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Transformation of Money in the Digital Age



Summary

In the new digital age, the transformation of money is inevitable. Our study focuses on this challenge and the potential public policy response to it: the concept of central bank digital currency (CBDC). We briefly outline the historical development of money and the challenges posed by the current digital transformation for the financial system, especially in the area of monetary policy. In response to the Fintech and BigTech challenges and the potential 'digital' dollarisation of national currencies, the idea of a central bank digital currency is emerging as a growing and almost unanimous response among central banks. Implementation, however, involves a very complex set of decisions, fraught with design issues, challenges and risks. These decisions, in turn, need to be driven by general motives and the specific problems to be addressed. In the concluding part of our paper, we briefly look at where the introduction of central bank digital currency is most advanced in the world. Although we do not yet see the final full-scale introduction of CBDC in countries with significant economic weight, we have no doubt that the evolution of money will continue in this direction.

Journal of Economic Literature (JEL) codes: E52, E58, F02, N00, O30, P00

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INTRODUCTION

Throughout history, both the form and key functions of money have constantly changed, accompanied by evolution in the way we conceptualise money in economics and everyday life. Over time, the driving forces in this process have included many factors of varying significance: the prevailing concept of money, the surprisingly diverse changes in the dominant monetary theory, the expansion of money functions, the evolving role of central banks, geopolitical trends and technological breakthroughs. The achievements of the latest industrial revolution and the results of digitalisation have also been felt in the financial sector, and the (re)shaping of the form and concept of money is perhaps one of the most affected areas in the 21st century.

While it is evident that we have transitioned from commodity money with intrinsic value through representative money to the point where trust is the central, inescapable element of current ‘fiat’ money, the developments seen in recent years and decades raise many questions, the answers to which are far from trivial. Where does the trust in money come from? What ‘institution’ can best provide this trust for society? Can technology-based solutions at least partly take over the role of a central institution with a legal mandate? How can central banks maintain their privileged role in a financial and economic environment that is undergoing an extremely dynamic change, and is it even necessary for them to do so? What role can one of the most talked-about and most actively studied concepts of recent years, central bank digital currency (CBDC), play in this process? The revolution of money is taking place before our very eyes, unstoppable and pervasive, and thus it is critical for not only practising economists, but essentially for everyone to try to understand it as well as possible.

In this study, we first illustrate the ever-changing, dynamic nature of the functions and theory of money in a brief historical overview. We then present some of the key current challenges brought to the fore by the changing technological-socio-economic environment. Finally, we focus on central bank digital currency (CBDC) as one possible response to these challenges.

For money and the financial system, one of the most influential changes of the present is the acceleration of technological development. The conceptual novelty of this may be that, while previous changes had more to do with the form in which money was presented, the current challenges are increasingly substantive in nature. Alongside the rise of new payment technologies, digital money substitutes, cryptocurrencies, stablecoins and the like offer an increasingly attractive alternative to at least partially replace traditional money. Although we are not yet at the stage where the solutions available completely fulfil the classical functions of money, the issuers of such are clearly moving in this direction and undoubtedly achieving some partial results. This also means that – for certain purposes and functions – they offer solutions that are already popular with an ever-broader social stratum and thus represent real competition to ‘traditional’ forms of money and national currencies.

Digital dollarisation and its effect on monetary sovereignty, or in extreme cases, the loss of monetary sovereignty, may pose a serious challenge for central banks. One response to this could be the concept of CBDC, which central banks have begun to explore as a priority area

in recent years. Although this is a constantly developing field, it is now possible to adequately identify and present the motivations behind the introduction of CBDC and the expectations related to it, as well as the decisions and economic, social and public policy considerations arising in the planning and implementation process. With the rapid proliferation of relevant analyses, a number of central banks are now at an advanced stage, not only in terms of research, but also in testing with pilot projects, giving us the opportunity to briefly review the related international experiences.

THE EVOLUTION OF FORM AND CONTENT

Historically, money had a very similar settlement function as it does today, even though it was constantly changing with technological breakthroughs. The settlement function of money has an importance beyond itself when the monetary sovereignty of a country is considered. The origins of central banks responsible for issuing money today can be traced back in history to the issuance of the highest quality financial liabilities used for broad settlement (Horváth – Horváth, 2021). Ulrich Bindseil's book, published in late 2019, shows that institutions in Italy, Amsterdam and Hamburg were already performing the functions of central banks in the 15th and 16th centuries. As defined by William Potter as early as 1650, one of the most important functions of central banks is to be able to issue the highest quality financial liabilities, which are widely used for settlement by economic actors within the community. In many cases, the central bank's ability to do so was confirmed by law, as Knapp explained in his 1905 paper on the state theory of money. As one of the theories explaining the creation and origin of money, the state theory of money suggests that the birth of money did not originate in barter, but rather may be a concomitant condition for the consolidation of the central powers necessary to organise various forms of government.

The state theory of money formed the basis of the chartalist notion of money, according to which the value and utility of money is not related to its intrinsic value, but to the state authority issuing it. According to Graeber (2015), monetary systems based on mentalism and chartalism using money with an independent value have appeared in alternating periods throughout history. The more volatile periods, characterised by extensive conflict, have been those of metallic monetary systems, with declining confidence in central power (Ábel et al., 2016), which supports the central role of the state in maintaining the value of money. The early experiences of the central banks show that social trust and secure settlement are the primary determinants, while the technology that can bring this about is actually less relevant. Thus, regardless of the theoretical approach, the most important basis for a well-functioning money is trust, supported by some institutional arrangement or legal framework (Carstens, 2018). As is the case for the functioning of money, one of the most important for a well-functioning financial system is the existence of trust, which – in modern monetary systems – is maintained by the central bank by preserving price stability and financial stability (Borio, 2019).

With the emergence of so-called internal money, the importance of external money, the final means of settlement provided by the central bank, also grew. When the parties involved

in real economic transactions start to use each other's debts as money, we can talk about the emergence of internal money. The bank deposits that we currently use as money, and which are increasingly part of the monetary aggregates of banks' private debts, can be seen as internal money, while settlements between banks are in central bank money, today mostly in the form of central bank liquidity (Horváth – Horváth, 2021). The growing prominence of endogenous money theory, according to which money creation is not primarily carried out by the central bank but by commercial banks via the provision of credit, highlights the increasing importance of domestic money, which is also being felt in practice through the gradual decline in the use of cash in transactions. The presence of reliable external money and confidence in the institution issuing it also have a stabilising effect on internal money within the financial system. The existence of a single external currency is a key element for the stable functioning of the financial system and the financial sovereignty of a given nation state or economic area, and its preservation is therefore an important consideration for central banks.

As in many other areas, the financial system could see significant transformation through technological developments. The technological revolution of money started in the financial system, where traditional commercial banks are increasingly facing challenges from FinTech companies offering innovative alternative solutions that effectively combine technology and finance. However, the threat posed by BigTech companies in the form of the emergence of financial alternatives is even more serious and global, and could compel central banks to think hard and innovate. Since the financial crisis in 2008, central banks have already been much more involved than in previous decades in stimulating the economy and shaping yields more actively (e.g. via asset purchases, targeted loan schemes), a novel role that has been further strengthened by the COVID-19 crisis. And the concept of central bank digital currency, which has come to the fore in recent years, has been explored by a number of central banks, for different reasons. Looking ahead, the role of the state and the central bank in the financial system will presumably continue to increase in the coming decades. "States are renegotiating the terms of money creation with the financial system. States, through central banks, will have an even stronger presence in the private financial system through digital money, new regulation and new money creation." (Matolcsy, 2020¹).

DIGITAL TRANSFORMATION OF THE FINANCIAL SYSTEM AND MONETARY POLICY CHALLENGES

In recent decades, the monetary system has evolved at an ever-quicker pace, initially mainly through changes in the form of money. The changes made possible by technological advances have been driven mainly by efficiency and convenience, and further catalysed by the openness and confidence of younger generations in digital solutions. Undoubtedly, in contrast to traditional economic thinking, which focuses on real variables, the change in the form of money has its economic effects, but we cannot ignore its technological, sociological, political, cultural and other aspects as well (Dodgson et al., 2015). Although the

low international interest rate environment has made cash more popular as a means of accumulating wealth in many places, its role in transactions is gradually declining in many developed countries as financial processes become virtualised, raising the possibility that it may be removed entirely from circulation over time. Consequently, a situation may arise where households and non-financial operators cannot directly hold risk-free money with claims on the central bank.

The financial innovations of FinTech companies can have an impact on monetary policy as well as financial stability. By seeking to replace or even complement the activities of traditional banking actors, non-banking, technology companies also affect monetary policy transmission and the financial aggregates observed by central banks (Bernoth – Gebauer, 2017). The effect of the emergence of FinTech companies providing services linked to national currencies on the impact of monetary policy is not yet clear to economists and may strengthen or weaken the effectiveness of interest rate policy, depending on regulation and market characteristics. On a theoretical basis, points can also be identified whereby the increasing presence of non-bank operators may even strengthen the transmission of monetary policy. For example, non-bank financial companies that are less constrained by macroprudential rules and potentially more leveraged may have a lending channel with a more prominent role, or be less affected by capital requirements that could dampen the impact of moves in the interest rate (Bernoth – Gebauer, 2017). However, while such theoretical effects are mostly due to regulatory differences between traditional and non-traditional financial actors, empirical results are not conclusive with regard to the effects of non-bank actors on monetary policy measures.

The emergence of cryptocurrencies has opened a new chapter in the transformation of the content and nature of money. Distributed ledger technology (DLT), which allows secure and controlled transactions to be carried out without a central controller, could in itself drive significant changes in the financial system. At the same time, the emergence of private digital currencies poses a greater challenge from a monetary policy perspective. Cryptocurrencies differ in nature from all previous popular forms of money in that they are widely available, electronic and can be used for direct peer-to-peer transactions, even though they are not issued by a central bank. In the wake of this, the rapid rise of Bitcoin and other cryptocurrencies has led economists to fundamentally rethink their views on money and the role of central banks in the era of the money digitalisation (Carstens, 2018).

The spread of private money, in parallel with the traditional banking sector, may also pose a new challenge for national currencies and thus for states, in a process that we can refer to as digital dollarisation. This phenomenon is essentially similar to traditional dollarisation, where the currency of one state is replaced by the more trusted currency of another. Digital dollarisation may occur when the role of a country's currency is partly or entirely taken over by the currency of a digital platform (Brunnermeier et al., 2019). Digital payments can provide an alternative form of deposit, hence making traditional deposit collection more difficult or costly. Moreover, digital currency issuers can compete with the banking sector not only on the funding side, but also on the lending side, competing for customers from commercial banks. Some economists argue that, like FinTech companies, the

emergence of digital currencies could provide an incentive for traditional financial services providers to operate more efficiently and offer more services, thus ultimately benefiting consumers. However, if the issuer of a digital currency starts to perform classical banking functions such as deposit taking or lending, monetary policy transmission may be compromised, as the central bank cannot directly influence the lending and deposit rates of such currencies through its interest rate policy.

Experience with cryptocurrencies in circulation so far suggests that they pose only a limited threat to the role of national currencies for the time being (Horváth – Horváth, 2021). For a virtual external currency to take over the role of a national currency, it must not only enjoy a high degree of social trust, but also be at least approximately capable of performing the classical monetary functions. The main criticism of popular cryptocurrencies in fulfilling monetary functions is the volatility of their exchange rates, which have fluctuated significantly in recent years. Coins with the highest market capitalisation, such as Bitcoin or Ethereum, are all quoted in US dollars, also partially reinforcing the dominance of USD. However, there is also a question as to whether these currencies are aiming to take on the role of traditional currencies at all, or whether they are aiming to play the role of the ‘digital gold’ often referred to in Bitcoin.

However, a subset of cryptocurrencies, namely stablecoins, were created specifically to address the problem of volatility, and may even pose a more direct threat to national currencies. Stablecoins work on the basis of a stabilisation mechanism to preserve their value relative to traditional national currencies (ECB, 2020). While stablecoins are undoubtedly better suited to perform monetary functions than more volatile cryptocurrencies, they are not currently so widespread as to threaten the role of national currencies.

The risk of digital dollarisation is particularly high in relation to currencies developed by tech giants with their own digital ecosystems and massive user bases (Horváth – Horváth, 2021). The phenomenon was brought to the attention of regulators by the announcement of the Facebook-backed currency Diem (originally called Libra). Following intense feedback from regulators, the Diem Association, which is developing the currency, refined the original concept, for example by ‘rebranding’ the virtual currency under development as a payment system.

The emergence of digital currencies at the expense of national currencies could lead to a partial loss of monetary sovereignty and, in extreme cases, to its complete loss. The widespread use of financial services and currencies developed by technology companies could also significantly alter the functioning of the financial system, leading to disintermediation, as economic operators would use the platforms of tech companies instead of traditional banks (Brunnermeier et al., 2019). With a sufficient user base, digital currencies could displace national currencies, limiting the scope for action of central banks. In such a situation, as monetary transmission weakens, central banks would be less and less able to influence interest rates and monetary aggregates, and hence the behaviour of real economic actors. Such a narrowing of the scope of the central bank’s action could become a serious problem in crisis situations in particular (Szalai, 2021).

CENTRAL BANK DIGITAL CURRENCY – A POSSIBLE CENTRAL BANK
RESPONSE TO THE CHALLENGES

Central banks have started to focus on the concept of digital central bank currency (CBDC) in order to preserve their monetary sovereignty in the face of the challenges posed by digitalisation. There is no widely accepted definition of digital central bank currency, and in our study we use the BIS definition (BIS, 2020). Accordingly, central bank digital currency is a digital form of money issued by the central bank in its own currency, different from traditional central bank reserve or settlement (CPMI-MC, 2018). Initially, leading central bankers emphasised that the digital financial revolution should not endanger national currencies, but now they are explicitly highlighting the issue of monetary sovereignty.² There is no doubt that central banks must respond in some way to the challenges posed by the digitalisation of finance. In this chapter, we briefly show how central bank digital currency can address these challenges and how it can benefit the implementation of monetary policy.

Possible motivations for the introduction of CBDC

For a country or an economic area, access to electronic payment and financial services and the reduction of the associated costs require a continuous series of analyses and interventions by public policymakers and, more specifically, by central banks. Over the past decade, and especially over the past two years, the possibility of introducing CBDC has increasingly dominated the public debate, with most of the world's central banks exploring the possibilities CBDC could offer. A limited number of central banks have already launched pilot projects to test a specific form of CBDC for possible future introduction. The motivational factors behind the intention to introduce CBDC can be grouped according to the international literature as follows (Fáykiss – Szombati, 2021):

- **Maintaining monetary sovereignty:** Among the ongoing innovations in technology and payment systems, the 2019 announcement by the Facebook Libra Alliance (now Diem) to develop a fast, low-cost, accessible payment solution for anyone, based on the worldwide Facebook customer base, was a highlight. The proposal came under strong regulatory attack as it would have significantly restricted monetary sovereignty at the level of each country concerned by creating a dual monetary system and would have also posed significant financial stability risks by allowing exit from the domestic monetary system. The proliferation of payment solutions from global technology companies has increased the need to maintain central control over local payment systems in many countries around the world³ and has accelerated local CBDC projects. The introduction of CBDC would allow the state to retain the ability to create money (Horváth – Horváth, 2021). CBDC can also help to preserve the national currency's unit of account function. A payment instrument unit of account function is increasingly important in the digital age and is of great importance from an efficiency point of view, as it facilitates transactions by reducing legal and financial uncertainties (Borio, 2019).

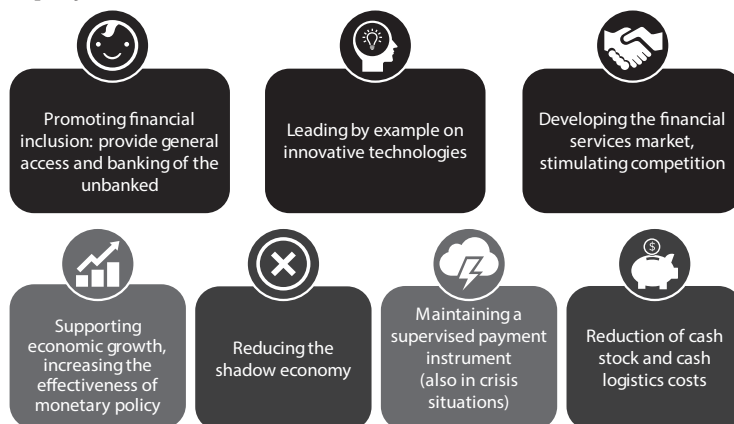
- **Providing a digital payment alternative to cash for a wide section of society:** In addition to the direct costs of cash management, policymakers also want to reduce the social costs that result from the exclusion or reduced access to modern bank account-based digital payment solutions for certain social groups. CBDC can also bring fast, cheap, secure digital payment solutions to these groups, which can mean enhanced digital skills, better empowerment, greater security and greater entrepreneurial freedom for the wider society. Overall, it can support the development of a more socially efficient payment system, including a reduction in the use of cash.
- **A new monetary policy instrument for central banks:** CBDC would allow the central bank to directly influence the level of deposit interest rates perceived by a very wide range of economic operators. This could result in a monetary policy instrument that could address the Keynesian liquidity trap and change the velocity of money when necessary. According to Silvio Gesell's idea, real economy transactions could be speeded up not only by an interest rate, but also by a kind of maturity. In Bindseil's view (Bindseil, 2020), perhaps the most efficient solution would be for the CBDC to function as electronic cash (anonymous and interest-free) up to a certain limit, while above this limit it would earn interest, which the central bank could adjust according to the monetary policy.
- **Creating an instrument for targeted stimulus:** the COVID-19 pandemic, coupled with the resulting restrictive measures, led to a significant global economic downturn. In order to mitigate the social impact of the significant loss of income and unemployment, fiscal authorities in many countries around the world decided to pay an extraordinary, immediate, universal benefit. However, getting this to the people quickly and in a targeted way was far from straightforward, so the US administration, for example, started issuing checks. A general CBDC with wide public access could provide a good basis to ensure the viability of the rapid, targeted stimulus tools needed in similar cases.
- **Central banks can even provide credit to the real economy in the form of digital central bank currency,** as was the case with early central banks. Direct central bank lending could strengthen monetary transmission, as it would allow the central bank to have a direct impact on the perceived credit interest rates of economic operators. By having the central bank directly influence lending rates, monetary transmission can be maintained even if there is a disruption in the functioning of credit markets (Felcser et al., 2021). In addition, the central bank can also use its lending activities to buffer the economic damage caused by the pro-cyclical behaviour of traditional financial actors. Early central banks were no strangers to holding a smaller proportion of credit instruments directly linked to the real economy on their balance sheets (Bindseil, 2019). At the same time, the main criticism of direct central bank lending is that it would replace the banking system itself, which already has the infrastructure and risk-taking practices in place.
- **Developing a new platform for innovative services:** in the context of creating a central infrastructure to support long-term financial innovation, a growing

number of central banks⁴ consider that a completely new payment system, capable of handling alternative payment solutions such as smart contracts, may be needed to complement the existing system and gradually incorporate new types of payment solutions and new business approaches based on them.

Social and public policy considerations for the introduction of CBDC

Public policy intervention in the payments system and public commitment to a new, as of yet unimplemented, CBDC solution can be expected from central banks if a clear market problem, failure or public policy consideration can be identified that triggers thinking outside the current framework and a new form of central bank manifestation. Based on the international literature, Chart 1 gives an overview of possible directions.

Chart 1: Public policy considerations behind CBDC initiatives



Source: Authors' work based on BIS and central banks' websites

Although several of these factors are typically behind each of the ongoing central bank projects, the following can be identified as common points for the more advanced countries:⁵

- **Digitisation of cash, expanding the possibilities of financial transactions by strengthening financial inclusion:** the spread of digital payment solutions has increased the need for a digital payment instrument issued and guaranteed by the state, which is widely accepted as a means of payment, similar to cash, and which can perform the function of a payment instrument in digital form. A free, uniformly accessible, secure and fast electronic payment system, operated by the central bank, could open up access to financial services for those who previously made payments exclusively in cash.
- **Ensuring the robust operation of a payment instrument and system, including in crisis situations:** to overcome possible malfunctions of electronic payment solutions currently provided by the private sector, it may be necessary to

build and maintain a back-up system, which should be operated by a central actor such as the central bank. Similarly to cash, this system would be based on a generally accepted, widely available cost-free and risk-free payment instrument which is digital.

- **Developing the financial services market, stimulating competition:** as an alternative to payment services, CBDC could be a good starting point for the development of truly instant, low-cost payment platforms. In the same way, such a platform can support further developments and technological innovations, for example through smart contracts linked to payment transactions, where further processes can be triggered once payment is completed.

Expectations for a CBDC framework

In designing the operational framework for CBDC, policy makers will face a number of dilemmas and, in some cases, constraints, and it is necessary to weigh up the potential benefits and drawbacks in the design process. However, some general principles can be identified for the development of CBDC, which are relevant for the potential instrument and support sustainable, successful implementation in the longer term (Brunnermeier et al., 2019; Adrian – Griffole 2019; Auer et al., 2020a; Kahn et al., 2018; Riksbank, 2018; BIS, 2020; ECB, 2020a). It is important that (i) the introduction of CBDC has an appropriate public policy rationale and (ii) does not jeopardise the central bank’s fundamental monetary and financial stability objectives, i.e. that the introduction of a new type of central bank currency has neither a negative impact on the conduct of monetary policy in general or on the stability of the financial system, nor limits the central bank’s ability to fulfil its mandates. In addition, (iii) it should be essentially complementary, i.e. it should be able to work in parallel with other types of money already available (cash, commercial bank money, central bank money), not replace them. Finally, (iv) it is important to promote financial and economic efficiency, and (v) to facilitate or even stimulate innovation.

The following main functional requirements can be identified for a CBDC framework (Fáykiss – Szombati, 2021):

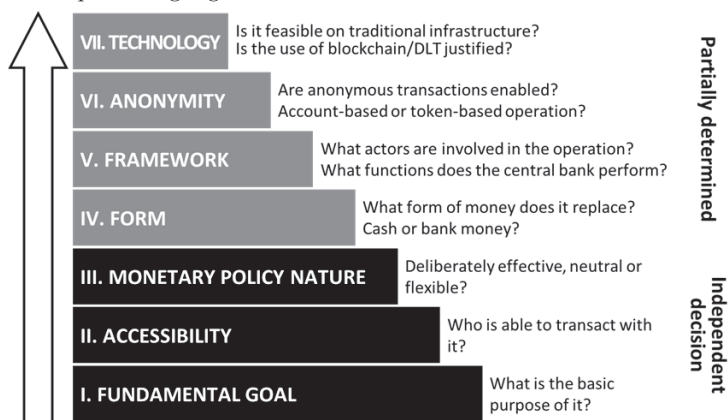
- **Central bank expectations:** From a central bank perspective, it is important that CBDC is resilient, secure and convertible into other forms of money in accordance with the central bank’s function. Scalability is important: it should be gradually expandable, able to handle higher volumes and transaction numbers. It should be consistent not only with the legal environment in which it is issued, but also with all other related legal requirements.
- **User needs:** The importance of specific user needs depends strongly on the potential user base of CBDC. With an universally available CBDC customers want a fast, user-friendly, easy-to-understand and inexpensive service, operating 24/7.
- **Market considerations:** It is important that CBDC is interoperable with other payment systems. It should support the exploitation of comparative advantages, encourage competition for complementary services, be flexible and even expandable in a modular way.

With regard to these expectations, it is worth pointing out that, while these basic functional expectations can be considered general, their criticality will depend on the other design frameworks for CBDC, in particular the range of accessors. For example, in the case of an essentially ‘wholesale’ CBDC, resilience, security and scalability are critical requirements, while cost-effectiveness or user-friendliness are less important. By contrast, a CBDC that is essentially ‘retail’, i.e. accessible to the general public, may have higher expectations in terms of user-friendliness, inclusiveness or modularity.

Key decision points and considerations in the design of CBDC

As indicated above, in designing the operational framework for CBDC, policymakers face a number of dilemmas and, in some cases, constraints. This framework basically identifies seven major decision steps that are useful to consider when designing a CBDC (Chart 2). These decision steps essentially build on each other.

Chart 2: Decision ‘steps’ in designing a CBDC



Source: (Fáykiss – Szombati, 2021).

For the first three ‘steps’, there is still a relatively high degree of freedom for each dimension, but after that, many decisions may be partially determined (Fáykiss – Szombati, 2021):

- I. Definition of the fundamental goal**, which can be used to define the motivation for the introduction of CBDC.
- II. Defining accessibility**, i.e. which economic and social actors will have direct access to the CBDC.
- III. Determining the monetary policy nature** of the CBDC, whether it will be an active, neutral or flexible instrument for monetary policy purposes, and whether the central bank will apply certain restrictions (for example, on the amount that can be held on the account or the size of transactions).

- IV. Defining the specific form of the CBDC**, i.e. what form of money it can be (cash, central bank money, etc.) and what functions it can have. Relevant to this issue is whether it is ‘token-based’ (essentially linked to possession, e.g. private key, digital asset) or ‘account-based’ (linked to the owner, similar to bank accounts).
- V. To define the operational framework**, i.e. which actors will be involved and what functions the central bank will perform in this context.
- VI. A record of how anonymity is handled**, where it can be specified whether anonymous transactions can be carried out, and if so, under what restrictions and at what levels (‘multi-level anonymity handling’).
- VII. Determining the technology to be used**, i.e. whether the system would operate on the traditional infrastructure or other systems, e.g. blockchain-based systems, would be developed.

INTERNATIONAL EXPERIENCES AND MAIN RESEARCH AND IMPLEMENTATION DIRECTIONS FOR CBDC

A significant number of central banks globally are now exploring CBDC at some level (Chart 3). In a recent BIS survey (Boar – Wehrli, 2021), 65 central banks, including the MNB, were surveyed, and the results show that 86% of them are working on CBDC, 60% are experimenting and 14% are in the development phase.

Chart 3: Countries researching CBDC



Source: Edited by MNB based on Auer et al. (2020b) and central banks’ websites. As of 31 August 2021.

The importance of the survey is reflected in the fact that the central banks surveyed account for 91% of global GDP. It is therefore not surprising that, in addition to the motivations outlined earlier in this paper, the risk of missing out is now also driving central banks to start research. However, despite the gradual announcement of CBDC projects, with a few exceptions, no formal

decision has yet been taken by central banks on the future issuance of CBDC.

Europe is still lagging behind other regions. In addition to the successive announcements of CBDC projects, it is worth analysing their maturity level. Starting a research phase is considered a low entry threshold, while announcing a pilot programme requires a higher level of commitment. The Global CBDC Maturity Index by PwC (2021) shows which countries are considered pioneers (Chart 4). The results show that, compared to the European region, countries in Asia, the Caribbean and South America are ahead in the development of CBDC. Emerging and developing countries are in the lead for ‘retail’ CBDC, while developed countries ahead in ‘wholesale’ CBDC (PwC, 2021). This is because developed countries have well-established retail payment systems, so putting them on a new footing with ‘retail’ CBDC would have fewer benefits and higher risks than in developing countries. By contrast, ‘wholesale’ CBDC offers attractive opportunities for countries with developed interbank and capital markets.

Chart 4: PwC Global CBDC Maturity Index

Retail CBDC		Wholesale CBDC	
1.	Bahamas	1.	Thailand
2.	Cambodia	2.	Hong Kong SAR
3.	Mainland China	3.	Singapore
4.	Ukraine	4.	Canada
5.	Uruguay	5.	United Kingdom
6.	Ecuador	6.	France
7.	Eastern Caribbean	7.	Republic of South Africa
8.	Sweden	8.	European Union (Euro area)
9.	South Korea	9.	United Arab Emirates
10.	Turkey	10.	Japan

Source: (PwC, 2021)

The Bahamas was the first official issuer of a retail CBDC. In October 2020 (CBoB, 2020), the island nation officially issued the ‘Sand Dollar’, the world’s first ‘retail’ CBDC. The primary motivation of the central bank was to promote financial inclusion. The country’s geography meant that the commercial banking network could not serve some of the population efficiently, and cash logistics were also hampered. Through retail CBDC, the central bank saw an opportunity to directly support financial inclusion and reduce transaction costs. Citizens and businesses can open a digital wallet to use the Sand Dollar through verified financial intermediaries. In the KYC⁶/AML⁷ framework used, a multi-level digital wallet is available, with two levels for the residential and one for business clients. At the first retail level, no ID is required, but a maximum monthly balance of \$500 for storage and \$1,500 for tran-

sactions is available. The second level requires satisfying similar identification criteria to those for opening a commercial bank account, but with a less limited wallet use. Financial stability risks are thus limited at all available levels to mitigate sudden or large outflows of commercial bank funds (CBoB, 2019, 2021).

China, the world's second largest economy, has one of the most advanced 'retail' CBDC pilot projects (e-CNY). Live testing of the digital yuan is already underway in several regions of China, with nearly 21 million retail CBDC account opened. There are three main motivations underlying the development of e-CNY. The first is to assure that the central bank can ensure accessibility and usability of central bank money in a modern, digital society, and, through that, promote financial inclusion. The second objective is to promote efficiency, security and competition in the retail payments market. The nature of the payments market favours large companies, due to strong network externalities (Kiff et al., 2020), which may in turn undermine certain public policy objectives and lead to failures on the market. The third motivation is to promote the international role of the yuan and improve the efficiency of cross-border transactions. The PBoC uses a two-tier hybrid model, where end-users access digital yuan through controlled financial intermediaries. Similarly to The Bahamas, in China there are also multiple tiers of digital wallets available depending on KYC requirements. Further expansion of e-CNY testing is expected at the Beijing 2022 Winter Olympics (PBoC, 2021).

In the European Union, the Swedish central bank's e-krona project remains the most advanced (Riksbank, 2021), but important steps were also taken with the ECB's digital euro in October 2020, when the first comprehensive report on the digital euro was published and a public consultation was announced in parallel to involve the public and business in the conceptualisation of the digital euro (ECB, 2020a). After the evaluation of the results, the official decision was taken to launch the two-year research phase of the digital euro (ECB, 2021a). The aim of the research is to prepare the central bank for the development and introduction of the digital euro, which is expected to take another three years (Panetta, 2021). In addition, the ECB and euro area central banks published joint pilot results on the feasibility of different technological models: centralised account-based and decentralised distributed ledger technology (DLT) solutions and their interconnectivity (ECB, 2021b).

The first official issuance of 'wholesale' CBDC has yet to occur, but several international projects are at an advanced stage. It is generally observed that research phases are shorter than for 'retail' CBDC, but pilot programmes are long (PwC, 2021). This can also be explained by the fact that, based on international experience to date, central banks are conducting multi-level pilot programmes. Usually, the first stage involves testing use cases within the national jurisdiction, while the next stage is for testing cross-border processes through international cooperation. A good example is the Swiss National Bank's (SNB) Project Helvetia, which first tested the feasibility of replacing of central counterparties (CCPs) with a clearing system based on DLT technology (SNB et al., 2020). Project Jura, which is the continuation of Project Helvetia, is working with the Banque de France to investigate the role that 'wholesale' CBDC can play in cross-border transactions (SNB, 2021). The project in Singapore has gone down a similar path: the ongoing Project Dunbar builds on the Monetary Authority of

Singapore's (MAS) earlier successful Project Ubin experiment, and aims to design, develop and test multi-CBDC platforms for cross-border transactions and settlements (MAS, 2021). In addition to MAS, the project also involves the Australian, Malaysian and South African central banks and the Singapore Centre of the BIS Innovation Hub (BIS, 2021a). The Multiple CBDC Bridge (m-CBDC Bridge) project is also worth mentioning, which aims to develop a working prototype of a multi-CBDC platforms that supports instant cross-border PVP⁸ operations in multiple currencies (BIS, 2021b). It also builds on a previous experiment, a joint project between the Bank of Thailand and the Hong Kong Monetary Authority (Project Inthanon-LionRock), which examined the improvement of the efficiency of cross-border transactions using distributed ledger technology (BIS, 2021b). Based on international practice, it is clear that the potential of 'wholesale' CBDC to increase the efficiency of cross-border transactions can be truly explored in the context of multi-stakeholder cooperation projects.

NOTES

- ¹ <https://novekedes.hu/mag/a-penzforradalom-evei-jonnek>
- ² For example, Banque de France President Francois Villeroy de Galhau said that "Europe needs to move as quickly as possible on digital money before risking the erosion of monetary sovereignty." (<https://www.reuters.com/business/monetary-sovereignty-risk-push-digital-euro-french-central-banker-2021-06-29/>)
- ³ Among the most important central banks, the European Central Bank, the Fed, which was previously sceptical on the subject, but also the PBoC.
- ⁴ Examples include the ECB, the Bank of England and the Monetary Authority of Singapore.
- ⁵ For example, The Bahamas, China, Cambodia.
- ⁶ Know Your Customer
- ⁷ Anti-Money Laundering
- ⁸ Payment versus payment

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