

Digital Transformation in India's Payment and Settlement Systems: The Way Forward

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“Free Enterprise was born with man and shall survive as long as man survives”.

- A. D. Shroff
Founder-President
Forum of Free Enterprise



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(24-12-1949 – 19-10-1988)

Late Mr. Shailesh Kapadia, FCA, was a Chartered Accountant by profession and was a partner of M/s G.M. Kapadia & Co. and M/s Kapadia Associates, Chartered Accountants, Mumbai.

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Shailesh enjoyed the confidence of clients, colleagues and friends. He had a charming personality and was able to achieve almost every task allotted to him. In his short but dynamic professional career, spanning over fourteen years, Shailesh held important positions in various professional and public institutions.

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Shailesh was member, Institute of Fiscal Studies, U.K.; member of the Law Committee and Vice-Chairman of the Direct Taxation Committee, Indian Merchants' Chamber. He was also a Director of several public companies in India and Trustee of various public Charitable Trusts.

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Abstract

India has made significant headway in payment and settlement landscape during the last two decades following financial sector reforms pursued vigorously since the early 1990s. An attempt has been made here to provide a historical perspective of digital transformation in India's payment and settlement systems, critically examine the opportunities and challenges in this space, outline the unfinished agenda in this sector; and explore the possibility of RBI issuing digital fiat currencies (DFCs) or central bank digital currencies (CBDCs) going forward. Despite rapid growth of digital transactions during recent years, India's currency-GDP ratio remains elevated. More efforts are required to wean away people from cash transactions. Although DFCs/CBDCs have the potential to reduce the use of cash, the macroeconomic implications of introducing DFCs/CBDCs are yet to be fully understood.

Key Words: Digital Transformation, Payment and Settlement System, Central Bank Digital Currency, Unified Payment Interface, Central Counterparty

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Digital Transformation in India's Payment and Settlement Systems: The Way Forward

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I. Introduction

The payment and settlement system (PSS) plays a critical role in an economy. It consists of cash and non-cash transactions. Non-cash transactions have two components - paper-based transactions and digital/electronic transactions. As the financial system evolves, the PSS generally travels the path of cash to paper and then to digital transactions with the first two modes of transactions gradually shrinking commensurate with the growth of digital transactions. A developed PSS typically captures

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weaknesses of a financial system at the earliest and alerts policymakers to take preemptive measures before such weaknesses spill over to the real economy. Negligence in reading early warning signals of an impending financial crisis, manifested in the PSS, costs an economy heavily in terms of loss of output and employment. Memory is still fresh about the collapse of the PSS, particularly in the developed countries, in the wake of the global financial crisis in 2008-09. During the last three decades, the PSS has become highly sophisticated globally in terms of product/process/institutional innovations mainly due to the proliferation of information and communication technology (ICT).

India has made significant headway in payment and settlement landscape during the last two decades following financial sector reforms pursued vigorously since the early 1990s. An attempt has been made here to briefly analyse the progress of India's digital transformation in the PSS so far, discuss the unfinished agenda in this space, and look forward to an orderly development of this sector going forward based on lessons learned in the journey. More specifically, Section II provides a historical perspective of the digital transformation in India's PSS; Section III critically examines the opportunities and challenges of innovations in this space; Section IV outlines the unfinished agenda in this sector; Section V delves into the possibility

of RBI issuing a digital fiat currency going forward; and Section VI provides concluding observations.

II. Digital Transformation in India's PSS: A Historical Perspective

Payment system is always regarded as a public good. During the last three decades, the RBI has been the driving force behind the development of a modern PSS in India. The broad objective has been to provide 'a payment ecosystem that enables safe, quick, and affordable digital payments to everyone across length and breadth of the country as well as in the universe of cross-border payments and transactions' (Das, 2021). Some milestones of digitisation in India are given in Box 1.

Box 1: Digitisation in India: Some Milestones

- Information Technology Act, 2000 (amended in 2006, 2008)
- Payment Systems Vision Document by RBI, every three years since 2002
- New Department of Payment and Settlement Systems (DPSS) in RBI since 2005
- Payment and Settlement Systems Act, 2007
“...provide for the regulation and supervision of payment systems in India and to designate RBI as the authority for the purpose and for matters connected therewith or incidental thereto.”

- Payment System Operators: CCIL (2001), NPCI (2008), Card Payment Network, ATM Networks, PPI Issuers, BBPS, etc.
- Digital India Programme, 2015
 - Safe and secure digital infrastructure
 - Governance and services on demand
 - Digital empowerment of citizens

Source: Compiled from RBI and Government websites.

The Information Technology Act, 2000, as amended from time to time, and Digital India Programme, 2015 are government initiatives with wider coverage and are not discussed in this article. The Payment and Settlement Systems Act, enacted by the government in 2007, provides the legal backing for the RBI to develop the PSS in India. In terms of Section 4 of the PSS Act, 2007, 'no person other than RBI can commence or operate any payment system in India unless authorised by it'. The RBI has since authorised various Payment System Operators (PSOs) such as CCIL (central counterparty), NPCI (retail payments organisation), card payment networks, ATM networks, cross-border inbound money transfers entities, PPI issuers, Instant Money Transfer operators, Trade Receivables Discount System (TReDS) platform providers, and Bharat Bill Payment Operating Units (BBPOUs) to operate different payment systems in the country. Major innovations showing digital

transformation in the payment space in India are given in Table 1.

The RBI has issued guidelines relating to each instrument from time to time based on international best practices. The wholesale segment of the PSS is systemically important involving large value transactions and therefore centralised. The RTGS for example is fully centralised and operated by the RBI. The RTGS service is available round the clock for 365 days a year since December 14, 2020. India is the third country in the world after Mexico and South Africa to provide this service on a 24x7x365 days basis. The other wholesale and systemically important segments are Money Market (interbank call/notice money, interbank repo/reverse repo, CD/CP, Tri-party Repo), G-Sec Market, Foreign Exchange market, and Derivatives clearings. Transactions in these segments are settled by the RBI-regulated Clearing Corporation of India Limited (CCIL) - the only central counterparty in the money, debt, forex, and derivative markets. Although the SEBI-regulated central counterparties such as National Securities Clearing Corporation Ltd. (NSCCL), Indian Clearing Corporation Ltd. (ICCL), MCX-SX Clearing Corporation Ltd. (MCX-SXCCL) are responsible for the clearing of stock-market related security/derivative transactions, corresponding payments are settled through the CCIL. Although falls in the retail segment, the

Table 1. Digital Transformation in India's Payment Space

Sl. No.	Instruments/Innovations	Offering Institutions/ Year	Beneficiaries
1.	Credit and Debit Cards	Banks/Non-Banks (1980s)	Retail Customers
2.	Internet Banking	Banks (1990s)	Retail Customers
3.	Tri-Party Repo and Money/G-Sec/ Forex/Derivatives clearing	Clearing Corporation of India (CCIL) (2001)	Wholesale users
4.	Real-Time Gross Settlement (RTGS)	RBI (2004)	Wholesale Users /Retail Customers
5.	National Electronic Funds Transfer (NEFT)	RBI (2005)	Retail Customers
6.	Mobile Banking	Banks/Non-Banks (2007)	Retail Customers
7.	Cheque Truncation System (CTS)*	RBI (2008) (Grid-Based Clearing, NPCI, 2013)	Retail Customers
8.	Immediate Payment Service (IMPS)	NPCI (2010)	Retail Customers
9.	National Automated Clearing House (NACH) (earlier ECS/EFT)	NPCI (2012)	Retail Customers / Corporates etc.

Sl. No.	Instruments/Innovations	Offering Institutions/ Year	Beneficiaries
10.	Unified Payments Interface (UPI)	NPCI (2016)	Retail Customers
11.	National Electronic Toll Collection (NETC) (FASTag)	NPCI (2016)	General Public Driving Vehicles
12.	Bharat Bill Payment System (BBPS)	NPCI (2016)	Traders/MSMEs
13.	Bharat QR Code	NPCI (1917)	Retail users/ MSMEs etc.
14.	RuPay Credit Card	NPCI (2017)	RuPay Card Holders
15.	e-Money (Pre-Paid Instruments, wallets)	Banks/Non-Banks (Master Direction in 2017)	Retail Customers
16.	Peer-to-Peer Lending	FinTech companies 2017)	Retail Customers
17.	Payment/Account Aggregators	Banks/FinTech companies (2017)	Retail Customers/ e-commerce

*CTS is a paper-based transaction. Except for CTS, all are digital transactions.

NEFT is considered as systemically important and therefore operated by the RBI.

In the retail segment, National Automated Clearing House (NACH), Immediate Payment Service (IMPS), Unified Payment Interface (UPI), Unstructured

Table 2: Authorisation of Payment System Operators (as of end-March)

Entities	Number	
	2020	2021
A. Non-Banks – Authorised		
PPI Issuers	43	36
WLA Operators	8	4
Instant Money Transfer Service Providers	1	1
BBPOUs	9	8
TReDS Platform Operators	3	3
Cross-border Money Transfer Service Scheme Operators	9	9
Card Networks	5	5
ATM Networks	2	2
B. Banks – Approved		
PPI Issuers	62	56
BBPOUs	39	42
Mobile Banking Providers	540	566
ATM Networks	3	3

Source: Reserve Bank of India, Annual Report 2020-21.

Supplementary Services Data (USSD), JAM (Jan-Dhan, Aadhaar, Mobile) payment facilities are managed by National Payments Corporation of India (NPCI). Besides banks, FinTech companies are active in providing pre-paid instruments, Trade Receivables Discounting System, Mobile Banking, Peer-to-Peer Lending, Payment/Account aggregator services, etc. An elaborate payment system infrastructure involving both banks and non-banks has emerged that caters to the needs of customers for a variety of digital transactions, in both wholesale and retail segments (Table 2).

In the last ten years, there is a clear shift in preference from paper-based transactions to digital transactions (Table 3). The volume of paper-based transactions declined from 60% in 2010-11 to 3% in 2019-20 while in value terms, it shrank from 89% to 20% during the same period. On the other hand, there was an exponential growth in digital transactions, mainly digital transfers (retail electronic), which surged dramatically from 18% to 61% in volume terms and from 10% to 75% in value terms in the comparable period. Contributions of NEFT, IMPS, UPI, and NACH are significant for the dramatic increase in digital transfers. The services of NEFT, IMPS, and UPI are currently available round the clock throughout the year.

Table 3. Growth of Payment System Transactions in India (2010-2020)

Item	Volume (Lakh)			Value (₹ '000 Crore)		
	2010-11	2015-16	2019-20	2010-11	2015-16	2019-20
Wholesale Payment System						
1. RTGS	493	983	1507	48487	82457	131156
Retail Payment System						
NEFT	1323	12529	27445	939	8327	22946
IMPS		2208	25792		162	2338
UPI			25186			2132
NACH		14041	36979		380	1976
ECS	2741	2638	19	255	271	5
Others			198			1
2. Total Digital Transfers	4064 (18)	31415 (45)	215619 (61)	1194 (10)	9140 (51)	29398 (75)
3. Card Payments	5022 (22)	19593 (28)	73013 (21)	114 (1)	399 (2)	1535 (4)
4. Pre-Paid Instruments		7480 (11)	53317 (15)		48 (0.3)	215 (1)
5. Paper-Based Instruments	13873 (60)	10964 (16)	10414 (3)	10134 (89)	8186 (46)	7824 (20)
6. Total Retail Payments (2+3+4+5)	22959 (100)	69452 (100)	352363 (100)	11442 (100)	17775 (100)	38974 (100)

Note: Figures in the parentheses are percentages of total retail transactions.
Source: Reserve Bank of India.

The volume of retail transactions is typically large while the values at the aggregate level are relatively small compared to the RTGS transactions. Except for NEFT, as the value of transactions under each retail digital instrument is relatively small, disruptions in any segment are unlikely to pose a systemic risk and thereby cause undue damage to the PSS. Therefore, the strategy of the RBI has been to decentralise retail transactions and thereby infuse competition among the retail service providers.

Besides other service providers, the RBI-regulated NPCI has made commendable progress in the retail payment space. The IMPS, UPI, NACH, RuPay, JAM trinity have become popular among users. The UPI service is now available for domestic as well as cross-border transactions with several countries (Box 2). Like CCIL, the NPCI has also emerged as a critical financial market infrastructure - truly an umbrella organisation for retail payment systems. The RBI has issued guidelines on August 18, 2020 for setting up a pan-India new umbrella entity for retail payments similar to NPCI. Although a few applications have been received by March 31, 2021, the RBI is yet to issue licence to any such entity.

Box 2. Unified Payment Interface

The unified payments interface or the UPI is an instant payment system developed in 2016 by the National Payments Corporation of India (NPCI), an RBI-regulated entity. The UPI, built over the IMPS infrastructure, is simple, free of charge, and instantaneous. It supports person to person (P2P) and person to merchant (P2M) payments and can be used over a smartphone (app-based), feature phone (USSD based), and at merchant locations (app-based). Currently, one can pay up to ₹1 lakh in a single UPI transaction. The UPI service is available 24/7, throughout the year since December 20, 2019. The cross-border payment agreements using UPI are currently available with Bhutan, Malaysia, Singapore, and United Arab Emirates.

One can set up a UPI account in five simple steps:

1. Two things are needed to enjoy the benefit of UPI: a smartphone and a bank account of a UPI-member bank. Most banks in India are member banks of UPI as of today. The mobile number must be registered with the bank.
2. The next step is to download any UPI supporting app on the smartphone. Some popular examples of UPI apps are Google Pay, PhonePe, SBI Pay, Paytm, BHIM, MobiKwik, Uber, and BOB UPI.

3. Once the download is complete, the app will ask to create a virtual ID (identity). That is the unique ID to make or receive any UPI payment. Bank will then send a one-time password (OTP) to your mobile number to confirm that it is indeed your bank account.
4. Once the verification is over, one can set up the Virtual Payment Address (VPA). The VPA is the gateway that allows you to pay with your phone, from your bank account. It is also possible to link more than one bank account to the same VPA.
5. UPI Personal Identification Number (UPI-PIN) is a 4-6 digit passcode, which can be created during first-time registration with the help of an app. One has to enter this UPI-PIN to authorize all bank transactions.

The sender and the receiver of money need not type the bank account details of both parties participating in the UPI payment. The UPI through VPA is a user-friendly platform compared to digital wallets, credit cards, or normal bank transfers. Several security features have been embedded in the app to make the system safe and secured.

As a part of institution building, an Institute for Development and Research in Banking Technology (IDRBT) was set up by RBI at Hyderabad in 1996. It developed the Indian Financial Network (INFINET

- the communication network of the Indian banking and financial sector), the Structured Financial Messaging System (SFMS - a robust messaging platform used in the RBI operated payment systems, i.e., RTGS and NEFT), the Indian Banking Community Cloud (IBCC), the National Financial Switch (NFS), etc. which now provide the backbone of India's PSS. While INFINET, SFMS, IBCC systems have been transferred to Indian Financial Technology and Allied Services (IFTAS) - a wholly-owned subsidiary of the RBI, the NFS is given to NPCI for clearing services (NACH). The IDRBT is currently involved in research in 6 critical areas - Analytics, Mobile Banking, Cloud Computing, Cyber Security, Affordable Technology, and Payment System - besides offering certification courses and training on PSS.

III. Opportunities and Challenges of Innovations in India's PSS

Globally, digital transformation is a revolution that is changing almost every aspect of human life. As a part of the fourth industrial revolution, digitisation has been innovative, skill-sensitive, and disruptive. The exponential growth of digitisation brings in multiple benefits as well as challenges for policymakers. Discussion in this section is limited to innovations in India's PSS.

Digital transactions provide multiple opportunities. Notable among them are 'anytime anywhere' banking, decline in the transaction cost, increase in the speed of transaction, move towards less-cash economy, increase in efficiency and productivity in providing banking/financial services, increase in transparency, etc. Moreover, digital transactions reduce corruption/illegal activities such as money laundering, drug/terrorist financing mainly due to audit trails available in such transactions. The government is using the digital mode of transactions for direct benefit transfers (DBT) to the poor people under different social security schemes and thereby eliminating intermediaries/middlemen. Banks, financial institutions, corporate and government departments use NPCI's NACH platform for handling high volume and low-value credit/debit transactions, which are generally repetitive in nature. The digitisation programme of the government has improved the governance standard, which includes *inter alia* online submission of application/returns, payment of fees for government services, faceless processing of income tax returns, and collection of GST, etc. To reduce cash transactions, the Government has mandated the use of "FASTag" based toll collection, which is facilitated through NETC, operated by NPCI. The FASTag, issued by a bank or the Indian Highways Management Company Limited (IHMCL)

and affixed on the vehicle, is linked to an underlying payment instrument - bank account (savings, current), nonbank PPIs, cards, UPI, etc.

The RBI has recently constructed a Digital Payment Index (DPI) for India with March 2018 as 100, which has gone up to 153.47 in March 2019 and 207.84 in March 2020. It is now published semiannually. Notwithstanding disruption caused by the Covid-19 outbreak, the DPI has further increased to 217.74 in September 2020 and 270.59 in March 2021. Despite rapid increase in the DPI, India's currency-GDP ratio has not fallen during recent years (Table 4). The currency-GDP ratio in India is the highest among BRICS countries.

Table 4. Currency-GDP Ratio in India

Year	Currency with Public (CWP) ₹ trillion	GDP at Current Prices ₹ trillion	CWP/GDP Ratio in India
1990-00	1.89	20.23	9.34
2004-05	3.56	32.42	10.98
2009-10	7.67	64.78	11.84
2014-15	13.86	124.88	11.10
2019-20	23.50	203.51	11.55
2020-21	27.58	197.46	13.97

Source: Handbook of Statistics on Indian Economy, RBI.

The cash-less digital transaction (CDT) is yet to become a mass movement in India. Weaning away people from cash transactions has been a major challenge. Consumer satisfaction is low due to several reasons such as failure of transactions, poor dispute resolution, mis-selling of products, and inadequate cyber security. Moreover, the urban-rural divide in India is intense relating to digital literacy, logistics and digital infrastructure, which prevent penetration of digitisation into rural areas.

Major challenges of digitisation in India are cyber security, data localisation, data privacy, poor risk management, and above all inadequate dispute resolution mechanism/consumer protection. Data localisation issue remains a major area of contention among the digital service providers, particularly by Big Tech companies with foreign origin like Google, Amazon, Facebook, and other e-commerce platforms operating in India.

As individuals own their personal information/data, they have the right to authorise their collection, processing, and use. The Supreme Court allows data privacy as a fundamental right in India. This is called data democracy. Since personal data breach often leads to misuse, many countries have general data protection regulations (GDPR). In India, the data protection law is weak and breaches

of personal data privacy and cyber-crimes are high. India does not have a stand-alone personal data protection law to protect personal data/information shared and/or received in a verbal/written/electronic form. A comprehensive data protection bill is currently under the consideration of the Joint Parliamentary Committee.

Risks associated with digital transactions should be clearly understood by banks, digital service providers, users, and beneficiaries, besides their regular monitoring and risk mitigation mechanisms put in place. Digital transformation not only changes the character of existing risks but also creates new risks. Notable digital risks are cyber-attack, data governance and data privacy breaches, process automation risk, third-party risk, business resilience risk, workforce risk, and compliance risk. In a highly digitised world, most of these risks are hidden or difficult to anticipate. Very often they suddenly emerge and disrupt the PSS. Therefore, regulators should be ahead of the curve with regulations that are robust and proactively fine-tuned from time to time.

The process automation risk is essentially an operation risk arising due to several reasons such as errors in programming, natural disasters, frauds perpetrated by people/third parties, etc. Banks choose to engage the third party for several

reasons and assume multiple risks associated with doing business with the third party, which include poor performance, financial risk, compliance, and litigation risk, reputation risk, business resiliency risk, etc. As the workforce dynamically changes from time to time, there may be workforce risk due to new persons handling technically sensitive areas leading to human errors. Regulators should be vigilant about the compliance and their interpretation on a real-time basis to avoid any untoward situation in the PSS.

IV. Unfinished Agenda

Improvement in the PSS is an ongoing process. For the orderly development of India's PSS, the RBI has been putting out vision documents in the public domain every three years since 2002 and diligently pursuing those proposals over the years. The latest vision document relates to 2019-21, which contains 36 action points in four areas - promoting competition, reducing cost, increasing convenience, and fostering consumer confidence. The status of each recommendation is given in Annex 1. Major areas of the unfinished agenda are briefly discussed below.

1. Self-Regulatory Organisation

The intention of having an SRO of the payment system operators (PSOs) is to release the

regulatory burden on RBI. The SRO is expected to adopt international best practices concerning the PSS. This is yet to materialise in India as several issues relating to the SRO remain ambiguous in the guidelines. All stakeholders in the payment space are unlikely to be represented in the SRO as it is limited to PSOs. Even among the PSOs, some are banks; some are non-banks; including FinTech companies. It is not clear whether there will be only one SRO or multiple SROs by similar peer groups. As per the guidelines, an SRO must be a not-for-profit company, which bears a heavy regulatory burden, unlike many non-profit associations that are registered as a society. The Payments Council of India and the Indian Banks Association are expected to set up an SRO - a non-profit entity and apply for recognition by the RBI under the framework.

2. Regulatory Sandbox

The regulatory sandbox is an innovative way of testing the new product/process live in a controlled environment. After a product passes the cohort stage(s), it enters into the test phase. After clearing cohort/test phases, the RBI takes a view of whether the product can be considered for adoption by the regulated entities, subject to regulatory compliance. The RBI has so far introduced three cohorts relating to 'Retail Payments', 'Cross Border

Payments’, and ‘MSME Lending’. The fourth cohort - ‘Prevention and Mitigation of Financial Frauds’- is being introduced. Six entities out of 32 who applied for new technology in retail payments have completed their test phase. In the case of cross-border payments, eight entities (out of 27) have now been allowed to enter the test phase after completion of the cohort phase. Application for the third cohort on MSME lending is still open. The RBI has started inviting ‘On Tap’ applications for adopting new products relating to the theme of closed cohorts. ‘Retail Payments’ is now open for such applications. Moreover, the RBI is ready to introduce a framework for carrying out retail digital payments in offline mode across the country.

3. *Data Privacy/Tokenisation*

Pending the enactment of a comprehensive data protection law in India, the RBI has issued several guidelines from time to time for the protection of consumers’ personal data. With effect from January 2022, no entity in the card transaction/payment chain, other than the card issuers and/or card networks, shall store the actual card data. However, entities can store limited data - the last four digits of the actual card number and card issuer’s name – under the card tokenisation framework to track and/or reconcile the transactions. Initially, card-on-file tokenisation was limited to mobile phones

and tablets, which has been extended to laptops, desktops, wearables (wrist watches, bands, etc.), Internet of Things (IoT) devices, etc. The card issuers have to offer card tokenisation services as Token Service Providers (TSPs). Tokenisation of card data shall be done with explicit customer consent requiring Additional Factor Authentication (AFA) validation by the card issuer. This is also applicable to e-commerce marketplaces that are undertaking direct payment aggregation. The e-commerce marketplaces availing the services of a payment aggregator (PA) shall be considered as merchants.

4. *Contactless Payments/QR Codes*

To promote contactless payments, a QR code-based payment has been introduced where payment is performed by scanning a QR code from a mobile app. In August 2016, NPCI launched UPI with UPI QR code specifications. Moreover, the NPCI, MasterCard, and Visa developed Bharat QR with provisions for three additional fields: bank account and IFS (Indian Financial System) code, Unified Payments Interface (UPI), and Aadhaar. There are other proprietary QR codes in existence such as Paytm, MobiKwik, etc. To address the issue of multiple QR codes, the RBI in October 2020 issued instructions to keep only two interoperable QR codes (Bharat QR and UPI QR). All PSOs using

proprietary QR codes have been asked to shift to one of the interoperable QR codes by March 31, 2022.

Contactless digital transactions are also promoted under Bharat Bill Payment System (BBPS), National Electronic Toll Collection (NETC), Trade Receivables Discounting System (TReDS), etc. Initially, five mandatory categories of billers were allowed under BBPS - electricity, water, gas, telecom, and Direct-to-Home (DTH). Since September 2019, BBPS was extended to include all categories of billers who raise recurring bills. Since February 15, 2021, while the use of FASTag for toll collection under NETC has been made mandatory for all four-wheelers in all national highways, only a few state highways have been integrated into NETC so far. TReDS is not yet popular in India. MSME sellers, corporate and other buyers, including Government Departments and PSUs, and financiers are direct participants in the TReDS. All transactions processed under this system are “without recourse” to MSMEs. The RBI has not made it mandatory for any buyer, seller, or financier to participate in TReDS.

5. Geo-Tagging of Payment System Touch Points

It is essential to have the geographical location of the payment system touch points (bank branches,

ATMs, Points of Sale (PoS) terminals, BCs, etc.) across the country on an ongoing basis. The RBI has already established a framework to capture the location of commercial bank branches, ATMs, and BCs across the country. The RBI has proposed a similar framework to capture and maintain information about PoS terminals and other payment system touch points like QR codes etc. On January 5, 2021, the RBI announced the Payments Infrastructure Development Fund (PIDF) Scheme to encourage the deployment of PoS infrastructure (both physical and digital modes) in tier-3 to tier-6 centres and north-eastern states. This fund would help develop a framework for geo-tagging (capturing geographical coordinates -, viz., latitude and longitude) of physical payment acceptance infrastructure used by merchants.

V. Central Bank Digital Currency

The central banks enjoy monopoly power of issuing currency or legal tender of a country. The evolution of currency/legal tender has traveled a long way from commodity to precious metals and then to fiat money i.e., physical paper currency, including small denomination coins. Time has come to think of central banks issuing digital fiat currencies (DFCs) or central bank digital currencies (CBDCs). This would appear as a liability in the balance sheet of a country's central bank, similar to the physical

currency and backed by eligible assets. The idea of issuing anonymous electronic cash was given by Chaum in 1985 and also suggested by Tobin in 1987. Central banks did not embrace it as the time was probably not ripe then to explore it further.

Private virtual currencies or cryptocurrencies such as Bitcoin, Ethereum, Binance Coin, Ripple, etc., have already pervaded financial markets with their presence felt in many countries. Cryptocurrencies are not backed by any asset and are growing as an unregulated financial innovation. Stablecoins, issued by private agencies with some asset backing, are certainly better than cryptocurrencies, but could not impart stability to such currencies mainly due to the lack of regulations (Arner *et al.*, 2020). According to the World Economic Forum (2021), cryptocurrencies in aggregate were valued at more than US \$ 2 trillion by June 2021. By October 2021, the market capitalization of cryptocurrencies has surpassed the US \$ 2.5 trillion. Crypto transactions are recorded in a decentralised and/or distributed public ledger (blockchain) and are becoming increasingly popular globally mainly due to privacy and scarcity ensured by blockchain technology. It is disruptive to the extent it eliminates intermediation by banks/FIs, bypasses the central bank control over currency, and poses a potential threat to financial stability. Many countries have banned the use of cryptocurrencies while several others have

adopted suitable regulations and even tax crypto transactions. Global understanding is evolving and coordinated action is yet to emerge.

Many central banks are currently exploring the possibility of issuing CBDCs in response to the growing popularity of cryptocurrencies. According to a recent survey conducted by the BIS (with the participation of 66 central banks, covering 75% of the world's population and 90% of its economic output), 86% were actively researching the potential for CBDCs, 60% were experimenting with the technology, and 14% were deploying pilot projects in 2020. China is the only major economy, which has rolled out CBDC (e-CNY) on a pilot basis in four major cities in April 2020. Bahamas, Cambodia, and El Salvador have introduced CBDC in some form or the other.

1. Difference between CBDC and Cryptocurrency

There is a need to understand the basic differences between cryptocurrency and CBDC. The CBDC is entirely a different product altogether, which differs from cryptocurrency in respect of application programming interface (API/technology), architecture, deployment, security, privacy, efficiency, interoperability, scalability, and exchange rate as indicated in Table 5. The distinguishing features of CBDC depend on how the central banks

design the product/architecture keeping in view the objectives and user interests. As cryptocurrency is not a legal tender of any country, it does not qualify to be called a currency. At the most, it is a speculative investment, which is being used globally as an unofficial mode of payment. The users know for sure that downside risks are many and there is no grievances redressal mechanism in case of any problem in crypto transactions. According to the BIS Annual Economic Report (2021), ‘CBDCs are used to facilitate money laundering, ransomware attacks, and other financial crimes’.

Table 5. Comparison between CBDC and Cryptocurrency

Functionality	Central Bank Digital Currency	Cryptocurrencies
API / Technology	Specifically designed to enable central banks to issue DFC	Created to eliminate reliance on a central authority
Architecture	Digital bearer instrument	Ledger entries, distributed and replicated
Deployment	Leverages existing digital systems	Replaces existing financial systems
Settlement	Instant and final	Probabilistic convergence

Connectivity	Bearer instrument can be stored and transacted offline	Online transactions only
Security	Layered security protected in hardware	Participant-managed asymmetric keys, stored in software
Privacy/ Anonymity	Based on design/ policy	Fully private and anonymous/ pseudonymous
Efficiency	Minimal energy consumption	Exorbitant energy and power requirements
Inter-operability	Interoperable with all digital wallet and payment systems	Closed system
Scalability	Highly scalable; '000s transactions per second	Limited to a few transactions per second
Exchange Rate	Expected to be stable similar to physical currency	Highly volatile

Source: Compiled from BIS/IMF/central bank Discussion Papers.

2. Design of CBDCs

The global standard is yet to emerge regarding the design of CBDC although several models are being discussed in the academic circles. Many

central banks like the Bank of England, European Central Bank, Bank of Canada, the US Fed, etc., have come out with discussion papers for the issuance of CBDCs. The BIS has also analysed the forms of CBDC in its Annual Economic Report 2021 (Chapter III) and also through Working Paper No. 948 (2021). The design issues mostly revolve around four broad themes - centralised vs. distributed ledger technology, wholesale vs. retail CBDC, account-based vs. tokenised CBDC, and direct issuance to retail users vs. two-tier and/or hybrid systems.

As mentioned above, cryptocurrencies are traded in a decentralised platform based on distributed ledger technology (DLT). However, some form of control/centralised oversight is necessary for issuing CBDCs, failing which the central bank may lose monetary policy independence. Many experts agree that the decentralised DLT is not suitable for CBDCs. If CBDC is fully centralised and the general public would have claims over the central bank, then this may lead to the conversion of bank deposits into CBDC, particularly when there is potential bankruptcy/financial instability, unless commercial banks/other financial institutions provide attractive interest rate on deposits. This would hamper credit dispensation at a competitive cost. It has the potential to completely disrupt the intermediation process as intermediaries might

run into insolvency. Therefore, central banks may not like to directly deal with general public for owning CBDCs and settling all retail transactions in their balance sheets. Moreover, central banks are typically not competent to directly deal with individual accounts of the general public and verify their KYC requirements. In designing the CBDC, a combination of partly centralised (core ledger) and partly decentralised architecture is likely to emerge keeping in view the users' convenience.

The fiat money in digital form is currently available only to the regulated banks/financial institutions in the form of reserves accounts. The wholesale CBDC may look like this and be restricted to banks/financial institutions with their inter-bank transactions being settled in the central bank balance sheet (Figure 1). Retail CBDCs in contrast should be available to the general public through intermediaries, which could be either account-based or tokenised wallets. While account-based retail CBDCs would be linked to an identification scheme of all users, the token-based retail CBDCs would be accessed via password-like digital signatures/additional factor authentication and could be accessed anonymously. Banks would ensure KYC requirements and Anti-Money Laundering/Combating the Financing of Terrorism (CFT) regulations.

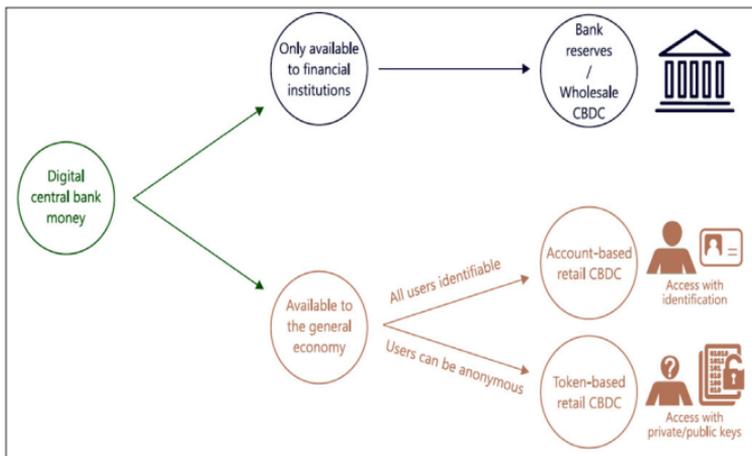


Figure 1. Forms of Central Bank Digital Currency
 Source: BIS Annual Economic Report, 2021.

The design of CBDC should be least invasive (Auer and Bohme (2021)). The two-tier system with the central bank at the top as regulator and banks/FIs as regulated entities is likely to continue (Bindseil, 2020). The central bank may use the regulated entities as distributors of CBDCs (Chaum *et al.* 2021). While the central bank would maintain the core ledger, the regulated entities would be linked to the core ledger through an application programming interface (API). The regulated entities would act as payment interface providers to the retail users of CBDCs (Grey *et al.* 2017). The retail CBDC transactions may be settled at the bank/FI level while the inter-bank settlement would take place in the central bank balance sheet. A prototype of

the platform model of CBDC, proposed by the Bank of England, is given below (Figure 2), which is a hybrid system CBDC architecture.

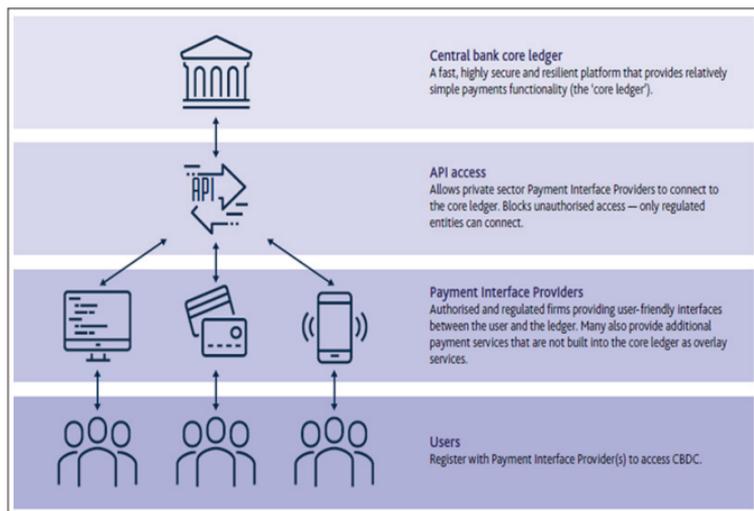


Figure 2: Platform Model of CBDC

Source: Bank of England Discussion Paper: Central Bank Digital Currency, March 2020.

Whether the platform model of CBDC meets the design principles? The design principles broadly fall into three categories - reliable and resilient, fast and efficient, innovative, and open to competition. The first category covers several features such as resilient, secure, available, scalable, compliant, and private, while the second category encompasses principles such as fast, user-friendly, efficient, inclusive, and transparent. The third category of design principles should be open to competition,

interoperable, extensible, and compatible with the existing digital infrastructure. There are certain trade-offs and complementarities among the principles. For example, too much security may come in the way of the user-friendly character of CBDC. Similarly, too much privacy in CBDC transactions is unlikely to ensure transparency. In a digital world, complete privacy of transaction, as in the case of physical currency, is not possible. Efforts must be made to achieve as many principles as possible while designing CBDC although it is difficult to achieve all principles at a time.

Broadly speaking, the CBDCs shall coexist with the physical currency till such time CBDCs are highly popular among the users. Given the distinguishing features of CBDCs, they are a good substitute for physical currency but will take time to be generally accepted as a medium of exchange. Although CBDCs are perceived as a complement to the existing bouquet of digital instruments discussed earlier, the possibility of CBDCs swamping some of the digital innovations is not ruled out.

3. *Need for CBDC in India*

Indians are one of the leading users of cryptocurrencies. The RBI in a press release issued in December 2013 expressed its concern about the risks involved in dealing with private virtual currencies. In April 2018, the RBI imposed a ban

on the entities regulated by it, from dealing with the cryptocurrencies leading to the shutdown of crypto platforms. However, the Supreme Court revoked the RBI decision in March 2020. Consequently, crypto exchanges in India have once again become highly active in dealing with cryptocurrencies with their market value currently exceeding the US \$ 2 billion. The Crypto business in India has been growing in a regulatory vacuum.

A high-level Inter-Ministerial Committee (IMC) was set up by the government in November 2017 to study the issues relating to virtual currencies in India and to propose specific actions to be taken in this regard. The IMC in its report in February 2019 recommended a law to ban cryptocurrencies in India. Accordingly, the Government of India introduced a Bill (The Banning of Cryptocurrency and Regulation of Official Digital Currency Bill, 2019), which could not be passed by the Parliament. The government has once again proposed to introduce a new Bill (Cryptocurrency and Regulation of Official Digital Currency Bill, 2021), possibly in the winter session, which would provide the basis for the introduction of CBDC in India.

As indicated earlier, cash transactions are still the preferred mode of payments in India despite the commendable progress of digital transactions witnessed in recent years. To reduce the cost

of printing paper currency and the physical infrastructure necessary for their distribution, there is a need for the RBI to issue CBDC at the earliest. The RBI can meet the public demand for digital currencies by issuing CBDC and thereby exercise at least some control over money-laundering and terrorist financing, which are easy to perpetrate through the use of cryptocurrencies. Other benefits of CBDCs include real-time money transfer at a competitive cost, no settlement risk as the settlement in CBDC is instantaneous and final. Moreover, it can provide safer/competitive payment services to the users, including cross-border payments, compared to cryptocurrencies. The RBI has indicated its intention to introduce CBDC in a phased manner (T. Rabi Sankar, 2021). The RBI Governor, Shri Shaktikanta Das, has recently indicated that the RBI is ready to launch a pilot project on CBDC soon.

4. *Legal Framework*

Can RBI issue CBDC without amendment in the RBI Act? According to Section 24 of the RBI Act, 1934, the denomination of currency is approved by the central government based on suitable security features proposed by the RBI from time to time. Similarly, Section 25 of the RBI Act empowers the central government to approve the design, form, and materials used in the banknotes as proposed

by the RBI. Although Inter-Ministerial Committee believes that no change in RBI Act is needed for introducing CBDC, some experts believe that there is no clarity about legal arrangement. It is not clear whether corresponding changes in The Coinage Act, 2011, FEMA, 1999, Information Technology Act, 2000, Payment and Settlement System Act, 2007 will be required.

The introduction of CBDC in India is incumbent upon streamlining several legislations. Besides amendment of existing legislations mentioned above, the central government may have to expedite the passing of several legislations such as Cryptocurrency and Regulation of Official Digital Currency Bill, 2021 (not yet introduced in the Parliament), Data Protection Bill, 2021. As of now, the RBI can at the most introduce CBDC on a pilot basis. But its pan-India adoption depends upon ongoing reforms in the digitisation process in India besides a comprehensive legal framework. The RBI has to proactively devise the regulatory and supervisory requirements necessary for introducing CBDC in India. Moreover, the RBI has to study the outcome of guidelines recently issued for tokenisation, Pan-India New Umbrella Entity, Payment Aggregators and Payment Gateways, and Account Aggregators besides cyber security, which has been a major source of distrust by the users of digital transactions in India.

VI. Concluding Observations

Central banks are actively involved in the research and testing of CBDCs before their adoption at the national level (Boar and Wadsworth, 2020). The physical currency will be ultimately replaced by digital currency (Prasad, 2021). The macroeconomic implications of introducing digital currencies in any country are yet to be fully understood and may turn out to be pervasive unless CBDCs are designed properly. It would not only be limited to the PSS but also spill over to the entire financial system. The commercial banks have already lost their monopoly access to the central bank liquidity as many non-bank financial institutions and/or payment service operators have been allowed to have settlement account with central banks. The digital revolution in the payment space has also adversely affected the intermediation process with e-money (digital wallets/P2P lending/NETC/BBPS etc.) disrupting the traditional banking business (Adrian *et al.*, 2019).

Much before the global financial crisis in 2007-08, shadow banks had established themselves as financial intermediaries competing with banks. Banks should not only be prepared to face intense competition from shadow banks but also from innovations in the PSS, including CBDCs. The transaction costs would continue to decline further

after CBDCs become popular among users. Due to a dramatic decline in the transaction cost, CBDCs may be popular among the general public going forward - a truly low-cost financial inclusion indeed.

If banking network would be utilised for the distribution of CBDCs, distinct CBDC accounts of customers and/or CBDC wallets would in some way or the other affect conventional banking services such as deposit facility, transfer facility, and/or conversion of deposit to physical currency at par on demand, offered by banks. Conditions such as minimum balance in savings accounts, the penalty for more than specified withdrawals in a month/week from such accounts, etc., may cause migration of deposits from savings/current accounts to CBDC accounts. As of now, CBDCs are perceived to be fostering innovations in the PSS, leaving banks' credit creation/risk analysis intact, which may change over time. If digital transformation, without CBDCs, is progressing well in promoting a less-cash economy, is there strong case for introducing CBDC in a hurry? According to Christopher Waller, Member, Board of Governors of the Federal Reserve System, the CBDC is a solution in search of a problem (2021).

The impact of CBDCs on monetary policy formulation and/or implementation is yet to be fully researched. Currently, what is certain is

that CBDCs would be an additional component of reserve money. Its impacts on the velocity of money, money multiplier, liquidity management, and transmission of monetary policy signals are uncertain. While the developed countries believe that central banks may surmount the limitation of monetary policy at zero lower bound by directly paying interest on CBDCs (Bordo and Levin, 2017), developing countries may not have the confidence to experiment with paying interest on CBDCs (vis-à-vis no interest paid on cash holding), at least at the early stage of their adoption. Moreover, what kind of new challenges CBDCs would pose for coordination between monetary policy and fiscal policy is difficult to anticipate at this stage. The CBDC being a revolutionary innovation, central banks cannot afford to remain behind the curve while designing CBDCs. It should ensure central bank independence, promote innovations in the PSS, preserve the integrity of financial markets, and above all, protect the interest of users to win their trust.

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Annex 1.

Progress of Major Recommendations of the Vision Document 2019-21

Sl. No.	Major Recommendations	Progress/Current Status
A. Increasing Competition		
1.	Self-Regulatory Organisation for all PSOs	RBI issued a framework for recognition of SRO for PSOs on October 22, 2020.
2.	Encourage and facilitate innovation in an environment of collaborative competition	FinTech companies are allowed to provide financial services through innovative instruments. They are not competing with banks but are collaborating with them.
3.	Feature phone-based payment services	Limited services are available.
4.	Off-line payment solutions	Pilot projects successfully conducted. Detailed guidelines for retail digital payments in offline mode for the whole country are awaited.
5.	USSD-based payment services	*99# - a USSD-based mobile banking service of NPCI is available.
6.	The global outreach of payment systems	RBI has entered into a Cooperation Agreement (CoA) on FinTech with

		International Finance Corporation (IFC) for RegTech and SupTech. RBI has joined the Global Financial Innovation Network (GFIN) for collaboration and cross-border testing of financial innovations. India is the chair of the SAARC Payment Council.
7.	Fostering innovation in a responsible environment through regulatory sandbox	RBI has set up Regulatory Sandbox (RS): First Cohort: Retail Payments; Second Cohort: Cross Border Payments; Third Cohort: MSME Lending; and Fourth Cohort: Prevention and Mitigation of Financial Frauds. 'On Tap' application facility has been introduced for themes of closed cohorts.
8.	Review of membership to centralised payment systems	Payment system operators, regulated by RBI, to take direct membership in Centralized Payment Systems (CPSs).
9.	Inter-regulatory and intra-regulatory co-ordination	Two Committees have been set up for resolving inter-regulatory and intra-regulatory issues.

10.	Benchmarking India's Payment Systems	The benchmarking among 21 countries was done over a range of 21 areas and 41 indicators.
B. Reducing Costs		
11.	Accessible, affordable, and inclusive services	Charges are reduced/ eliminated in case of several instruments. Payments Infrastructure Development Fund (PIDF) has been set up. The Reserve Bank operationalised PIDF in January 2021 to encourage acquirers to deploy payment acceptance infrastructure in tier-3 to tier-6 centres and northeastern states.
12.	Review of corridors and charges for inbound cross border remittances	The role of payment services providers for inbound cross-border remittances is being explored by RBI.
13.	Inter-operability and building capability to process transactions of one system in another system	Interoperability is mandatory for full-KYC PPIs. Proprietary QR codes shall migrate to interoperable QR Codes (Bharat/UPI QRC) by March 31, 2022.
14.	Acceptance infrastructure to address supply-side issues	An elaborate acceptance infrastructure has developed.

15.	System capacity and scalability	Fairly high and scalable.
16.	Increasing Legal Entity Identifier (LEI) usage for large value cross border payments	The LEI number required for all payment transactions of value ₹50 crore and above, undertaken by entities (non-individuals) using centralised payment systems, viz., RTGS and NEFT. RBI is one of the vice-chairs of the LEI-Regulatory Oversight Committee of the global LEI system.
17.	Regulation of payment gateway service providers and payment aggregators	Guidelines were issued on March 17, 2020. Payment Aggregators cannot store customer card credentials within their database or the server i.e. Card-on-File (COF). Similarly, their onboarded merchants cannot store the payment data of their customers from January 1, 2022.
C. Increasing Convenience		
18.	Harmonizing turn-around time (TAT) for resolution of customer complaints	In September 2019, RBI issued guidelines for harmonized TAT. The RBI has advised authorized PSOs to implement an online dispute resolution system by January 1, 2021.

19.	Setting up a 24x7 helpline	PSOs are advised to introduce a centralized 24x7 helpline by September 2021 to redress customer grievances in digital payments.
20.	Enhancing awareness	The Reserve Bank has been conducting electronic banking awareness and training (e-BAAT) programmes regularly for the benefit of the cross-section of customers/ bankers /students/ public. The Reserve Bank constructed and published a composite Digital Payment Index.
21.	Conducting customer awareness surveys	Is being explored.
22.	Internal ombudsman for digital payments	Ombudsman Scheme for digital transactions introduced on January 31, 2019. Internal Ombudsman for non-bank PSPs by January 2020.
23.	National settlement services for card schemes	Settlement of card transactions in the Reserve Bank book is being explored.

24.	Enhanced availability of retail payment systems and a wide bouquet of offerings	Multiple PSOs are available for retail payments.
25.	Widen scope/use of domestic cards	<p>National Common Mobility Card was launched in March 2019.</p> <p>RBI permitted relaxation in Additional Factor of Authentication (AFA) in case of Card Present (CP) transactions using Near Field Communication (NFC)-enabled EMV Chip and PIN cards for small values (up to ₹ 5,000/-). Transactions beyond this limit can be processed in contactless mode, but with AFA.</p> <p>This relaxation in AFA is, however, not applicable for ATM/online transactions.</p>
26.	Explore adoption of newer technologies including DLT for enhancement of digital payment services	<p>The Reserve Bank Innovation Hub (RBIH) has been set up at Hyderabad in November 2020 and is expected to create an ecosystem for idea generation and development through collaboration with tech innovators as well as academia.</p>

27.	E-mandates / Standing Instructions for recurring payment transactions	The processing of recurring transactions (domestic and cross-border) using cards/PPIs/UPI under arrangements/ practices shall not be continued beyond September 30, 2021.
D. Fostering Confidence		
28.	Increased coverage of the Cheque Truncation System (CTS)	All bank branches to participate in image-based CTS in their respective grids by September 30, 2021. A concept of a Positive Pay Mechanism for all cheques of value ₹ 50,000 and above was introduced on January 1, 2021.
29.	Increased scope and coverage of the Trade Receivables Discounting System	'On-tap' authorisation was introduced in October 2019. Participation is not mandatory.
30.	Geo-tagging of payment system touchpoints	The Reserve Bank has established a framework to capture the location and business details of commercial bank branches, ATMs, and business correspondents (BCs). A framework for geo-tagging of physical payment acceptance infrastructure, viz., Point of Sale (PoS)

		terminals, Quick Response (QR) codes, etc., used by merchants is being finalized.
31.	Contact-less payments and tokenization	FASTag system for toll collection is now implemented. RBI guidelines issued for card-on-file tokenization to be achieved by January 1, 2022.
32.	Enhanced security of mobile-based payments	Master Direction was issued on February 18, 2021.
33.	Oversight for maintaining the integrity of payment systems	Regulatory oversight has been put in place.
34.	Third-party risk management and system-wide security	A separate regulatory framework for outsourcing arrangements by non-bank payment service providers is being explored by RBI.
35.	Framework for collection of data on frauds in payment systems	RBI has created a web-based platform to facilitate online payment fraud reporting by payment system participants.
36.	Framework for testing the resilience of payment systems	Is being done periodically.

The views expressed in this booklet are not necessarily those of the Forum of Free Enterprise.

“People must come to accept private enterprise not as a necessary evil, but as an affirmative good”.

- Eugene Black
Former President,
World Bank

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