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Artigos

The Regulatory Sandbox for the Pilot Project of Retail E-rupee Currency: Consideration for Reserve Bank of India

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Abstract

Recent advancements in technology-based payment methods have prompted central banks all over the world to consider the possible advantages and hazards of issuing Central Bank Digital Currencies (CBDC) in order to keep up with the current innovation trend. The Indian payment system is no exception to this fintech innovation trend. As a result, the Reserve Bank of India (RBI) must begin considering related patterns and develop a phased implementation plan that progresses gradually through the pilot project. The present research is proposing a Pilot project on the issuance of retail e-rupee first. The research is primarily based on the normative method presenting a qualitative analysis of the creation of a digital rupee possibly like paper money and its smooth implementation. The study examines the potential effects of retail e-rupee implementation on the banking industry, monetary policy, technology architecture options, potential retail e-rupee applications, issuance methods, etc., as well as privacy issues. Thus, it will assist RBI in making policy decisions.

Keywords: E-Rupee; digital currency; retail e-rupee; India digital currency.

O Sandbox Regulatório para o Projeto Piloto de Varejo Moeda E-rupee: Considerações sobre o Reserve Bank of India

Resumo

Os recentes avanços nos métodos de pagamento baseados em tecnologia levaram os bancos centrais de todo o mundo a considerar as possíveis vantagens e riscos de emitir Moedas Digitais do Banco Central (CBDC) para acompanhar a atual tendência de inovação. O sistema de pagamento indiano não é exceção a essa tendência de inovação fintech. Como resultado, o Reserve Bank of India (RBI) deve começar a considerar os padrões relacionados e desenvolver um plano de implementação em fases que avance gradualmente por meio do projeto piloto. A presente pesquisa propõe um projeto piloto sobre a emissão de e-rupee de varejo primeiro. A pesquisa baseia-se principalmente no método normativo, apresentando uma análise qualitativa da criação de uma rúpia digital possivelmente semelhante ao papel-moeda e sua implementação tranquila. O estudo examina os possíveis efeitos da implementação da e-rupee de varejo no setor bancário, na política monetária, nas opções de arquitetura tecnológica, nas possíveis aplicações da e-rupee de varejo, nos métodos de emissão, etc., bem como nas questões de privacidade. Assim, ele ajudará o RBI a tomar decisões sobre políticas.

Palavras-chave: E-Rupee; moeda digital; e-rupee de varejo; moeda digital da Índia.

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El Sandbox Regulatorio para el Proyecto Piloto de Comercio Minorista. E-rupee Currency: Consideración para la Reserva

Resumen

Los recientes avances en los métodos de pago basados en la tecnología han llevado a los bancos centrales de todo el mundo a considerar las posibles ventajas y peligros de emitir monedas digitales de bancos centrales (CBDC) para mantenerse al día con la actual tendencia de innovación. El sistema de pagos indio no es una excepción a esta tendencia de innovación fintech. Como resultado, el Banco de la Reserva de la India (RBI) debe empezar a considerar los patrones relacionados y desarrollar un plan de implementación por fases que progrese gradualmente a través del proyecto piloto. La presente investigación propone primero un proyecto piloto sobre la emisión de rupias electrónicas al por menor. La investigación se basa principalmente en el método normativo que presenta un análisis cualitativo de la creación de una rupia digital posiblemente como el papel moneda y su aplicación sin problemas. El estudio examina los posibles efectos de la implantación de la rupia electrónica minorista en el sector bancario, la política monetaria, las opciones de arquitectura tecnológica, las posibles aplicaciones de la rupia electrónica minorista, los métodos de emisión, etc., así como las cuestiones de privacidad. De este modo, ayudará al RBI a tomar decisiones políticas.

Palabras clave: E-Rupee; moneda digital; e-rupee minorista; moneda digital india.

Le bac à sable réglementaire pour le projet pilote de commerce de détail. E-rupee Currency : Consideration for Reserve

Résumé

Les récentes avancées dans les méthodes de paiement basées sur la technologie ont incité les banques centrales du monde entier à examiner les avantages et les risques possibles de l'émission de monnaies numériques de banque centrale (CBDC) afin de suivre la tendance actuelle à l'innovation. Le système de paiement indien ne fait pas exception à cette tendance à l'innovation fintech. Par conséquent, la Reserve Bank of India (RBI) doit commencer à examiner les modèles connexes et élaborer un plan de mise en œuvre progressive qui progresse graduellement dans le cadre du projet pilote. La présente recherche propose un projet pilote sur l'émission de l'e-rupee de détail en premier lieu. La recherche est principalement basée sur la méthode normative présentant une analyse qualitative de la création d'une roupie numérique pouvant ressembler à de la monnaie papier et de sa mise en œuvre sans heurts. L'étude examine les effets potentiels de la mise en œuvre de l'e-rupee de détail sur le secteur bancaire, la politique monétaire, les options d'architecture technologique, les applications potentielles de l'e-rupee de détail, les méthodes d'émission, etc. ainsi que les questions de protection de la vie privée. Il aidera ainsi la RBI à prendre des décisions politiques.

Mots clés : E-Rupee ; monnaie numérique ; e-rupee de détail ; monnaie numérique indienne.

在Sandbox平台上试运行零售类电子卢比的若干问题和对印度储备银行的建议

摘要

电子支付新技术的发展促使世界各国的中央银行评估发行数字货币(CBDC)可能的优势和风险。紧跟当前的科技创新趋势，印度储备银行(RBI-印度的央行)也在考虑开发电子卢比支付系统，目的是利用金融科技的优势。因此，储备银行开始制定电子货币支付系统的使用规范，并制定分阶段实施的计划，通过试点项目逐步推进。作者建议央行首先发行零售类电子卢比。本研究主要使用质性分析法，对数字卢比的发行问题进行分析，同时探讨了零售类电子卢比对银行业发展、货币政策、技术架构选择、将来数字货币的发行方式等的潜在影响，以及有关隐私保护的问题。因此，它将会有助于印度储备银行制定政策，提供建议。

关键词：电子卢比；数字货币；零售业电子卢比；印度数字货币。

Die regulatorische Sandbox für das Pilotprojekt des Einzelhandels. E-Rupie-Währung: Überlegungen zur Reserve

Zusammenfassung

Die jüngsten Fortschritte bei technologiebasierten Zahlungsmethoden haben Zentralbanken auf der ganzen Welt dazu veranlasst, die möglichen Vorteile und Gefahren der Ausgabe von digitalen Zentralbankwährungen (CBDC) zu prüfen, um mit dem aktuellen Innovationstrend Schritt zu halten. Das indische Zahlungssystem ist keine Ausnahme von diesem Fintech-Innovationstrend. Daher muss die Reserve Bank of India (RBI) damit beginnen, entsprechende Muster zu berücksichtigen und einen stufenweisen Implementierungsplan zu entwickeln, der schrittweise durch das Pilotprojekt fortschreitet. In der vorliegenden Studie wird zunächst ein Pilotprojekt zur Ausgabe von E-Rupien für Privatkunden vorgeschlagen. Die Untersuchung basiert in erster Linie auf der normativen Methode, die eine qualitative Analyse der Schaffung einer digitalen Rupie, die möglicherweise dem Papiergeld ähnelt, und ihrer reibungslosen Umsetzung darstellt. Die Studie untersucht die potenziellen Auswirkungen der Einführung der E-Rupie für Privatkunden auf den Bankensektor, die Geldpolitik, Optionen für die Technologiearchitektur, potenzielle Anwendungen der E-Rupie für Privatkunden, Ausgabemethoden usw. sowie Datenschutzfragen. Auf diese Weise wird sie die RBI bei ihren politischen Entscheidungen unterstützen.

Stichworte: E-Rupie; digitale Währung; E-Rupie für Privatkunden; digitale Währung in Indien.

Introduction

The Reserve Bank of India (RBI) has an explicit objective to maintain monetary and financial stability along with wider access to robust and safe payments. Because the Reserve Bank is required by the RBI Act, of 1934, to control the issuance of banknotes and the holding of reserves, monetary stability is ensured by this legislative obligation for currency management. Money access to the public and financial institutions including banks is the safest form of money and is a mode by which reserve banks implement their public policy money Developments in money and finance coexist with the changes in monetary history due to the evaluation of diverse forms of cash as money. It carries intrinsic value that signifies ownership of items or ownership in one of the forms of debt instruments. In modern countries, the currency is a legal tender and in the form of money issued only by central banks backed by the sovereign.

Regional Bank Money serves as a store of value for a jurisdiction as well as a means of exchange and a unit of account. Payment systems are rapidly evolving through technological advancement and quicker and simpler payments at anytime from anywhere are a demand of users due to digitalization making other facets of life easier (Bech; Garratt, 2017, p. 55-70). Systems that permit very quick retail payments among people are spreading throughout the world. In the field of payment and settlement systems, India has consistently been a nation that has encouraged innovation and growth. Numerous payment methods have developed over the past few decades, all for the benefit of the average person. Since the middle of the 1980s, the Reserve Bank of India has undertaken several attempts such as Electronic Clearance Service (ECS) in 1990, Real Time Gross Settlement

(RTGS) in 2004, National Electronic Funds Transfer (NEFT) in 2005, Immediate Payment Service (IMPS) in 2010, Cheque Truncation System (CTS) 2011, National Automated Clearing House (NACH) in 2012, and recently introduced Unified Payments Interface (UPI) 2016 services, all these developments in India's payment system are technologically enabled banking system solutions. These Modern, cutting-edge payment methods are a source of national pride due to their availability, cheaper, practical, effective, secure, and available all the days a year.

The introduction of mobile-based payment systems like the Bharat Bill Payments System (BBPS), the IMPS, the UPI for instant payment settlement, and the National Electronic Toll Collection (NETC) to enable electronic toll payments are the most recent technological developments that are transforming the Indian payment eco-system and making headlines around the globe.

As these are the alternate convenient payment methods substitute to cash are leading to quick adoptions. The expansion of e-payments is aided by third-party applications, i.e., Prepaid Payment Instrument (PPI) issuers, and BBPOUs, which are all non-bank FinTech enterprises. RBI has served as a catalyst while attending to public policy goals of the creation and promotion of robust and interoperable payment systems.

Private digital currencies have no inherent value because they are not commodities/claims on commodities, and hence contradict the conventional notion of money. The unexpected rise in popularity of private cryptocurrencies in recent years has tested the foundational idea of money as we now understand it. As a technical advancement that will create decentralized money and destroy the present financial system, cryptocurrency has the benefits of decentralization.

In order to bypass the existing, regulatory intermediation and oversight mechanisms necessary to uphold the integrity and stability of the monetary and financial environment, cryptocurrencies are designed from the ground up. As the guardian of the monetary policy framework & responsible for preserving India's financial stability, the RBI has repeatedly drawn attention to the myriad risks connected to cryptocurrency. Due to their detrimental effects on the financial sector, these digital assets endanger India's financial and macroeconomic framework. A broader circulation of cryptocurrencies may limit the capacity of the country's monetary authorities to regulate its monetary system and develop its monetary policy, which presents a serious danger to the stability of the financial system of the nation. Even the sorts of money used to make payments are changing, in addition to the payment procedure itself. The public receives money from the central banks in the form of actual currency, and banks and other financial institutions receive it via reserves and

settlement accounts. The availability of new private-sector financial goods and services, such as e-wallets, mobile payment applications, and new electronic assets, is the result of recent technological advancements. Despite the fact that cash is still the most important form of payment, the Committee on Payments and Market Infrastructures and the Markets Committee encourage Central Banks to think about how new digital currencies can supplement or replace conventional money. New central bank digital currencies are forcing central banks to consider how they might supplement or supplant conventional currency. Digital currency is a third type of base money, and central banks all over the world are investigating its viability, potential advantages, and associated hazards. Based on the findings of a study on CBDCs undertaken in 2021 among 81 central banks by the Bank for International Settlements (BIS) (Kosse; Mattei, 2022), 90% of central banks are actively working on producing or testing digital currency.

Legal material and methods

The article strives to highlight that Central Bank Digital Currencies (CBDC) also known as a Sovereign Digital Currency/ Digital Currency (DC) backed by technology 2.0/ fintech is evolving in innovative ways. As an alternative to the generally accepted forms of money, it is revolutionizing the conventional methods and procedures used in the digital form of currency notes. Being digital, it is probably simpler, quicker, and less expensive. It also offers all the advantages for transactions that other digital payment systems provide. No payment system market or regulator is left unaffected by these technological developments. This has raised very significant legal questions on the type of digital currency to issue, modes for issuance and management of it, forms of digital currency and Remunerated or Non-remunerated, Degree of Anonymity, and the possible effect of banking disintermediation, etc.

This paper identifies the issuance of retail e-rupee[1] as India's Digital Currency by RBI and possible consequences on the overall Indian payment eco-system. The article proposes a regulatory sandbox pilot project on the issuance of Retail E-rupee to govern and address this innovative technology usage, addressing various risks associated with it and clarifying present legal framework application if any.

[1] E-Rupee is a tokenized digital version of the Indian Rupee, issued by the Reserve Bank of India (RBI) as the central bank's digital currency.

Result and Discussion

Benefit/ reasons for issuing E-rupees

Some nations have supported the use of DC for several very distinct reasons, including the following:

- Sweden's central banks aim to promote the adoption of a more generally recognized electronic form of money in response to the dwindling usage of paper money;
- US, Japan, Denmark, and Germany with substantial physical currency usage attempting to increase the efficiency of the issue;
- The Bahamas and the Caribbean, which had a dispersed population of various-sized islands, had a reason to adopt digital currency because of geographic limitations that restricted the physical transfer of money;
- In order to satisfy the public growing demand for DCs—which is reflected in the rising use of private virtual currencies—central banks work to prevent the more negative effects of such private currencies.

The fact that digital currencies are sovereign currencies provides settlement finality, lowering the risk of settlement in the financial system, and giving them a distinct edge over other electronic payment systems. DC may also enable the seamless and more affordable real-time integration of cross-border payment systems. In terms of innovation regarding online payments, India has made great progress. Retail and wholesale customers can access the payment systems 24 hours a day, 365 days a year, and they are largely real-time. Users have various alternatives for completing transactions, transaction costs are among the lowest in the world, and digital payments have grown at a stunning Compound annual growth rate (CAGR) of 55% (Reserve Bank of India, 2023) over the last five years.

The E-rupees platform will advance the integration of finances, the monetary system of payment, and India's electronic economy, thanks to the country's cutting-edge, cost-effective, easy-to-use, efficient, secure, and risk-free payment systems. There are several and varied reasons why India should take into account E-rupees. Below are a few significant reasons why India should think about issuing it.

Reduction in the expenditure of managing physical cash- In comparison to the prior year (July 1, 2020 to March 31, 2021), the total amount spent was 4,012.10 crore on security printing from April 1, 2021 to March 31, 2022 was 4,984.80 crore (Reserve Bank of India, 2022b). Money, the public at large, businesses, banks, and the RBI are the main stakeholders

who bear the majority of printing costs. DC increases the overall value of the money-issuing function insofar as it reduces operational expenses like printing, storage, transporting, and replacing banknotes, and also the costs associated with delays in reconciliation and settlements. While upfront fixed infrastructure expenses to establish a DC creation or issuance may be substantial, ongoing marginal operating costs will be very low. The economic viability of managing cash via digital currency as opposed to real currency is a further driver in the development of DC, which might also be seen as environmentally advantageous. In addition to meeting the nation's growing cash needs, DC will save money since it will do away with various processes associated with the delivery of physical money across the country. Furthermore, DC is expected to facilitate easy transactions due to geographic dispersion and locations where it is challenging to make actual currency available.

To advance digitization in order to transition away from a cash-based economy- India presents a unique situation since, despite considerable digitalization in the payments industry, the country's economy has seen a surge in cash. Notwithstanding the growth of online payment options, there is still a desire for cash. The number of banknotes rose in value by 16.8% and 9.9% in the 2020–2021 and 2021–2022 fiscal years, respectively, whereas the volume of notes climbed by 7.2% and 5%, respectively (Reserve Bank of India, 2022b). People's cautious holding of currency is primarily due to the COVID-19 epidemic's second wave, which caused a high increase in the number of banknotes in circulation in the years 2021–2022. As per RBI pilot research conducted between December 2018 and January 2019 in six cities on people's preferences for retail payments revealed that cash remained the most common way to pay for and receive money for everyday expenditures, with digital mode placing in second. Low-value transactions up to Rs. 500 are typically conducted with cash. Any unpredictable circumstance, like the one brought on by the COVID-19 epidemic, can make DC a preferred means of keeping central bank funds on hand rather than cash. Additionally, provided appropriate anonymity is maintained, the preference for cash transactions for routine costs and modest payments may be shifted to DC acceptance. The nation's shift to digital technologies will be accelerated as a result.

Since its introduction, the RBI Digital Payment Index (RBI-DPI) has shown a considerable increase i.e. DPI Index 100 in March 2018 (base) to 349.30 in March 2022 in the adoption and deepening of digital payments throughout the nation (Reserve Bank of India, 2022a). The RBI-DPI rise is a sign that the country's use of digital payments is deeper and spreading, and it shows that Indians are interested in using them. Due to its simplicity of use and sovereign guarantee, the central bank's digital currency will therefore offer an

additional alternative for advancing the cause of digital payment, in addition to the variety of other digital payment instruments already accessible.

Promoting payments competitiveness, efficiency, and innovations- The world is undergoing a digital revolution, and no sector has undergone as much change as payment and settlement systems. As a result, the average person now has access to a wide range of digital solutions. Customers now have a variety of alternatives to consider when choosing a payment method to complete a transaction. Each payment method has a certain use and goal; thus, they choose a particular payment method based on the value they assign to it in that particular circumstance. The dependence on electronic payment systems grows as a result of the move away from cash payments, which has an impact on the variety and robustness of the payment environment. DC might further improve payment resiliency and offer essential services for payments beyond the framework of the commercial banking system. It can provide an alternate method of payment and broaden the selection of available payment alternatives, especially for e-commerce where the Cash on Delivery (COD) option is only instead of cash. The DC-based system of payment is not anticipated to replace other forms of current payment alternatives; instead, it will complement them by giving the general public access to an additional payment option. When DC is implemented, as has been the case with many payment systems, innovations surrounding the product will only increase the options available, and competitiveness will aid in bringing about cost and time reductions. In the contemporary economy, the majority of payments are made with privately held funds that are held by banking institutions as deposits on demand and are therefore the banks' liabilities. Commercial banks ensure that their currency can be converted to reserve bank money on demand at a fixed price, most notably at par. This guarantees the value of the currency and forms a significant portion of bank deposits. Even if a commercial bank is solvent, it may be challenging to fulfill an unanticipated surge in demand to convert a sizable quantity of bank deposits to central bank money under a fractional reserve system. A crucial contrast between the two forms of money is the central bank's capacity to fulfill its commitments using its own nonredeemable money as opposed to the money of commercial banks. The latter involves counterparty risk. The only kind of money that is not subject to credit or liquidity risk is that which is issued by the central bank. As a result, it is the preferred asset to settle payments in the infrastructure of the financial markets. As a result, e-rupees would provide easy access to digital currency for the general people without introducing credit or liquidity risk. As a result, it may provide a secure environment for innovations from the private sector to satisfy the expanding need for payment services. Furthermore, it will assist in levelling the playing field among businesses

of all sizes in terms of payment innovation. For some smaller businesses, the risks and expenses of issuing a safe and trustworthy kind of private tender may be prohibitive. By removing this obstacle, e-rupees would let private-sector businesses concentrate on developing new access services, distribution strategies, and related service offerings. As the demands for speed and efficiency in the digital economy change, a CBDC may produce novel abilities to meet them. Additionally, the finality of payments made with e-rupees lowers the risk of settlement in the financial system. This allows market players to select from a variety of settlement choices. Utilizing bilateral settlement without a centralized counterparty using e-rupee accounts, settlement in central banks, or settlement in commercial bank accounts with or without using clearing organizations, e-rupees will do away with the necessity for interbank settlement. It is comparable to a cash-based transaction where e-rupees are given in place of banknotes, resulting in a quick settlement. The payment mechanism should become even more efficient as a result of this.

To investigate the e-rupee's potential for enhancing cross-border transactions- The present-day sophisticated payment systems in India are a source of national pride because they are affordable, accessible, easy, effective, safe, and secure. Cross-Border Payments, on the other hand, is a sector that is particularly open to change and could profit from emerging technology. India was the world's top recipient in 2021, receiving $87 billion in remittances, according to the World Bank. Over 20% of these payments came from the USA, which was the largest source overall (World Bank Group, 2021). Given the sizeable Indian diaspora dispersed throughout the world and the potential misuse of informal/illicit channels, therefore, it is quite important to consider the cost of transferring money to India. The G20 additionally endorsed a detailed program to overcome the major barriers and gave strengthening cross-border payments priority that stands in the way of cross-border payments, including their high costs, slow speeds, restricted access, lack of transparency, and frictions that exacerbate these obstacles. Systems will be advantageous to individuals and economies all around the world, fostering economic expansion, commerce, growth, and financial integration. According to the findings of a BIS survey (Auer *et al.*, 2021) of central banks performed in June 2021, the existing frictions in cross-border payments may be reduced by digital currency, particularly if central banks take a global perspective into account while developing DCs. BIS noted that unless central banks design their DCs with cross-border considerations from the start and interact globally, the potential advantages will not be readily reached. Many central banks are presently looking into the advantages, drawbacks, and various designs of DC, primarily with a heavy emphasis on domestic requirements. Even if exclusively for domestic use, DCs are expected to have effects that

cross national boundaries, hence CBDCs from different jurisdictions need to coordinate their efforts and find points of agreement. The "clean slate" provided by CBDCs might be used to improve cross-border payments if structured properly.

As per the BIS survey of central banks conducted in late 2020 (Auer *et al.*, 2021), the effectiveness of cross-border payments is a significant driver of CBDC issuance, particularly for wholesale DC initiatives. CBDCs may promote innovation in cross-border payments by accelerating transactions and assisting in overcoming significant obstacles related to time zones, currency rates, and legal and regulatory requirements across nations. The interoperability of DCs also offers ways to reduce the risks and snags associated with international and cross-currency transactions, enhancing the function of central bank money as a payment system anchor. Therefore, one of the main reasons for considering the issuing of DC is the possible application of DC in easing difficulties with cross-border payment.

Encourage financial inclusion- India's yearly Financial Inclusion (FI)-Index for March 2022 is 56.4, up from March 2021's 53.9 (Reserve Bank of India, 2021). It shows that even while different stakeholders have taken steps to improve financial inclusion in the nation, a more concerted effort is needed on the part of policymakers to reach the desired outcome.

Poor connectivity, a lack of specialized goods, a dearth of physical infrastructure, sociocultural hurdles, and a lack of integration of credit with additional financial services like insurance, pensions, etc. are some of the current obstacles to financial inclusion. With the right design decisions, the e-rupee might be able to offer the general public a secure sovereign digital currency for a range of transaction requirements. The unbanked and underbanked people will have easier access to financial services as a result. The offline capability will make it possible to conduct CBDC transactions without using the internet, enabling access in areas with weak or non-existent internet connectivity. In the banking system, it will also leave digital tracks of the unbanked populace, making it easier to obtain loans.

The universal access features of an e-rupee, especially offline functioning, provision of universal access devices, and interoperable among various platforms, will prove to be a game-changer in terms of strengthening the entire e-rupee system for reasons of resiliency, reach, and monetary inclusion.

Protect the public's faith in the national currency against the expansion of crypto assets- The role of central banks is to preserve public confidence in our currency. To identify sound principles and promote innovation, central banks must closely coordinate with one another to steer the investigation of central bank digital currencies. The growth of crypto assets can provide serious hazards for money laundering and terrorism financing. Furthermore, central banks must protect the public's confidence in our currency by

preventing the unchecked usage of crypto assets. To identify sound principles and promote innovation, central banks must closely coordinate with one another to steer the investigation of central bank digital currencies. The growth of crypto assets can provide serious hazards for money laundering and terrorism financing. It's also feasible that as the e-rupee develops, the general public will have access to a virtual currency that offers them legal advantages without the hazards associated with using privately owned virtual currencies. It might therefore meet the growing need for secure digital currency while also protecting people in general from the very high amount of volatility some of these digital currencies encounter. One of the main justifications for the launch of the e-rupee was to preserve the public's trust in the Indian Rupee amid the rise of crypto assets.

E-rupee Design Considerations

Risk-based strategy- There are three crucial guiding concepts that central banks should consider when releasing an e-rupee: (i) It should adhere to the "do no harm" concept and not conflict with public policy goals or prohibit banks from carrying out their fiscal stability mandate. (ii) It should be used in addition to and as a substitute for current payment methods (the coexistence principle). (iii) Based on the premise of innovation and efficiency the payment system's overall usability and effectiveness can be increased orderly. It should encourage innovation and competition.

Considering the aforementioned principles, domestic circumstances dominate the design options taken into account while issuing e-rupee. Therefore, it will not take a "one size fits all" approach. A highly secure, resilient, and scalable infrastructure that can accommodate many users at once will be needed for an e-rupee to operate effectively. The functions that the e-rupee is anticipated to accomplish define its design, which in turn decides how the e-rupee will affect monetary policy, payment systems, the structure of the financial system, and other factors. The risk will vary according to the jurisdictions' architecture and processes, necessitating extensive analysis by a central bank before adoption. Any risks to financial stability should be adequately mitigated by a central bank before issuing any e-rupee.

Types of CBDC

E-rupee can be classified into two broad types based on their usage and functions, as well as their various levels of accessibility: retail E-rupee for the general public at large

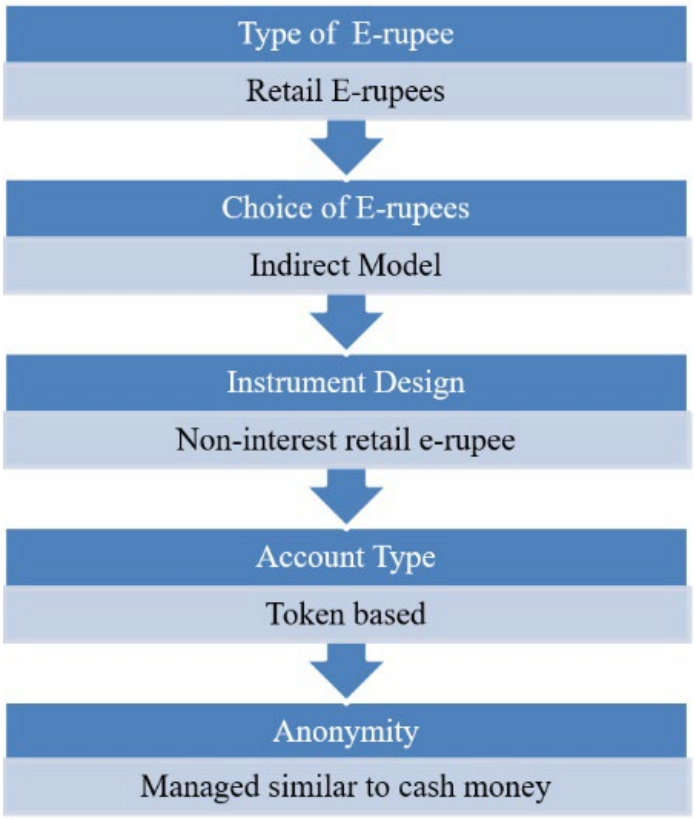
and wholesale E-rupee for financial institutions. The wholesale E-rupee is not considered in this research paper therefore focus is only on retail E-rupee-related aspects. Retail E-rupee may be used by all private sector, non-financial consumers, and businesses. Retail E-rupee is expected to be issued by RBI and must be interested in addressing financial inclusion.

Electronic money called Retail E-rupee is primarily intended for use in the retail sector. With a wide variety of payment options—including ECS, NEFT, and UPI—and a rapid rise in digital transactions, India already has a reliable payment infrastructure in place. Retail E-rupee will offer a safe RBI instrument with immediate access to cash for settlement and payment. Additionally, it is asserted that it might increase the robustness of India's retail payment infrastructure. In the event that other payment system infrastructures are disrupted due to operational and/or technical issues, E-rupee can serve as a substitute payment method for online transactions. With a focus on liquidity and credit risk, the e-rupee might aid payment systems (Dyson; Hodgson, 2016). Given the various benefits of Retail E-rupee, there may be merit in introducing it.

Who administers the Retail e-rupee and what role does the RBI play?

A crucial consideration in the creation of a retail e-rupee would involve the roles that the RBI and the private sector should play in promoting accessibility to and utilization of an E-rupee. At present, there are three approaches for the issuance and administration of digital currency used globally i.e. direct model, the indirect Model, and the Hybrid model. The way legal claims are organized and the central bank's track record are the main differences. The indirect approach could prove to be the most suitable architecture for implementing retail E-rupee in India out of these three options. The proposed design choice for RBI is as follows:

***Figure 1**: The Proposed design choice for RBI*



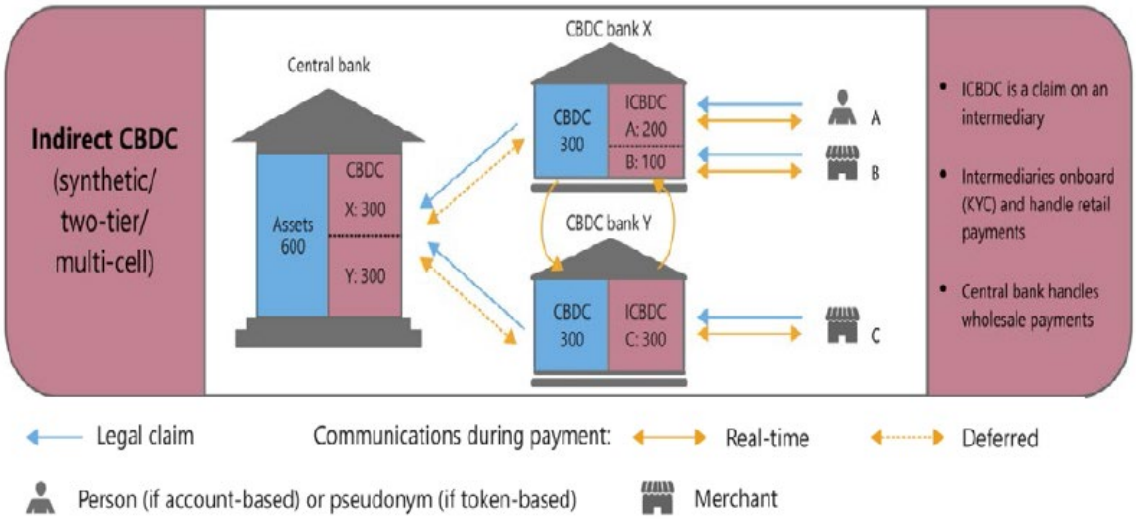
***Source**: Author's self-analysis*

Let us understand the proposed design choices in detail.

Proposed indirect model

In this model (figure 2), there are two entities i.e., RBI and other service providers. Each performs its assigned function. The intermediate architecture includes two models: the indirect and the hybrid model. Consumers in the "indirect E-rupee" model would keep their retail e-rupee in an account/wallet with a bank or service provider. Instead of the RBI, an intermediary would be required to deliver the E-rupee upon request. The RBI would only monitor the intermediaries' wholesale E-rupee balances. The RBI has to make sure all of the retail balances accessible to retail customers match with wholesale e-rupee balances.

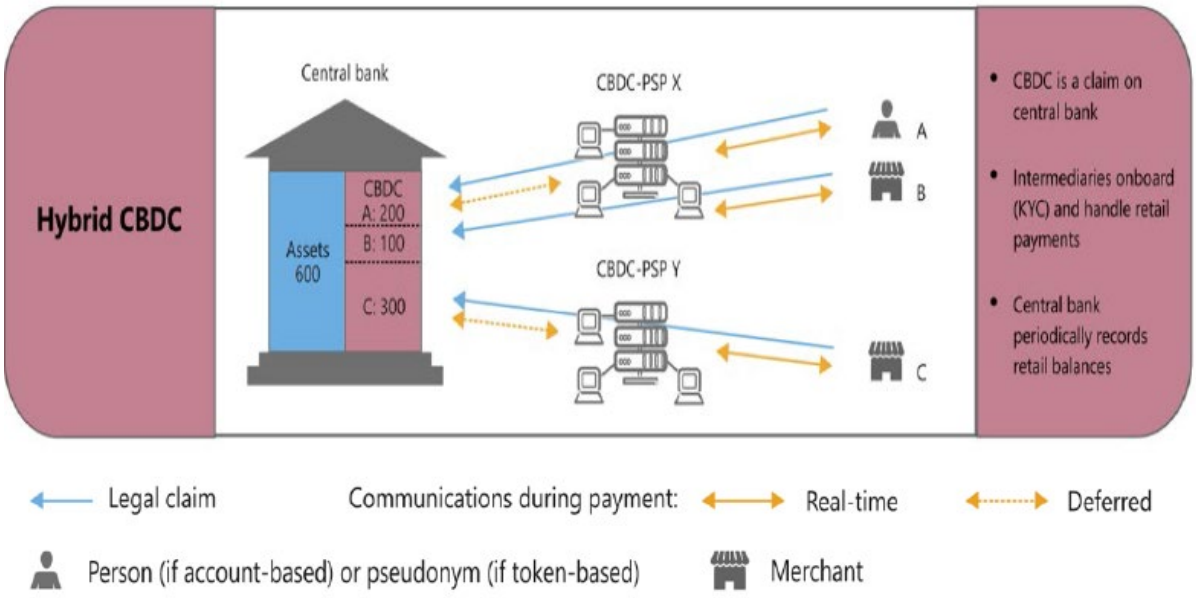
***Figure 2**: Indirect Model*



***Source**: Bank for International Settlements (BIS))*

The Hybrid approach (figure 3) combines a direct claim on the RBI with a private-sector communications layer. The RBI will issue an E-rupee to other entities, making them liable for all customer-related activities. Under this arrangement, retail services are offered to end users by payment service intermediaries, while the RBI maintains a record of retail transactions.

***Figure 3**: Hybrid Model*



***Source**: BIS*

The advantages of the indirect model are that the E-rupee will be issued by RBI so liability will be on RBI and operations, maintaining the ledger will be handled by intermediaries, and no settlement finality from a single side until the other side confirms it. Moreover, the RBI Act, 1934 (RBI Act) was amended by the Finance Act, 2022, to expand the scope of the term of "bank note" by including digital banknotes. The tokens will subsequently be given out to end users who participate in retail transactions via Token Service Providers (TSPs), who are authorized entities. As a result, the RBI will generate and distribute tokens under this model to TSPs. The justification for this is as follows:

Throughout the supply chain, the banks have a comparative and competitive advantage over RBI, particularly in an environment where technology is rapidly changing, such as the public distribution of E-rupee, account-keeping services, Know Your Customer verification, compliance with AML/CFT checks, verification of transactions, and so forth. Therefore, banks and other financial organizations have the skills and expertise needed to offer these services. These businesses can allow their clients to conduct transactions both in and out of e-rupee, enhancing the customer experience and potentially facilitating greater adoption of retail e-rupees.

Should Retail e-rupees bear interest?

Retail E-rupee's economic design could be influenced by the E-rupee's purpose as well as the technology and entities involved. For example, the majority of debates on retail digital currency make the premise that it will largely be used as a means of payment akin to cash and that it won't earn interest.

If a retail E-rupee is intended to not pay interest, consumers will have less motivation to convert from bank deposits to E-rupees, reducing the effect of banking disintermediation. Otherwise, the features of e-rupees will become deposit-like characteristics instead of cash-like characteristics. Bank deposit losses, may seriously disrupt the financial system and restrict banks' ability to stimulate the economy with lending. It will lead to cascading effects on banks. The trade-off is that India's capacity to communicate monetary policy may not be improved by non-interest-bearing retail e-rupees. It can even prevent major interruptions to financial services and possible bank disintermediation. A trade-off between improved interest rate transmission and a congested credit market as a consequence of banking disintermediation constitutes a policy challenge posed by interest-bearing Retail e-rupee. As a result, financial flows and credit conditions must be influenced for interest rate transmission channels to function. The current transmission dynamics will not be disrupted

by the non-interest-bearing retail e-rupee, so the main objective in handling this trade-off should be to eliminate any potential for financial disintermediation.

At the moment, neither China nor the Bahamas pay interest on their Digital Currency so it cannot compete with bank deposits. Even while DC loses value as a savings tool if it is non-interest, it might still be attractive as a means of exchange and can significantly prevent banking services disruptions and potential bank disintermediation.

Achieving anonymity through token-based Retail e-rupees

An electronic transferable digital token that is like a banknote that is issued by and is the responsibility of the RBI would make up a token-based retail e-rupee system. A retail e-rupee token is a bearer instrument, similar to banknotes; as a result, whoever "holds" the token at any one moment is assumed to be the owner. In contrast, an account-based system would require keeping track of all transactions and balances for retail e-rupee users in addition to identifying ownership Retail e-rupee is mainly made for use by the general population and has characteristics comparable to those of conventional currency, such as anonymity and a unique serial number. Since anybody may acquire an electronic signature, a token-based system would offer universal access and strong privacy by default. The token will also have a special token number, making it possible to spot fake tokens and perhaps restore value if someone loses the device. Under a token-based retail e-rupee system, users could withdraw digital tokens from banks likewise they withdraw actual currency. They may use an app, go online, or store their electronic tokens in a wallet and use them to make purchases. Because all digital transactions leave a trail, anonymity for a digital currency is particularly difficult. To resolve this key design decision concept of a retail e-rupee with programmable money elements can be considered. For small transactions, people might be issued a set number of "anonymity vouchers," but bigger transactions would still be accessible to banking intermediaries and regulators, such as those in charge by AML and CFT. To resolve this issue, there can be anonymity for small values and traceability for high values, as in the case of anonymity associated with physical cash. The significance of safeguarding individual privacy rights and data security must be taken into account in order to increase accessibility and greater acceptance.

Retail e-rupees will have fixed denomination

The use of a token with a low minimum value may result in increased volume, increasing processing time, and causing performance issues. The launch of retail e-rupee in fixed denominations such as Rs. 500, 100, 50, and so on, as in physical currencies, will contribute to achieving the same degree of trust among citizens and experience, although through digital means. It is anticipated that the retail e-rupee's likeness to current money would promote acceptability and adoption. With the aid of TSPs, it will streamline transactions via the exchange administration of the nation's legal tender tokens. As a result, the introduction of fixed denomination retail e-rupee is currently regarded as preferable in the Indian context.

Considerations for Retail e-rupee Technology

Since retail e-rupee transactions are digital, technological factors including robust cybersecurity, technical stability and resilience, and good technical governance will always come first. It is suggested that the architecture used for the deployment of the retail e-rupee might include certain layers of the tech stack that are centralized and others that use distributed ledger technology. Thus, the following features and key requirements can be achieved by the aforementioned technology architecture.

***Table 1**: Retail e-rupee Technology Architecture*

Features	Key Requirements
High scalable to handle a high volume of transactions with constant performance	Zero downtime for smooth functioning of the economy
Robust technology for the financial ecosystem's stability	Zero frauds to avoid economic destabilization
Tamper-proof access control methods and cryptography are used to ensure the security of data, both retail e-rupee and transactional data.	A decentralized system is necessary for effective ecosystem engagement.
Support for a range of client apps leveraging retail e-rupee for financial services across platforms	confidentiality, authentication, data integrity, and non-repudiation

Features	Key Requirements
Capability to integrate with other financial IT platforms	Capacity to handle high volume and rate of Transactions at lean and peak load periods while remaining cost-effective
Flexible workflow configuration for RBI policy implementations	Through a mission-critical approach, there must be zero loss as a result of Distributed Denial of Service (DDoS) and other serious cyberattacks.
Administration, reporting, and data analytics utilities that are comprehensive	Scalable architecture to accommodate future large-scale developments
Strong cybersecurity monitoring to prevent financial fraud	End-to-end trusted environment for data sharing with the relevant party only for verification

***Source**: Author's self-analysis*

Recoverability

The issue of recoverability in token-based retail e-rupee will be handled by custodian and user-held model which will complement each other. The wallet's keys, which the user uses to retain the tokens, are under the control of the Token Service Provider (TSP). With this design, the user's public address, wallet pin, and tokens may all be used to retrieve the wallet. The security of the tokens depends on how strong the TSP's security protocols are since the service provider maintains possession of the user's information. While reliance on an external entity ensures recoverability, because the service provider will constantly be aware of token transactions going in and out of the wallet, it can endanger anonymity. In the user-held model, key holding is the responsibility of the user and their device. In the event that the user's Smartphone is lost, the wallet cannot be recovered.

Offline Functionality

In India, 825 million individuals have internet connectivity out of a total population of 1.4 billion (143.3 crores) (Telecom Regulatory Authority of India, 2021). As a result, many Indians will be unable to use retail e-rupee due to a lack of connectivity. Offline capabilities must be included to ensure its widespread adoption. It is critical to have standardized

standards and processes for the offline exchange of retail e-rupee. RBI must mandate extensive stakeholder participation to guarantee the durability and adaptability of these standards and procedures.

Programming the Retail e-rupee by connecting it to the intended purpose

Some of the examples are banks may set up their agricultural credit, for instance, such that it can only be utilized at input shop outlets. In a similar vein, this may solve the problem of money diversion and promote more financial inclusion for MSMEs and others. This may aid in securing the end-use, which financial institutions must constantly contend with around the world. Also, the token should not have an expiry within which it should be spent to ensure consumption. Smart contracts or the token version may both be used to provide this functionality. Smart contracts, in which business rules are stored as code and executed during transactions to guarantee that the token is used properly, or the token version, which may be closely related to the technical code class, can both be used to provide this functionality.

Interoperability and integration with existing payment systems

In terms of electronic transaction innovation, India is at the forefront. Its payment system is largely real-time, available round-the-clock to both retail and wholesale customers, and has some of the lowest transaction costs in the world. Retail E-rupee should be able to use existing payment infrastructure such as UPI and electronic wallets such as Paytm and Gpay. Interoperability amongst payment systems helps end users achieve adoption, integration, innovation, and effectiveness. It would be critical to incorporate a retail e-rupee into India's broader payments landscape. This might help increase end-user acceptance i.e. both for the general public and merchants. As a result, there is no longer a need to create a parallel acceptance infrastructure. RBI might employ existing messages, data, and other technical standards as well as develop technical interfaces to communicate with other systems in order to achieve interoperability. API integration between systems should allow for a lightweight yet secure interoperable design. It will also be required to ensure the resilience of APIs for increased cyber-security. However, technological, commercial, and legal impediments to interoperability are likely to exist. Engagement between stakeholders would be critical to dealing with these issues. All stakeholders in the industry in the Indian payments system must actively participate in the collaborative effort of interoperability.

Cyber security

Although the highest levels of cryptography should be maintained throughout the token creation process to guarantee item-level security. In a similar vein, token transactions must also be protected to maintain a reliable ecosystem. Increased digital payment-related fraud may extend to retail e-rupee in India which has lower financial literacy levels in villages. Assuring robust standards for cybersecurity and complementary work on financial literacy is thus critical for any nation that addresses Digital Currency. The retail e-rupee ecosystem is also thought to be a high-value target due to its importance in sustaining public trust. While addressing cyber risks related to Retail e-rupee can benefit from the following principles: 1. From inception, security should be the prime design concern 2. Users in the retail e-rupee networks need to be subject to a stricter risk management framework because of their privileged status. 3. The user interface must be thoroughly tested in addition to the back-end infrastructure to prevent any vulnerabilities from being used against it. 4. No Single Point of Failure 5. Retail e-rupee should be resistant to quantum-resistant algorithms which are cryptographic algorithms that can withstand quantum computer attacks. 6. It could be theoretically possible to promptly recall them or implement extra security protections digitally if a specific sequence of tokens is compromised. As a result, while focusing on technological options, an open-ended flexible approach is required. It is also crucial that there be no vendor lock-in when employing any technological service provider. There must be enabling clauses that give the RBI complete ownership of any proprietary technologies used. Furthermore, rather than mining through competitive reward techniques, RBI will issue retail e-rupee based on algorithm-driven processes through separate technical subsidiaries engaging external agencies. There could be resource intensiveness given in Token-based systems which would necessitate the creation of unique tokens based on agreed-upon processes. Furthermore, the energy consumed when authenticating transactions and storing them on distributed or centralized systems must be included when calculating the resource intensiveness of the retail e-rupee eco-system.

Consumer protection and grievances resolution

The advantages of retail e-rupee include improved speed, ease of use, and cost-effective access to a wider range of goods and services. The risks include data breaches, privacy invasions, digital fraud, and security blunders. Given the e-rupee architecture and technology design concerns, the following are the primary consumer-related major risks and

grievances with it: Privacy risk related to the anonymity of customers 2. Security protocol design & its technical implementation are important for the safety and soundness of products/ services, these issues are beyond the understanding of an average customer. Therefore, adequate technical as well as auditing standards may be required to eliminate technical barriers that may create consumer risk inadvertently. 3. In terms of the risk associated with consumer protection, determining who will be liable for consumers in the case of a loss is crucial and fundamental. The digital nature of retail e-rupee may result in the emergence of numerous types of consumer issues, such as a lack of service by intermediaries, a technical disruption in CBDC supply, transactions, and so on. The efficient as well as rapid resolution of customer complaints will be critical in fostering public adoption of CBDC. A comprehensive and effective grievance redressal procedure could encompass the breadth of retail e-rupee-related grievances.

The Implication of Retail e-rupee on RBI Policies

1. *Monetary policy*

Retail e-rupee can enable timely transmission of monetary policy without changing the fundamental mechanics of monetary policy. Its consequences on monetary policy are largely determined by how it is built and how widely it is used. Given that there are at present only a few governments have issued digital currencies, it is still unclear how this could affect monetary policy and is entirely hypothetical. This can be done by setting a cap on the amount that can be converted from cash or deposits into retail e-rupee, or with less interest on it than bank deposits, such as by paying none at all.

2. Impact on Liquidity Management

The RBI must forecast retail e-rupee as a distinct source of system-wide liquidity change to design and implement its discretionary liquidity injection/absorption policies. If the demand for retail e-rupee rises along with the price of actual currency, it will result in losing deposits in the banking system. The shift from physical to digital currency might cause the general people to modify how they manage their finances, choosing cash over bank accounts and physical over digital currency. The type of change cannot be foreseen because the majority of central banks are still looking into the issuance of digital currencies. It is also suggested that Retail e-rupees must be non-remunerated. Banks' reserve money,

money supply, net demand and time liabilities (NDTL), velocity, repo rate, and other concerns are carefully handled to greatly limit possible disruptions to monetary policy and the financial intermediation process.

3. Financial Security

Retail e-rupee encompasses the potential to boost the financial system's functionality and resilience. However, it could have an impact on the organization of the financial markets and present business strategies. As the financial system matures, this might pose dangers to the stability of the economy, particularly given the possibility of bank disintermediation. RBI may research security elements that might be added to retail e-rupee to solve this issue. For instance, restrictions on client holdings or transactions, access that is only permitted for certain people, etc.

4. Legal implications

Retail e-rupee is a token-based new form of money that incorporates the RBI's liabilities. Most of the time, pre-digital eras were when current legal frameworks were created. Hence, law reform is required to ensure that the legal consequences of retail e-rupees are covered under the current Indian legal system. As the legislative statutes were developed with paper money in mind, the RBI's introduction of the retail e-rupee in India required a favourable legal environment. The RBI Act of 1934 in its preamble gives the bank the authority to

> [...] regulate the issuance of banknotes and the maintaining reserves with a view to ensuring monetary stability in India and, in general, to operate the country's currency and credit system to its advantage (India, 1934, p. 11).

The effects of retail e-rupee issuing on payment system laws must also be considered if RBI's payment system activities are limited to just interbank networks. Issuing tokens in the form of retail e-rupee will result in the creation of a rival payment system.

5. Impact on the balance sheet

The effect on the balance sheet of switching from cash to retail e-rupee are just two different types of RBI liability and may affect composition but have no effect on the size of household and RBI balance sheets because the process of conversion i.e., household

exchanges one asset in cash for one retail e-rupee, and RBI exchanges one liability of cash for one retail e-rupee will remain same.

A bank's balance sheet will not change its status by the conversion of deposits to retail e-rupee in the same way that cash is withdrawn from an ATM or bank branch. It will diminish the bank's balance sheet by reducing both the bank's assets and liabilities. The structure of the RBI obligations varies as reserve liabilities decline and retail e-rupee liabilities increase, but the size of the RBI's balance sheet does not alter immediately. A deposit movement to retail e-rupee may result in financial institutions retaining lower reserves overall. Banks might want to buy more reserves from the RBI if they find they do not have enough reserves to fulfils their own or supervisory liquidity risk standards. If the RBI chooses to release more reserves to fulfil this demand, the amount will be added to the balance sheet.

6. Anti-Money Laundering (AML) /Combating the Financing of Terrorism (CFT) Viewpoint

The retail e-rupee framework should handle the following two components of AML/CFT: i. The ultimate duty for Customer Due Diligence (CDD) must be handled by commercial banks as they are the Payment Interface Providers in the framework. ii. The structure of the system must include an integrated system for tracking and identifying transactions by cash-related thresholds to safeguard the integrity of the financial sector.

Conclusion & Suggestions

As globally issuing Central Bank Digital Currencies (CBDC) through technology 2.0 is making a substantial impact and opening new avenues so is the case of the Indian banking and payment system and intermediaries will be none to second to leverage such benefits. India has made progress in the area of digital payments, although a sizable percentage of the population is still unaffected. These new avenues are simultaneously bringing potential harms and associated risks to customers and the financial ecosystem in India. RBI must be vigilant on how this technology is being used, its benefits, and its drawbacks while issuing retail e-rupee and usage by intermediaries in the Indian financial system. Sooner or later Digital currency is going to transform the present scenario and business models used by intermediaries. Therefore, it is recommended that RBI must give a thorough consideration for practical policy changes, pros, and cons of introducing retail e-rupee, and disruption to the financial system. The proposed regulatory sandbox is a foundational concept on which RBI can start its pilot project restricted to the issuance of retail e-rupee and its consequences

on the Indian economy including monetary policy consideration etc. As a large number of Indian populations aren't already using UPI, we may reasonably conclude that they are trading in cash. Along with the residents in the banked group who feel uncomfortable utilizing UPI applications, these categories also include the underbanked and unbanked. Retail e-rupee may be considered as an effort at this inclusion with its present design of tokenized currency notes and wallet-based operations without a bank account, providing a simple payment method for those who are used to dealing in several currencies. After all, several payment methods may survive in a nation as varied as India.

This will guarantee that social services are delivered without leaking and result in significant cost savings when it comes to running welfare programs. The public infrastructure for the digital rupee may be driven completely by a part of the Payment Infrastructure Development Fund that the union government may allot. The main goal, in this case, might be to make it possible for payments and receptions of digital rupee to be made via offline banking channels of the banks, including branches, business correspondents, ATMs, and Digital Banking Units. We need to wait and watch how RBI is formulating technological architecture considering all dimensions discussed in this research and the outcome of the pilot project for the successful implementation of the issuance of retail e-rupee in India. Thus, the present regulatory sandbox is a foundational concept on which RBI can start its pilot project restricted to the issuance of retail e-rupee and its consequences on the Indian economy including monetary policy consideration, etc. As there is a further scope of expansion of the proposed regulation as and when it is required to cover wholesale e-rupee for the settlement of interbank transfers and related wholesale transactions.

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