

*Payment and Settlement: The Plumbing in the Architecture of India's Financial System**

In India, the policy approach to build a less-cash economy, while ensuring safe, secure, efficient and robust payment systems, has yielded phenomenal growth in digital transactions. Initiatives in fintech that are transforming the provision of financial and payment services are also progressing apace with efforts towards managing the inherent risks. India has a leading/strong position in terms of several parameters pertaining to digital transactions, technology infrastructure, and payment and settlement laws and regulation. At the same time, there exists vast potential for growth of digital transactions in India owing to low per capita quantum currently.

Introduction

Payment and settlement systems are at the heart of a modern economy. They provide the infrastructure for channelising savings and investments for the entire economy, the gateway for effective transmission of monetary policy, the anchor for financial stability and a vehicle for financial inclusion.

Over the years, the payment and settlement landscape has witnessed unprecedented waves of innovation. Mobile wallets have literally made banking services available 'on tap'; digital-only banks have done away with the need for brick and mortar presence. Biometric authentication has made doing transactions much safer and more convenient than the conventional modes of payment. Blockchain may be a potentially disruptive technology but it is

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creating strong tailwinds in the area of payments for automating and decentralising financial transactions. Another technological wave is being generated by the application of Artificial Intelligence (AI) to FinTech industry in the form of automated data analysis, chatbots and robo-advisers. AI is being employed to detect fraud by monitoring patterns of customer behaviour. Near Field Communication (NFC)¹ technology and central bank digital currencies (CBDCs) are other path-breaking innovations that have emerged into the payment and settlement landscape.

In India, the payment and settlement system has made substantial progress over the years. India ranks second in terms of FinTech adoption, with an adoption rate of 52 per cent (Ernst and Young, 2017). The Unified Payments Interface (UPI), Bharat Bill Payment System (BBPS), Bharat QR and Aadhaar-enabled Payment System (AePS) are proving to be game-changers in digital payments, in online payment platforms and fund transfers, driving efficiency gains in the financial sector. At the same time, these innovations that have ushered in the rapid adoption of financial technologies and emergence of new business models, have implications for the stability and integrity of the financial system (BCBS, 2018; FSB, 2019). The payments industry is the prime target for cyber attacks. Deficiencies in security aspects can very easily bring down a large empire in a short span of time (Financial Times, 2019). This article presents a broad overview of the latest developments in payment systems and FinTech across the world in general and in India in particular. Section II provides an update of notable global developments in the FinTech space for the period 2018-19. Section III details the evolution of the Indian digital payment systems. Section IV concludes with the key features of developments in the Indian payment system aided by digital technology.

¹ Near field communication (NFC): a wireless technology which allows a device to collect and interpret data from another such closely located device. NFC devices can be used in contactless payment systems, similar to credit cards and electronic smart cards and facilitate mobile payment.

II. Global Developments in FinTech

The FinTech revolution is widespread across developed and developing and emerging market economies. In the US, banks are increasingly adopting open banking business culture and are investing heavily in developing open Application Programming Interfaces (APIs) and customer-friendly payment tools (Anand, 2018). The use of APIs allows different software applications to communicate with each other and exchange data directly. This is directed to unravel numerous possibilities for application developers to build innovative value-added services linked to bank accounts and to unbundle many services that have been traditionally offered by banks. Several jurisdictions are now developing frameworks for the application of APIs.

Sandboxes are seen as incubators for fintech companies. However, the majority of central banks and regulators have underestimated the cost of designing and operationalising regulatory sandboxes relative to its success (UNSGSA, 2019). While the importance of sandboxes is acknowledged, they should not be the sole means for regulators to engage with market participants. It is in this context that in March 2019, the Federal Reserve Bank of New York launched a Fintech Advisory Group to provide bank leaders with a high-level platform for collaborating with leaders of the fintech industry. The primary goal of the Advisory Group is to find solutions to the emerging issues related to financial technologies, their application and their market impact, and to integrate them with New York Fed's regulatory and supervisory tools to help it achieve its mandate.

Following the success of its Fintech Accelerator project, the Bank of England set up a permanent FinTech Hub in March 2018. The Hub is envisaged to be a nodal authority for the fintech sector to engage with the Bank and to help in integrating fintech into the Bank's functions.

Similar to the US, the Open Banking Standard and Payment Services Directive (PSD2) initiatives are gaining traction in the European Union. They aim to foster innovation by requiring banks to share customer data with authorised third party service providers subject to the customer's approval (Ramsden, 2018; Mersch, 2019). This will enable the latter to develop better functionalities in smartphone applications.

The blockchain technology, which underlies bitcoin and other crypto currencies, is widely believed to have the potential to transform the payment process through diversified verification. However, recent research rejects the viability of this technology for large-scale payment (Conesa, 2019). The absence of intermediaries and requirement of validation in a decentralised setup leads to a resource-intensive and less efficient payments system. Similarly, payments made in crypto assets have high transaction costs owing to the need for proof of work (Auer, 2019). Analogously, CBDCs may entail central banks adopting retail lending roles (Carstens, 2019).

Singapore has become a leading hub for fintech activities. It organises a fintech festival every year. Last year's headlines were grabbed by the Application Programming Interface Exchange (APIX) platform which is a collaborative effort between ASEAN Bankers Association, the International Finance Corporation (IFC), and Monetary Authority of Singapore (MAS). APIX is both an online fintech marketplace and sandbox for collaboration between financial institutions (FIs) and fintechs. As a marketplace, it will enable FIs to discover and connect with fintech firms through APIs on a globally curated platform. As a sandbox, it provides a platform for FIs and fintech firms to collaborate and experiment on solutions in a contained environment (Menon, 2018).

MAS has led the way in application of state-of-the-art data analytics tools like AI and Machine Learning to

spot market manipulation. Its advanced data science tool named Apollo uses data based on past misconduct cases to spot suspicious patterns. The Bank of Canada and MAS have conducted a successful experiment on cross-border and cross-currency payments using CBDCs. This is the first such trial between two central banks, and has great potential to increase efficiencies and reduce risks for cross-border payments.

China accounts for about 40 per cent of global e-commerce transactions, a stellar rise from just 1 per cent a decade ago (Lipton, 2019). Chinese banks are investing heavily in fintech and are launching services to counter competition from internet giants, such as Baidu, Alibaba Group Holding, Tencent Holding and JD.com. (Lee, 2019). The Bank of China (BoC) launched its first global fintech innovation lab on November 14, 2018 in Singapore to harness the power of AI, blockchain, big data and cloud technologies. The Lab will also establish a training structure to build a pipeline of talents and foster financial innovation and research collaborations with partners such as fintech firms, institutes of higher learning and the government. The People's Bank of China is pilot-testing a trade finance blockchain platform which can assist small and medium enterprises (SMEs) in getting access to broader financing options, including asset-backed securities (Manalo, 2018). It will provide seamless and efficient interbank transactions and help banks conduct business authenticity audits and reduce business costs.

The rapidly changing fintech world has created a need for cross-border fintech regulation along with the quest for finding the right balance between furthering financial inclusion and raising efficiency. The IMF and the World Bank have launched the Bali Fintech Agenda in October 2018 - a set of 12 policy elements which can be a guiding document for countries in the process of policy formulation in financial technology.

The Global Financial Innovation Network (GFIN) was formally launched in January 2019 by an international group of financial regulators and related organisations. It is a global sandbox that will enable regulators across the globe to share experience and knowledge of emerging technologies and business models. It aims to create a new framework for co-operation between financial services regulators on fintech-related issues. It will also provide a platform for joint RegTech² work and provide environment for cross-border fund transfer experiments.

III. Payment and Settlement in India

In India, the policy approach to build a less-cash economy, while ensuring safe, secure, efficient and robust payment systems, has yielded phenomenal growth in digital transactions (Annex). Initiatives in fintech, that are transforming the provision of financial and payment services, are also progressing apace with efforts towards managing the inherent risks at the same time. Recognising the growth potential of fintech companies, the Reserve Bank of India (RBI) has proposed to set up a regulatory sandbox to provide a suitable control environment for beta-testing new products on a restricted number of customers. In view of the increasing retail participation in Peer-to-Peer (P2P) platforms – where people looking to invest their money can find people who want to borrow without any intermediary – the Reserve Bank has issued master directions to regulate this sector. In a bid to ensure greater availability, the Reserve Bank has extended the window of RTGS customer transactions by 1.5 hours. The Reserve Bank is also examining the possibility of making NEFT available 24x7. Reserve Bank has implemented an 'Ombudsman Scheme for Digital Transactions' to provide an economical and expeditious grievance redressal mechanism for strengthening

²Regtech is the management of regulatory processes within the financial industry through technology. The main functions of regtech include regulatory monitoring, reporting, and compliance.

Table 1: Digital Transactions

	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19
	Value (₹ billion)			Volume (million)		
1. RTGS Customer Transactions	8,49,951	10,36,699	11,84,368	104	121	133
2. RTGS Interbank Transactions	1,31,953	1,30,426	1,72,514	4	4	3
3. Retail Electronic Clearing (ECS, NEFT, NACH, IMPS)	1,32,250	1,92,018	2,58,745	4,205	5,467	7,113
4. Cards Usage (PoS)	6,583	9,190	11,969	3,486	4,749	6,177
5. Prepaid Payment Instruments	838	1,416	2,129	1,963	3,459	4,604
6. UPI (including BHIM)	69	1,098	8,770	18	915	5,343
Total Digital Transactions	11,21,644	13,70,847	16,38,495	9,780	14,715	23,373

Source: RBI.

consumer confidence in digital channels. With a view to understanding the Indian payment ecosystem and its challenges, a High Level Committee (Chairman: Shri Nandan Nilekani) on Deepening of Digital Payments constituted by the Reserve Bank submitted its report in May 2019 (RBI, 2019a). It reviews the level of digitisation and recommends ways to encourage its adoption. It also suggests means to strengthen security aspects of digital payment infrastructure and instil customer confidence in digital transactions. In order to provide an impetus to digital funds movement, the Reserve Bank, in its latest Bi-monthly Monetary Policy 2019-20, decided to do away with charges levied on transactions processed in the RTGS and NEFT systems.

In the recent period, there has been a consistent growth in individual segments of retail electronic payment systems and decline in paper-based transactions. A synoptic view of India's digital transactions is provided in Table 1.

Digital Transactions

Total digital transactions³ in volume terms recorded a growth rate of 58.8 per cent during 2018-19,

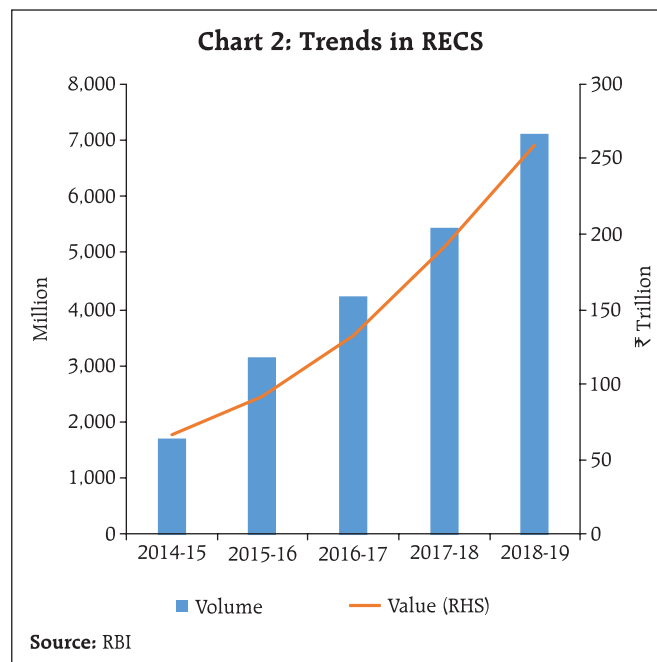
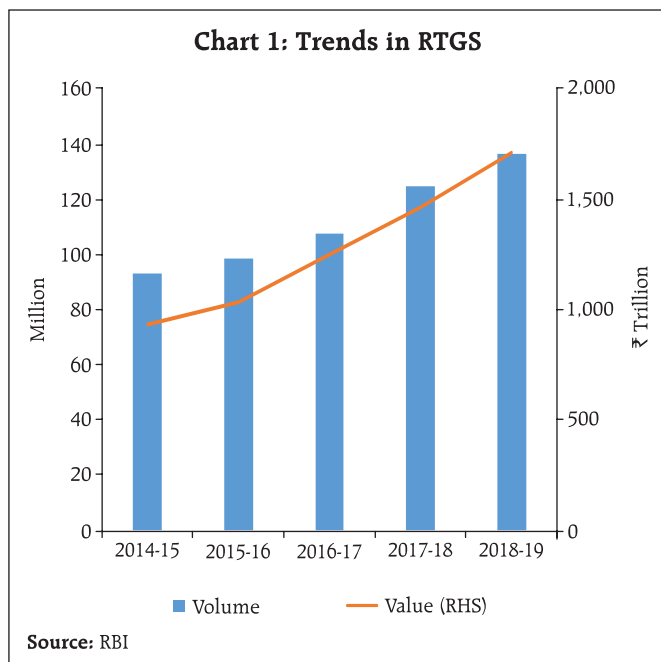
³ It includes RTGS customers and interbank transactions, retail electronic clearing – ECS, EFT, NEFT, IMPS, NACH, card transactions at PoS, UPI (including BHIM and Unstructured Supplementary Service Data (USSD) (financial transactions)).

on top of a growth of 50.4 per cent during 2017-18. Digital transactions in value terms grew by 19.5 per cent during 2018-19, compared to the growth of 22.2 per cent during 2017-18. The bulk of digital transactions in value terms (82.8 per cent) are accounted for by RTGS transactions.

Retail component of digital transactions (excluding RTGS customers and interbank transactions), witnessed volume growth of 59.3 per cent during 2018-19 (50.8 per cent growth in the previous year). In value terms, retail transactions grew by 38.2 per cent, on top of 45.8 per cent growth last year. They accounted for 99.4 per cent and 17.2 per cent of total digital transactions volume and value, respectively.

Real Time Gross Settlement (RTGS)

The RTGS platform, which deals with high value transactions (customer and interbank), processed the largest ever monthly volume of 13.64 million transactions, for total value of ₹148.7 trillion and averaged ₹10.9 million per transaction during March 2019 (Chart 1). The growth momentum of RTGS platform was supported by customer transactions which accounted for 97.9 per cent and 84 per cent of total RTGS (customer and interbank) transactions in volume and value terms, respectively.



Retail Electronic Clearing Services

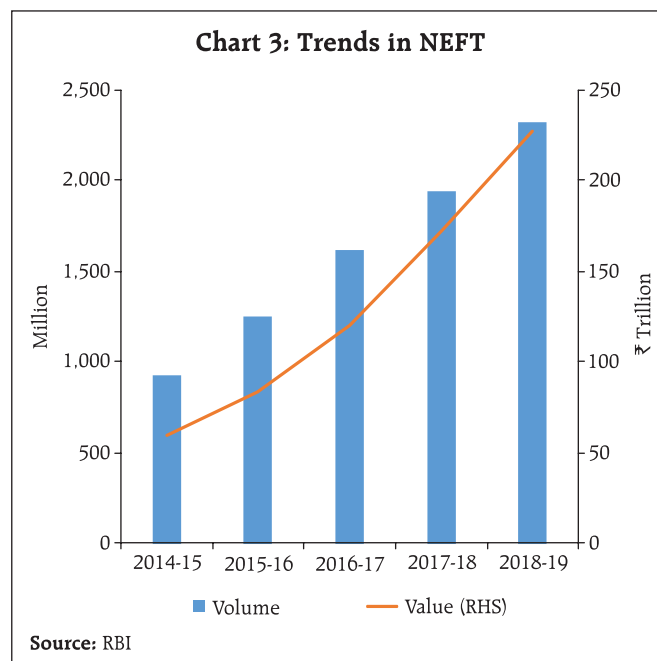
Retail Electronic Clearing Services (RECS), comprising Electronic Clearing Service (ECS), Electronic Funds Transfer (EFT), National Electronic Funds Transfer (NEFT), Immediate Payment Service (IMPS) and National Automated Clearing House (NACH), witnessed overall transaction volume growth of 30.1 per cent during 2018-19, similar to the previous year. In value terms, growth was 34.8 per cent during 2018-19 on top of 45.2 per cent recorded in 2017-18 (Chart 2).

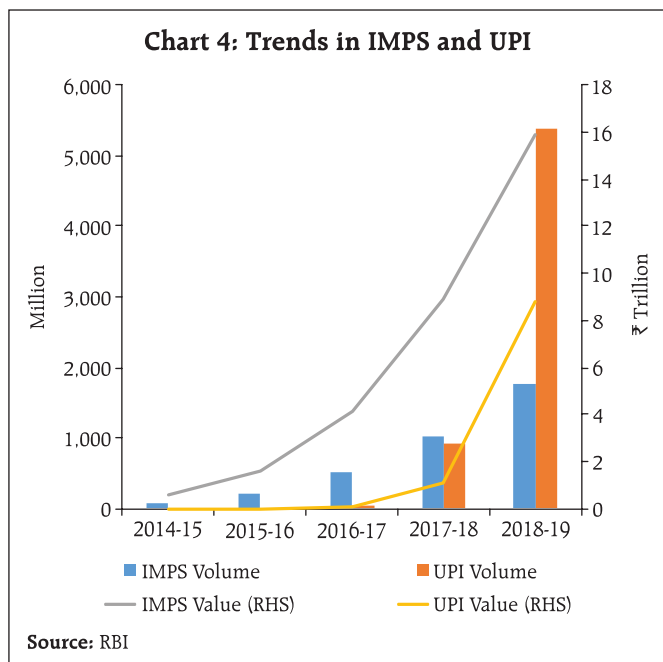
National Electronic Funds Transfer

The growth momentum of RECS was led by NEFT (Chart 3). During March 2019, NEFT processed the highest ever monthly volume of 242 million transactions for value ₹25 trillion, with average value per transaction at ₹1,05,079. Annually, NEFT volume grew by 19.1 per cent during 2018-19, over and above the growth of 20.0 per cent in 2017-18. In terms of value, NEFT recorded annual growth of 32.3 per cent during 2018-19, on top of 43.5 per cent witnessed during 2017-18.

Immediate Payment Service (IMPS)

Immediate Payment Service (IMPS) is an instant payment inter-bank electronic funds transfer system in India, enabling customers to operate through mobile phones. Unlike NEFT and RTGS, the service is available 24/7 and throughout the year including bank holidays. Since its launch in November 22, 2010,





the IMPS has registered high growth momentum. The remittances through IMPS witnessed volume growth of 73.6 per cent during 2018-19, on the top of 99.3 per cent witnessed last year. In value terms, IMPS transactions recorded annual growth of 78.2 per cent in 2018-19, on top of 117.1 per cent in 2017-18 (Chart 4).

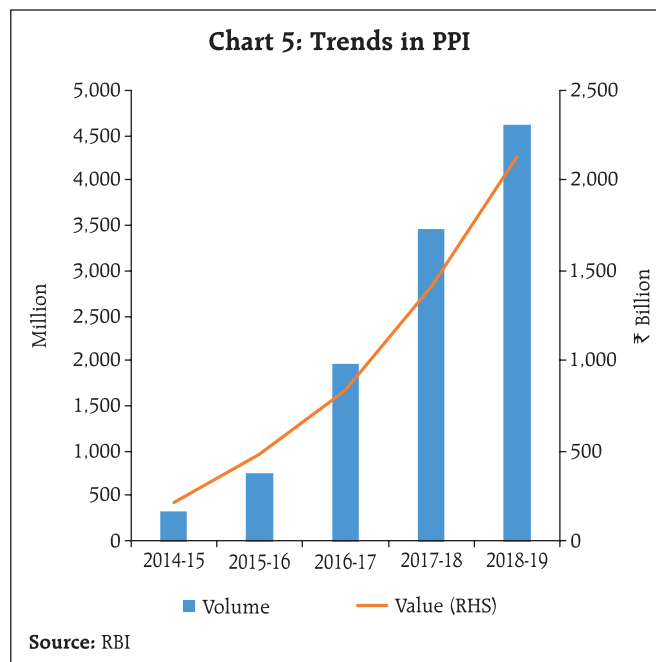
Unified Payments Interface (UPI)

Similar to the IMPS, UPI is an immediate money transfer system that enables round the clock inter-bank fund transfer, throughout the year. Since its commercial launch in August 2016, it has seen a mammoth rise in volumes by far exceeding the transactions done on the IMPS platform.

UPI volume reached a peak of 799.5 million in March 2019, 4.5 times the volume in March 2018. For the year as whole, the total UPI volume was six times larger than the volume during 2017-18. In terms of value, UPI transactions witnessed an eight-fold increase over the previous year. The average value per transaction stood at ₹1,670 in March 2019.

Pre-paid Payment Instruments (PPIs)

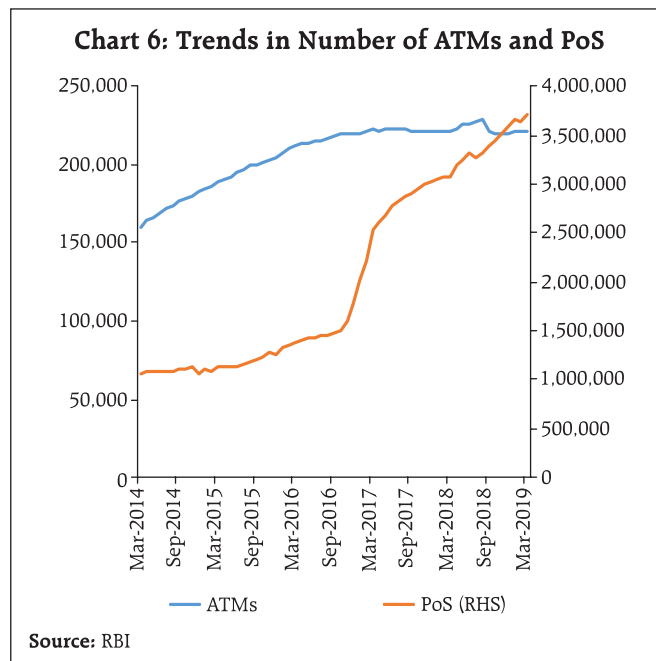
Pre-paid payment instruments (PPI) recorded significant volume and value growth (33 per cent and

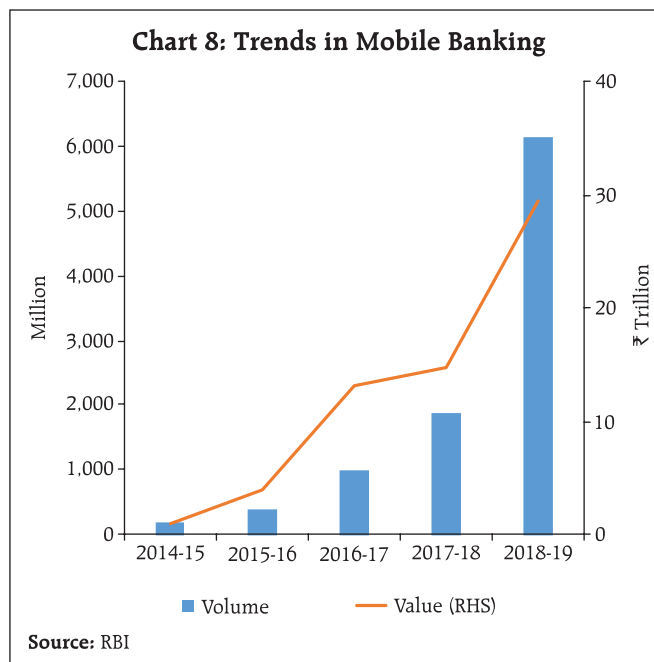
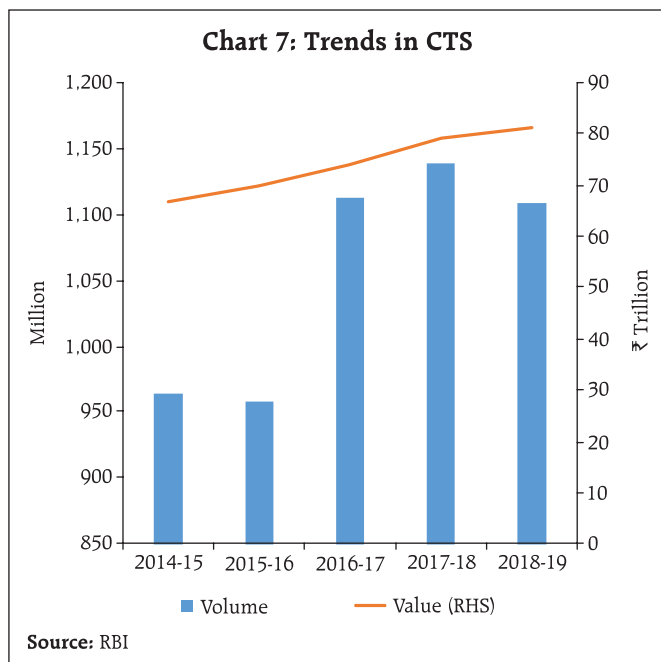


50.3 per cent during 2018-19, on top of 76.2 per cent and 69 per cent in the previous year), buoyed by the growth in mobile wallets (Chart 5).

Cards Acceptance Infrastructure

Annually, the volume of cards in point-of-sale (PoS) transactions grew 30.1 per cent during 2018-19 (36.2 per cent last year) and in value terms, by 30.2 per cent (39.6 per cent last year) (Chart 6).





During 2018-19, debit cards grew by 19.5 per cent and 16.3 per cent in volume and value terms (9 per cent and 24.9 per cent last year). However, credit cards witnessed higher growth of 25.4 per cent and 31.4 per cent in volume and value, respectively, during 2018-19 (29.2 per cent and 39.7 per cent a year ago). Though ATM usage accounted for major share of debit card transactions (69.1 per cent in volume and 84.8 per cent in value), there is evidence of increase in usage of debit cards at PoS consistently, from 4 per cent in 2011-12 to 15 per cent in 2018-19 in value terms. During 2018-19, debit card PoS usage grew by 32.0 per cent and 29 per cent for volume and value, respectively (39.3 per cent and 39.5 per cent a year ago).

Paper Clearing

Reflecting the impact of digitalisation, Cheque Truncation System (CTS) witnessed a negative growth of 2.6 per cent in volume, while increasing marginally by 2.3 per cent in value terms (2.4 per cent and 7.3 per cent, respectively, a year ago) (Chart 7).

Mobile Banking

The volume of digital transactions using the mobile banking channel has witnessed sharp annual

increases (227.7 per cent in 2018-19 as against 91.7 per cent last year). The acceleration in value terms has also been remarkable at 99.5 per cent, which was substantially higher than 12.5 per cent witnessed during 2017-18 (Chart 8).

IV. Conclusion

Owing to policy initiatives of the Reserve Bank and the Government of India, payment systems in India have taken long strides towards digitisation. The push towards digital infrastructure has been complemented by the greater acceptance of digital modes of transaction among the general public. Transactions through the PPI, UPI, IMPS, RTGS and NEFT systems are on a rising trend. Some noteworthy features of the Indian digital revolution are:

- Paper clearing (CTS) is conceding turf to customer-friendly digital applications;
- UPI has superseded IMPS in terms of transaction volumes;
- Debit card usage at PoS is showing healthy signs of growth;
- PoS infrastructure has seen rapid expansion; and

- the Indian payment system is poised to fulfil the goals envisaged in the Reserve Bank's Vision Document 2019-21.

According to the Report on Benchmarking India's Payment Systems (RBI, 2019b), India has a leading/strong position in terms of several parameters pertaining to digital transaction, technology infrastructure, and payment and settlement laws and regulation. At the same time, there exists vast potential for growth of digital transactions in India owing to low per capita quantum currently.

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Select Payment Services in India

Payment Service	Description	Launch Date	Operator
Electronic Funds Transfer	One to one fund transfer facility. This system has been replaced by more efficient NEFT system for use by the general public.	1997	RBI
Real Time Gross Settlement (RTGS)	Settlement of fund transfer orders occurs individually on a continuous and real-time basis. Minimum amount for customer transactions is ₹2 lakh. No upper limit. Available from 8 am to 6 pm for customer transactions and 8:00 am to 7:45 pm for interbank transactions on working days.	2004	RBI
National Electronic Fund Transfer (NEFT)	One to one fund transfer with half-hourly net settlement. No minimum or maximum limit. Available from 8 am to 7 pm on working days.	November 2005	RBI
National Electronic Clearing Service (NECS)	NECS (Credit) facilitates multiple credits to beneficiary accounts with destination branches across the country against a single debit of the account of the sponsor bank.	October 2008	RBI
Credit & Debit Cards	PoS terminals which enable customers to make payments for purchases of goods and services by means of credit/debit cards. To facilitate customer convenience, the Reserve Bank has also permitted cash withdrawal using debit cards issued by the banks at PoS terminals and ATMs.	November 2009	Banks
PPIs (Cards & Wallets)	Pre-paid instruments are payment instruments that facilitate purchase of goods and services against the value stored on these instruments. The value stored on such instruments represents the value paid for by the holders by cash, by debit to a bank account, or by credit card. The pre-paid payment instruments can be issued in the form of smart cards, magnetic stripe cards, internet accounts, internet wallets, mobile accounts, mobile wallets, paper vouchers, etc.	2009	PPI Operators
IMPS	Round the clock peer-to-peer fund transfer facility with immediate money transfer through multiple channels like Mobile, Internet, ATM, SMS, Branch and USSD.	November 2010	NPCI
NACH	Web-based solution to facilitate interbank, high volume, electronic transactions which are repetitive and periodic in nature.	2011	NPCI
Cheque Truncation System (CTS)	CTS is the process of stopping the physical movement of cheques. As per the amended Negotiable Instruments Act 1881, in cheque truncation, the movement of the physical instrument is stopped and replaced by electronic images and associated MICR line of the cheque.	2011	NPCI
Aadhaar-enabled Payment System	Basic banking transactions can be done at Micro ATM of the Business Correspondent of any bank using Aadhaar authentication.	January 2016	NPCI
UPI	Peer-to-peer fund transfer facility with immediate money transfer through mobile device round the clock 24*7 and 365 days. BHIM app supports multiple bank accounts into a single mobile application. Upper limit is ₹2,00,000.	August 2016	NPCI
National Electronic Toll Collection	NPCI has developed the National Electronic Toll Collection (NETC) programme to meet the electronic tolling requirements of the Indian market. It offers an interoperable nationwide toll payment solution including clearing house services for settlement and dispute management.	2016	NPCI
Bharat Bill Payment System	Umbrella system for payment of all bills.	July 2017	NPCI