR through 2030. The end-user industry, retail held 48.73% revenue share in 2024, whereas healthcare is advancing at a 13.22% CAGR through 2030.

Internet banking, also termed as online banking, e-banking or virtual banking, is an electronic payment system that enables customers of a bank or other financial institution to conduct a range of financial services/ banking products through the financial institution's website. The Reserve Bank of India as the regulatory body and chief bank of India has rolling out many initiatives towards implementing latest technology from conventional to high tech on customer friendly approach banking system. In India, Banking sector merges their banking functions with new technologies from 1980's through mechanization of cheque processing to progression of ATMs, NEFTs, automation (computerization) of branches (in

1990s) to adopting online and telebanking post 2000 but there onwards observed a very slow progress on digital payments adoption by users. The Indian Banking and Payment Sector has gradually but consistently shifts toward digital platforms rather than conventional methods since 1990 onwards to till date. The transformation of the scenario of paper-based banking towards digital payment system has been a challenge for the market players and for regulators of the sector. However, digital payment methods are now more acceptable and useful in today's time it has faced the Judgmental views in the past two decades that people still have their questionable views with the use of technology. It is also can be seen an god outcome of Digital India Programme and demonetization and effect of COVID-19 in adoption of internet/mobile banking. According to India Brand Equity Foundation (IBEF) Reports on growth of Indian banking and payment Sector 2025 Digital payments have significantly increased in recent years, because of coordinated efforts of the Government and RBI with all the stakeholders, UPI volume for FY24 (until May) recorded to 27,338. Digital payments have significantly grown in recent decade, with help of mutual initiatives taken y of the Government and RBI with all the stakeholders of Digital Payment Sector in India, UPI volume for FY 2025 (until June) recorded to 2,762 US\$ billion. India accounts for nearly 46% of the world's digital transactions (as per 2022 data). As on July 2024, there were 602 banks actively using UPI.

Mobile banking is a digital platform that allows bank account holders to real time faceless access towards banking services through a smartphone after using respectively mobile banking applications or web portals. Mobile phones roll out a way to reach out to people in remote and out of reach areas. Mobile banking is cost-efficient for bankers and customers. Mobile banking services by the bank extended to Account information, fund transfer, investment, and other support. Banks construct mobile-friendly or specific mobile apps for this access. Account holders can transfer funds between their accounts, pay bills, send money to others or businesses, and execute various financial transactions using mobile/smartphones.

Recent trends and developments in Indian Digital Payment Sector

Striking volume in digital transaction volume: UPI volumes and digital merchant payment shoes outstanding growth in last eight years. NPCI product statistics and government releases depicts UPI processing tens of billions of transactions each month, and hundreds of billions annually. The growth is observed both in person-to-person (P2P) and person-to-merchant (P2M) digital payments. NPCI statistics for late-2025 reveals monthly transaction numbered in the tens of billions and continued year-on-year growth in both transaction count and value in money — a trajectory that turned UPI into a global benchmark for real-time payments. Government statements and IMF references in 2025 even cite UPI as accounting for a very large share of global real-time retail payments. This trends might be cause of edge of competency of Indian digital payment methods for scale reduces per-transaction cost, enables new merchant models (micro merchants, kirana digital acceptance), and creates network effects that are difficult for competing rails to displace.

Policy and regulatory directions by competent authorities have strengthen the structural legal framework and make it stronger authentication and consumer protection oriented In 2025, the RBI and other regulators edge-lined guidelines and directions towards authentication and consumer protection. New directions have more emphasis on stronger (often two or multiple layered) authentication for digital payments, risk-based authentication, and higher standards for customer grievance redressal complaints in accurate and speedy manner. The motive is to achieve optimum phase in convenience with security as transaction volumes grown and cyber fraud threats diversify. These policy enhancement compelled PSPs (payment service plyers) in Digital Market space to strengthen their functional operating flows (biometric, device-binding, tokenisation), streaming their operational front with legal frameworks, and invest more in fraud analytics research and professional services.

Merchant adoption and QR proliferation is another feather attained global interest in Indian Digital Payment market space. A sustained agenda to facilitate small merchants with interoperable QR codes and

low-cost POS options are efforts that proved a significant scenario altering, government and NPCI disclosures point out tens of crores of QR deployments and millions of merchants now accepting digital payments. This widened digital acceptance beyond urban formal retail to informal and semi-formal sectors (tiffin sellers, street vendors, small service providers), helping convert previously cash-heavy transactions into digital ones.

Diversification and multiple usage ways of digital payment product/services credit for an example buy-now-pay-later (BNPL), and value-added layers Payment rails have become innovative ways for adjacent financial services. Banks and fintech's layer credit, BNPL, small savings, insurance, and loyalty comes foremost for uninterrupted payment flows. Embedded finance—short-term micro-credit at checkout, merchant lending based on flow data are more secured and expanded version of digital payment methods. Payment data used for risk scoring and fast disbursements created new revenue streams for aggregators and lenders alike. The afore mentioned new innovations in Digital Payment space leads towards the transaction rail which is increasingly monetised through lending, data services, and ecosystem fees, raising questions about data governance and fairness.

Competitive tendencies in service/product modifications consolidation, partnerships, and platform rivalry can be studied as new happenings in Indian digital market space. Oligopoly market of said large non-bank players (PhonePe, Google Pay, Paytm) continued to make their prominent presence in total market share of consumer payments, while banks and newer fintech challengers have been observed competing on niche segments (merchant acquisition, BNPL, cross-border remittance). Strategic partnerships among banks, tech platforms, and PSPs are seemingly increased and firms experimented with loyalty ecosystems and platform playbooks. Market share figures in late 2025 show PhonePe and Google Pay with substantial UPI processing shares while Paytm and bank apps retained meaningful volumes in payments and merchant acceptance. (PwC 2024-29)

Interoperability & globalisation can become a benchmark progress for digital payment transactions as UPI cross-border experiments follows the leads very effectively. UPI's simple API and low cost made it an attractive model for cross-border remittances and merchant acceptance platform for outside India. Pilot programmes and bilateral integrations (e.g., with select foreign payment rails or through card schemes) aspired allow inbound/outbound flows using Unified Payment Interface IDs. While full globalisation of this service lagging behind by local regulation and settlement ambiguous treaties, 2024–25 has witnessed more ambition and pilot work towards cross-border reach.

Cybersecurity, Potential digital frauds, and operational elasticity is another frontline discussion as the Digital payment Market space is continually growing. With increasing voluminous digital payment transactions, digital fraud attempts are seen more often and in high value number, viz., SIM swap frauds, social engineering, fake merchant scams, and API misuse. The RBI's has given more emphasis on stronger authentication and NPCI's tech hardening directions were seem to be the responses to operational incidents and the need to preserve trust in people in general. Digital payment market players are seek to invest in fraud detection, device-binding, tokenization, and merchant KYC/AML tooling. Operational resilience (DDoS mitigation, SLA observability) became a board-level concern and need of time for the all stakeholders of the sector.

Financial inclusion and the digital specified and diversified product and larger market segments used service generation is market demand as well as leads towards the Digital Economy dream. Digital payments expanded financial inclusion, more people will have access to formal digital payment options which are enabled by ubiquitous UPI IDs and low-cost onboarding. But with this financial inclusion implementation criteria, digital literacy, intermittent connectivity in remote regions, and affordability of smartphones stands as strongest challenges. Hybrid models of Digital Payment methods with conventional (offline QR, feature-phone USSD where supported, assisted onboarding at kirana stores) helped reduce the divide.

Conclusion

Digital financial inclusion has been a prominent policy framework for agenda of Digital Economy of the Central Government of India (GoI) and it is also viewed as a mainspring of the Government's vision of Viksit Bharat, leading India on the way of developed nation by 2047. Planned and majored initiatives have been implemented by various ministries, the Reserve Bank of India (RBI), National Payments Corporation of India (NPCI), and the industry to generate consciousness, improve accessibility, which results into increase the usage of digital payments. This has resulted in retail digital payments recording a whopping 90-fold increase in the last 12 years. According to International monetary fund (IMF), India now captured around nearly 49% of the world's digital transactions with standing out from other developing economies of the world. Apart from this, Unified Payments Interface (UPI) is the major driving force behind this unprecedented growth. The user-friendly approach, customer oriented service base and convenience offered by UPI have led its share in digital payments to be around 80% in 2023. (PwC Analysis) To enhance the objective of financial inclusion of the Digital Economy mission, the NPCI further launched innovative features in UPI to allow people to transact digitally offline (UPI Lite X) and through conversations in Hindi and English (Hello! UPI). Besides UPI, users also have the option of availing other online payment avenues such as debit and credit cards, Immediate Payment Service (IMPS), National Electronic Funds Transfer (NEFT), Real-Time Gross Settlement (RTGS), Aadhaar enabled Payment System (AePS), among others. All these multiple hyride and new age digital payment-based service/products has significantly transformed the way people transact in both Person-to-Person (P2P) and Person-to- Merchant (P2M) categories across small and high-value monetary transaction levels.

India's public digital infrastructure model purposefully framed per-transaction fees comparatively low to reward-based adoption. That thrust PSPs to seek large transactions scale and monetise through adjacent services (lending, insurance, merchant services), without highly and solely dependent on per-transaction charges alone. Merchants are required to pay for value for analytics, inventory finance, mini-CRM and embedded credit. Aggregators and large platforms bundle payments with these services and monetise via take rates, interest income and platform commissions. Platforms further competitive edge towards monopolistic market situation with help of consumer financial products for an instance like micro-loans, insurance, mutual funds, co-branded cards and merchant funded offers. Buy now and Pay later concept (BNPL) and instant checkout loans created remarkable consistent revenue generating streams, however regulators are in opinion to pay more attention to consumer protection.

UPI's API-centric model lead participants to adopt real-time, event-driven architectures enabling near instant settlement and notification. Many PSPs modernised powered systems to support real-time reconciliation, event streaming, and fraud scoring. Tokenisation (card and UPI token models) and stronger device binding framed out a common way to replace weaker SMS-OTP loopholes. RBI directions motivated multilayered and risk-based authentication, which speeding-up the process of token adoption and device bio-metric fingerprinting. Machine learning models with help of new generation advanced artificial intelligence technology for behavioural fraud detection, oddly scoring, and personalised offers have got matured. Firms used transaction metadata and AI to detect fraud in minutes, and to personalise credit offers or loyalty rewards in real time which maintain their potential clientele base. To meet with the challenges regarding inconsistent connectivity, Service providers can gave offers like offline QR, contactless edge modes (NFC), and store-and-forward architectures for merchant terminals existed in Digital pockets. These allowed transaction occurrence without the need of internet connectivity and perform the payment offline digitally and can be reconciled once Internet connectivity accessed. Interoperability standards for merchant onboarding, dispute resolution, and data exchange matured. NPCI and industry bodies promoted common schemas for merchant metadata, refunds, and settlement messaging to reduce reconciliation friction.

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