

# The evolution of the digital currency

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## Abstract

In the new digital age, with the rapid development of electronic devices and the Internet, the transformation of money is also inevitable. Cash and credit card payments are beginning to be replaced by mobile, online payment methods. Advances in technology have hastened the spread of cryptocurrencies and created digital currencies. However, this development and the emergence of cryptocurrencies began decades ago. Although decentralized finance does not seem to be a substitute for the traditional financial system, it is unlikely that it will become an official currency in the future, but emerging digital currencies could play this role. The aim of this study is to present the background to the emergence of digital currencies and to seek answers to the challenges it will face in the future to become a full-fledged currency.

*keywords: cryptocurrency, digital currency*

## 1. Introduction

Nowadays, devices that use electronic and, in particular Internet connections are gaining ground. As a conclusion, these are starting to become an essential part of our daily lives. As a result of the coronavirus, online events have gained even more ground, and we are increasingly choosing online solutions and platforms during our purchases. It is also due to the growing trend of fewer and fewer cash purchases. Credit card payments have become more common, but nowadays we can find payments with a mobile phone in many places, which is usually accompanied by a current account, but nowadays cryptocurrencies are also accepted in many places. The latest development that could bring a new era in payment systems is nothing but digital currency. However, this development and the emergence of cryptocurrencies began decades ago. In my study, first I present the evolution of digital currencies through the development of cryptocurrencies. Then I compare cryptocurrencies with digital currencies and then conclude the study with the challenges of digital currencies.

## 2. The evolution of the digital currency

The transformation of the monetary system has become increasingly rapid in recent decades. At first, it meant more a formal change in money, but with the development of technology, the focus was on convenience and efficiency, so the digitization of money also began. More than a decade ago, a person (or group) called

Nakamoto, developed a new technology, initially considered only a financial innovation to develop an alternative payment system to the banking environment. The technology is based on a chain of digital signatures. This is called a blockchain, which is basically a digital ledger that lists the previous owners and their associated transaction events through signatures. Blockchain technology was initially used by developers of cryptocurrencies to allow the exchange of financial assets without the involvement of a third party (Nakamoto, 2008). These cryptocurrencies opened a new era in the transformation of money. However, this was preceded by a number of failed attempts, such as DigiCash, Hashcash, or Bitgold. The first digital currency can be traced back to David Chaum, who produced the digital form of real cash in 1982. It is an encrypted sequence of numbers that can identify the values of cash and record all the information about transactions. However, it must not be forgotten that transactions must remain anonymous as in the case of cash payments, so a blind signature has been created. According to Maulid (2015), a good blind signature has four important characteristics:

- Non-falsification
- Non-repudiation
- Untraceable
- Invisible

The essence of a blind signature is to preserve the anonymity of users that has been implemented in the system of digital currencies. (Maulid, 2015) A blind signature eliminates two important problems at once. While cash payments operate anonymously, their disadvantage is that give free vent to crime. In contrast, digital currencies that operate without a blind signature have the potential to curb crime, but the protection of personal data is pushed into the background. A financial system with a blind signature provides a solution to both problems. The essence of the method is that the central party approves – signs – the transaction without knowing the details of the transaction. (Chaum, 1983)

However, the early virtual currencies contained various flaws. For example, Hashcash's system lacked the control of inflation that Bitcoin, developed by Nakamoto, solved by periodically adjusting the difficulty of the computational tasks. The Bitcoin system has solved the problems of its predecessors by creating independent revenue for cryptocurrencies and decentralizing network management. Thus, Bitcoin can be considered a technological novelty because it goes beyond the cryptographic ideas of its predecessors. Nakamoto's breakthrough, however, does not stem from the invention of individual factors (hash, proof of work, timestamp, etc.) – as they have already been developed for earlier digital currencies – but from their incorporation into a single system. The decentralized form of digital currency is thus tied to Nakamoto's name, as it has made it unnecessary for central banks to control the rate of inflation. Since the advent of Bitcoin, a number of new cryptocurrencies

have appeared and even appear day by day, yet most central banks do not accept them as real currencies. (Huber - Sornette, 2020)

Today, Bitcoin is the best-known cryptocurrency – which has not yet widely used as a means of payment but rather a risky form of investment (Bugár – Uzsoki, 2013) (Bugár - Somogyvári, 2020) due to sharp fluctuation of the market price – that uses a blockchain to finalize transactions, authenticate them in chronological order and decrypt them. This is how the blocks evolve, which forms the blockchain. These blockchains are operated by a peer-to-peer network of computers that have nodes on them, and each of these nodes stores a complete copy of the general ledger. The system is open source, making the network accessible to everyone, without the need for third party to carry out transactions between the two parties (Urban, 2018). So cryptocurrencies are decentralized by their system. After all, the peer-to-peer system of cryptocurrencies, as its name suggests, indicates a network and the connection between them in which each computer acts as a server, thus providing direct access between two parties without a central server, while in digital currencies banks would appear as third part. For cryptocurrencies, transactions and their associated data are available in a digital ledger, organized into blocks. These blocks are connected to each other, authenticated and time-stamped by the nodes in the peer-to-peer system. This authentication certifies that no double spending occurs. The authenticated data blocks thus connected form a chain. This is called a blockchain (Nakamoto, 2008).

The main change in the financial system by cryptocurrencies is the decentralized nature made possible by distributed general ledger technology (DLT). The blockchain and shared ledger technology represent the core technology of the 21st century economy. DLT technology also includes blockchain and other similar technologies. A DLT is a decentralized network in which data is shared among network members, and any authorized member of the network can access, modify, or authenticate the data. Blockchain is the most common form of DLT that contains an extra criterion compared to a split general ledger, which is nothing more than chaining data blocks. In addition, the data in the blockchain cannot be modified retrospectively. (Urban, 2018)

Blockchain and shared ledger technology (DLT) are the core technology of the 21st century economy. DLT technology also includes blockchain and other similar technologies. A DLT is a decentralized network in which data are shared among network members, and any authorized member of the network can access, modify, or authenticate the data. Block chain is the most common form of DLT that contains an extra criterion compared to a shared ledger, which is chaining data blocks. In addition, the data in the blockchain cannot be modified retrospectively. (Urban, 2018)

After Nakamoto's publication, several articles about the blockchain have appeared, so there are several definitions, a few of which I will mention:

- According to Don and Alex Tapscott, the blockchain is a programmed ledger that contains economic transactions that cannot be changed. (Tapscott – Tapscott, 2016)
- According to Chen, a blockchain is a shared ledger that stores transactions in the form of blocks that are chaining to each other. (Chen, 2018)
- According to Marr, the blockchain is a decentralized ledger that allows transactions between the two parties to be time-stamped and recorded without the involvement of a third party. (Marr,2018)
- According to Bogart and Rice, a blockchain is usually a shared ledger, a chronological chain of blocks, where each block contains a record of valid network activity since the last block was added. (Bogarat – Rice, 2015)
- According to Kakavand et al., a blockchain is a database of transactions in chronological order, called blocks, in which any transaction can be checked. (Kakavand et al., 2017)

Based on these, it can be said that a blockchain consists of a set of transactions that follow one another in chronological order and take place between two parties without the involvement of a third party.

In summary, a blockchain system is a worldwide, decentralized computer network in which all computers connected to the network can be considered as nodes. Each node has the latest version of the blockchain and competes to decipher the last member (Nakamoto, 2008). Although the cryptocurrency system is considered secure, the risk of abuse and fraud is very high as it is not under direct control. Cryptocurrencies exist only in electronic form, use online and offline wallets, and use a two-key architecture to secure transactions. (Gross – Bechtel, 2020)

As it is already mentioned, cryptocurrencies are also accepted in many places, and for the reasons mentioned above, they are unlikely to function as currencies in the future. However, the rise of cryptocurrencies has encouraged - and continues to encourage - scientists to become more familiar with the underlying blockchain technology that has opened new gates. Blockchain technology is now used in many places, including public administration, healthcare, but also a digital currency uses it, which is important in this study. So the main features of which I discuss below.

The main advantage of cryptocurrencies over previous forms of money is that they are widely available due to their electronic nature. Another advantage is that they are capable of peer-to-peer transactions but are not issued by a central bank. These benefits and digitalization have sparked the need for the emergence of digital currencies. (Carstens, 2018) This could lead to digital dollarization, which is very similar to classical dollarization, in which a more trusted currency displaces the existing currency. By digital dollarization, we mean when digital currencies take over the role of a country's currency. (Brunnermeier et al., 2019) In addition to social trust, it is essential for the digital currency to have the classic monetary functions. The main

problem with cryptocurrencies is the volatility of their exchange rates. Stablecoin solves this problem by trying to keep their value against national currencies through a stabilization mechanism. (Fáykiss et al., 2021) Although stablecoins are not as widespread as real currencies, their risk for cryptocurrencies is much lower. If the stablecoin could take over the role of real currencies, the powers of central banks would be significantly reduced, so central banks have begun to focus on the creation of digital currencies.

The BIS 2021 survey shows that by 2020, 60% of central banks will be conducting research, while 14% will be moving towards development activities. More than 60 central banks were surveyed, and 86% of them are currently surveyed to look at the pros and cons of digital currencies. Although there is a great deal of interest in digital currencies, no formal decision has yet been made on their issuance and use as a real currency, with a few exceptions. One example is the sand dollar introduced in the Bahamas in October 2020 as a common digital currency. The geographical features of the country are behind this. The central banking network was unable to serve part of the population effectively and was seen as able to support inclusion through digital currencies and reduce transaction costs. (Boar - Wehrli, 2021) Another example of digital currencies in China is DC/EP, which is based on the model of the dual offline payment system, so it can replace the traditional cash payment method, as payment is independent of the Internet. The Chinese test phase also revealed that DC/EP can be used with a mobile application that does not require a bank account to be linked to a digital wallet. As a result, the use of DC/EP will remain anonymous, making it unverifiable except for the People's Bank of China. (YU, 2021)

In April 2020, China's central bank began its test phase in four Chinese cities (Shenzhen, Suzhou, Chengdu, Xiong'an), giving thousands of people the opportunity to participate in the test experiment using a predetermined amount of digital currency in those major cities. China aims to have a successful test phase behind it to get the digital currency up and running for the 2022 Beijing Olympics. (Gross - Bechtel, 2020) According to Fáykiss (2021), three main motivations for the introduction of the Chinese digital currency can be mentioned:

1. Promoting financial inclusion with the needs of the digital society in mind.
2. Efficiency promotes security and market competition.
3. Support the international role of the yuan and improve the efficiency of cross-border transactions.

It is clear from the discussion above how the money has developed over the last nearly forty years. The traditional form of cash was initially replaced by bank cards, but there is no question of a complete replacement, as both forms coexist to this day. Nearly forty years ago, with the development of technology, cryptocurrencies began to emerge, which initially contained only separate components, which Nakamoto integrated into a system in 2008, giving birth to Bitcoin, which was able to eliminate

the shortcomings of its predecessors. However, cryptocurrencies are primarily unable to take over the role of real currencies due to their riskiness, resulting in the formation of stablecoin, which use a stabilization mechanism to reduce their volatility. Although stablecoin would be volatile as a real currency, they are not able to replace the currencies in use today due to their decentralized form. Taking advantage of the positive features of cryptocurrencies, under the pressure of digitization, central banks have begun to research digital currencies and, in some places, have already put them into a testing phase. More and more central banks are joining the research on digital currencies, motivated not only by the possibility of switching, but also by the risk of failure.

### 3. Advantages and disadvantages of digital currencies

The development of a new payment system raises a number of issues for decision-makers and may face different costs. It is therefore necessary to consider the characteristics of digital currencies and the potential advantages and disadvantages. In this chapter, we review the decision steps associated with digital currencies that are important to the study, as well as the advantages and disadvantages of digital currencies.

During the development of the digital currency payment system, it is necessary to go through decision points, which are built on each other (Figure 1): (Fáykiss, 2021).

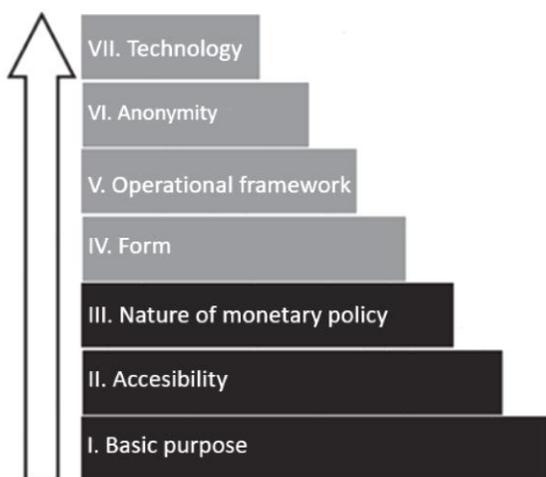


Figure 1. Decision steps in the design of a digital currency payment system. Forrás: Fáykiss P. et al. (2021). *A pénz átalakulása a digitális korban / The transformation of money in the digital age.*

The first is to define the basic purpose of motivating the creation of a digital currency. This is followed by determining accessibility, i.e. who can access digital currency. It is also important to define monetary policy, followed by a definition of

form, which also includes the functions of the digital currency. These are followed by the definition of the operational framework, where the role of the central bank is also clarified. This is followed by the formulation of the level of anonymity and finally the selection of the appropriate technology. Here, in terms of short- and long-term returns, it is important to consider whether it is worthwhile to use the existing infrastructure or whether the development of a new system (e.g. blockchain) is more profitable in the long-term. (Fáykiss, 2021)

In order for these decisions to be made, it is important to know the characteristics of digital currencies, and after the pros and cons of digital currencies, which are described below, through DC/EP. Digital currencies, like cryptocurrencies, are based on blockchain technology and have their data in a digital ledger (Peters – Green – Yang, 2020). Another similarity of digital currencies compared to cryptocurrencies is that they exist only in electronic form. Like fiat money, digital currencies are devices created specifically for payment purposes that are also suitable for the purchase of physical goods and services. These, although using a blockchain system, can still be considered as digital currencies issued and controlled by central banks. In doing so, they can be a reliable exchange tool and thus replace the currencies in use today, as they have a more stable market price and safer value preservation with government approval (Yu, 2021). It also follows that the shared ledger is also controlled by the government or the central bank, which gives a free hand over full control over the financial economy, making their use highly repressive to fraud, abuse and money laundering (Peters – Green – Yang, 2020).

DC/EP can be used with a smartphone application that does not require an intermediary, as it is distributed through a digital wallet, not a bank account. This is because we can't talk about physical money that should be stored in a bank account, so DC/EP is really completely digital. (Ezquer, 2020) This application, or digital wallets issued by the People's Bank of China, as it excludes the intermediary party and the related infrastructures, thus resulting in lower transaction costs. Another advantage is that there is no need for prepaid network payments because the central bank and the issuing banks are directly connected to each other, so this also means a reduction in costs. Compared to mobile payment systems, the advantage of DC/EP is that it does not require an Internet connection, thus it is easier to use, it becomes more widely applicable, and last but not least, it prevents interruptions due to network failures or power outages. (Gross - Bechtel, 2020) Furthermore, compared to cash, it is not negligible, especially in the current circumstances, that it provides a much more hygienic solution. Another important advantage is the low cost and the associated high efficiency. Low cost refers to a reduction in transaction costs by excluding intermediaries. Its efficiency is reflected in the number of transactions per second (TPS). According to a study, DC/EP can achieve a transfer rate of 220,000 transactions per second. By comparison, PayPal has 40,000 and Visa's networks have about 1700, Ethereum 30, and Bitcoin average 5 TPS. Improvements are underway, of course, such

as the Ethereum software update expected by the end of the year or early next year, allowing the current 30 TPS to grow to 100,000 TPS using horizontal scaling. The third benefit is the reduction of economic crime and fraud. Compared to fiat currency, digital money is hard to counterfeit. Transaction records are encrypted and under full control. This, in turn, raises one of the biggest societal disadvantages of digital currencies, namely data protection issues. After all, transactions can't be completely anonymous, DC/EP has users' personal data that can be tracked and all money movements from use to storage can be recorded. The issue of abuse may also arise on the part of governments, after all, they will have the financial information of all users. This information can also be a potential target for cybercriminals. The spread of digital currencies can be a major challenge even for financial intermediaries, mobile and online payment platforms and banks. (Kshetri, 2021)

The advantages and disadvantages listed are summarized in the table below. (Table 1)

*Table 1: Advantages and disadvantages of using digital currencies*

<b>Advantages</b>	<b>Disadvantages</b>
Lower transaction cost	Controlled/ full supervision
Network card payment is not required	Lack of data protection
Internet connection is not required	Possibility of abuse
It can be used more widely	Potential target for cybercriminals
It is more hygienic than cash	
Reliable, low-risk payment method	
High efficiency	
Controlled/ full supervision	

#### **4. Comparison of cryptocurrencies and digital currencies**

In this section, we compare the differences and similarities between cryptocurrencies and digital currencies as a summary of the above, which are summarized in Table 2.

The first and most important difference between the two systems is the control by a third part. After all, Bitcoin's peer-to-peer system, as its name suggests, refers to a network and the connection between them in which each computer acts as a server, thus providing direct access between two parties without a central server, while in digital currencies banks would appear as third party. For cryptocurrencies, transactions and their associated data are available in a digital ledger, organized into blocks. These are connected to each other, authenticated and time-stamped by the nodes (computers) in the peer-to-peer system. The authenticated data blocks thus

connected form a chain. This is called a blockchain. In contrast, if we consider digital currencies, which are also based on the blockchain system and whose data are in a digital ledger, the difference is that they are not authenticated by the computer nodes, but will be controlled by the government or the bank, which gives you full control over the financial economy. Thus, another big difference emerges. Although the cryptocurrency system is considered secure, the risk of abuse and fraud is very high because it is not under direct control. In contrast, digital currencies, due to their control, could also curb fraud, abuse and money laundering to a large extent.

The main common denominator between cryptocurrencies and digital currencies is that they only exist in electronic form. Also common is the use of online and offline wallets and the use of a two-key architecture to secure transactions. Although, as already mentioned, cryptocurrencies are also accepted currencies in many places, they are unlikely to function as a general currency in the future, but rather remain risky investment assets. In contrast, digital currencies, which are assets created specifically for payment purposes, may replace the currencies in use today.

*Table 2: Comparison of cryptocurrencies and digital currencies based on the above-mentioned characteristics*

<b>Cryptocurrency</b>	<b>Digital currency</b>
Decentralized	Centralized
There is no intermediary/controller	Controlled by the government or banks
Based on a blockchain system	Uses a blockchain-like system
Data in digital ledger	Data in digital ledger
Nodes authenticate data	The data is authenticated by the government and banks
There is a high risk of abuse and fraud	It curbs abuses and scams
It exists only in electronic form	It exists only in electronic form
Uses online and offline wallets	Uses online and offline wallets
Applies a two-key architecture	Applies a two-key architecture
A risky investment asset of the future	The currency of the future

## 5. Summary

Overall, the first part of the study showed the transformation money has undergone over the past forty years and what processes and factors have shaped the emergence of digital currencies. The second part of the study looked at the decision-making process needed for a new financial system to emerge, with a focus on digital currencies. To do this, it was essential to explain the advantages and disadvantages of digital currencies. It is clear from the study that a new financial system is emerging, but full implementation is yet to come. In addition, cryptocurrencies have been found

to have exploded into the public consciousness for more than a decade but have not been able to replace the currencies in use today.

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