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A Review of Blockchain Technology: Central Bank Digital Currency(CBDC)

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Abstract - A digital representation of a nation's fiat currency that is issued and supported by the central bank is known as Central Bank Digital Currency (CBDC). As various central banks have been working on creating their own digital currencies, the idea of CBDC has received a lot of interest. This review article gives a general overview of the CBDC idea, potential advantages and hazards of its use, and the status of CBDC projects globally at the moment.

Keywords – Digital Currency, Central Bank Digital Currency, Blockchain, centralization and decentralization.

I. Introduction**Blockchain**

Blockchain is a distributed ledger system that enables safe and open data and digital asset storage and movement. It was first presented in 2008 as the core technology for the Digital Currency, but it has subsequently found use in a variety of other fields, including voting, supply chain management, and the financial and medical sectors.[1] A blockchain is fundamentally a distributed, open, and transparent database that is maintained by a network of computers, or nodes, as opposed to a single centralized organization. Every node in the network maintains a copy of the blockchain, and before being added to the ledger, each new transaction or piece of data that is added to the blockchain is verified by the whole network.[1] The blockchain's security and immutability are ensured by this validation process, which uses sophisticated mathematical algorithms and consensus procedures. The ability to conduct secure and transparent transactions without the aid of middlemen like banks or other financial organizations is one of the main advantages of blockchain technology.[2] More trust and responsibility between parties are possible results of this, along with faster, less expensive, and more efficient transactions. But, blockchain technology also has significant drawbacks and difficulties. For instance, some blockchain applications may not be scalable due to the high computational and energy requirements for blockchain validation. However, even though blockchain transactions are generally safer than conventional transactions, fraud and hacking are still possible. Ultimately, blockchain is an exciting technology with a wide range of possible uses and advantages, but it is crucial to approach it with a clear awareness of its strengths and weaknesses as well as taking the unique requirements and difficulties of each use case into account.[3]

Public, private, and consortium blockchains are the three most common varieties. Public blockchains, like those used by Ethereum, are accessible to everyone and do not require authorization to use. Since they are decentralized, no one organisation or entity has control over the network. All users have access to the complete ledger and a network of nodes

validates transactions on public blockchains. Anyone can upload transactions to the blockchain and take part in the consensus process. A single company or a collection of organizations has permission over and is in charge of private blockchains. These blockchains are frequently utilised for internal business operations or in sectors like healthcare or finance that demand a high level of anonymity. Only those who have been given permission can access the ledger and approve transactions in a private blockchain. A mix of public and private blockchains is known as a consortium blockchain. It is governed by a collection of businesses that collaborate to keep the network operational. Blockchain consortiums are frequently employed in sectors where several organizations must collaborate to operate a single database or ledger. There are further versions and fusions of these three primary blockchain types in addition to these three. Some blockchains, for instance, employ a hybrid method in which they merge public and private blockchains, or they use a private blockchain for the majority of transactions but sporadically log a summary of events on a public blockchain for transparency reasons. In the end, the particular needs and specifications of the application or business will determine the kind of blockchain that is utilized.[3]

Central Bank Digital Currency

The emergence of CBDC as a viable alternative to traditional cash is a result of the development of digital technology and the rising popularity of digital currencies. CBDC is comparable to a type of digital currency that a central bank issues and backs. Benefits including greater financial inclusion, reduced transaction costs, and improved security are possible outcomes. Yet, there are a number of dangers associated with its adoption, including the possibility of cyber attacks and money laundering. The growth of CBDCs has accelerated in recent years as nations investigate cutting-edge payment methods and virtual currencies.[4] The introduction of CBDCs is considered as a way to provide a digital alternative to conventional currency and round out the current payment infrastructure. When saved in digital wallets or accounts, CBDCs can be used for transactions and payments, including peer-to-peer (P2P) transactions, online purchases, and in-store purchases. They can be created to be used similarly to cash or traditional bank deposits. Retail and wholesale CBDCs are the two main types of CBDCs that can be issued. While wholesale CBDC is exclusively accessible to financial institutions for use in interbank payments and settlement, retail CBDC is open to the general public and can be used for everyday transactions.[5] In comparison to traditional currencies and payment methods, CBDCs may offer a number of benefits, such as increased financial inclusion for people and enterprises without access to conventional banking services, decreased transaction costs and settlement times, and improved system efficiency. However, the introduction of CBDCs also presents a number of difficulties, including the possible effects on the banking system, privacy issues, the requirement for cyber security, and the need to guard against fraud. The creation and adoption of CBDCs are being studied by a number of central banks throughout the world, including the People's Bank of China, the European Central Bank, and the US Federal Reserve. It will be interesting to watch how CBDCs develop and impact the global financial system in the years to come as their design and execution are still in their infancy.[7]

LITERATURE REVIEW

History and Overview of Blockchain Technology

The paper "A Survey on Blockchain Technology: Its Uses, Benefits, and Limitations" by Alam et al. provides an overview of blockchain technology, its history, and its potential applications(2020). The authors explain the core principles of blockchain, such as decentralisation, immutability, and consensus. The potential benefits of blockchain, such as

increased efficiency, security, and transparency, as well as its disadvantages, such as scalability, interoperability, and regulatory concerns, are also discussed. [8].

Blockchain Technology Use Cases

The author of the study "Blockchain Technology Applications: Many applications of blockchain technology are listed in "A Complete Evaluation" by Kshetri (2018). These comprise supply chain management, voting, identity management, healthcare, and payment systems. Additionally, the author investigates how blockchain technology may enhance each of these areas' security, transparency, and effectiveness. [9].

Supply Chain Management and Blockchain Technology

One application of blockchain technology being looked into is supply chain management. The study "Blockchain Technology in Supply Chain Management: A Review" by Singh et al. provides an overview of how blockchain might be used to increase transparency and efficiency in supply chains (2019). The authors discuss how supply chain management may benefit from blockchain technology in terms of greater confidence, decreased fraud, and improved traceability. [10].

Medical Blockchain Technology

Healthcare is another industry looking into blockchain technology. Blockchain can be used to improve security and privacy in the healthcare industry, according to the Mettler (2018) study "Blockchain Technology for Healthcare: Creating Trust in a Lack of Trust Setting. The author describes how using blockchain may be used to securely store patient data and enable safe data exchange between healthcare providers. [11].

Description of CBDC

Barrdear and Kumhof (2016) introduce CBDC, discuss its potential drivers, and discuss its ramifications in their study "Central Bank Digital Currency: Motivations and Consequences." The authors claim that CBDC may provide benefits over conventional cash, such as increased productivity and decreased costs. Also, they discuss CBDC's potential risks and challenges, particularly how they may affect monetary policy and financial stability. [12].

Different CBDCs

The two forms of CBDC are retail and wholesale. Auer and Boehme (2018) analyse the differences between these two types of CBDC in their essay, "Central Bank Digital Currency and its Impact on the Financial System." Retail CBDC is meant for the general public and would be used for everyday transactions, but wholesale CBDC would only be available to financial institutions and be used for interbank transfers. [13].

Monetary policy and CBDC

One of the key reasons for concern is the potential influence of CBDC on monetary policy. According to Cecchetti and Schoenholtz, the authors of a 2018 paper titled "Central Bank Digital Currency: When Price and Bank Stability Conflict," CBDC may change the existing relationship between the central bank and commercial banks. They assert that CBDC could lead to disintermediation and make it more difficult for the central bank to uphold financial stability and control inflation. [14].

Financial Inclusion and CBDC

The CBDC may also have a big impact on financial inclusion. In the paper "Central Bank Digital Currency and Financial Inclusion" by Boar (2020), the author demonstrates how CBDC might help end financial exclusion by providing a low-cost, secure, and easily accessible method of digital payment. The author also discusses the potential risks and challenges of CBDC, including privacy concerns and the need for effective regulation.[15].

Cross-Border Payments and CBDC

CBDC might alter how we conduct international business. In his article, "Central Bank Digital Currencies and Cross-Border Payments: A Policy Proposal," Agisilaou (2019) provides a policy framework for the use of CBDC in cross-border payments. The author claims that while CBDC may offer significant benefits such as quicker processing times, lower costs, and increased transparency, effective regulation and coordination are still needed. [16].

Title	Year	Author	Description
Research of a Possibility of Using Blockchain Technology without Tokens to Protect Banking Transactions	2019	Natalia Popopva and Natalia Butakova	A. This study describes the use of blockchain technology without tokens to secure banking transactional information. In a distributed database, they described four different failure types: transactional failure, node failure, media failure, and communication line failure. Hence, blockchain technology can be used to solve the distributed database problem without the need for miners. In this case, the bank would do any transaction's mining, and the new transactional block would be formed and joined to the blockchain. This paper also offers mining- and non-mining-based algorithms for creating blocks in a blockchain.
A systematic literature review of blockchainbased applications: Current status, classification and open issues	2018	Fran Casino, Thomas K. DasaKlis and Constantinos Patsakis	This essay examines the uses, categories, and unresolved problems of blockchain. Exploration of blockchain applications in finance, integrity verification, IOT, healthcare, data distribution, and certification management. This report also acknowledges unresolved difficulties, including the applicability of blockchain for industrial applications, scalability, sustainability of the blockchain protocol, interoperability, privacy and security solutions, and data management.
Blockchain application and outlook in the banking industry	2016	Ye Guo and Chen Liang	The difficulties in deploying blockchain in the financial sectors are highlighted in his study. It shows how some of the current top banking institutions are looking into the matter. Although Blockchain is a totally decentralised system—as has already been mentioned—many situations need for

			some level of security, particularly when dealing with money. As a result, they have contrasted Public, Consortium, and Private blockchains. They suggest a large number of financial organisations that can build a consortium blockchain, which is the promising approach for the banking sector. They have also suggested ways in which this technology might be used to implement industry standards.
Exploration and Practice of Inter-bank Application Based on Blockchain	2017	Tong Wu and Xiubo Liang	This article demonstrates how blockchain technology may be used to register and record a variety of tangible and intangible items, including intellectual property rights, images, property proofs, vote data, smart contracts, and more. Because they all demand an open and transparent information source. The main topic of the paper is distributed databases, which have the advantage that even if one or more nodes fail, the transactions saved on the other nodes are unaffected, and the failed nodes can still back up data from the remaining nodes in the network. They also show how untrusted parties might agree on a set of contract rules through the use of smart contracts. It also suggests a way to use blockchain to solve problems with conventional interbank payments by establishing private blockchain networks in order to Transactions take less time and are less prone to risk.
Blockchain and its Application-A Detailed Survey	2017	Supriya Thakur Aras and Vrushali Kulkarni	The idea of a non-tokenized schema, blockchain taxonomy, and hybrid methods to transform a permissionless blockchain into a permissioned blockchain are explained in this paper. With the Proof of Work (POW) protocol, each node in the network can brute-force its way to the solution of a cryptographic challenge. The winning node is then awarded with some money, which is subsequently broadcast across the network. The Proof of Stake (POS) system, which does not rely on a lot of processing, is essentially block verification by miners utilising ethereum

			and other altcoins.
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Comparison of centralized and decentralized currencies

A traditional currency system that is maintained and controlled by a single entity, usually a government or central bank, is referred to as centralized currency. The US dollar, Euro, Japanese Yen, and many more currencies are examples of centralized money. Contrarily, decentralized currency refers to a digital currency system that runs independently of any central authority.

Here are some key differences between centralized and decentralized currencies:

A central authority that has the capacity to control the money supply and establish monetary policy is in charge of centrally managed currencies. On the other hand, decentralized currencies are managed by a network of users who jointly verify transactions and keep the blockchain up to date. Because every transaction is documented on a public blockchain, decentralized currencies are more transparent than centralized ones.[6] Users can follow their transactions and confirm the legitimacy of transactions more easily as a result. Because they employ cutting-edge encryption methods and are secured by a decentralized network of users, decentralized currencies are typically regarded as being more secure than centralized currencies. They are nevertheless still susceptible to hacking and other security hazards. When it comes to processing transactions, centralized currencies often process transactions more quickly than decentralized currencies. This is so that centralized currencies can support a higher volume of transactions and have a more established infrastructure. While centralized currencies may need additional criteria like a bank account, decentralized currencies may be more available to anybody with an internet connection. Decentralized currencies are prone to value changes as a result of market demand, whereas centralized currencies are typically more stable[6].

The choice between centralized and decentralized currencies will ultimately depend on the unique use case and the user's preferences. Both have advantages and cons. While decentralized currencies are frequently used for peer-to-peer transactions, smart contracts, and other applications that need security and transparency, centralized currencies are best suited for more common transactions like payments and investments. In the end, it's likely that the continuous growth of both centralized and decentralized monetary systems will boost innovation and broaden access to finance for individuals all around the world.

Conclusion

To sum up, blockchain technology and Central Bank digital currency (CBDC) are two innovative fields that are interconnected and have the potential to change not only the financial sector but also other industries. In both situations, a collaborative and multi-stakeholder strategy that takes into account the demands and concerns of various stakeholders, including users, regulators, and financial institutions, will be necessary for the successful adoption of blockchain technology and CBDCs. To solve the difficulties and constraints and to realise the full potential of these advances, additional research and development are also required. In general, CBDCs and blockchain technology are fascinating new areas of innovation with the potential to significantly alter the financial industry and other industries. While there are difficulties and dangers, there are also substantial opportunities and advantages, and these technologies appear to have a bright future. Through the provision of a safe and effective substitute for conventional cash, CBDC has the potential to completely reshape the financial landscape. Nonetheless, the dangers associated with its implementation must be carefully considered by central banks before beginning their own CBDC operations.

The current condition of CBDC initiatives worldwide reveals that this field is fast evolving, and it is still unclear how this will affect the financial sector.

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