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## CENTRAL BANK DIGITAL CURRENCY (CBDC)

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### ABSTRAC

India has shown a remarkable effort in adaption of online payment system called Unified Payment Interface (UPI) born on 11 Apr 2016. With nearly 6 billion transactions a month, valued over Rs 10 lakh crore and touching 260 million users, India's UPI has become the best performing real-time ecosystem in the world in just 6 years. With Success of UPI in hands India is under process of creating a new Digital Currency called Central Bank Digital Currency (CBDC). CBDC is based on Blockchain Technology used in Crypto Currencies. Crypto currencies are unregulated Digital Currencies operating the International Market with many Pros and Cons. Free from regulation means the price is mostly determined by speculation. There are no way to control the flow of digital currencies to anti human activities like (Terrorism, Drugs, Human Trafficking) making it one of the most abused currency system. With the launch of CBDC Indian Central Bank (RBI) will venture in the digital currency market. Trial is also under way for CBDC by USA and China. This paper will discuss scope of CBDC in India and world.

*Keywords:* Blockchain, Digital, UPI, Technology, Crypto

### 1) **INTRODUCTION**

Currency has been in existence since the humans have started trading and accepting currency in lieu of goods or services some 5000 years ago, before this human have used barter system. Barter System means exchange of goods or service for other goods or services. With introduction of currency necessity of having other tradable good or service which may or may not be tradable at the time was removed. Currencies have gone a tremendous change before coming into present form. They were initially made of leather then various metals and now the special papers or metals are used for minting the currency. A new form of currency in 2009 was born called Crypto currency. These were digital currency based on Block Chain Technology. These Cryptos were not in control of any Central Bank or Government, making them perfect recipe for speculation.

**1.1 Crypto Currency:** Founded in year 2009, BitCoin remains best known crypto currency even today. With everyday launching of a new crypto, it is estimated that there are 12000 crypto currencies in existence today. The rise of Crypto was fuelled by the speculations, making their prices unreachable for most of traders. Slowly, new cryptos were launched day after another, making the market crowded. There were some 12000 crypto reported in year 2022. Crypto currencies had an edge over the regular currencies all over the world.

### 1.2 Physical Money Vs Crypto

Money was invented for convenience of exchange as the barter system required some tradable



goods or service at the time of exchange, which may not be possible all the times. Money has various forms from leather to metal to paper based currencies. Physical Money has always been prone to loss, wear and tear, burning or getting wet and spoiled. It can be taken away by thief or burglars. It entails a cost on government while printing and maintain them. Cost of cash management in India has continued to be significant. The total expenditure incurred on security printing during April 1, 2021 to March 31, 2022 was ₹ 4,984.80 crore as against ₹ 4,012.10 crore in the previous year (July 1, 2020 to March 31, 2021)

Crypto is a system where the money is in form of digital blocks. It has benefit over the traditional money in form it can neither be lost nor torn or prone to damage by fire or water. The cost of maintain the crypto currency is significantly less than the traditional system of currency.

### **1.3 Digital Money Vs Crypto**

Digital Money is simply the money which is backed by physical existence of the currency and can be change to physical form as and when required. It can only be transferred from one account to another online but finally the currency is which has been in existence. The digital transactions have been for some decades in existence and are now well adopted in the banking system. Bank to bank transfer, credit card, debit card have made our lives easier and faster. There have been various companies which fuelled the growth of the financial ecosystem like VISA, Mastreo, Master Card and Paypal. On April 11, 2016, India demonstrated a remarkable effort in the adaptation of an online payment system known as the Unified Payment Interface (UPI). With nearly 6 billion transactions per month, a monthly value of over Rs 10 lakh crore, and 260 million users, India's UPI has become the world's best performing real-time ecosystem in just 6 years. India Also Has launched Rupey debit and credit cards.

Crypto currencies are digital blocks separate from the physical currencies and bear no relation to existing physical currencies. These currencies are minted using the complex computer programs which use energy and space of the computer systems. They remains as separate currencies, however these currencies are traded for speculation with reference to existing physical currencies.

### **1.4 Blockchain: The technology behind Crypto**

Crypto Currencies are created and validated using a new technology called Blockchain. As the name suggest Blockchain is a set of connected Blocks which are linked and secured using cryptography. Each block comprises a set of transactions which have been corroborated by each network member. Every new block created must be authenticated by each node before being acknowledged, making forging transaction histories nearly impossible. Each block has a hash pointer which is linked to previous block, transaction data and timestamp. This makes modification of the data of boclks of crypto currencies impossible.



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Blockchains are designed to be secure, and they are an example of a distributed computing system with high Byzantine fault tolerance. As a result, decentralised consensus has been achieved using a blockchain.

According to experts, blockchain technology can benefit a variety of industries, including supply chains, as well as mechanisms such as electronic voting and crowd funding. Big banks are evaluating the use of blockchain technology to cut payment expenses by streamlining payment processing.

### **1.5 What is Crypto Currency?**

Cryptocurrency is just a digital payment method that does not rely on banks for validation. It's a peer-to-peer payment system that allows anyone, anywhere to transfer and receive money. Crypto currency payments exist solely as digital entries to an electronic database describing specific transactions, rather than as physical money passed around and exchanged in the real world. Transactions involving crypto currency funds are documented in a public ledger. Digital wallets are where crypto currency is kept.

The term "cryptocurrency" refers to the use of encryption to ensure data integrity. This means that advanced coding is required in order to store and transmit cryptocurrency data between wallets and to public ledgers. Encryption's goal is to provide safe and secure environment.

### **1.6 How does cryptocurrency work?**

Cryptocurrencies are based on blockchain, a decentralized public ledger that keeps track of all transactions that are updated and kept by currency holders. Mining is a process that uses computer power to solve complex mathematical problems that generate coins to create cryptocurrency units. Users can also purchase the currencies from brokers and use cryptographic wallets to store and spend them.

In terms of finance, cryptocurrencies and blockchain technology applications are still in their early stages, and more applications are expected in the future. The technology could eventually be used to trade bonds, stocks, and other financial assets. There are approximately 12000 crypto currencies as of the date. Few of the cryptocurrencies are Bitcoin, Ethereum, Litecoin, and Ripple.

### **1.7 Minting**

The process of creating new coins by verifying data, creating new blocks, and recording the information onto the blockchain using a "proof of stake" protocol is known as crypto mining. This method can be used to create new cryptocurrency units as well as Non-Fungible Tokens (NFTs).



Freshly minted cryptocurrency is introduced to the market to be traded, which is where the term "minting" comes from, just like a government minting simple physical coins.

Proof of stake is a minting method for forming blocks through staking rather than "mining" under the "proof of work" protocol. Users who mint cryptocurrency are referred to as validators rather than miners.

**1.8 Advantages:** The cryptocurrency holds numerous advantages over the existing currency system. The blockchain technology is in its nascent stage. It hold the promising result over the banking and digital transactions. Few of the benefits of the cryptocurrencies are enumerated below:

- (a) **Secure:** Security of any system is of primary concern for proper functioning of system. The blockchain and cryptography are at the heart of the system of any cryptocurrency and make them secure. They are decetralised and are therefore not prone to hacking or theft. Crypto security is heavily influenced by hash rate. The greater the hash rate, the greater the computational power required to compromise the network. Bitcoin is regarded as the most secure cryptocurrency due to its higher hash rate than other networks.
- (b) **Fast and easy transaction:** Crypto transactions can be completed quickly, at a low cost, and in a relatively private setting. Almost anyone can send and receive cryptocurrencies using a smartphone app, hardware wallet, or exchange wallet.
- (c) **Short Settlement Times and Low Fees:** While somep people invest in crypto for speculation, at many places it can be used as a medium of exchange. Most crypto payments settle within minutes, if not seconds. Bank wire transfers, on the other hand, can be significantly more expensive and often take three to five business days to settle.
- (d) **No Bank Involved:** No bank is involved in the process of whole crypto processand therefore the charges are less and is free from influence of government and their Central Banks.
- (e) **Cross-Border Payments:** Cryptocurrencies are borderless and therefore the transactions can be carried out all over the world without regards to nationality. With the traditional financial service can take time in transaction with cryptos it can be done in seconds. The process of traditional transaction is cumbersome and costly. In some cases, doing so might not even be possible due to regulations, sanctions, or tensions between specific countries. Cryptocurrency gets around all of that, as users can engage in peer-to-peer transactions from anywhere in the world.



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(f) **Portfolio Diversification:** There have been investments in and around various assets existing in the market system at present. Cryptocurrencies is relatively a new concept and can provide much needed diversification to any existing portfolio. Cryptos in recent years have started behaving in correlation with various stock exchanges. So, in terms of diversification, cryptocurrencies offer investors another vehicle with which to try and grow their money outside of stocks, ETFs, or bonds. Crypto has its own unique risks, but it is another avenue for potential returns for investors.

(g) **Always-Open Markets:** Stock Markets all over the world have their time of opening and closing also they have holidays. Crypto markets, on the other hand, operate 24 hours a day, seven days a week, without exception. Some of the only things that could interrupt a person's ability to trade cryptocurrency would be a power outage, internet outage, or centralized exchange outage.

(h) **Specialization:** Some cryptos can be designed specifically for certain projects or uses. Some cryptos, for instance, are designed to work with metaverse projects or games, and can be used to help create in-game assets or tokens.

(i) **Exponential Industry Growth:** The crypto currency industry is one the fastest with introduction in year 2009 to \$1.6 Billion 2013 and \$930 Billion in year 2022. While the industry as a whole has seen incredible growth over the past decade it holds promising future for the financial and non-financial systems of the world.

(j) **The Possibility of Outsized Returns:** Bitcoin has been one of the best-performing assets of the last 13 years. When it debuted in 2009, Bitcoin essentially had no value, but in the following years, it would rise to a fraction of a penny, and then eventually to tens of thousands of dollars. This represents millions of percentage points' worth of gains. By comparison, the S&P 500 index of stocks returns an average of about 8% per year. During 2022, Bitcoin's price has fallen by more than 60% as of September, making it most speculated business.

(k) **More Private Transactions:** Although crypto currency uses a decentralized method to verify the blocks and records it remains private and is not regulated or recorded by the bank or governments Privacy makes it favorite form of asset for transaction.

(l) **Potential Inflation Hedge:** cryptos with limited mineable supply are good hedge against inflation as monetary inflation can occur when central banks and governments print more money (increasing the supply), things that are more scarce tend to appreciate in value. With more currency in supply and less supply of crypto, the price of these fixed-supply coins as measured in dollars has a higher chance of going up..



(m) **A More Inclusive Financial System:** Some of the people do not trust or do not have access to the existing financial system and the crypto system is extends benefits to them also. Due to its decentralized and permission-less nature, one of the benefits of cryptocurrency is that anyone can participate outside of that system. People don't need permission from any financial authority or government to use the crypto ecosystem. Participants also don't necessarily need to have a bank account.

(n) **Transactional Freedom:** Crypto are used for exchange of value between two independent parties. This can be done with having regards to third party involvement. As in traditional system a bank or a third is involved for a transaction between two parties. Banks, or other payment processors, can choose to cut off services to anyone for any reason. This can make things difficult for some journalists, political dissidents, or other individuals working in nations with oppressive government regimes.

(o) **Adaptability:** Crypto currencies are more and more efficient and uses newer technologies. Whereas, the traditional banking system, which is often stuck utilizing outdated technologies and protocols. The ability of cryptos to change things up in a big way, and on a widespread, operating level, means that it has another advantage over traditional systems.

### **1.9 Disadvantages**

(a) **Volatility:** The Crypto world is very volatile and even a small news can change the value to significant levels. Crypto can reach highs and lows very fast and there is no prediction for this. It is only a speculative asset and can harm investors greatly. Bitcoin has experienced rapid surges and crashes in its value, climbing to as high as \$17,738 in December 2017 before dropping to \$7,575 in the following months.

(b) **Speculative:** Cryptos have no underlying assets, therefore it does not draw its value from anything and remains only speculative asset. It only is a digital record and as such does not have any value imbedded in it. The price fluctuation is only based on the speculation.

(c) **Technicalities:** If we not digitally aware, understanding the crypto and its working can be very tedious and complex for any of us. Dealing in something which we are not fully aware is not a sound advice and people do not accept them as legal tender in lieu of goods and services.

(d) **Asset:** Crypto is not an asset or have any underlying asset to draw its value from. In case of going low it has no lower limit and it can go upto zero because it is only a speculative asset and is not like bond, shares or other assets. Crypto has been here only for a shorter period and has not been well integrated into our lives. The London Stock Exchange, for example, was founded in 1801. Gold has been a proven custodian of value for millennia.



(e) **Scalability:** While we consider cryptocurrency to be lightning fast, they do not operate like that and with increase in the scale the transaction processing time slowing down. Blockchain has certain capacity limitations which slow down the transaction processing. With the size of world population so large and increase in the transactions and numbers of crypto can it can be a frustrating experience for transaction participants

(f) **Security Risks:** With increase in the number of cryptos in the market, newbies are vulnerable to security risks. Cryptocurrencies might not have the risks that come with using central intermediaries, but that doesn't mean they're completely free from security issues. We can loose all our holdings if we loose our private key. Hacking, Phising and other malicious means to defraud can cause substantial loses. Though cryptocurrency blockchains are highly secure, other crypto repositories, such as exchanges and wallets, can be hacked.

(g) **Traceability:** Though they claim to be an anonymous form of transaction, cryptocurrencies are actually pseudonymous. They leave a digital trail that agencies such as the Cental Bureau of Investigation (CBI) can decipher. This opens up possibilities of governments or federal authorities tracking the financial transactions of ordinary citizens.

(h) **Criminality:** Cryptocurrencies have become a popular tool with criminals for nefarious activities such as money laundering and illicit purchases. Cryptocurrencies have also become a favorite of hackers who use them for ransomware activities. With the world already heavily divided the new system of crypto will make it more unstable. Terrorist, drug peddlers, human traffickers, cyber criminals and many others will take benefit of the system and will use flow of fund to them more untraceable. Tax and investigating agency will have difficult to find and prosecute the criminals. Central Bnak will loose control thereby any way to control inflation will also be lost.

(i) **Highly concentrated:** In theory, cryptocurrencies are meant to be decentralized, their wealth distributed between many parties on a blockchain. In reality, ownership is highly concentrated. For example, an MIT study found that just 11,000 investors held roughly 45% of Bitcoin's surging value.

(j) **Mining Cost:** One of the conceits of cryptocurrencies is that anyone can mine them using a computer with an Internet connection. However, mining popular cryptocurrencies requires considerable energy, sometimes as much energy as entire countries consume. The expensive energy costs coupled with the unpredictability of mining have concentrated mining among large firms whose revenues running into the billions of dollars. According to an MIT study, 10% of miners account for 90% of its mining capacity.



(k) **Control:** With no Central Bank and no government in control the price of crypto is determined by speculation and there is no stability which is required for any financial system to be more predictable. With the borderless character it is more likely to be used for criminal act than for a stable system of exchange.

(l) **Bursting Bubble:** Failure of any of the crypto can cause significant losses to investor and there is no recovery possible as there is no inherent value of crypto. The collapse of FTX, one of the world's largest cryptocurrency exchanges, has unleashed another bout of volatility in the highly speculative digital asset market. The fortune of FTX's founder, Sam Bankman-Fried, went from nearly \$16bn to zero within days as his crypto empire filed for bankruptcy protection in the US.

## 2) **CENTRAL BANK DIGITAL CURRENCY (CBDC)**

Like physical currency is a claim on central bank, a Central Bank Digital Currency (CBDC) is the digital form of a country's fiat currency and is also a claim on the central bank. Instead of printing money, the central bank issues electronic coins or accounts backed by the full faith and credit of the government. It is essentially identical to banknotes, but because it is digital, it is probably simpler, quicker, and less expensive. It also offers all the advantages for transactions that other digital payment systems do.

CBDC is a digital currency that is distributed by a sovereign nation's central bank. It is, by definition, freely convertible against the actual money that the same central bank issues. Similar to using physical money, using CBDCs does not require a bank account. CBDCs will, however, have an infinite life because they cannot be destroyed or lost in any physical form, which is a key distinction between them and physical money. It will be controlled through a digital ledger that might or might not support blockchain technology.

A central bank will issue currency notes in the form of digital currency, or "Central Bank Digital Currency" (CBDC). The majority of central banks worldwide are investigating the issuance of CBDC, but the main drivers behind it depend on the particular needs of each nation.

### 2.1 **Type of CBDC**

The two broad categories of CBDC are general purpose or retail (CBDC-R) and wholesale (CBDC-W). While wholesale CBDC is intended for restricted access to specific financial institutions, retail CBDC would potentially be available for use by all, including private sector, non-financial consumers, businesses, and organisations. Retail CBDC is an electronic version of cash primarily intended for retail transactions, as opposed to Wholesale CBDC, which is intended for the settlement of interbank transfers and related wholesale transactions.





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Given that Retail CBDC is a direct liability of the Central Bank, it is thought that it can offer access to safe money for payment and settlement. Wholesale CBDC has the potential to improve the security and efficiency of the financial transaction settlement systems. According to the potential each of them offers, it might make sense to introduce both CBDC-W and CBDC-R.

**2.2 Features of CBDC:** The features of CBDC include:

- (a) CBDC is a form of sovereign currency that central banks issue in accordance with their monetary policies.
- (b) freely convertible into both cash and commercial bank currency
- (c) all individuals, businesses, and governmental organisations must recognise it as a valid form of payment, legal tender, and a secure place to store value.
- (d) on the balance sheet of the central bank, it is shown as a liability.
- (e) expected to reduce the expense of issuing money and conducting transactions
- (f) holders of fungible legal tender who are not required to have a bank account

### 2.3 Challenges

There are several challenges, and each one needs careful consideration before a country launches a CBDC.

- (a) Citizens may withdraw too much money from the existing banking system affecting their ability to lend and sending a shock to interest rates.
- (b) New payments systems create externalities that impact the daily lives of citizens, and can possibly jeopardize the national security objectives of the country.
- (c) CBDCs also carry operational risks, since they are vulnerable to cyber-attacks.
- (d) They can limit a nation's ability to track cross-border flows and enforce sanctions.
- (e) CBDCs require a complex regulatory framework including privacy, consumer protection, and anti-money laundering standards which need to be made more robust before adopting this technology.

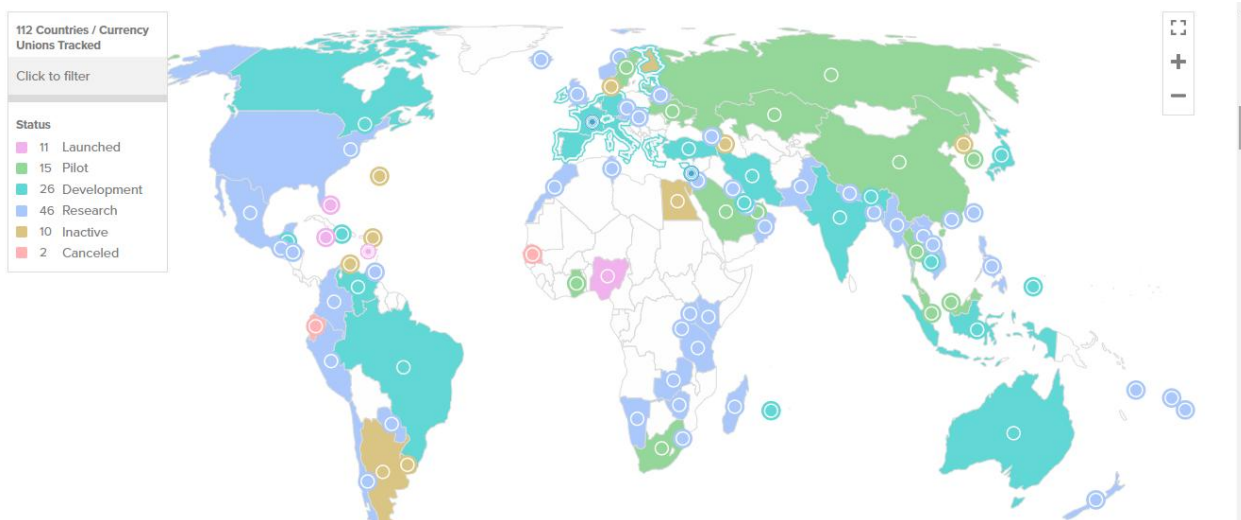
## 2.4 CBDC in India

**Digital rupee:** The India’s Central Bank (Reserve Bank of India) is launching its Central Bank Digital Currency (CBDC) from November 2022. It will launch CBDC in two formats, CBDC-W (Wholesale) and CBDC-R (Retail). CDC-W to be used for Inter-bank large transactions and CBDC- R to be used for retail transactions. CBDC is substantially not different from banknotes, but being digital it is likely to be easier, faster and cheaper. It also has all the transactional benefits of other forms of digital money.

Initially, CBDC will not have any impact on the general currency usages but will provide an additional option to the citizens. CBDC will help in direct payments from customers, reducing transaction costs and enabling real-time account settlements. CBDC will expedite cross-border transactions and remove the requirement for opening a bank account.

## 2.5 CBDC in other parts of world

More than 100 Central Banks or countries are either under process of implementation of CBDC or working on the system to implement CBDC. As per the reports 105 Countries representing 95% of world’s GDP are investigating CBDC implementation. 10 nations have introduced CBDCs, with Jamaica's JAM-DEX being the most recent. The first was the Bahamian Sand Dollar in 2020. China was the first major economy to pilot a CBDC in April 2020, and by 2023 it hopes that the e-CNY will be widely used domestically. CBDCs are being viewed more and more as a revolutionary development and as the next development in the evolution of sovereign currency.



*Fig: World CBDC tracker*



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Of the Group of Twenty (G20) countries, about 19 are investigating the issuance of CBDCs, and the majority of them have advanced past the preliminary research stage.

China has advanced the most among the developed countries in terms of the widespread use of CBDCs. Numerous effective pilot projects are currently underway in various Chinese cities. WeChat, the nation's top messaging and payment platform, recently introduced a feature that enables users to choose e-CNY, China's CBDC, as a method of payment on the platform.

3) **Scope:** The future belongs to Digital Currencies whether issued by the Central Bank or not. The rise on new currencies not under any bank has posed both promises and challenges. Central Banks are under different stages of implementation of CBDC. They have to find solution to the problems posed by the existing uncontrolled digital currencies.

(a) **One size does not fit all:** As the world economies are different in size and scale, also they are different in the way they function, therefore there is no universal size that fits all. There may be different type and different way of introducing CBDC or not introducing at all depending upon the requirement and response of the stakeholders. So, central banks should tailor plans to their specific circumstances and needs.

(b) **Financial stability and privacy:** Financial stability and privacy considerations are fundamental to the design of CBDCs because they are essential to the success of any system. The aim of central banks is to lessen the effect of CBDCs on credit provision and financial intermediation. This is crucial for the economy's machinery to function properly. Every economy puts regulatory checks for the holding and flow of Physical money to check the money laundering, terrorist financing and similar nefarious activities. Yet there is privacy in holding the physical money. Country implementing CBDC shall choose a blend of privacy and control.

(c) **Balance:** Countries need to find a balance between design and policy advancements for introduction of CBDC. A correct design will require time, money and learning experience nationally and internationally. Close collaboration with private companies will be required to create e-wallets, distribution of CBDC, addition of new features and pushing the boundaries of technology. But the policy considerations, such as creating new legal frameworks, rules, and case law, are also crucial. A CBDC needs careful planning on both fronts in order to meet policy objectives like financial inclusion and prevent unfavorable side effects like unexpected capital outflows that could threaten financial stability. Trust in the physical currency has been built over the years and same cannot be done in such short period. It will need considerable time for Central Banks to build trust in the CBDC.



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#### 4) **Conclusion**

CBDC, the central bank digital currency, holds a lot of promises by way of ensuring transparency, and low cost of operation among other benefits and the potential to expand the existing payment systems to address the needs of a wider category of users.

CBDC, across the world, is in conceptual, development, or at pilot stages. Therefore, in the absence of a precedence, extensive stakeholder consultation along with iterative technology design must take place to develop a solution that meets the requirements. While the intent of CBDC and the expected benefits are well understood, it is important to identify innovative methods and compelling use cases that will make CBDC as attractive as cash if not more.

#### **BIBLIOGRAPHY**

1. CBDC Tracker, (<https://www.atlanticcouncil.org/cbdctracker/>)
2. Popper, Nathaniel; Li, Cao (1 March 2021). "China Charges Ahead With a National Digital Currency". The New York Times
3. Anton N. Didenko and Ross P. Buckley(2021): "Central Bank Digital Currencies: A potential response to the financial inclusion challenges of the pacific;
4. Areddy, James T. (5 April 2021). "Bahamas is the first country in the world to issue central bank digital currency (Bahamian Dollar)
5. Ahmat, N and S Bashir (2017): "Central Bank Digital Currency: a monetary policy perspective", Bank Negara Malaysia Staff insights, 2017/11, September
6. Sahil Deo and Shardul Manurkar (2020); Central Bank Digital Currency in India: Deeper engagement and thorough exploration needed before execution ;
7. Kumhof, Michael; Noone, Clare (May 2018). "Central bank digital currencies — design principles and balance sheet implications
8. Charles M. Kahn, Francisco Rivadeneyra and Tsz-Nga Wong (2018); Should the Central Bank Issue E-money?; Bank of Canada Staff Working Paper; (<https://www.bankofcanada.ca/wp-content/uploads/2018/12/swp2018-58.pdf>)
9. Mayer, Thomas (6 November 2019). "A digital euro to save EMU
10. Rod Garratt, Michael Lee, Brendan Malone, and Antoine Martin (2020): Token- or Account-Based? A Digital Currency Can Be Both; Federal Reserve Bank of New York;