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Central Bank Digital Currency (CBDC) – Part 2

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This article is only for providing some basic knowledge, definitions, and understanding at the public level, and there won't be any technical terms.

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Central Bank Digital Currency (CBDC) – Part 2

National Digital Money or Central Bank Digital Currency (CBDC)

Introduction – Part 2

Monetary Developments in the Contemporary World

From the very beginning to the present day, money—as the most vital instrument of exchange, identity, and store of value—has undergone various stages of evolution: from commodity money to paper money and now to digital money. Digital and communication technologies have created a novel landscape for the creation of diverse forms of money, in which emerging technologies such as blockchain and cryptography play a central role.

The Necessity and Objectives of CBDC

With the growing demand for fast, secure, and low-cost transactions, coupled with the declining use of cash across various countries, central banks find it necessary to develop a new form of official digital money that guarantees security, stability, and governmental control. Central Bank Digital Currency (CBDC) has been proposed as a response to this need.

The principal objectives of CBDC are as follows:

a) Increasing the speed and reducing the costs of financial transactions.

b) Enhancing financial inclusion by providing easy access to monetary services for all segments of society.

c) Improving monetary and fiscal policies through greater transparency and more precise control over money flows.

d) Combating money laundering, tax evasion, and illegal activities.

e) Strengthening the independence and policymaking capacity of the central bank.

Challenges and Concerns

The development of CBDC is accompanied by challenges such as safeguarding user privacy, security risks, potential impacts on commercial banks and financial stability, and the need for appropriate legal and regulatory frameworks—all of which must be carefully examined and managed.

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Money, as the most important economic instrument in human societies, has perpetually been in a state of transformation and evolution. From commodity money to paper money and, more recently, electronic money, each transformation has laid the groundwork for sweeping changes in financial, economic, and social systems. The emergence of modern information and communication technologies—including the internet and cryptographic technologies—has made it possible to develop new forms of money, known as Central Bank Digital Currency or CBDC.

Central Bank Digital Currency is the official and legal money of nations, issued and managed in digital form, with the aim of facilitating payments, enhancing financial inclusion, improving security, and exerting greater control over liquidity flows. In this regard, central banks of various countries are seeking to leverage modern technologies to create digital currencies that can introduce the advantages of digital technology into the economy while preserving the country's monetary and economic stability.

Challenges such as the declining use of cash, the growth of digital financial services, and the imperative to combat illegal financial activities exist on one hand, while the need to preserve user privacy and security exists on the other.

Important Considerations in Selecting an Implementation Model

The selection of a CBDC implementation model must be based on the economic conditions, technology, financial system structure, and policy objectives of each country. Factors such as technological infrastructure, the extent of public access to banks, transaction volume, privacy and security concerns, and the legal and regulatory environment are influential in this regard.

Advantages of Central Bank Digital Currency (CBDC)

The use of CBDC can significantly reduce costs associated with money transfers, fees, and infrastructural expenses related to cash and electronic payment systems.

Facilitation of Monetary and Fiscal Policies

CBDC can provide the central bank with new instruments for implementing monetary policies, such as direct negative interest rates, better liquidity control, and the execution of economic stimulus programs with greater speed and precision, as outlined below:

1. Increasing Transparency and Combating Money Laundering

With the capability to trace transactions and transparently record information in digital systems, CBDC can contribute to reducing illegal financial activities, money laundering, and tax evasion.

2. Security and Reduction of Systematic Risks

Reducing the use of cash—which is susceptible to theft and counterfeiting—and replacing it with a secure and controllable digital system can enhance financial security and reduce risks within the banking system.

3. Improving Efficiency and Transaction Speed

CBDC enables instantaneous and unmediated settlement of transactions, which is of particular importance in international trade and micropayments.

Challenges and Implementation Considerations of CBDC

1. Preservation of Privacy and Information Security

One of the most significant concerns in the implementation of CBDC is how to guarantee the preservation of user privacy against extensive surveillance and potential misuse. Striking a balance between transparency for combating illegal activities and the privacy of individuals constitutes a key challenge.

2. Technology and Cybersecurity Risks

Digital systems are vulnerable to cyberattacks, software errors, and technical problems. Any disruption in the CBDC infrastructure could have serious consequences for the financial system and public trust in the country.

3. Impact on the Banking System

The introduction of CBDC may cause capital outflows from commercial banks (bank disintermediation), which could lead to reduced lending capacity and increased financing costs for banks.

4. Legal and Regulatory Complexities

The implementation of CBDC requires new legal and regulatory frameworks. Issues pertaining to liabilities, transaction transparency, the right of access to information, and dispute resolution must be carefully examined.

5. Social and Economic Risks

These include concerns regarding inequality of access to technology, changes in the financial behavior of the populace, and the possibility of instability in financial markets due to rapid technological developments.

Global Examples and Current Status of CBDC Projects in Progress

a) China – DCEP Project (Digital Currency Electronic Payment)

China, as a pioneer in the field of CBDC, has launched its digital currency project under the name DCEP, meaning "Digital Currency Electronic Payment System." This project, in collaboration with the People's Bank of China and technology institutions, is being tested in several major cities such as Shenzhen and Suzhou. The primary objectives of this project are to reduce dependence on the dollar, exert greater control over monetary circulation, and support governmental monetary policies.

b) Sweden – e-Krona Project

Sweden is one of the most advanced countries in the world in reducing cash usage. The e-Krona project, meaning "Electronic Krona," is in the testing phase as a solution to preserve the role of official money and counter the complete elimination of cash.

c) European Union – Digital Euro Project

The European Central Bank is examining the development of a digital euro, with the objective of preserving the competitiveness of the euro in the digital world and facilitating cross-border transactions.

Other Countries in Testing Phases

a) Japan and South Korea are in testing phases.

b) Canada and the United Kingdom have conducted detailed studies and modeling.

c) The Bahamas is the first country in the world to have officially implemented CBDC on a widespread scale (Sand Dollar).

Specialized Technologies in Central Bank Digital Currency (CBDC)

1. Distributed Ledger Technology (DLT) and Blockchain

Definition and Structure of DLT

DLT is a system that maintains data and transaction information in a distributed manner across multiple nodes in a network, such that there is no central controlling point or control is limited. Blockchain is a specific type of DLT in which data is stored in ordered and interconnected blocks.

Types of DLT and Blockchain

a) Public Blockchain: Any individual can join the network and validate transactions (e.g., Bitcoin and Ethereum).

b) Private Blockchain: Access and transaction validation are restricted to specific entities; this system is suitable for banks and financial institutions.

c) Consortium Blockchain: Several organizations share control of the network, such as two-tier CBDC models.

Advantages and Disadvantages in CBDC

a) Advantages: High security, transparency, immutability of data, and the capability for precise tracking of transactions.

b) Disadvantages: Limited scalability in public blockchains, high energy consumption, technical complexity, and privacy preservation challenges.

2. Advanced Cryptography in CBDC

Cryptographic Algorithms

a) Symmetric Cryptography: Such as AES (Advanced Encryption Standard), which is used for rapid data encryption.

b) Asymmetric Cryptography: Such as RSA (Rivest–Shamir–Adleman), a family of public-key cryptographic systems, and ECC (Elliptic Curve Cryptography), both of which are used for digital signatures and secure key exchange.

Digital Signatures and Authentication

Digital signatures ensure that transactions have been signed by the rightful owner of the private key and are immutable. Multi-factor and biometric authentication contribute to enhancing the security of user access.

Privacy-Preserving Technologies

a) Zero-Knowledge Proofs (ZKP): This technology enables the verification of transaction validity without disclosing sensitive information.

b) Ring Signatures and Confidential Transactions: Techniques for anonymizing transactions that can be utilized in certain CBDC projects.

3. Implementation Models and CBDC Architectures

Single-Tier Model (Direct CBDC)

In this model, the central bank directly maintains accounts and manages transactions. This approach is simple but highly risky and requires very robust infrastructure.

Two-Tier Model (Indirect or Hybrid CBDC)

In this model, the central bank issues the currency, but banks and financial institutions serve as intermediaries in the distribution and management of accounts.

Smart Contract-Based Models

Smart contracts are programmed codes that execute automatically and can perform transactions according to predetermined conditions, such as automatic tax or subsidy payments.

4. Application of Cryptographic Technology in CBDC

a) Securing Transactions:

For example, when you make a purchase using CBDC, asymmetric cryptography ensures that your transaction has been signed solely by you and cannot be forged.

b) Preserving Privacy in Transactions:

If a country wishes to better preserve privacy, it may utilize Zero-Knowledge Proofs (ZKP) so that transaction information remains confidential while the central bank can easily verify its validity.

c) User Authentication:

The use of biometric authentication, such as fingerprint or facial recognition, in CBDC digital wallets—particularly in countries with large populations—prevents misuse.

5. Application of Implementation Models in the Real World

a) Single-Tier Model (Direct CBDC):

In a small country with a limited population, the central bank may directly manage accounts itself; for example, some small island nations such as Malta. This model ensures complete control remains with the central bank, but it may entail a heavy technical and security burden.

b) Two-Tier Model (Indirect CBDC):

This model is employed in countries such as Sweden and Canada, where the central bank issues the digital currency, but banks are responsible for providing services to customers. This model offers the advantage of preserving the role of banks and reducing the technical burden on the central bank.

c) Smart Contract Model:

For instance, automatic tax or subsidy payments are executed on a scheduled basis without human intervention through smart contracts. Suppose the government wishes to deposit livelihood assistance directly and automatically into citizens' accounts—this is where smart contracts readily come into operation and perform this task swiftly, transparently, and securely.

6. Practical Economic and Social Impacts

a) Reduction of Transaction Costs:

CBDC, by eliminating multiple intermediaries, significantly reduces the costs of money transfers and payments.

b) Acceleration of Money Circulation:

The high speed of transactions increases the efficiency of financial markets and commerce.

c) Financial Inclusion:

Individuals who lack access to banks can enter the economic cycle using CBDC digital wallets, such as daily wage workers or residents of deprived rural areas.

d) Combating Money Laundering:

With the capability to trace transactions, governments can more easily identify and control illegal activities.

e) Potential Harm to Commercial Banks:

With the transfer of deposits to the central bank (in the single-tier model), commercial banks may face a reduction in financial resources; preventing this requires new policy measures.

Hypothetical Practical Example:

For instance, in the near future, the government of the Islamic Republic of Iran could use the CBDC of its central bank to deposit cash subsidies directly into citizens' digital accounts. Using smart contracts, these deposits would be made automatically and at specified times. Individuals could receive their subsidies and even pay their daily expenses using digital wallets installed on their mobile phones—all without the need for in-person visits or standing in queues at bank branches.

End of Article Number Seventeen.