

ФІНАНСИ, БАНКІВСЬКА СПРАВА ТА СТРАХУВАННЯ<https://doi.org/10.26565/2311-2379-2026-110-08>

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CBDC-IMPLEMENTATION – THE TRUE PRICE

The manuscript examines the economic, institutional, and societal implications of implementing central bank digital currencies (CBDCs), with a particular focus on the European context. The study critically analyses the motivations behind the introduction of national digital currencies and evaluates whether CBDCs are capable of solving existing problems in payment systems, financial inclusion, and monetary sovereignty. Special attention is paid to the true price of CBDC implementation, which is interpreted not only as direct financial costs but also as indirect economic, social, and political consequences. Using a mixed-method research approach that combines a systematic literature review, comparative analysis of international pilot projects, and assessment of empirical data from central banks and international financial institutions, the paper identifies key risks associated with CBDCs. These include threats to financial stability, increased cyber and operational risks, loss of transaction anonymity, potential erosion of the traditional banking sector, and negative spillovers for innovation ecosystems and labour markets. The study also highlights the specific challenges of implementing CBDCs in a multi-country monetary union, where differences in economic structures, regulatory frameworks, and user behaviour may amplify systemic risks. The findings suggest that, under current technological and regulatory conditions, CBDCs do not offer clear advantages over existing or alternative digital payment solutions, such as private-sector FinTech innovations or stablecoin-based instruments. The manuscript concludes that a premature or forced transition to CBDCs may generate more costs than benefits and recommends a cautious, phased approach that preserves cash circulation, supports private innovation, and prioritises cybersecurity, financial literacy, and human-centric policy design.

Keywords: **CBDC, FinTech, financial security, monetary policy, AI-based start-ups.**JEL Classification: *E52, E58, G21, G28, O33.*

Introduction. The banking sector and the national currency are at the centre of every country's interest and financial security. However, given the complexity and relevance of this area, its close link to users' personal data, people's psychology and the aspect of tradition, transformations in the banking sector and monetary policy are very slow. Progress is inevitable and the banking sector will be no exception. In modern society, more and more calls are being made, both by experts and the public, for a transition to a more digital society and payments. However, not all of them are motivated by an objective need. Another key issue is security – the financial security of the state, each individual user, and, speaking of innovation, the security of alternatives for users and companies, as well as free stable and safe, stimulating environment for the growth of companies and start-ups working on the creation of new digital products, including in the field of FinTech, preventing monopolisation and digital totalitarianism by the state through the use of unjustified technologies and solutions. It is therefore particularly important to properly assess all risks and opportunities before introducing a solution, digital mechanism or innovation.

Although this issue is relevant, there is a need for additional research at the present stage due to the gaps in existing researches and works. The main research gaps this paper addresses is the lack of comprehensive analysis of Central Bank Digital Currency (CBDC) implementation costs and risks in multi-country monetary unions. While previous studies focused on single-country



implementations or theoretical frameworks, this research uniquely examines: the cascading effects of CBDC implementation across interconnected EU economies; the indirect costs of CBDC implementation and caused by this process structural changes in the banking sector; the specific challenges of implementing CBDCs in a diverse monetary union; the impact on financial innovation and start-up ecosystem.

The subject of this study is the EU financial system, as well as user behaviour driven by changes in the financial system, and its feedback effects on the financial system and monetary policy. The purpose of this study is to identify the reasons for the introduction of national digital currencies, as well as to clarify their essence, opportunities, advantages and threats arising from this process, to identify the main opportunities to avoid threats or find an alternative solution.

The main contribution of this research is providing an integrated assessment framework that considers both direct and indirect costs, while offering evidence-based alternatives to CBDC implementation that maintain financial innovation without compromising system stability. The results of this study provide a better understanding of the opportunities and threats, as well as the reasons that drive governments to introduce digital national currencies. The study also analyses the main assumptions that have driven both government and independent experts to develop national digital currencies, their relevance and the extent to which they are justified based on the results of empirical analysis and pilot project results. It contributes to the decision-making process on the directions of development of payment instruments in the EU and worldwide, and the choice of digital technologies that will form their basis.

Literature Review. The academic debate on CBDCs has expanded rapidly over the last decade, focusing on wide range of different aspects as their technological design, monetary policy implications, financial stability, and societal impact.

Early work by S. Ammous (2018) examined cryptocurrencies' monetary functions, concluding that only Bitcoin shows meaningful value-storage potential, while volatility and scalability severely limit everyday use.

Conceptual contributions by R. Auer and R. Böhme (2020; 2021) emphasise the importance of a minimally invasive technological design that preserves the existing two-tier banking system while introducing digital central bank money. Their work has become foundational for understanding how CBDCs may coexist with commercial bank money without triggering excessive disintermediation.

W. Engert and B. S. C. Fung (2017) analysed economic motivations of the usage of CBDCs and found limited efficiency gains over existing systems, particularly regarding interest rate management and crisis response.

Critical assessments of CBDCs have been further developed by U. Bindseil (2022), who revisits earlier arguments in favour of CBDCs and concludes that their transformative potential is often overstated, particularly when compared to the risks to financial stability and privacy. Similarly, M. Chorzempa (2021) questions the strategic narrative of being a 'first mover' in CBDC adoption, arguing that early implementation does not necessarily transform into long-term economic or geopolitical advantages.

Another part of the research focuses on cross-border payments and international monetary spillovers. R. Auer et al. (2021) examine multi-CBDC arrangements and show that, despite their technical promise, such systems introduce new layers of governance complexity and coordination risks. These concerns are echoed by IMF and BIS-affiliated researchers, who emphasize that interoperability and standardisation challenges may offset potential gains in speed and cost reduction.

Finally, a growing part of research addresses societal and behavioural aspects, including privacy, financial inclusion, and user trust. A. Lannquist and B. Tan (2023) and also I. Scher (2020) caution that CBDCs may unintentionally exacerbate exclusion for certain social groups and intensify perceptions of state surveillance, thereby undermining public acceptance. These studies underline that the success of CBDCs depends not only on technical feasibility but also on behavioural responses and institutional trust.

Overall, the literature reveals a clear divide between optimistic policy-oriented narratives and more cautious academic evaluations. While CBDCs are widely recognised as a potential innovation in payment systems, existing research highlights significant uncertainties regarding their net economic benefits, especially in complex, multi-country monetary unions such as the EU. This study builds on and extends this critical strand of the literature by placing particular emphasis on indirect

costs, systemic risks, and long-term structural effects. It also addresses these gaps through an integrated mixed-method framework that quantifies direct and indirect costs in the EU context, evaluates pilot project outcomes, and proposes evidence-based alternatives that preserve innovation and system stability.

Purpose of the research. The purpose of this research is to critically assess the economic, institutional, and societal implications of implementing a CBDC within the EU. Specifically, the study aims to identify the key drivers behind the introduction of national digital currencies, to clarify the economic essence and design logic of CBDCs, and to evaluate their potential advantages and risks in comparison with existing and alternative payment instruments. A further objective is to examine both the direct and indirect costs of CBDC implementation in a multi-country monetary union and to determine whether these costs are justified by the expected benefits. Based on this analysis, the research seeks to explore viable alternatives and policy strategies that could support digital innovation in payments while minimising risks to financial stability, monetary sovereignty, and individual economic freedom.

The methodological and theoretical basis of this study was based on the scientific works of foreign and domestic scientists and financiers, which are limited due to the fact, that CBDCs are new and there is not enough practical material to study, analytical and statistical information on the state of payment instruments, the financial market and the needs of users of financial services, as well as regulations created to regulate the financial services market.

To comprehensively assess the costs and risks associated with CBDC implementation, the study adopted a mixed-method empirical approach that combined quantitative and qualitative analyses. First, a systematic review was conducted using a snowball sampling method, where 60 key academic articles, professional researches, industry reports, and regulatory documents were identified and critically evaluated. Quantitative data were extracted from reliable secondary sources such as central bank reports, international financial institutions (e.g., the IMF, BIS), and reputable statistical databases to measure infrastructure investments, cost trajectories, and potential impacts on liquidity and employment within the banking sector.

The quantitative analysis involved comparative assessments across different jurisdictions and pilot projects. In instances where pilot data were available, cost metrics and performance indicators were compared with theoretical models to validate the underlying assumptions. Qualitative insights were derived from analysis of reports of financial experts and a review of policy documents, which were used to contextualize the empirical findings and provide a balanced view of the benefits and risks of CBDC implementation.

However, the empirical analysis faced several data limitations. As CBDCs remain in the early stages of implementation globally, the available data are largely drawn from pilot studies and theoretical models, which may not fully capture the complexity of a large-scale rollout. Inconsistencies in regulatory frameworks and technological infrastructures across different countries further complicate direct comparisons. Additionally, the scarcity of long-term empirical data introduces uncertainties regarding the scalability and sustainability of the proposed models. Future research should prioritize primary data collection from ongoing pilot projects, which will potentially by then go further in development and provide more comprehensive and concrete, and most importantly measurable, results to refine these initial findings and better capture the dynamic landscape of digital currency implementation and its prospects.

Main research results. The essence of CBDCs. In a world where almost everything is already digital, people imagine financial services differently. For example, according to a study by McKinsey (2020), modern users are demanding more flexible FinTech solutions (also based on artificial intelligence (AI)), around 71% of customers prefer multi-channel interaction and 25% want a fully digital banking experience with remote human support. This has been favoured by the COVID-pandemic and people's changing lifestyles. Also, the large number of migrants from Ukraine coming to the EU with their bank cards and services offered by Ukrainian banks and start-ups, showing the local population, that financial services can be more digital, have a great, albeit not so obvious, influence on the change in people's thinking. This all is fuelling the idea of adopting the digital euro among people. Recently, as the European Parliament has been preparing to vote on the introduction of the digital euro, and even up to this point, more and more statements have been and are being made that it will not only be more convenient, but also a cheaper solution for the EU. The same opinion is shared by A. Martin from BEUC, an umbrella organisation of 45 consumer organisations

across Europe, as, in their opinion, it is not in the interest of the banking industry to develop a digital euro that would be free, would protect people's privacy and could serve as a means of payment anywhere in the EU (Fanta & Bollein, 2024). Such a vision is not uncommon these days. But nothing in reality is free, both literally and figuratively. The situation with national digital currencies is no exception. And the state of CBDC implementation, as well as its results, testifies to this. From April 2021, when CBDC was introduced in only one country (out of 74 interested countries), and until the end of 2022, the number of countries introducing CBDCs gradually increased. It grew fastest between April and December 2021 – from 1 to 10 (out of 96 interested countries), and only in the second half of 2022 their number increased to 11 (out of 112 interested countries). Until June 2023, their number remained unchanged, but then the number of countries that had introduced CBDCs rapidly decreased – to 3 – while the number of interested countries increased to 135 by March 2023 (Atlantic Council 2024). This means that not everything in the existing CBDC-model under modern conditions is efficient enough. It is therefore worth to analyse what the main threats and shortcomings of CBDCs have been discovered and what impact they and other factors will have in the EU.

Considering that some of the threats are influenced by the essence of CBDC, i.e. the digital euro, it is necessary to identify the principles on which this currency is based and the main similarities and differences between the main types of digital currencies. Although there are many forms of digital money or payment instruments, the main ones that can become a means of payment on a regular basis are cryptocurrencies, stablecoins and CBDCs. They all have many similarities and differences.

Cryptocurrencies, built on blockchain technology, are primarily decentralized systems that provide user anonymity and have a finite supply (Phillips et al., 2021). They typically rely on mining or predefined algorithms, rewarding participants. These digital currencies enable peer-to-peer transactions without intermediaries (Lewis, 2023), giving users more control over their funds. While cryptocurrencies can be centralized through exchanges, they maintain a pseudonymous nature that appeals to users, especially for international payments or in countries with political instability.

Operating in a legal grey area, cryptocurrencies can offer opportunities for additional income due to fluctuating values. However, they also face challenges that hinder their use as a global payment method. Privacy concerns are complex; while users became significant privacy, which is not as high as previously thought (OoPA, 2019; Zafar, 2026), it can create security risks for governments, and practical privacy levels may not be as high as assumed. Additionally, users risk losing access to wallets if they forget their keys, highlighting the need for some form of administration.

Scalability limits, such as transaction throughput and consensus requirements, can lead to delays in high-load periods, making cryptocurrencies unsuitable for daily transactions (Lewis, 2023). Increased maintenance fees and volatility further impede their stability, exemplified by cases like the Thodex crypto exchange (Mihm, 2021). This is caused by both fraud attempts and the fact that a sudden drop in prices leads to the bankruptcy of cryptocurrency companies. The volatility of cryptocurrencies is also evidenced by their sensitivity to economic and political changes. For example, after President Yoon Suk Yeol declared martial law in South Korea 2024, Bitcoin dropped by over 30%, while other cryptocurrencies like XRP dropped by over 56%. Cryptocurrencies reacted almost instantly by changing the exchange rate (Binance, 2024), while the national currency lost only 2-3%, which means that the same fluctuation would have been observed for both the stablecoin pegged exclusively to it and the CBDC. Studies have also shown that although all cryptocurrencies can theoretically and practically serve as a means of exchange, only Bitcoin has demonstrated the potential to store value, which has contributed to its use as a means of exchange (Ammous, 2018). This only confirms the opinion of academics that cryptocurrencies cannot serve as a model for digital currencies that are used on a regular basis as a full-fledged payment instrument, one of which is provided by R. Auer and R. Böhme (2021).

Stablecoins are a type of cryptocurrency, but they are more stable. They were developed to minimise volatility by pegging their value to the value of another asset (national currency, cryptocurrency, etc., and to several assets at the same time). Stablecoins are often backed by the reserves of the asset to which they are pegged, which guarantees their value. They can be either centralised or decentralised, depending on the governance structure (WEF, 2023). Stablecoins can be issued by both regulated banks and non-banks and are increasingly subject to regulation. They

fall into two categories: collateralised and unsecured/algorithmic (Baughman et al., 2022). They are the main alternative to CBDCs (Kwok & Côté, 2023). The problems of stablecoins include the fact that they are not widely known among users, so their implementation requires some promotion. There is the problem of choosing the right model. For example, redeeming some assets, it may not be possible to ensure a buyout with the preserved price. When it comes to a private system, there may be a problem of stability, as in the case of cryptocurrencies. Also, the numerous advantages of stablecoins can only be revealed if they are stabilised by pegging them exclusively to fiat money. An example of a problem that arose due to the double pegging of stablecoin to cryptocurrencies as a second asset is the case of TerraUSD, which collapsed due to fluctuations in the value of the related digital token Luna, which caused losses of \$60 billion (Shen, 2022). Potentially, stablecoins can be a good alternative for international payments, as well as an alternative for people travelling or as a tool for financial inclusion.

CBDCs are fully regulated by central banks. They are intended to complement or replace physical cash. CBDCs are like cybercurrency, but at the same time they have some important differences. CBDCs are the digital versions of central bank-issued funds that can be listed on the blockchain. There are three main types of CBDCs:

- retail CBDCs – are used by consumers and businesses and can be categorised into two types depending on how users access them and where they are used: token-based with access via private or public keys, allowing users to conduct transactions more or less anonymously; account-based with digital identification to gain access to the user account;
- wholesale CBDCs – used by banks, financial organisations and payment processors for interbank transfers, they are similar to holding reserves in a central bank;
- hybrid CBDCs – combine the features of both types for the global use of CBDCs. In general, it is a complete penetration into all areas of the economy and people life. Basically, this is exactly what is meant by digital euros nowadays.

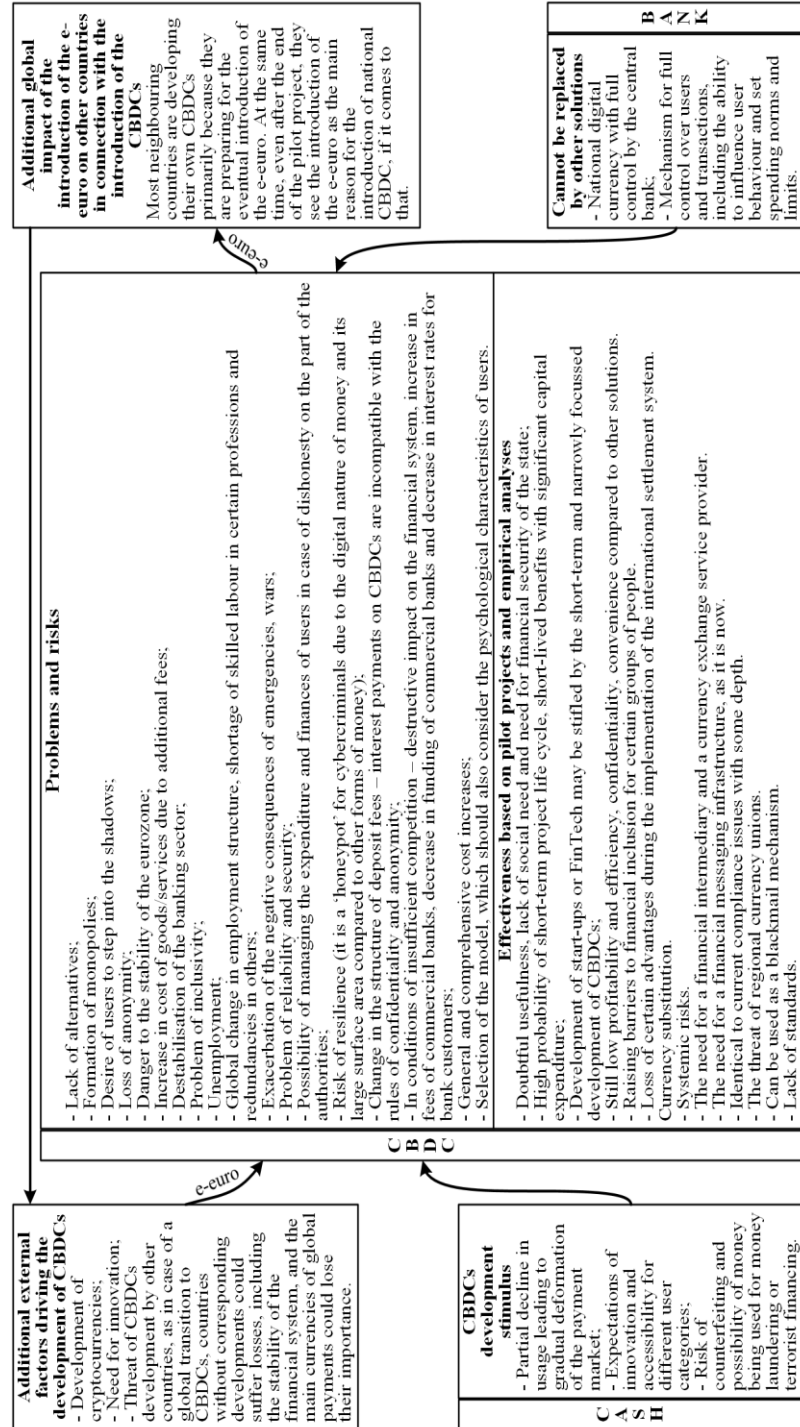
A comparative analysis of the main characteristics of the above-mentioned forms of money is presented in Table 1.

Table 1 – Comparative Analysis of CBDCs and their main alternatives

Aspect	Cryptocurrencies	Stablecoins	CBDCs
Regulation	Decentralized, often in legal grey area	Increasingly regulated, centralized / decentralized	Fully regulated by central banks
Stability	Volatile, subject to market fluctuations	More stable, pegged to assets like fiat	Stable, backed by central bank
Privacy	Pseudonymous, but risks exist	Varies, depends on governance	Deeply depends on design
Use Case	Speculative, international payments	International payments, financial inclusion	Retail and wholesale payments, complement to cash

Source: authors' representation

The implementation of any innovation is not free. In order to fully assess the feasibility of its implementation or the need to find alternatives, it is necessary to identify the main motives behind its development, the possibility of solving existing problems with its help, as well as the complex real cost of innovation, its social impact and the impact on the financial system in general. Based on the empirical analyses as well as on the basis of a comprehensive analysis of 60 literary sources by snowball method, which included studies and articles of scientists, reports and analytics of various organizations that work in this field, including central banks of various countries, as well as the results of pilot projects on the implementation of the CBDCs, the main external risks and motives for introducing the digital euro, the risks found in result of technology implementation, are shown in Figure 1.



In view of the risks associated with the introduction of CBDCs and the dubious effectiveness of such a solution, it makes sense to continue research in this area as an alternative or in the situation of an urgent need for such a solution in the future, also for the purpose of developing innovations. However, there should be no rush to introduce CBDCs. It would make more sense to focus on the development of alternative financial services and to stimulate the development of FinTech start-ups, especially those using AI-technology, that can achieve the desired result with significantly lower investments — both in capital and human resources —, significantly lower risks, and to avoid global dependence of financial systems on the introduction of a specific technology with dubious feasibility.

Fig. 1. The main motives for the development of e-euro and the associated risks
Source: authors' representation

Also based on the results obtained using this method, as well as based on the analysis of additional studies, including alternatives, appropriate conclusions have been drawn at the end of this article.

The first point relating to the price of the digital euro is already embedded in its essence and structure. This is the root of the main problems and costs in the implementation of CBDCs, which can be divided into the following categories: actual price, indirect price (immaterial or predominantly immaterial) and results identified through the implementation of pilot projects or the practical implementation of CBDCs. They should be considered more detailed.

Actual price. First and foremost, are the cost of developing the technology. CBDCs are based on blockchain technologies or similar and require a completely new system. Such systems require the generation of blocks, and each successive block is more expensive than the previous one, including in terms of energy costs. Of course, the process of generating CBDCs will be different from Bitcoin, but analysing the cost of generating a blockchain block using Bitcoin as an example will help to calculate the approximate cost of generation.

Creating each new block in a blockchain becomes increasingly complex due to the underlying cryptographic processes (Hübner, 2018), impacting the speed and volume of transactions processed. As user numbers and payments rise, more blocks are required. While implementation costs at the EU level may appear manageable, the expenses for developing new networks, providing terminals, IT consulting, cybersecurity, and training staff are substantial.

This high cost is why existing pilot projects have been limited in user numbers (Atlantic Council, 2024). Limited user participation and low network load restrict the ability to assess the model's safety, stability, and overall user experience nationally, as pilots have been concentrated on specific countries without scalable results.

For the digital euro to function effectively as a payment method, it will require a sufficient user base, necessitating incentives from the EU government. Such incentives, like promotions and cash-back initiatives, may seem beneficial but ultimately burden taxpayers. Additionally, transitioning to a digital euro necessitates the replacement of existing infrastructure, which includes providing devices such as smartphones to users who lack them, further adding to the financial requirements.

Indirect price. This category is quite comprehensive. Here are the most important elements.

Loss of anonymity. Even though CBDCs are designed to replace cash, their use leaves not much or no room for anonymity, depending on the design chosen. On the one hand, it should reduce the level of criminal financial flows and stimulate the population to declare all their income and pay taxes honestly, thus increasing budget revenues. On the other hand, criminals find ways to take advantage of new circumstances faster than law enforcement agencies develop preventive measures (Dupius et al., 2021; Kumhof & Noone, 2021). Also, CBDCs will not necessarily be the main channel for illegal transactions and informal economic activities (CPMI-MC, 2018). And from a psychological point of view, people try to reduce the pressure, and excessive control always generates resistance. This means that some ordinary users will look for ways to avoid this control. Potentially, such mechanisms will not always be safe and legal. And even if it becomes dangerous, some users will continue to take risks. The government or central banks will collect all the personal information, including behavioural information. The state will be able to trade this information or even programme what users can and cannot buy, where they spend their money, even how much and when. And such developments have already been realised, for example in China in the form of a system of social credit. Furthermore, the example of China shows that the introduction of CBDCs can serve as the first stage of monetary reform if the government creates all the conditions for the abolition of cash in circulation. This was the case with the introduction of the digital yuan through the Digital Currency and Electronic Payments Initiative, when such measures, supported by tough government policies aimed at making cash payments unprofitable and complicated, and the promotion of electronic wallets as the only universal means of payment, led to a significant decline in cash in circulation to the point where the abolition of cash is a purely technical issue. In practice, the introduction of such a system can start with seemingly positive innovations – limiting payments for alcohol, tobacco products and some groups of medicaments for minors or certain groups of people (which has already been considered even in the EU), which initially has a positive impact on society, and later turns into a system of greater restrictions. This means that such measures will become a trap for most social groups on the part of the regulatory authorities or the government, leaving people with no alternative and no freedom of choice. Unfortunately, this situation seems very realistic. That's

why experts from the International Monetary Fund and the Bank for International Settlements have already warned that CBDCs need regulation because of total control by the banks and total control of the population by the government (Carsten, 2023; Lannquist & Tan, 2023).

The security of the state in case of the transition to CBDCs and the reduced role of cash is also questionable. In the situation of total instability, natural disasters, and when there are more and more warnings that a war may threaten Europe in the coming years, and digital wars are also the main part of modern war activities, it may lead to the collapse of the payment system. Or at least it may happen, that some people in certain territories will lose the ability to make payments for a certain period of time, as there will be no replacement available. All this shows that the economy dominated by digital payment systems will be inherently unstable without an effective and reliable anchor. No matter how close digital payments come to cash in their characteristics, they cannot replace it as an anchor, which can be clearly seen in Table 2.

Table 2 – Evaluation of payment instruments according to the most important payment features

	Legal money creation	Convenience	Direct regulation	Anonymity	Availability	Reliability	Reliable reserve	Material/budgeting	Security	Efficiency	Remote payments	Payments for large amounts >5000 euros
Cash	+	+	+	+	+	+	+	+	+/-	+/-	-	-
Bank cards	-	+	-	-	+/-	+/-	-	-	+/-	+	+	+
Debit cards	-	+	-	-	+/-	+/-	-	-	+/-	+	+/-	+/-
Credit cards	-	+	-	-	+/-	+/-	-	-	+/-	+/-	+	+
Prepaid cards	-	+	-	+	+/-	+/-	-	-	+/-	+/-	+/-	-
Credit transfers	-	+	-	-	+/-	+	-	-	+/-	+	+	+
Direct debit	-	+/-	-	-	+/-	+/-	-	-	+/-	+	+	+
Cheques	-	-	-	+/-	+/-	+/-	-	-	-	-	-	-
Mobile payments	-	+	-	-	-	+/-	-	-	+/-	+/-	+	-
Internet	-	+	-	-	-	+	-	-	+/-	+/-	+	+
Cryptocurrency	-	+/-	+	+/-	-	-	-	-	-	+/-	+	-
Instant payments	-	+	+	-	-	+	-	-	+/-	+/-	+	+
CBDC	+	+/-	+	-	+/-	+/-	?	-	+/-	+/-	+	?

Source: *CashEssentials (2018) and author*

The transition to digital currencies presents significant challenges for the banking system and its users. Contrary to the belief that a negative national exchange rate is impossible in a cashless society, research by German academics G. Rösl, F. Seitz, and K.-H. Tödter disproves this notion. Their models demonstrate the viability of a cashless economy alongside various scenarios involving digital money and cash, revealing that the transition may not yield the expected benefits and could potentially lead to financial crises. In stable financial environments, such conditions risk crises, while in unstable ones, they can trigger severe destructive phenomena. Current financial instruments designed to manage crises are applicable only in cash societies. Cash, albeit a small part of

transactions, acts as a buffer that helps stabilize the financial system more effectively (Rösl et al., 2017) especially in countries with high level of inflation (Becker, 2026).

Moreover, W. Engert and B. Fung (2017) indicate that central banks can influence consumer prices with existing mechanisms tied to cash, but this manipulation would be complicated in a CBDC context. They also highlight the challenges in achieving marginal savings gains under a cashless system and echo concerns regarding zero and negative interest rates. Attempting to navigate these issues using CBDCs could lead to significant political and economic ramifications, diminishing confidence in central banks and adversely impacting on less sophisticated consumers who rely on interest income.

This means that a full transition to CBDCs would pose significant risks to monetary policy. This is especially true because most existing monetary policy regulation mechanisms are based on the availability of cash and its abolition would pose a strong threat to financial security.

The conversion of different currencies poses significant challenges, especially regarding foreign currencies, while the integration of traditional and digital euros remains straightforward. Currently, seven EU member states, along with Switzerland, use their own currencies, resulting in high volumes of cross-border movements that could amplify tensions within the EU.

Membership of the country in the EU monetary union may be threatened, incentivizing people to exchange traditional banknotes for digital euros, which would still be liabilities of the European Central Bank. This shift could lead to a significant loss of liquidity for banks in such member state, worsening already unstable conditions, as the availability of digital euro balances may become a crisis catalyst (Panetta, 2021).

Additionally, the high liquidity of digital currencies may attract disproportionate foreign investment, reducing the ability to respond to economic shocks that can affect exchange rates and financial conditions (Panetta, 2021). Conversely, the absence of digital currencies linked to the European region could hinder Europe's international development and expose the economy to vulnerabilities amid global instability.

Ordinary users can cause complications, too; the desire to transfer savings from deposit accounts to digital euro accounts may result in widespread financial consequences. If users each transfer about 3,000 euros, banks could incur revenue losses of 36.5 to 43.7 billion euros related to loan refinancing, representing approximately 1.35% to 1.62% of eurozone banks' capital. Demand for such transactions could further escalate these losses, potentially exceeding 5-5.5% in the long term, indicating severe financial implications for the banking sector.

One of the core problems is the issue of security. Any large system that collects or operates with a huge mass of data is of particular concern to cyber criminals, and this is not just CBDCs themselves, but also the financial institutions that operate with them, what was already well-seen on example of FinTech start-ups, especially BigData and AI based ones. According to research by the World Economic Forum (2024), large companies in the FinTech sector have shown remarkable gains in cyber resilience in recent years, but the number of medium-sized companies that meet minimal levels of cyber resilience has decreased to 30%. And 90% of surveyed companies of all sizes indicated that significant steps need to be taken to increase cyber resilience. Approximately 29% of companies surveyed had experienced a cyber-attack during 2023. Almost 41% of FinTech companies have been affected by attacks on their partner or through its cyber vulnerabilities, and according to research by SecurityScorecard (2023) and Cyentia Institute, 98% of companies have had relationships with at least one third party in the last 2 years. And the situation is set to get worse. This makes it necessary to strengthen the protection of digital banking networks. On the one hand, CBDCs aims to solve this problem by providing additional security and transparency of all transactions, but on the other hand, there are other mechanisms that allow criminals to take advantage of the growing share of digital money and digital systems, especially in the early stages of adoption when they are not yet technically strong enough. In addition, many CBDC research projects and pilots have identified gaps in IT (and security) capabilities that have not been addressed (Auer & Böhme, 2020), which also depends on chosen design of CBDC (Zhang & Fan, 2025). This means that investment in this area is of particular importance. On the one hand, it will lead to an increase in infrastructure spending, and on the other hand, additional IT specialists will be needed, especially those with financial expertise. But there are not enough specialists in this field on the labour market and several financial companies and organisations are already suffering from the lack of such specialists, and in some organisations from the EU, employees themselves have to invest in their

further education and training in this field, as their employers, even large ones, cannot afford it (WEF, 2024; Paus et al., 2019). They are not ready for this now and need time to stabilise and change.

In case of a transition to CBDCs, concerns arise regarding the impact on research and innovation within the FinTech sector. Start-ups have traditionally driven advancements by enhancing payment technologies to meet customer needs. A shift to solely CBDCs could diminish the relevance of these start-ups, centralizing power with the state and monopolizing the market while stifling alternatives. Consequently, public spending may rise, as private entities typically invest in research and development under a freer monetary policy. An example of the promotion of such start-ups, which has also had a positive impact on the monetary system, is the US (Meyers, 2022; Mertzanis et al., 2025).

Furthermore, the introduction of CBDCs could disrupt the labour market, accelerating the decline of traditional banking structures. An aggressive move towards a digital euro may expedite the erosion of conventional banks, negatively affecting their roles in international payments and diminishing Europe's political and economic influence. This transformation may lead to significant job losses in the banking sector, with many professionals facing unemployment and the challenge of retraining for new roles.

In 2024, the banking sector in the EU employed around 2,19 million people (Statista, 2025) and it is difficult to calculate how many people work in the ancillary areas that serve the banking sector, including financial organisations that will lay off people (not to mention mints, where there are also a lot of staff, which are not only engaged in the production of banknotes and coins, but also serve as research centres for the development of new security elements, inks, paper and other materials). This means that in the situation of mass redundancies, a potentially larger number of people will be affected. Statistics show that there were approximately 201,09 million employees aged 15-64 in the European Union in the fourth quarter of 2024 (Statista, 2026). At least these 2,19 million employees who work purely in the banking sector and can be dismissed represent approximately 1,09% of additional very specific unemployment across the EU.

It should also be noted that this is not just about 1,1% additional unemployment, but that the structure of unemployment is heterogeneous and differs depending on the sector and qualifications of employees. This points to a potential crisis in the financial sector, as the excessive supply of labour will also distort the structure of demand for it, lower the average wage level in the industry and reduce the desire of applicants to study in the relevant fields. In other words, it will have a broader and longer-lasting cumulative destructive effect.

There are also other threats that are not so obvious in the short term but are nevertheless significant. For example, digital networks are consuming more and more electricity. And here comes ecological aspect, which is not often appreciated when it comes to new technologies. To support such networks, especially if they will work in parallel with traditional ones, a lot of energy and more and more new secure networks will be needed. This is not only about electricity, but also about the Internet and all elements of infrastructure.

Conclusions from the practice. CBDCs are still totally new and there is not so much experience with them, this also leads to limited practical research in this area. Moreover, most countries that have implemented CBDCs for some periods of time are very different from the EU. Nevertheless, some elements of their experiences as well as the conclusions that the countries close to the EU have obtained during the CBDC-implementation or pilots allow to draw important conclusions that can influence the implementation of CBDC. First of all, it must be said that CBDC has not yet been implemented anywhere where an alliance of countries is involved. And all countries have tried to roll out CBDCs architectures and models that meet the needs of the country and the psychology of the population. In the EU will arise additional complications because these are countries with their own characteristics and populations with different behavioural patterns and psychology. This means that the best architecture will not be rolled out from the outset and the chosen architecture is likely to be based on the features inherent in the leading EU countries, leaving the characteristics of the smaller and eastern member states completely or partially out of the picture.

At the outset, it is important to note that an attempt to completely abandon cash or significantly reduce its volume is irrational. The experience of Nigeria has shown that people have taken to the streets in mass protests in the face of cash shortages (Atlantic Council, 2024). At the same time,

various shocks or unforeseen circumstances will only exacerbate the situation, as people need to have a reliable means of payment, and its absence can exacerbate chaos.

A similar conclusion was reached in Sweden. At the conclusion of the CBDC pilot implementation process, the Riksbank (2023) called for an urgent strengthening of cash holdings at the legislative level. The report points out that strengthening cash holdings is not only the responsibility of the state, but also in the areas of inclusion and security. The country with the lowest level of cash has come to an interesting conclusion – the statistics do not indicate a decline in the use of cash, but there is an area where some stabilisation is emerging (Regeringskansliet, 2023). In addition, the possibility of monitoring the availability of cash payments, at least for essential goods, by the end of 2025 is being considered. If this is not possible or the possibility of such payment becomes more difficult, the state should take responsibility for ensuring the availability of such payments and appropriate guarantees. Other important findings from the pilot phase of the digital krona include the emergence of numerous problems with the technical support of online payments, which can lead to the need to change bank cards when payment limits are changing (Regeringskansliet, 2023). Given the size of the EU, the problem could in practice take on a more global scale, and at some point, lead to the collapse of the payment system. Furthermore, the digital krona pilot project has shown that there is currently insufficient social demand for its introduction.

The pilot project of Bitcoin-introduction, which was cancelled several times and then continued, also failed. The House of Lords found no convincing arguments in favour of CBDC and also identified significant security risks, including the risk of data breaches and the risk of destabilising the banking sector. At the same time, it should be noted that there are currently enough less risky alternatives (also AI-based), which are developing rush nowadays (UK Parliament, 2022).

China's pilot project was also not very successful. Although the main objective was to create an alternative and equalise the global importance of the dollar and the euro in the international market, which was one of the incentives for the development of the digital euro, it was not achieved. And its achievement has been called into question. At the same time, the problem of profitability of financial instruments was identified (Kaminska, 2021; He et al., 2026).

Various research has also shown disappointing results in other areas. For example, U. Bindseil (2022) argues that the predicted transformation potential of CBDCs and payments may be overestimated due to the constant evolution of money and the relatively unchanged challenges of commercial and centralised banks. Commercial banks, in terms of meeting user needs, and central banks, in turn, have not confirmed the efficiency of CBDCs at significant costs. M. Chorzempa (2021) comes to a similar conclusion in his research and warns that the current benefits of digital national currencies will only be short-term due to changing technologies and markets. W. Engert and B. Fung (2017) testified that CBDCs could not demonstrate that they outperform other solutions in this area in terms of economy, efficiency, privacy or convenience. This also applies to the fight against financial crime. In this area the same results could be obtained with other solutions, also blockchain and AI based. This view is not only confirmed but also deepened by the results presented by R. Quarles (2021), according to which CBDCs can pose a threat to the stability and resilience of the banking system, as they serve as a 'honeypot' for cybercriminals due to their digital nature, prevalence and value compared to other forms of money.

It was found, that CBDC are not so efficient in simplifying, accelerating and reducing the cost of **international payments**. Optimal situation can only occur in ideal laboratory conditions. In practice, the first obstacle is that it is difficult to assess how this mechanism will work at this stage, as there has been very limited research in this area and most central banks have focused on retail CBDCs, with experiments limited to national interconnections (CoinMarketCap, 2024).

The study identified several problematic or debatable issues. First, trying to ensure the global functioning of such payments, CBDCs have lost certain advantages, depending on the chosen model. A faster transaction speed, making them almost instantaneous, could be achieved with direct transactions. However, given that none of the projects exploring a simple direct payment architecture have chosen a specific model, it is difficult to assess how this would work in practice on a large scale, and this also reflects the limited experience of banks in this area (Constantinescu, 2023). This solution also has certain threats. CBDC architectures, standards, and regulatory frameworks need to be consistent across countries, which makes such a solution almost impossible in a global context. This can be solved by implementing a CBDC outside the issuer's jurisdiction, which will limit the need for currency conversion. However, such a solution would lead to currency substitution and volatility of

capital flows, increase the perception of shocks in the global financial system or a particular country by other local financial systems. The biggest problem is currency substitution, as it can have a destabilising effect on countries outside the jurisdiction of the country issuing the CBDC (in particular, if a foreign CBDC will be used as a unit of account in the country, domestic monetary policy will lose its authority), as well as on its own financial system through uncontrolled capital inflows (Reslow et al., 2024). This, in turn, contradicts the seventh principle of the Principles of Public Policy for Retail CBDCs (G7, 2021). In other words, this indicates the need for a financial intermediary and a currency exchange service provider that will have direct or indirect access to convertible currencies. Such a solution leads to increased supervisory complexity and the need for compromises in this area, as well as a compromise on the intermediary's access to the funds transfer system and central bank's reserves. In addition, designing such a system is highly possible to repeat some of the existing problems in the field of correspondent banking, namely long transaction chains, lack of financial incentives for the intermediary, and limited number or no intermediaries in servicing certain corridors (IMF, 2022).

Some of the risks of international settlements with CBDCs for the international monetary system can be mitigated by setting restrictions on the amounts held by individuals and legal entities working with developing countries and limits for residents and non-residents. However, in the first case, it may be a matter of discrimination and limiting digital inclusion (Lannquist & Tan, 2023). Also, if a non-resident will be able to use a foreign CBDC for payments in their country of residence, this may lead to currency substitution in that country. Setting restrictions in such situation may not help to solve the problem of currency substitution, as they should be set by the issuing country, which will not benefit from it and for which the risk in a foreign jurisdiction will not be important. In the case of limits, the problem of volatility of capital flows and currency substitution can be solved, but a risk associated with currency replacement occurs. It arises when non-residents can use CBDCs outside the jurisdiction of the issuing country. If they are granted temporary access to CBDCs only for the duration of their stay within the jurisdiction, this risk does not exist. However, this is not only accompanied by discriminatory risks, but the system of setting such limits and adjusting them depending on many factors, as well as identifying these same factors, and conducting of a jurisdiction-specific assessment is a very complex process. The development of limits leads to complexity and additional financial burden, as it will also require the development of a system of rules, regulations and controls. This will lead to a decrease in system efficiency and possible failures and errors, when payments will continue to be processed despite the established limits (Reslow et al., 2024). A certain alternative to the problem of limits may be the use of a 'waterfall model', although this solution is also not optimal.

Given that different countries will choose different CBDC architectures and models, potentially a need for messaging infrastructure or the use of an application programming interface (API) occurs (CPMI, 2022). Such approaches can help solve several problems, but if such projects will involve a small number of participants and will be not profitable enough, or will not have enough foreign exchange, it will lead to a decrease in market liquidity. This could lead to multiple exchange rates in situation of a segmented market. There is also the problem of tariffs if payments are made between central banks connected to different systems.

Another solution to the problem may be the deployment of automated market makers (AMMs) (BISIH, 2023), which use the smart contract algorithm in a decentralized manner to provide liquidity. However, this is accompanied by an increase in user costs, as well as problems associated with assessing the real value of the asset.

In terms of compliance, the challenges in this case will be identical to those in the current infrastructure, which will be exacerbated by the more complex architecture of CBDCs, especially in international settlements (Hazlett & Luther, 2020). At the same time, the need for 24/7 availability will increase the risk of operational and cybersecurity, as well as fraud, given the instantaneous implementation of the payment and the lack of time required for verification.

This is only a brief overview and analyses of the opportunities and threats of CBDCs in international payments, given the limited scope of the study. Nevertheless, they allow to conclude that CBDCs will not be able to solve the current problem of international payments. Moreover, they can potentially create new problems that will be difficult to solve. In other words, CBDCs can be an alternative, but not the main solution. The conclusion of this study correlates with the results obtained by the Bank for International Settlements, according to which CBDCs will not be able to solve the

main problems in international payments (CPMI & Innovation Hub, 2022). Also, the idea of instant, freely convertible, reliable payments contradict the Fleming-Mandell monetary policy trilemma, which imposes restrictions on these processes (Obstfeld et al., 2005). In addition, to ensure efficient payments, central banks in many countries have begun to develop their own projects designed to address these issues. Among them, for example, are Icebreaker, Nexus, PayNow, PromptPay, and others (FSB, 2024). While such initiatives are positive and may in the long run help to solve some of the problems associated with international settlements, they pose a threat of regional currency unions and thus the dominance of specific currencies in the market. Over time, this could have a more profoundly destructive effect. As noted earlier, one of the main reasons for the introduction of CBDCs is that some countries see the danger of their introduction in neighbouring countries with which they have ties (Regeringskansliet, 2023). The government or central bank of the dominant country may make it impossible to settle accounts with the neighbouring country in its national currency or make settlements in a currency other than their own CBDC's unprofitable. In such circumstances, the neighbours that have become dependent will be forced to integrate into the local currency union and switch to the currency of the dominant country. It can also become a mechanism for putting deeper pressure on neighbouring countries or influencing them to obtain certain benefits. For those countries that have become dependent, this situation may become hopeless. In this case, the key issue could be anything from tax breaks and customs concessions to currency swaps and integration into the dominant country. Moreover, a country located near any major monetary union, a country with a dominant economy or currency could potentially become a hostage to such a situation. Given the events of recent months, when the newly elected US president threatens to change import rules, which could completely destroy Canada's economy, including for the hypothetical accession of its territories to the US (The White House, 2025), and given the aggressive policy of the new government, in particular with regard to possible territorial expansion and expansion of political influence, such possibilities go beyond theory and become more than real and dangerous. Moreover, in fact, such a pressure, so far a deep trade pressure, has already begun. Although its concept was presented in December 2024, the official vision was published on the official White House portal on February 1, 2025, meaning that the global market had enough time to prepare for the possible consequences of such a decision, but despite this, the market reacted extremely sharply after the official statement by the US President on March 4, 2025. There has been a significant drop in trade between the countries since the first announcement of such intentions according to the data of US Census Bureau. Moreover, the three major indices in the US fell by the end of the day after official statement – Dow Jones Industrial by 1.4%, the S&P 500 by 1.75% and the Nasdaq by 2.6% (Sherman et al., 2025), which only confirms the sensitivity of the global market and financial system to such actions. The example of statements regarding labour migrants from Mexico can also illustrate another potential CBDC opportunity, when the US government may make it impossible to transfer or use dollar in Mexico. This would disrupt existing financial chains, lead to capital flight from Mexico, and encourage people to use other channels to transfer funds, even if they are risky, costly, and not always legal. Such a situation could arise in any country that wants to introduce strict migration regulation mechanisms and the CBDC is the perfect fit in this case.

In addition, it should be noted that the transition to CBDC will not lead to simplification of financial transactions or elimination of intermediaries. In other words, not many things will be simplified globally, and new standards will need to be developed. At the same time, the existing system is constantly improving according to CPMI monitoring, and has achieved high performance indicators, while national banks in most countries draw attention to the lack of finance and resources for the development and implementation of new multi-value technologies (FSB, 2024). As noted above, for the effective implementation of CBDC and the functioning of the global system, it is necessary to develop standards that would be implemented by all financial market actors. This opinion is shared and substantiated by academics such as R. Auer and his colleagues (Auer et al., 2021), as well as experts (Reslow et al., 2024; FSB, 2023). The implementation of international standards will have a positive impact not only on cross-border payments, but also on interoperability with domestic systems other than CBDC by reducing the burden on financial service providers. CBDC will face the same obstacles as current payment systems – a large number of regulations, outdated norms, uneven and not always consistent application of rules and restrictions in different jurisdictions. This is particularly evident in international payments, where long chains of transactions may involve several countries with different regulatory frameworks and compliance standards. In

such cases, the processing and payment time and the level of opacity potentially increase. Approaches to anonymous and pseudonymous payments and ensuring a balance between access to information and anonymity, may also differ from country to country.

However, at the current stage, the necessary **standards** for payment messages are absent, which creates friction due to the use of different approaches to the development of CBDCs, formats, codes and languages in different countries. The implementation of the ISO 20022 standard (FSB, 2023), which is identified as one of the main measures in the G20 Roadmap, should help to solve this problem. The question arises whether this standard will be able to solve all the problems and become a single and global standard. In theory, yes. From a practical point of view, it looks doubtful, at least in the short term, although some countries have already started implementing this standard. This happens because such transformations require significant investments that most governments and central banks cannot afford (FSB, 2024). In addition, over the long history of the modern financial system, it has not been possible to achieve harmonisation and full standardisation of the regulatory framework in this context. Given that a global consensus in this case is needed, and that the financial system is one of the levers of political influence, it will be very difficult, to achieve it. Even if the main political, cultural factors, national peculiarities and the situation of different countries will be set aside, it is important to remember that the introduction of a global standard may make certain countries dependent, and therefore they may refuse to adopt it. For example, counterparties may refuse to service countries with weak implementation of the rules, even if the country has implemented them and developed a CBDC (Reslow et al., 2024). Another factor is that countries with a low level of rule implementation, including due to a lack of financial and resource capacity, may find themselves in a situation where they are either isolated to some extent from available cross-border payments or forced to integrate into the financial system of a neighbouring dominant country, losing their monetary independence. Such a situation could in turn lead to segmentation of the financial services market on a regional basis or based on compliance with new requirements. Although this is unlikely, at least in the initial stages, it could arise in the future given the global situation and instability.

With this in mind, the IMF has launched an initiative to create an XC platform to help simplify and streamline cross-border payments. It is intended to be global and is based on the concept of wholesale CBDCs, including commercial banks, payment providers, and central banks. It is designed to reduce transaction costs and time. Its peculiarity is that central banks can issue certificates of escrow (CE) instead of CBDCs, which can be used exclusively on the platform. This will allow a wide range of entities to gain direct access to the central bank's reserves. CEs are similar to CBDCs and can be converted into central bank reserves. The advantage of the platform is that central banks can separate internal and external payments, conducting external payments through the platform and internal through the national system with the architecture that is most appropriate for a particular country (Adrian, 2022). This seems to be one of the most viable options at this stage, as the XC platform is designed to be broadly compatible with existing systems and requires minimal technical upgrades from central banks and helps to increase the efficiency of cross-border payments with low costs and risks, avoiding the problems associated with CBDC. However, it requires a compatible legal and regulatory framework in different countries to work.

The implementation of a global standard is also complicated by the fact that only about 60% of countries are developing a regulatory framework for crypto assets, most of which have different approaches to this process and create separate regulations. 9% create them based on existing legislation and 6% plan to do so. At the same time, every third country does not have an appropriate regulatory framework and is not developing it (Di Iorio et al., 2024).

Analysing the results of the implementation of the standards available at the current stage, we conclude that the biggest challenge in their development is governance, since each of the digital currency models involves the presence of a global system operator. Establishing standards for its operation will have many challenges and will potentially take place in several stages. In addition, given the complexity of the issue, the development of standards requires joint activities not only of standard-setting organisations such as ISO, FSB, BCBS, CPMI, but also the involvement of organisations working in the field of financial security and the fight against financial crime such as the FATF, commercial banks, financial institutions, various organisations, including non-profit organisations working in this area, academics, and public consultations. Only under these conditions it will be possible to create an effective standard and mitigate the problem of consensus. However,

this requires a significant investment of time. Given the current state of development and implementation of global standards, the implementation of CBDC in the near future looks unrealistic and risky. It is also likely that by the time such standards are finalised, a more favourable alternative will have emerged, which is realistic given the active work of many local and international bodies in this area.

Also, the issue of **financial inclusion** in society is becoming increasingly acute. Numerous studies by academics (Lannquist & Tan, 2023; Scher, 2020) and the results of certain pilot projects (Atlantic Council, 2024; Waliczek, 2023) show that the development of CBDCs will contribute to financial inclusion by increasing the availability of financial services for those who cannot use traditional services or those who live in areas without banking services. A similar view has been expressed by some central banks, including the Bank of England (2020). It is mostly assumed that this will have the greatest impact on developing countries. To some extent, this is true. However, not everything in this context is so clear-cut. First of all, the problem of inclusion exists in many countries, including developed countries, where a significant number of people do not use banking services even if they have access to them. For example, as of May 2020, 14 million American adults did not have bank accounts, used cheques and paid significant fees (Scher, 2020), bankbooks are still popular in South Korea and several other countries (IBS, n.a.), and in Germany, it is often necessary to receive a paper cheque by post to pay for an order. In other words, the fact that people do not use banking services is not always caused by the lack of availability of such services. There are many factors to consider. Studies in this area have already been conducted to varying degrees, for example, in Spain (Alonso et al., 2020). Some of them (CPMI-MC, 2018) have even pointed out that with the active development of CBDCs, the opposite process may occur – when barriers to the use of any digital currency may increase for some segments of the population, which may occur, among other factors, due to irrational limits (Lannquist & Tan, 2023). This is also related to the psychology of money users, which plays a significant role in the perception of such currencies. It has been proven that people spend more using digital money, and that not everyone, for various reasons, can accept the very fact of using such money, even though it can make their lives much easier (Katzer, 2016; Balland et al., 2020). Not all people have the appropriate level of knowledge and trust in technology.

In countries with high levels of instability, totalitarian governments, or high levels of public distrust or dissatisfaction with governments, the use of CBDCs may also be questionable. People will fear regulation and control by the state and potentially prefer riskier cybercurrencies just to avoid risk from the authorities. It needs to be considered that many people need a certain level of freedom. Here can be drawn a parallel with the broken windows theory, but in reverse. People who, under normal circumstances, have no desire to commit illegal or criminal acts, will do something illegal or risky out of internal protest, regardless of whether it is expressed in minor or major offences. Control in today's world with modern technology is needed more than ever, but the level of control must be balanced so that the negative impact of existing illegal mechanisms is not damaged or outweighed by the negative impact of excessive control. It is also necessary to consider the fact that there are a growing number of financial institutions created by mobile, postal operators, etc. that people use and have a significant level of trust in. In addition, such structures already exist and can provide quality services with fairly low fees, also to attract customers. This may be a more promising and simpler solution for people living in countries with low financial infrastructure and trust in digital technologies.

All of this suggests that the issue of inclusion is not the one that can be approached from a practical and technical point of view, but rather the one of user psychology and alternatives. Not always the mere appearance of one additional digital financial instrument, which theoretically should improve life, can encourage its use and solve a problem. Given the above, and the fact that more and more central banks are justifying the need to protect cash circulation (UK Parliament, 2022; Regeringskansliet, 2023), given the large number of safer and cheaper, user-friendly alternatives to CBDC, they can be one of the elements of increasing financial inclusion, but not the solution that can comprehensively and effectively solve the problem.

Thus, while benefits like payment efficiency and financial inclusion are possible, these are potentially short-term and may not outweigh the risks. The quantitative findings illustrate that the direct and indirect costs of CBDC implementation are enormous – from multi-billion-euro investments and potential revenue losses in the banking sector to the risk of significant employment shifts. Qualitatively, the risks span from a loss of financial privacy to the potential destabilization of monetary policy and economic structures. The synthesis of these factors suggests that, at least in

the current state of technology and regulatory readiness, CBDCs may not provide a net benefit over existing systems.

The digital transformation of financial services is inevitable, but the rush toward implementing CBDCs – especially in a multi-country union like the EU – could generate significant financial, operational, and socio-political risks. The high quantitative costs (infrastructure investments, potential liquidity losses, and employment impacts) combined with qualitative challenges (privacy, cybersecurity, regulatory complexity, and innovation stifling) argue for a more measured and alternative approach. Future strategies should focus on a gradual digital evolution that leverages private sector strengths and robust international cooperation, rather than an abrupt transition to a centrally managed digital currency. Based on the results of the analyses it was concluded, that in order to avoid negative consequences of CBDC implementation in case of such a decision, it will be necessary to make some alternative decisions both politically and strategically, namely:

- gradual integration – instead of an immediate and full transition to CBDCs, a phased approach that maintains the coexistence of cash and digital payments could help mitigate risks. This would allow for iterative improvements in technology, regulation, and user adaptation;
- support for private innovation – encouraging commercial banks and FinTech startups to develop digital tools may provide a more balanced path forward. Such an approach would promote financial innovation without centralizing power excessively, thereby preserving competition and safeguarding consumer interests;
- enhanced cybersecurity and regulatory standards – there are a clear need for robust cybersecurity frameworks and international standards. Collaborative efforts between central banks, regulatory bodies, and industry stakeholders will be essential to ensure that any digital payment system can be both enough secure and interoperable;
- improving the literacy of the population and professionals – improving financial and IT literacy among the population will not only help to reduce risks while using new financial technology (including CBDC) but will also increase its acceptance and level of accessibility for the population. It will also help to properly assess risks when using a particular financial instrument. At the same time, there is a real need for specialists with knowledge in parallel fields – both financial specialists with a certain level of knowledge in IT and IT specialists with certain knowledge of finance. This will help balance technology and make it more secure and responsive to the real needs of the user, as well as help to reduce the time and money spent on its development and avoid a significant amount of the bugs and vulnerabilities.

Also, implementing any technology that is global in nature and significantly affects the lives of the majority of the population, is based on an array of sensitive data, it is necessary, first and foremost, to be guided by the principles of human centricity. At the same time, decisions made in haste, dictated by dependence or fear of future possible danger, decisions made based on certain political interests, the desire to win in the technology race, dictated by the one-sided desire of IT professionals to create just an innovation without taking into account numerous factors from related industries that influence them, as well as behaviourism, are carrying significant threats and are requiring at least 'buffer' or 'insurance' alternatives and cannot be implemented in full as the only possibility in order to prevent global negative consequences in the future.

Conclusions. Although most countries pay great attention to CBDCs and some of them are heavily investing in their development, the introduction of such currencies can bring more problems for the financial system, the state and each individual user than real benefits. The costs of developing and launching a national digital currency are very high in all senses. Their benefits are short-term and questionable. Digital currencies, including the digital euro, are not essential for the stability and defence of the financial sovereignty of the state. They are not able to offer significant advantages over other less expensive and much more secure solutions. Most countries, financial institutions and the population are not ready yet for a comprehensive transition to digital currencies. Moreover, the implementation of CBDCs is not a case where the country that is among the first to implement it is bound to win. Rather, in this case it is worth to act more consciously and to examine alternatives more carefully. The European Central Bank should not rush the introduction of the digital euro. Considering all the risks and the fact that the EU's neighbouring countries see the start of full use of the digital euro as the main reason for implementing their own CBDCs, a hasty decision by the European Central Bank could cause profound long-term destructive processes not only in Europe but

also far beyond its borders. Therefore, it makes more sense to focus on alternatives, developing financial start-ups, especially those using AI-technology, and also encouraging commercial banks to develop digital tools, services and technologies, or at last implement it based on alternative decisions. It will not only promote progress, but also in this case banks will suffer less from the introduction of the digital euro, if it happens, as they will be able to sufficiently fulfil people's basic needs and thus ensure their own stability and consistency. This will also help to solve existing problems with minimal risk to the financial system and capital investment. At the same time, research towards CBDCs should not be stopped as there may be various situations in which this technology or its elements may become useful. To a certain extent, it will also stimulate the development of financial technologies and create a solid basis, including scientific ones, on which alternative solutions can be safely based in the future. Further research will focus on investigating such possibilities and their possible outcomes, as well as efficiency of the integration of AI in financial services and security mechanisms of financial institutions.

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ВПРОВАДЖЕННЯ СВДС – СПРАВЖНЯ ЦІНА

У статті досліджуються економічні, інституційні та соціальні наслідки впровадження цифрових валют центральних банків (CBDC) з особливим акцентом на європейські перспективи, зокрема в контексті використання цифрового євро. Проаналізовано основні мотиви створення національних цифрових валют та проведено оцінку того, наскільки CBDC здатні вирішити наявні проблеми у сфері платіжних систем, фінансової інклюзії та монетарного суверенітету. Справжня ціна впровадження CBDC розглядається не лише як прямі фінансові витрати на їх впровадження та підтримку, а й як сукупність непрямих економічних, соціальних і політичних наслідків. Методологічну основу дослідження становить змішаний підхід, що поєднує систематичний огляд наукових джерел, порівняльний аналіз міжнародних пілотних проєктів та оцінку емпіричних даних центральних банків і міжнародних фінансових організацій. Визначено ключові ризики впровадження CBDC, зокрема загрози фінансовій стабільності, зростання кібер- та операційних ризиків, втрату анонімності розрахунків, послаблення ролі традиційного банківського сектору, а також негативний вплив на інноваційне середовище і ринок праці. Особливу увагу приділено складностям реалізації CBDC в умовах багатонаціонального валютного союзу, де відмінності в економічній структурі, регуляторних підходах і поведінці користувачів можуть посилювати системні ризики. За результатами проведеного дослідження було зроблено висновок, що за сучасного рівня технологічної та нормативної готовності CBDC не мають переконливих переваг над існуючими або альтернативними цифровими платіжними рішеннями. Запропоновано обережний поетапний підхід до прийняття рішення щодо вибору цифрового платіжного інструменту та його дизайну, що передбачає збереження готівкового обігу, підтримку приватних фінансових інновацій та орієнтацію на принципи людиноцентричності.

Ключові слова: **CBDC, FinTech, фінансова безпека, монетарна політика, стартапи на основі штучного інтелекту.**

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