The Future of Money in Europe: Central Bank Digital Currencies?

▸ Ing. Kamil Nečas » Department of Resources Management, Faculty of Military Leadership, University of Defence, Kounicova 65, 662 10 Brno, Czech Republic; email: kamil.necas@unob.cz

▸ Ing. Vojtěch Müllner, Ph.D. » Department of Resources Management, Faculty of Military Leadership, University of Defence, Kounicova 65, 662 10 Brno, Czech Republic; email: vojtech.mullner@unob.cz

1. Introduction

Before the advent of money, people exchanged goods and services using a barter system, which, however, suffered from fundamental limitations, such as the need for mutual agreement, the physical presence of both parties, and the limited shelf life of the goods being exchanged. Commodity money, such as salt or livestock, gradually began to be used as a medium of exchange and a store of value. However, its shortcomings, particularly its difficulty in division and lack of standardization, led to the development of metal coins with intrinsic value, which, thanks to their durability and state guarantee, represented a stable form of money for many centuries.

Another significant change came with the introduction of paper money, which first appeared in China and spread to Europe in the 16th century. Its lighter weight and ease of handling contributed to the rise of banking and financial institutions. The Industrial Revolution and technological progress then fundamentally changed the form of money. From the mid-20th century, computing and digitization began to play a key role. The emergence of electronic payment systems, cashless transactions, and modern digital platforms such as PayPal and Apple Pay has led to a significant dematerialization of money and simplified everyday financial transactions (Arner et al., 2017; Böhme et al., 2015).

This development has gradually shifted from the physical to the digital realm. Technology has begun to serve not only as a means of exchange but also as a means of creating trust in the value of money. Modern technologies—such as cryptography, digital signatures, and DLT—are changing the very foundations of monetary systems and contributing to the emergence of new forms of money that are redefining the relationship between individuals, institutions, and the state (Nambisan et al., 2019).

A revolutionary moment came in 2009 with the introduction of Bitcoin as the first cryptocurrency based on blockchain technology. Bitcoin represented an alternative form of digital currency that is not issued or regulated by a central authority but operates on decentralized consensus and uses cryptographic security. This innovation opened the door to hundreds of other cryptocurrencies that expand the possibilities of exchange beyond the traditional financial system, but also bring new regulatory

challenges (Swan, 2015; Tapscott & Tapscott, 2016).

In response to this decentralization trend, central banks began exploring digital forms of currency that would be fully under their control. The result of these efforts is digital CBDCs, which combine the technological advantages of the digital environment with the trustworthiness and stability provided by the state. CBDCs represent a digital claim on the central bank and are denominated in the national currency (e.g., the digital euro). Their emergence is a natural outcome of the historical development of exchange and a response to the changing demands of the digital economy (Zetzsche et al., 2020).

2. Methodology

The aim of this paper is to assess the extent to which technological progress and pressure for digital sovereignty in Europe are leading to policies that reduce dependence on global technology platforms in payments and accelerate CBDC/digital euro projects at both national and Eurosystem levels. We start from two hypotheses. The first is that new technologies in the monetary and financial system are leading to the testing and introduction of CBDCs. The second is that greater institutional readiness (strategy, budget, dedicated team, legislative milestones) is associated with faster progress in the implementation steps for the digital euro.

The research combines quantitative and qualitative approaches. First, aggregated data are analyzed to identify general trends in new forms of currency, in particular the number of active CBDC projects, the technology used (DLT vs. non-DLT), regional distribution, and stage of development. These trends are then examined in depth using descriptive and comparative analytical methods.

The entire issue is first placed in a historical context, using secondary sources to illustrate the dynamics of the development of means of exchange, from the earliest forms of exchange to contemporary digital tools based on modern technologies. Attention is then focused on the different approaches of selected countries to the implementation and development of CBDCs, including their technological solutions. Particular emphasis is placed on European countries that are already actively working on pilot projects or research phases, such as France, Germany, and Italy (ECB, 2023).

Descriptive analysis of the professional literature is used to describe and evaluate the technological aspects of CBDCs, particularly concerning the use of blockchain and other types of distributed ledgers. This section is based on academic articles that discuss the technological characteristics of blockchain, the differences between Proof-of-Work and Proof-of-Stake protocols, and their possible applications in monetary systems (Lin & Liao, 2017).

The methodological approach also includes an analysis of secondary data, which makes it possible to map the current state of CBDC development in individual countries. This data is processed primarily in the form of summary tables and supplementary graphs (Kumar, 2023).

The CBDC Tracker platform (https://cbdctracker.org/) was used as the main database tool to determine the state of CBDC development. It provides up-to-date overviews of individual digital currency projects at various stages (research, proof of concept, pilot operation, launch). This database combines data from central banks, government documents, and specialist media and allows developments to be monitored in real time (CBDC, 2024).

Official documents of the ECB mapping the research and preparatory phase of the

digital euro project were also used, including consultation reports, public statements, and technical architecture proposals (ECB, 2025a).

As part of the literature review, the Scopus, Web of Science, and SSRN databases were systematically searched using keywords such as “Central Bank Digital Currency,” “CBDC,” “blockchain,” “digital euro,” and “monetary policy digitalization.” These texts provided the theoretical and analytical background for the technological and institutional parts of the article, in particular (Mu & Mu, 2022).

All sources were continuously verified in terms of their credibility, timeliness, and professional relevance. In the case of technological concepts, the interdisciplinary nature of the topic was taken into account, combining approaches from economics, computer science, political science, and law.

3. Blockchain

The term blockchain generally refers to a method of managing information in a distributed system that is characterized by specific properties. However, in 2025, there is still no uniform specification or established standards, which has led to different interpretations of this general definition in the professional literature. Blockchain is often confused with the term DLT, which represents a revolutionary approach that enables the registration, sharing, and synchronization of transactions with digital assets in an environment without the need for a central authority. This technology draws on knowledge from various fields of computer science, such as distributed systems, cryptography, data structures, and consensus algorithms. As a result, it offers a number of key features, including decentralization, openness, immutability, transparency, traceability, security, availability, and more (Antal et al., 2021).

Based on research in the available literature, we have listed examples of possible definitions of blockchain in Table 1, divided into three areas. The first two definitions are related to cryptocurrencies. In the media, the terms cryptocurrency and blockchain are often confused, especially with Bitcoin. Furthermore, definitions that are broader and more general have been selected, given that the term DLT does not refer to any specific data structure, includes generalizations, and blockchain is often used to refer to chains of blocks, which is why people tend to equate Blockchain with DLT (Tabatabaei et al., 2023). In this article, we will distinguish between the terms DLT and Blockchain. The last type of definitions is those that focus on the use of blockchains, in our case smart contracts.

If we focus briefly on the essence of how blockchain works, transactions are stored in individual blocks, and these blocks then form the blockchain. To ensure that the node reporting the transaction is legitimate, it must provide proof using a specific algorithm. These algorithms vary depending on the platform. For example, popular platforms such as Bitcoin and Monero use the Proof of Work (PoW) algorithm to connect a new block to the existing ledger by solving a cryptographic puzzle. Miners verify transactions by randomly trying all possible combinations of strings to obtain the desired result, called a “nonce.” Obtaining a nonce is very demanding and leads to high energy consumption (Lin & Liao, 2017). Other platforms, such as Ethereum or Cardano, use the Proof-of-Stake (PoS) consensus protocol, which requires validators to hold and deposit so-called tokens (Zhang & Lee, 2020). Once a transaction is verified and recorded by one node, it is transmitted to all nodes in the network, with each node storing identical copies of the verified transactions, called blocks. The nodes begin working on the next

set of transactions, and the process repeats (Dutta et al., 2020).

Table 1 » *Definition of blockchain according to areas*

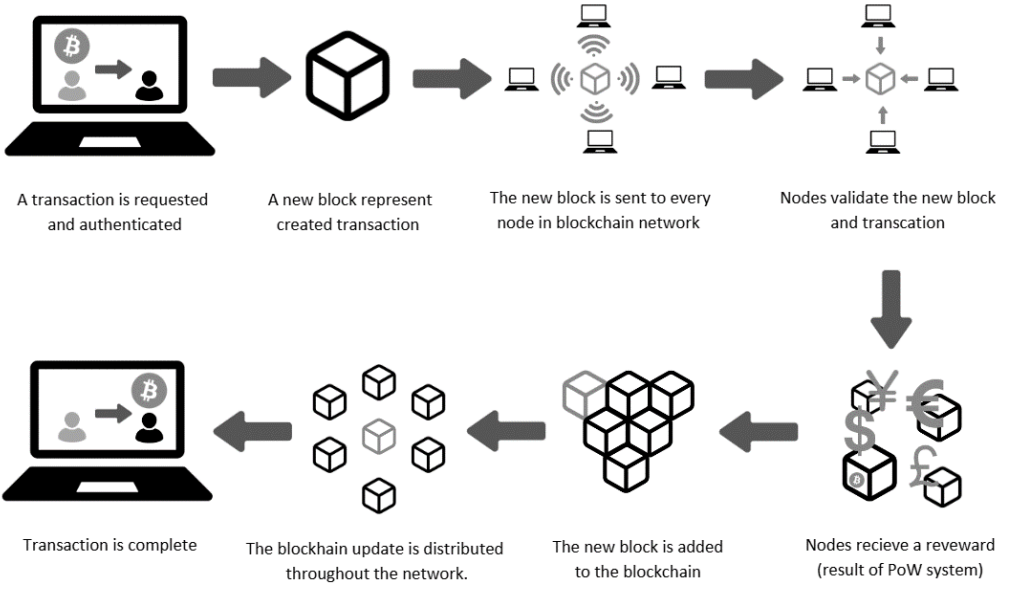
Areas of definition	Authors	Definition
Bitcoin cryptocurrency	Garay et al. (2024)	Bitcoin is a decentralized payment system that is based on maintaining a public transaction ledger in a distributed manner. The ledger is maintained by anonymous participants (parties, "players") called miners, executing a protocol that maintains and extends a distributed data structure called the blockchain.
Bitcoin cryptocurrency	Swan (2015)	The blockcian is the public ledger of all Bitcoin transactions that have ever been executed. It is constantly growing as miners add new blocks to it to record the recent transactions. The blocks are added to the Blockchain in linear, chronological order. (
Broader concept of blockchain	Bettín-Díaz et al. (2018)	Blockchain is essentially a distributed database of records; we can also call it a public ledger of transactions or even digital events that have been executed and shared among participating parties (nodes). In the general ledger, each transaction is verified by consensus of a majority of the participants in the Network, and once entered, the information cannot be erased, modified, or altered.
Broader concept of blockchain	Lafourcade & Lombard-Platet (2020)	Intuitively, a blockchain is a chain of transactions. More precisely, each element of the chain (each block) contains several transactions (or one or none), as well as a proof needed for consensus to take place.
Broader concept of blockchain	Bigini et al. (2020)	…, the Blockchain constitutes a distributed network, sharing a cryptographic secure, immutable ledger accessible to anyone. The ability to add blocks on the chain is guaranteed by a consensus protocol, a mechanism defined for the specific Blockchain through which the participants converge to reach consensus.
Blockchain applications	Lohmer & Lasch (2020)	A smart contract is a computerised transaction protocol that automatically executes if the terms of the specified contract are met. Contract clauses can be embedded in scripting languages (like Python or Solidity) to execute blockchain functions.

Source: own processing.

It is important to distinguish between the definition of blockchain and its characteristics. While there is no universally agreed-upon definition, the basic characteristics have been extensively explored in the literature. For example, blockchain data is immutable: new data can be added, but data that has already been included cannot be deleted or modified. In addition, blockchain provides resistance to unauthorized manipulation, i.e., protection of blockchain data against any unwanted modification. As already mentioned in the text, blockchain is often compared to a distributed database that is resistant to unauthorized access and has immutable data. However, there are fundamental differences. The first is that a database is a collection of data that represents the current state of a system and can be searched or used by user

queries. In contrast, most blockchain projects represent an accounting ledger that records a certain history of transactions. To a large extent, only specific data elements are stored in the blockchain due to its more expensive and less efficient storage compared to a database. The second difference is the trust model, where database servers usually trust each other in the sense that they do not expect an attack from within the system. In a blockchain environment, the interests of the participating computing devices are inherently different, so they need to verify the information they receive from each other and reach a consensus to agree on changes to the data (Tabatabaei et al., 2023). Figure 1 shows the basic principles of blockchain transaction processes.

Figure 1 » *Blockchain transaction process*



Source: own processing based on Panwar et al. (2022)

Initially, the concept of blockchain technology was primarily associated with the cryptocurrency Bitcoin, but blockchain technology is not specific to digital currencies; rather, it is a multi-sector application of expertise that can be applied to a wide range of social and economic relationships to make them more efficient, such as smart contracts, crowdfunding, and voting processes (Marple, 2021). Blockchain has gradually been applied in cybersecurity, banking, healthcare supply chains, agriculture, and many other areas of life. In recent years, there has been a convergence of technologies in applications, with the integration of blockchain into the Internet of Things (IoT) helping to secure data without any interruption, and the possibilities of blockchain can be equally well exploited in the field of cloud storage. The article will further focus on the area of digital currencies, such as cryptocurrency and CBDC.

4. Digital currencies

The twenty-first century has witnessed further evolution in money technology, with the advent of digital currencies. Among the best-known examples of digital currencies is

Bitcoin, which has disrupted traditional economic and political relationships. Although Bitcoin was only created in 2008, there is a rich history of work leading up to digital currencies before this date. As early as 1996, Law et al. addressed how to create anonymous cryptographic electronic cash, and Asokan et al. (1997) worked on the creation of electronic payment systems that would provide better security than traditional means of payment. All of these initial designs shared a common assumption, namely, central coordination, for example, in the form of a central bank. Unfortunately, the technical implications of central coordination and verification of electronic transactions on a large scale proved too difficult to overcome for these designs to ever be implemented (Marple, 2021).

In the context of the historical development of digital currencies mentioned above, the emergence of Bitcoin and other cryptocurrencies can be better understood. The Bitcoin design is based on an economic world without intermediaries (central banks), and should therefore overcome the previous technical and political obstacles to digital currencies. Taking advantage of the moment of dissatisfaction with centralized monetary authority, Bitcoin became one of the first decentralized digital currencies in the world. Bitcoin thus created a certain market space for digital currencies, which was gradually filled by hundreds to thousands of alternative cryptocurrencies. Shortly after the emergence of the first cryptocurrencies, companies around the world began accepting Bitcoin and other digital currencies as a means of transaction (PayPal, Airbnb, Adidas, and others). This step increased the credibility and importance of these innovative tools, which gradually became part of the global economy (Marple, 2021).

Gradually, other models of digital currencies began to develop, such as stablecoins, which by their nature maintain a stable price relationship to specific targets such as the dollar or gold. Corporate currencies have also been created, which are primarily intended for transfers between companies or should enable the replacement of fiat currencies and payment cards within a network of companies. However, states and their central banks are not lagging, launching pilot projects for digital currencies, which are better known as CBDCs.

Cryptocurrencies are digital coins based on blockchain technology that facilitate transactions and sometimes serve as a long-term store of value (Baur & Dimpfl, 2021). The best-known is Bitcoin, but other examples include Litecoin, Monero, Dash, and Zcash. These currencies, which operate on a decentralized network and use cryptography for security and protection against counterfeiting, offer a certain level of anonymity in peer-to-peer transactions. While Bitcoin accounts are beyond the control of law enforcement agencies and payment processors, this anonymity can also increase the potential for financial crime (Brown, 2016).

Stablecoins are digital tokens that have the potential to significantly increase competition and innovation in financial services by reducing our dependence on traditional intermediaries. They are linked to specific assets, such as the dollar or other national currencies. The most common types are stablecoins backed by fiat currencies, but there are also those linked to commodities such as gold. They are mainly used for market entry, hedging, storage, and facilitating transactions between the digital and physical spheres. Examples of such tokens include USD Coin, Gemini Dollar, and TrustToken (Catalini et al., 2022)

Consortium stablecoins, like asset-backed stablecoins, are issued by groups rather than individual organizations. Like other stablecoins, consortium stablecoins enable

instant cross-border payments and are particularly attractive to people outside the traditional financial system. The most interesting example was ultimately the never-launched stablecoin Diem (formerly Libra 1.0 and 2.0), backed by Facebook and its partners. They originally sought to create a blockchain-based currency backed by a basket of international currencies, including the US dollar, the euro, and the Japanese yen, thereby essentially creating a supranational currency independent of national and international regulatory authorities. The creation of the currency raised concerns among the G7 and G20, primarily regarding the risks associated with the financial stability of the system. Although the Libra 1.0 concept was revised to Libra 2.0 and later renamed to the Diem project, financial regulators strongly opposed it, and the project was terminated in 2023 (Read et al., 2020; Giudici et al., 2022)

Corporate currencies are primarily intended for transfers between businesses and leverage the speed and efficiency of public blockchains while maintaining control and enforcing restrictions. Pre-approved access ensures network legitimacy for participants. Examples of private corporate currencies include Signet and JPM Coin. In addition, retailers such as Walmart, Amazon, and Rakuten have announced plans to develop corporate currencies for payments within their networks. Retail banks could also issue corporate coins to replace fiat currencies in debit or credit cards. However, widespread adoption of corporate currencies could lead to confusion, as it would make it difficult for users to discern the relative value of different options.

5. Future of money: CBDC?

As a natural development in the context of the digital economy, there is a gradual debate and subsequent implementation of concepts in the area of digital money issuance by central banks for general use. On the other hand, commercial banks have had access to digital forms of central bank money in the wholesale payment system for several decades. Debates on CBDCs for ordinary users have gained momentum in recent years, with cryptocurrencies and stablecoins acting as catalysts for these debates and forcing central banks to take a more proactive approach to digital currencies. Given the different economic characteristics of individual countries and their varying needs, there are a number of definitions and approaches to central bank digital currency, and there is no single universally accepted definition (Horváth, 2023). An overview of selected definitions is shown in table 2.

Table 2 » *Definition of CBDC*

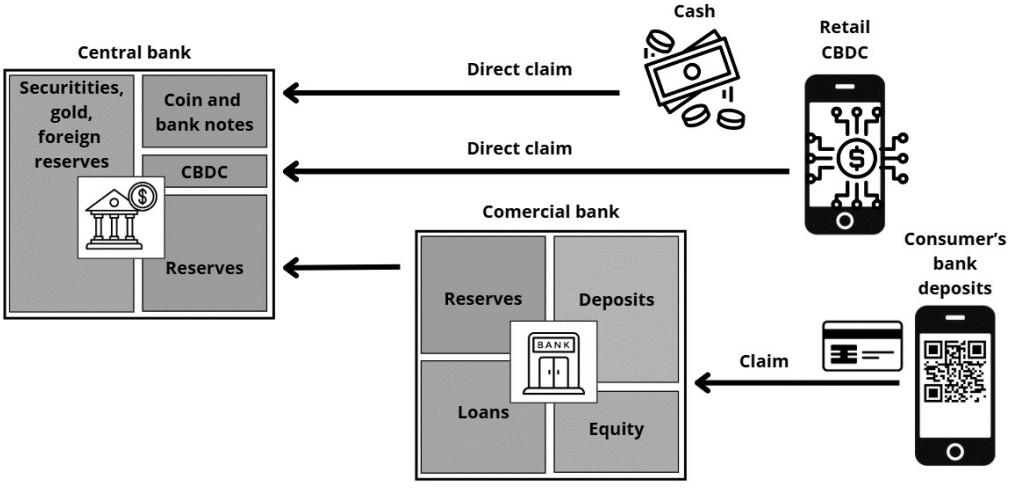
Authors	Definition
Mu & Mu (2024)	A CBDC can be been as a special type of digital money, backed by the sovereign. In this way, a CBDC is a digital instrument, denominated in the national unit of account, that is a direct liability of the central bank.
Náñez Alonso et al. (2021)	A CBDC is an electronic variant of cash issued by a central bank, which combines cryptography and digital ledger technology to offer this digital money. It is therefore a central bank liability, which can:
EDPS (2025)	-Emulate the characteristics of cash (if held by the public).
Bjerg (2017)	-Serve as a central bank reserve (if held only by banks and other financial intermediaries that have access to the payment system).
Agur et al. (2022)	Central Bank Digital Currency (CBDC) is a new form of

Authors	Definition
	money that exists only in digital form. Instead of printing money, the central bank issues widely accessible digital coins so that digital transactions and transfers become simple.
Mu & Mu (2024)	CBDC is electronic, universally accessible, central bank issued money.

Source: own processing

For this article, CBDCs can generally be understood as a digital form of money denominated in national currency and representing a direct liability of the central bank to its holders. These currencies can serve both wholesale and retail purposes and offer a wide range of uses in payment systems. CBDCs can be designed based on an accounting model that allows user identification or a token model that ensures transaction anonymity. In terms of technological solutions, CBDCs can be implemented either through DLT or using conventional technological infrastructure. This variability allows for flexible adaptation to the different needs and preferences of individual central banks. Figure 2 shows a monetary system with a retail CBDC, where the diagram compares cash and retail CBDCs, which are direct claims on the central bank's balance sheet, and consumer bank deposits, which are claims on commercial banks (which in turn hold reserves at the central bank).

Figure 2 » *Monetary system with a retail CBDC*

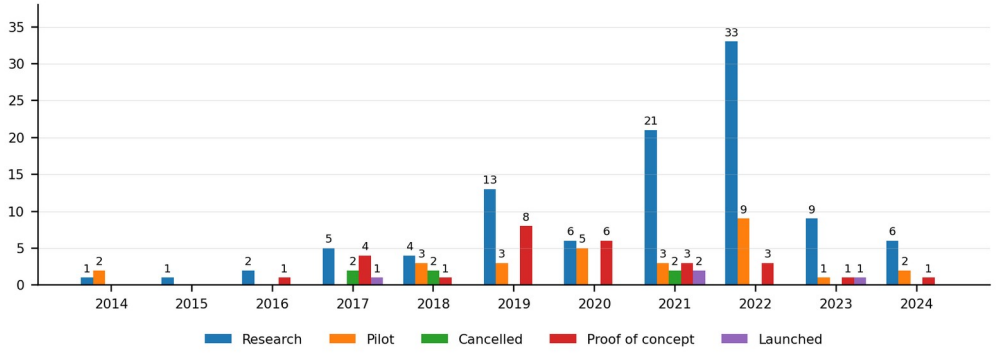


Source: own processing based on Panwar et al. (2022)

Several countries are researching and introducing their versions of CBDCs, with updates and news in this area coming from various sources, and the field is very turbulent. It is difficult for both experts and the general public to keep track of the current status and historical development of CBDCs, which is why specialized portals are being created to track individual CBDCs (such as www.cbdctracker.org, https://cbdctracker.hrf.org/home, https://www.atlanticcouncil.org/cbdctracker/, and others). For the upcoming figure 3, we use data from CBDC Tracker, which collects

information from several sources and presents it in a structured manner. The project also aims to popularize the idea of CBDC and take another step towards the future of money. CBDC Tracker not only shows the current state of digital currencies in different countries but also provides a historical overview of how this process has evolved in the past. The data used by the project is continuously updated. As can be seen from the graph, most CBDCs are in the research phase, with approximately 101 CBDC projects, 28 proof of concept (PoC) and pilot projects, and 6 projects terminated. Only 4 CBDCs have been launched worldwide: JAM-DEX, Sand Dollar, ZiG, and e-Naira.

Figure 3 » *CBDC status in the world*



Source: own processing based on CBDC Tracker. (2024).

5.1 CBDC in European Union countries: Digital Euro

In Europe, we will focus on EU member states, as they are a key and significant part of Europe in terms of population, area, and, above all, economic size. The EU currently has 27 members, 20 of which use the euro as their common currency. The international position of the euro is stagnating, with its share as a reserve currency remaining more or less the same as when the EMU was launched in 1999. The use of the euro in cross-border trade outside the euro area may come under pressure as China and other countries seek digital versions of their currencies that can also be used in cross-border trade without having to go through other systems and central banks. Since strategic autonomy also requires monetary autonomy, Europe needs an independent cross-border payment infrastructure – the response to this challenge should be the introduction of a wholesale version of the digital euro as soon as possible (Boonstra, 2022). Table 3 provides an overview of the current status of CBDCs in individual EU countries.

Table 3 » *Definition of CBDC*

Country	Name of CBDC	Announcement Year	Status	Retail / Wholesale	DLT / non-DLT	Euro
Austria	Delphi	2021	Research	W	DLT	YES
Belgium	-	-	-	-	-	YES
Bulgaria	-	-	-	-	-	NO
Croatia	-	-	-	-	-	YES
Cyprus	-	-	-	-	-	YES

Country	Name of CBDC	Announcement Year	Status	Retail / Wholesale	DLT / non-DLT	Euro
Czechia	Digitální koruna	2021	Research	-	-	NO
Denmark	-	-	-	-	-	NO
Estonia	-	-	-	-	-	YES
Finland	-	-	-	-	-	YES
France	Project Venus	2022	Pilot	W	DLT	YES
France	Project Mariana	2022	Research	W	DLT	YES
France	French Wholesale CBDC	2021	Pilot	W	DLT	YES
France	Project Prosperus	2021	Pilot	W	DLT	YES
France	Jura	2021	Research	W	DLT	YES
Germany	Trigger Solution	2023	Pilot	W	Non-DLT	YES
Greece	-	-	-	-	-	YES
Hungary	Hungary CBDC	2020	Pilot	R	-	NO
Ireland	-	-	-	-	-	YES
Italy	TIPS Hash-Link	2024	Pilot	W	Non-DLT	YES
Latvia	-	-	-	-	-	YES
Lithuania	-	-	-	-	-	YES
Luxembourg	Project Venus	2022	Pilot	W	DLT	YES
Malta	-	-	-	-	-	YES
Netherlands	-	-	-	-	-	YES
Poland	Digital zloty	2017	Reserach	R	-	NO
Portugal	-	-	-	-	-	YES
Romania	-	-	-	-	-	NO
Slovakia	-	-	-	-	-	YES
Slovenia	-	-	-	-	-	YES
Spain	Spanish Wholesale CBDC	2022	Research	W	DLT	YES
Sweden	e-krona	2017	PoC	R	DLT	NO
Sweden	Project Icebreaker	2022	Research	R	-	NO

Source: own processing

Several key conclusions regarding CBDCs in European countries can be drawn from the table above. First, there is a high level of involvement by euro area countries through the creation of a digital alternative to cash within the single currency area – the Digital Euro. France and Germany play a significant role here, standing out in terms of the number and scope of active projects, confirming their position as leaders in digital currency innovation.

Another observable trend is the prevailing focus on wholesale digital currency models, while projects focused on retail use are rarer and more experimental. In terms of technology, DLT is predominantly used, although some countries (e.g., Germany and Italy) are also exploring alternative solutions without DLT, reflecting diverse approaches to technical architecture. Countries outside the euro area, such as the Czech Republic, Poland, and Sweden, show a lower degree of coordination, and their projects generally remain in the research phase. Furthermore, a number of smaller EU countries have not yet announced any specific CBDC initiatives. This passivity may be due to expectations of a supranational solution at the ECB level in the form of a digital euro.

Overall, it can be said that the European area is gradually moving from theoretical considerations to practical testing of various CBDC options. The diversity of technological approaches and institutional strategies will require future standardization and interoperability, while the advanced

stage of some projects indicates that the introduction of CBDCs may become a reality within a few years.

Like most other CBDCs, the digital euro aims to offer a safe, efficient, and trustworthy alternative for digital payments in the digital age. The introduction of the digital euro gained momentum after the idea of a CBDC for the euro area was publicly presented in 2020, and the ECB launched its research project on the digital euro in 2021, which aims to make central bank money available to the public in digital form. The next phase, which began on November 1, 2023, is a two-year preparatory phase that is currently laying the foundations for the potential issuance of a digital euro (ECB, 2024a).

The ECB is interested in a digital euro for three reasons. First, the digitalization process means both the emergence of private currencies such as Bitcoin and a reduction in the use of cash. Private currencies challenge the role of national currencies and can be a threat to financial and monetary stability. At the same time, reduced cash use can help to remove some mistrust in the financial system. Second, although the euro area has both a sophisticated financial system and advanced payment systems, most payment services are still provided by non-European companies, which poses a risk to the EU's strategic autonomy. Finally, it is always necessary to be prepared for technologies that are new today but will become mainstream in the future and help to further improve payments (Demertzis & Martins, 2023).

Following discussions in 2024, the ECB will systematically address competition, synergies, and sustainable business models for payment service providers in the context of the introduction of the digital euro at its Euro Retail Payments Board meetings in 2025. The main objective of these discussions is to identify the potential benefits of a digital euro, as well as to mitigate the related risks and unintended consequences. The discussions will be supported by internal analytical input and structured in such a way as to take into account a broad range of market views. In parallel, the ECB plans to complete the tender procedure for the selection of providers for the digital euro platform, including the assessment of external technical components offered by private suppliers and internal solutions proposed by the national central banks of the Euro system. Active communication with the public remains an important element of the ECB's strategy, with the aim of increasing public awareness and confidence in the future form of digital currency (ECB, 2024).

The ECB's April report provides an update on the development of the digital euro, focusing on the development of a digital euro design that aims to harmonize payment rules across the euro area. The Rulebook Development Group is focusing on developing technical and functional specifications for payment service providers, with an emphasis on interoperability, cybersecurity, user protection, and user-friendliness. The standards being developed, such as the single account identifier (DEAN) and dispute resolution rules, are designed with low latency, operational reliability, and compatibility with European legislation (including DORA and PSD2) in mind. At the same time, the report reflects openness to adjustments in line with the legal framework for the digital euro, underscoring the flexibility and readiness of the system for legislative and technological developments (ECB, 2025b).

6. Discussion

The concept of CBDC brings with it several risks and challenges, and its introduction is accompanied by a wide range

of discussions. The discussion will first focus on macroeconomic aspects, such as possible forms of monetary and financial architecture transformation, institutional models of CBDC, and the use of CBDC as a monetary policy and regulatory tool. We will then discuss microeconomic aspects, such as privacy, cybersecurity, financial inclusion, digital inequality, and environmental aspects of CBDC use.

The introduction of CBDCs represents a major turning point in monetary sovereignty, the transmission mechanism of monetary policy, and the structural organization of financial markets. In the European context, the digital euro appears to be a potential tool for strengthening the resilience of the payment infrastructure and reducing dependence on global technology giants that dominate the payment platform landscape (Auer & Böhme, 2020; Bindseil, 2020). CBDCs offer a number of systemic benefits, including lower transaction costs (Mancini-Griffoli et al., 2018), more precise management of the money supply, and more effective support for inflation targeting. Some studies emphasize that CBDCs can strengthen confidence in the monetary system, especially in times of financial turmoil (Berentsen & Schär, 2018), while others point to the possibility of unintentionally weakening the role of commercial banks (Bear, 2021). In the European debate, there is a growing argument that CBDCs could serve as a tool of economic and political influence, with a digital euro being one of the instruments for ensuring strategic autonomy and limiting the monetary extraterritoriality of the US dollar (Brunnermeier, James & Landau, 2021). At the same time, however, questions remain about interoperability, standardization, and cross-border use (Auer et al., 2021), especially in the context of differences in digital readiness among member states.

In terms of institutional design, two fundamental models can be distinguished: the direct model and the two-tier model. While the direct model assumes that the central bank will operate accounts directly for individuals, the two-tier model retains the intermediary role of commercial banks (Kiff et al., 2020; Bindseil, 2020). In its discussion papers, the ECB tends to favor the two-tier model (ECB, 2020), which would minimize the risks of a bank run and the central bank being overburdened with unusual functions (Fernández-Villaverde et al., 2021). This is where the views of Keynesian economists, who prefer a stronger direct fiscal role for the state, diverge from those of monetarists, for whom excessive central bank power over microeconomic transactions would constitute an erosive intervention in the market (Tobin, 1987). Critics also point to the problematic transformation of the institutional identity of central banks and the risk of undermining their credibility (Niepelt, 2020).

CBDC could significantly change the dynamics of monetary policy, especially in periods of zero interest rates. The possibility of introducing negative interest rates on digital cash could theoretically expand the scope for unconventional instruments that have so far been limited by the physical existence of cash (Agarwal & Kimball, 2015). Examples include “helicopter money“ or expiring money with built-in consumption incentives (Davoodalhosseini, 2022). However, these proposals face considerable institutional and political resistance, mainly due to the controversial nature of their direct impact on individual household finances and interference in intertemporal decisions (Goodhart & Pradhan, 2020). Critics point to the possible blurring of the boundaries between fiscal and monetary policy, which could put pressure on central bank independence (Buiter, 2020).

CBDC can change the paradigms of privacy protection and citizens' trust in the

state. Digital transactions are inherently traceable, raising fundamental legal, ethical, and philosophical questions (Didenko et al., 2020). Regulators find themselves on a spectrum between "total traceability" (e.g., in the case of the digital yuan) and "anonymous digital cash" (e.g., eCash proposals), but there are few workable compromises between these two extremes. Empirical literature points out that in democratic regimes, concerns about digital control may weaken the adoption of CBDCs (Bai et al., 2022), while in authoritarian regimes, CBDCs are perceived as a tool of political surveillance. Therefore, the issue of trust and democratic legitimacy in the European context must be at the forefront of system design.

CBDCs are often presented as a tool for expanding financial inclusion, but available data show mixed results. For example, as stated in the methodological handbook on financial inclusion in the context of CBDCs (UNDP, 2025), without complementary policies on digital literacy and access to technology, CBDCs may, in some cases, exacerbate digital inequalities. Similarly, a study by Sahay et al. (2015) emphasizes that the effectiveness of CBDCs in this area is conditioned by broader social factors. Environmental impacts cannot be ignored either. If CBDCs were to use energy-intensive consensus mechanisms (e.g., proof-of-work), they would conflict with the European Green Deal and ESG objectives (Mooij, 2022; Blandin et al., 2020). It is therefore important to emphasize efficiency, renewable resources, and institutional energy standards when designing the technical architecture of CBDCs.

CBDCs are becoming not only an economic but also a geopolitical tool. The mCBDC Bridge project (HKMA-BIS) and Project Dunbar (Australia, Malaysia, Singapore, South Africa) point the way towards cross-border interoperability and the strengthening of regional sovereignty. The European Union should actively engage in this debate to avoid the "monetary marginalization" of the euro in the digital space, as warned by some forecasts (Panetta, 2022).

7. Conclusion

The digitization of the monetary system represents a fundamental shift in civilization, one of the highlights of which is the advent of central bank digital currencies (CBDCs). In the European context, this transformation can be understood as a multi-level process involving technological innovation, institutional adaptation, geopolitical ambitions, and social cohesion issues. This article aimed to comprehensively map the development of the CBDC concept in the European environment, analyze its potential benefits and risks, and identify the main factors that will determine the success of its implementation.

The analysis shows that CBDCs are not just a technological innovation, but above all a tool that can fundamentally transform the structure of the monetary and financial system. The digital euro, as a concrete form of a European CBDC, is currently at an advanced stage of preparation, with the debate shifting from technical feasibility to strategic issues of functioning within the existing Eurosystem architecture. The ECB's motivation for introducing a digital euro stems primarily from the need to respond to the decline in cash use, reduce dependence on global technology companies in the field of payments, strengthen the EU's monetary sovereignty, and prepare for the arrival of new forms of digital competition, such as stablecoins and corporate currencies.

From a technological perspective, there is a clear diversity of approaches, both between countries and within the ECB itself. While most European initiatives are exploring the

use of DLTs, solutions based on conventional database structures are also being developed in parallel. The different approaches reflect not only technological preferences but also varying degrees of trust in centralized versus decentralized systems, including issues of scalability, cybersecurity, and energy efficiency.

The institutional model chosen is a very important factor for the future of CBDCs. The debate between a direct and a two-tier model highlights a fundamental dilemma: while the direct model can strengthen the state's control over the monetary base and improve the transmission of monetary policy, the two-tier model preserves the important role of commercial banks and reduces the risk of financial stability being disrupted. The ECB's approach, which currently leans towards a two-tier model, appears to be a pragmatic compromise between innovation and system continuity.

CBDC also opens up new possibilities for monetary policy. In theory, digital currency would allow for a more effective response to cyclical fluctuations through instruments such as negative interest rates on digital currency holdings or so-called "expiring money." In practice, however, these instruments face institutional and political limits, including concerns about undermining consumer choice and weakening trust in monetary authority. Discussions on these tools, therefore, remain largely theoretical for the time being.

At the microeconomic level, it appears that the success of CBDCs will depend on the ability of regulatory authorities to balance three often conflicting requirements: ensuring privacy, enhancing financial inclusion, and achieving technological security. While the anonymity of cash is crucial for many users, the digital nature of CBDCs brings with it the inherent traceability of transactions. It is therefore essential to design an architecture that allows for at least some degree of pseudonymity or strong privacy protection without compromising the integrity of the system.

With regard to inclusion, the article points out that CBDCs may not automatically solve the problem of financial exclusion. Empirical findings show that without complementary measures—such as increasing digital literacy, developing infrastructure, or promoting access to technology—CBDCs may in some cases exacerbate inequalities. It will therefore be essential to combine the technological introduction of CBDCs with inclusive public policies, both at the national level and at the EU level as a whole.

Last but not least, we must not overlook the environmental dimension. At a time of growing climate challenges, the introduction of energy-intensive systems, such as those based on PoW, is difficult to justify. A European CBDC will have to be consistent with the European Green Deal, European ESG standards, and national climate targets. This places high demands on technological architecture and the process of selecting external suppliers, as is evident from the preparatory phase of the digital euro project to date.

From a geopolitical perspective, CBDCs are also taking on new significance. The digital euro project can be seen as part of broader European efforts to achieve strategic autonomy. In the context of growing competition from digital currencies, in particular the digital yuan and proposals for dollar-pegged stablecoins, the introduction of a digital euro could strengthen the EU's role in the global monetary system while limiting the influence of non-EU players on European payment flows.

The findings indicate that several recommendations for public policy can be formulated. The introduction of the digital euro should proceed in phases with clearly

defined milestones – from setting the rules for the functioning of the system, through the implementation of pilot projects and legislative anchoring, to the actual launch. At the same time, an information and education campaign should be conducted to increase citizens' confidence in the new system, as trust is one of the key prerequisites for successful implementation. Another recommendation is that interoperability should be based on open, well-documented standards that ensure smooth integration with existing wallets and terminals. We assume that a transparent and predictable cost framework is particularly important for small and medium-sized enterprises.

Recommendations in the area of social trust mainly concern education: the principles of how CBDCs work should be clearly explained to society, with a particular focus on the younger generation as part of their education on how to use these payment methods. Seniors and digitally vulnerable people are also an important group, for whom a support and education system should be created so that the new system is beneficial to them and its non-use does not lead to discrimination. In addition to education, it is essential from the citizens' point of view that the system is based on privacy protection and a high degree of transparency. The system should minimize data collection, provide adequate pseudonymity for low-value payments, and enforce strict, auditable access regimes for selected authorities, for example, in connection with criminal proceedings. Regular public reports (security, operability, incidents), clear management of rule changes, and meaningful user participation (consultation and testing of the user environment with citizens and merchants) are essential. Prepared crisis communication scenarios for outages, phishing, and misinformation will help prevent an increase in mistrust at critical moments.

Based on the above findings, several priorities for further research and development can be formulated. First, deeper empirical work is needed on the impact of CBDCs on consumer and firm behavior (cash substitution, savings patterns, willingness to adopt). Second, models of the interaction between CBDCs and monetary policy—combining standard instruments with digital features—should be developed to assess transmission and stability. Third, a detailed legal analysis is required (data protection, interoperability, liability, cross-border conflicts of law). Fourth, stress-testing financial stability under CBDC scenarios (deposit shifts, bank funding, credit supply) is essential. Fifth, environmental assessments should compare technological options under standardized ESG methodologies. Finally, participatory research on public trust—combining surveys and qualitative studies—should track attitudes toward privacy, state capacity, and digital readiness across social groups.

In conclusion, CBDCs are not merely a technological phenomenon but a complex socio-economic project whose impact will be felt across institutions, markets, and the daily lives of citizens. The success of the European digital currency will depend not only on the technical mastery of its implementation but above all on trust, transparency, and the ability to combine innovation with the protection of the public interest.

Acknowledgment

This paper was supported by the project SV22-FVL-K102-NEČ "The potential of blockchain technology for the development of the public sector in the Czech Republic with a focus on defence".

REFERENCES

AGARWAL, R. & KIMBALL, M. (2015). Breaking Through the Zero Lower Bound. In IMF Working Paper WP/15/224. Washington, D.C.: International Monetary Fund. ISBN: 9781513567327

AGUR, I., ARI, A. & DELL'ARICCIA, G. (2022). Designing central bank digital currencies. Online. Journal of Monetary Economics. Roč. 125, pp. 62-79. ISSN 03043932. https://doi.org/10.1016/j.jmoneco.2021.05.002.

ANTAL, C.; CIOARA, T.; ANGHEL, I.; ANTAL, M. & SALOMIE, I. (2021). Distributed Ledger Technology Review and Decentralized Applications Development Guidelines. Online. Future Internet. Roč. 13, č. 3. ISSN 1999-5903. https://doi.org/10.3390/fi13030062.

ARNER, D. W., BARBERIS, J., & BUCLEY, R. P. (2017). Fintech and regtech: Impact on regulators and banks. Journal of Banking Regulation, 19(4), 1–14. https://doi.org/10.1016/j.jeconbus.2018.07.003

ASOKAN, N., JANSON, P. A., STEINER, M., & WAIDNER, M. (1997). The state of the art in electronic payment systems. Computer. 30(9), 28-35. https://doi.org/ 10.1109/2.612244.

AUER, R. a BÖHME, R. (2020). The technology of retail central bank digital currency. In BIS Quarterly Review. Basel: Bank for International Settlements.

AUER, R., FROST, J., LAMMERS, J., LANE, P. & WEINSTEIN, A. (2021). CBDCs beyond borders: Results from a survey of central banks. In BIS Papers No. 116. Basel: Bank for International Settlements.

BAER, G. (2021). Central Bank Digital Currencies: Costs, Benefits and Major Implications for the U.S. Economic System. Washington, D.C.: Bank Policy Institute.

BAI H., et al. (2022). Adoption of central bank digital currencies: Initial evidence from China. Pacific-Basin Finance Journal, 72. doi.org/10.1016/j.jcorpfin.2025.102735.

BAUR, D. G., & DIMPFL, T. (2021). The volatility of Bitcoin and its role as a medium of exchange and a store of value. Empirical Economics, 61(5), 2663-2683.

BERENTSEN, A. & SCHÄR, F. (2018). The case for central bank electronic money and the non-case for central bank cryptocurrencies. In Federal Reserve Bank of St. Louis Review, 100(2), pp. 97–106. St. Louis: Federal Reserve Bank. https://doi.org/10.20955/r.2018.97-106.

BETTÍN-DÍAZ, R., ROJAS, A. E., & MEJÍA-MONCAYO, C. (2018). Methodological Approach to the Definition of a Blockchain System for the Food Industry Supply Chain Traceability. Online. In: Computational Science and Its Applications – ICCSA 2018. Lecture Notes in Computer Science. Cham: Springer International Publishing, p. 19-33. ISBN 978-3-319-95164-5. https://doi.org/10.1007/978-3-319-95165-2_2.

BIGINI, G., FRESCHI, V., & LATTANZI, E. (2020). A Review on Blockchain for the Internet of Medical Things: Definitions, Challenges, Applications, and Vision. Online. Future Internet. Roč. 12, č. 12. ISSN 1999-5903. https://doi.org/10.3390/fi12120208.

BINDSEIL, U. (2020). Tiered CBDC and the financial system. In ECB Working Paper Series No. 2351. Frankfurt am Main: European Central Bank. http://dx.doi.org/10.2139/ssrn.3513422

BJERG, O. (2017). Designing New Money - The Policy Trilemma of Central Bank Digital Currency. Online. SSRN Electronic Journal. ISSN 1556-5068. https://doi.org/10.2139/ssrn.2985381.

BLANDIN, A., et al. (2022). Global Cryptoasset Benchmarking Study. In Cambridge Centre for Alternative Finance: University of Cambridge.

BÖHME, R., CHRISTIN, N., EDELMAN, B., & MOORE, T. (2015). Bitcoin: Economics, technology, and governance. Journal of Economic Perspectives, 29(2), 213–238. https://doi.org/10.1257/jep.29.2.213.

BOONSTRA, W. (2022). CBDC and the international position of the euro. SUERF Policy Notes, 269.

BROWN, S. D. (2016). Cryptocurrency and criminality: The Bitcoin opportunity. The Police Journal, 89(4), 327-339. https://doi.org/10.1177/0032258X16658927.

BRUNNERMEIER, M., JAMES, H. & LANDAU, J. P. (2021). The Digitalization of Money. In Journal of Economic Literature, 59(1), pp. 35–89. Nashville: American Economic Association.

BUITER, W. (2020). Central Banks as Fiscal Players. Cambridge University Press. ISBN 9781108904292.

CATALINI, C., DE GORTARI, A., & SHAH, N. (2022). Some simple economics of stablecoins. Annual Review of Financial Economics, 14, 117-135. https://doi.org/10.1146/annurev-financial-111621-101151.

CBDC Tracker. (2024). Today's Central Bank Digital Currencies Status. Available at: https://cbdctracker.org/. [accessed 2024-12-30].

DAVOODALHOSSEINI, S. M. (2022). Central bank digital currency and monetary policy. In Journal of Economic Dynamics and Control, Vol. 143. Amsterdam. https://doi.org/10.1016/j.jedc.2021.104150.

DEMERTZIS, M. & MARTINS, C. (2023). Progress with the Digital Euro. Online. Intereconomics. 2023-07-01, roč. 58, č. 4, pp. 195-200. ISSN 1613-964X. https://doi.org/10.2478/ie-2023-0041.

DIDENKO, A. et all. (2020). After Libra, Digital Yuan and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems. European Banking Institute Working Paper Series 65/2020, University of Hong Kong Faculty of Law Research Paper No. 2020/036, UNSW Law Research Paper No. 20-59, http://dx.doi.org/10.2139/ssrn.3622311.

DUTTA, P., CHOI, T.-M.; SOMANI, S. & BUTALA, R. (2020). Blockchain technology in supply chain operations: Applications, challenges and research opportunities. Online. Transportation Research Part E: Logistics and Transportation Review. Roč. 142. ISSN 13665545. https://doi.org/10.1016/j.tre.2020.102067.

ECB. (2020). Report on a digital euro. Frankfurt am Main: ECB. https://www.ecb.europa.eu/pub/pdf/other/Report_on_a_digital_euro~4d7268b458.en.pdf. [accessed 2025-01-20].

ECB. (2023). Progress on the investigation phase of a digital euro – third report. Available at: https://www.ecb.europa.eu/euro/digital_euro/timeline/profuse/shared/pdf/ ecb.degov230424_progress.en.pdf. [accessed 2024-11-20].

ECB. (2024). Progress on the preparation phase of a digital euro - Second progress report. Available at: https://www.ecb.europa.eu/euro/digital_euro/progress/ html/ecb.deprp202412.en.html. [accessed 2025-02-20].

ECB. (2025a). Timeline and progress on a digital euro. Available at: https://www.ecb.europa.eu/euro/digital_euro/progress/html/index.en.html. [accessed 2025-01-27].

ECB. (2025b). Update on the work of the digital euro scheme's Rulebook Development Group. Available at: https://www.ecb.europa.eu/euro/digital_euro/timeline/profuse/ shared/pdf/ecb.derdgp250409_RDG_progress_report_April_25.en.pdf. [accessed 2025-06-10].

EDPS. (2025). Central Bank Digital Currency. Available at: https://www.edps.europa.eu/press-publications/publications/techsonar/central-bank-digital-currency_en. [accessed 2025-03-17].

FERNÁNDEZ-VILLAVERDE, J., SANCHES, D., SCHILLING, L. a UHLIG, H. (2021). Central Bank Digital Currency: Central Banking for All? In American Economic Association Papers and Proceedings, 111, pp. 574–578. Nashville: AEA. https://doi.org/10.1016/j.red.2020.12.004.

GARAY, J., KIAYIAS, A., & LEONARDOS, N. (2024). The Bitcoin Backbone Protocol: Analysis and Applications. Online. Journal of the ACM. 2024-08-31, roč. 71, č. 4, pp. 1-49. ISSN 0004-5411. https://doi.org/10.1145/3653445.

GIUDICI, P., LEACH, T., & PAGNOTTONI, P. (2022). Libra or Librae? Basket based stablecoins to mitigate foreign exchange volatility spillovers. Finance Research Letters, 44, 102054.

GOODHART, C. a PRADHAN, M. (2020). The Great Demographic Reversal: Ageing Societies, Waning Inequality, and an Inflation Revival. London: Palgrave Macmillan. ISBN: 9783030426569.

HORVÁTH, D. (2023). Money in the digital age: Exploring the potential of central bank digital currency with a focus on social adaptation and education. Sustainable Futures, 6. https://doi.org/10.1016/j.sftr.2023.100136

KIFF, et al. (2020). A Survey of Research on Retail Central Bank Digital Currency. IMF Working Paper No. 20/104. Washington, D.C.: International Monetary Fund.

LAFOURCADE, P. & LOMBARD-PLATET, M. (2020). About blockchain interoperability. Online. Information Processing Letters. Roč. 161. ISSN 00200190. https://doi.org/10.1016/j.ipl.2020.105976.

Law, L., SABETT, S., & SOLINAS, J. (1996). How to make a mint: the cryptography of anonymous electronic cash. Am. UL Rev., 46, 1131.

LIN, I., C. & LIAO T.C. (2017). A survey of blockchain security issues and challenges. International Journal of Network Security. 2017;19(5):653–659.

LOHMER, J. & LASCH, R. (2020). Blockchain in operations management and manufacturing: Potential and barriers. Online. Computers & Industrial Engineering. Roč. 149. ISSN 03608352. https://doi.org/10.1016/j.cie.2020.106789.

MANCINI-GRIFFOLI, et al. (2018). Casting Light on Central Bank Digital Currency. In IMF Staff Discussion Note No. 18/08. Washington, D.C.: International Monetary Fund.

MARPLE, T. (2021). Bigger than Bitcoin: A theoretical typology and research agenda for digital currencies. Business and Politics, 23(4), 439-455.

MOOIJ A.,A.,M., (2022) The Digital Euro and Energy Considerations: Can the ECB Introduce the Digital Euro Considering the Potential Energy Requirements? German Law Journal. ;23(9):1246-1265. https://doi.org/10.1017/glj.2022.78.

MU, Y. and MU, A. (2022). CBDC: Concepts, Benefits, Risks, Design, and Implications. Online. SSRN Electronic Journal. ISSN 1556-5068. https://doi.org/10.2139/ ssrn.4234876.

NAMBISAN, S., WRIGHT, M., & FELDMAN, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. Research Policy, 48(8), 103773. https://doi.org/10.1016/j.respol.2019.03.018.

NÁÑEZ ALONSO, S., L., JORGE-VAZQUEZ, J. & REIER FORRADELLAS, R., F. (2021). Central Banks Digital Currency: Detection of Optimal Countries for the Implementation of a CBDC and the Implication for Payment Industry Open Innovation. Online. Journal of Open Innovation: Technology, Market, and Complexity. Roč. 7, č. 1. ISSN 21998531. https://doi.org/10.3390/joitmc7010072.

NIEPELT, D. (2020). Monetary Policy with Reserves and Central Bank Digital Currency. In CEPR Discussion Paper No. DP15457. https://ssrn.com/abstract=3737590

PANETTA, F. (2022). The digital euro and the evolution of the financial system. In ECB Blog [online]. Frankfurt am Main: ECB. Available at: https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220615~0b859eb8bc.en.html
PANWAR, A., BHATNAGAR, V., KHARI, M., SALEHI, A. W., GUPTA, G., et al. (2022). A Blockchain Framework to Secure Personal Health Record (PHR) in IBM Cloud-Based Data Lake. Online. Computational Intelligence and Neuroscience. 2022-4-12, roč. 2022, pp. 1-19. ISSN 1687-5273. https://doi.org/10.1155/2022/3045107.
READ, O. & SCHÄFER, S. (2020). Libra Project: Regulators Act on Global Stablecoins. Intereconomics 55, 392–398. https://doi.org/10.1007/s10272-020-0936-7
SAHAY, R., et al. (2015). Financial Inclusion: Can It Meet Multiple Macroeconomic Goals? In IMF Staff Discussion Note No. 17/15. Washington, D.C.: International Monetary Fund.
SWAN, M. (2015). Blockchain: Blueprint for a new economy. O'Reilly Media.
TABATABAEI, M. H., VITENBERG, R., & VEERARAGAVAN, N. R. (2023). Understanding blockchain: Definitions, architecture, design, and system comparison. Computer Science Review, 50, 100575. https://doi.org/10.48550/arXiv.2207.02264.
TAPSCOTT, D., & TAPSCOTT, A. (2016). Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world. Penguin.
TOBIN, J. (1987). The Case for Preserving Regulatory Distinctions. In Federal Reserve Bank of Kansas City, Proceedings of the Symposium on Banking Structure and Competition. Kansas City: Federal Reserve Bank. https://doi.org/10.1080/ 05775132.1987.11471196
UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP). (2022). Driving Financial Inclusion through Central Bank Digital Currencies. New York: United Nations Development Programme.
ZETZSCGE, D. A., BUCKLEY, R. P., ARNER, D. W., & BARBERIS, J. N. (2020). Decentralized finance (DeFi). Journal of Financial Regulation, 6(2), 172–203. https://doi.org/10.1093/jfr/fjaa010.
ZHANG, S., & LEE, J. H. (2020). Analysis of the main consensus protocols of blockchain. ICT express, 6(2), 93-97.

The Future of Money in Europe: Central Bank Digital Currencies?

ABSTRACT

The article examines the historical development, technological foundations, and institutional implications of central bank digital currencies (CBDCs), with a particular focus on developments within the European Union. Bitcoin and other cryptocurrencies have challenged aspects of traditional monetary systems and accelerated interest in state-backed digital alternatives. In the European context, this transformation can be understood as a multi-level process involving technological innovation, institutional adaptation, geopolitical ambition, and social cohesion. CBDCs are not merely a technological innovation but represent a powerful tool capable of fundamentally transforming the structure of the monetary and financial system. From a technological perspective, there is a clear diversity of approaches both among countries and within the European Central Bank (ECB). While most European initiatives are exploring the use of distributed ledger technologies (DLT), alternative solutions based on conventional database structures are also being developed. These varied approaches reflect not only technological preferences but also differing levels of trust in centralized versus decentralized systems, and they raise key questions regarding scalability, cybersecurity, and energy efficiency. CBDCs also present new possibilities for monetary policy. In theory, digital currencies could allow for more effective responses to cyclical fluctuations through instruments such as negative interest rates. From a geopolitical standpoint, CBDCs are gaining significance, with the digital euro project forming part of broader efforts by the European Union to achieve strategic autonomy.

KEYWORDS

Blockchain, Central Bank Digital Currency, Digital Euro, Distributed Ledger Technology, Monetary Policy.

JEL CLASSIFICATION

E53; F33; G38; K24