

# Digital Currency Research Brief

## Lab 58 Technology Research Brief

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The advent of the internet and digital technologies has brought about innovation in the realm of financial products and services. One of those innovations is digital currency, which enables global transfer of funds outside of regulated financial channels like banks or card processors. Digital currency is available only in electronic form. Digital currency creates the foundation for financial inclusion by giving unbanked individuals access to financial services; millions of people around the world—including more than 7 million American households—do not have bank accounts.<sup>1</sup> Cryptocurrency is the most popular digital currency. It is decentralized, meaning that its transactions do not go through a bank, a credit card processor, or a central government entity. It runs on a peer-to-peer network called blockchain (Figure 1) that is secured by cryptography, a security protocol.

### Digital Currency Applications

This research brief will focus on two types of digital currencies—the decentralized cryptocurrency and the centralized Central Bank Digital Currency (CBDC). It will also highlight the role of blockchain as an enabling technology and present use cases that show how digital currency can foster financial inclusion for unbanked individuals.

Figure 1: This image is a representation of the cryptocurrency Bitcoin distributed on a peer-to-peer network called blockchain.

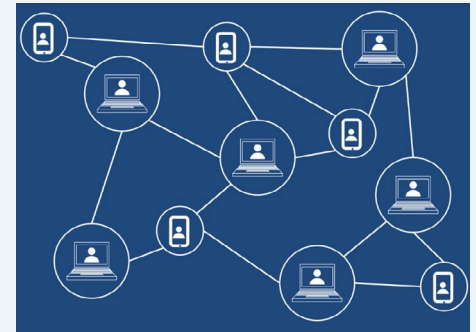


Image by Tumisu, Pixabay

KEY TAKEAWAYS

- The digital currency landscape is expansive, and the decentralized private digital currency called cryptocurrency is the most popular digital currency.
- Unlike electronic money, digital currency never takes a physical form like coins or paper.
- Digital currency was created with decentralization and privatization as its core, yet its impact to foster financial inclusion of the poor can be enhanced by the addition of CBDC, a centralized public offering.
- The potential areas for innovation in digital currency include the creation of interoperable financial platforms using open-source software and leveraging of the existing mobile payment networks.

<sup>1</sup> Federal Deposit Insurance Corporation (FDIC). (2020). *How America banks: Household use of banking and financing services*. FDIC.

## History and Types of Digital Currency

There are several types of digital currency. Some called cryptocurrency are decentralized and private; cryptocurrencies are the most popular form of digital currency. Others called CBDCs are centralized and public, and they are being created by central banks in response to the early success of cryptocurrencies like Bitcoin and Ethereum. CBDCs would enable governments to expedite public services like tax refunds, stimulus checks, and government aid, while also eliminating the cost of minting money.

The first digital currency was a cryptocurrency called Bitcoin, introduced in 2008 by Satoshi Nakamoto. Nakamoto's vision for Bitcoin centered on a cryptography-secured electronic currency that eliminated third-party involvement, making money secure and streamlining transactions.<sup>2</sup> Since then, several cryptocurrencies (e.g., Ethereum, Ripple, EOS, Tezos, Dogecoin) have gained popularity. Bitcoin remains the most widely accepted cryptocurrency.

## How Cryptocurrency Works

The fees and restrictions in the traditional banking world impose economic burden and force unbanked individuals to use cash. Cash-based transactions are restrictive and unsecure, and they provide few avenues for saving and investment. Therefore, the traditional financial methods and tools do not benefit the poor. Research shows that digital currency can connect the poor and the unbanked to the traditional financial services using readily available technology like mobile phones. An unbanked individual can start using digital currency like Bitcoin by getting a free digital wallet<sup>3</sup> using a mobile phone or an internet-connected device. The digital wallet has two types of keys, public and private. The public key<sup>4</sup> is like an email address and can be shared with others. The private key<sup>5</sup> is like a password and should not be shared with others. The private key is used to sign the transactions and to verify who owns the digital wallet. Verification for the transaction occurs via mining,<sup>6</sup> which is the process that cryptocurrencies use to generate new coins and verify new transactions.

The unbanked can use their digital wallet as a bank account. Digital wallets can receive Bitcoin as salary and send it as payments for bills. Once the habit of such a simple system without the fees and requirements of bank accounts is put into place, the unbanked can participate in other banking functions through distributed finance.

## How Blockchain Enables a Crypto Transaction

Although blockchain was originally developed as the technology underlying Bitcoin, it has the potential to become the default system of record for all types of transactions. According to a report by PwC, "More than 88% of CBDC projects at pilot or production phase use blockchain as the underlying technology."<sup>7</sup> Blockchain is an open, distributed ledger that can record transactions between two parties. Additionally, Blockchain acts as a peer-to-peer network and can become a default system of record for all transactions (Figure 2).

These peer-to-peer networks are encrypted; therefore, blockchain payments have increased security compared to regular card transactions.<sup>8</sup> As Bitcoin becomes more widely accepted, it can be used to purchase everyday goods and services. These digital transactions are fast and inexpensive. In addition, Bitcoin transactions cannot be executed if no Bitcoins are held, thereby avoiding overdraft fees and service charges that are common in traditional bank accounts.

Figure 2: How crypto transaction flows over Blockchain.

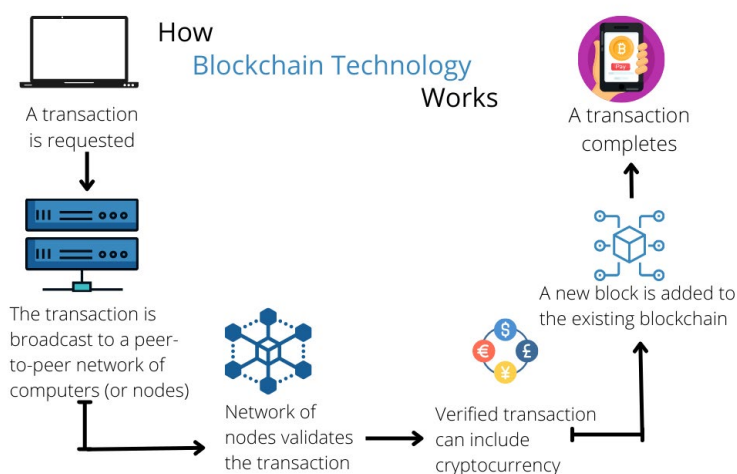


Image created in Canva.

<sup>2</sup> Nakamoto, S. (2008, October). *Bitcoin: A peer-to-peer electronic cash system*. Bitcoin.

<sup>3</sup> Kagan, J. (2022). *Digital wallet*. Investopedia.

<sup>4</sup> National Institute of Standards and Technology (NIST), Computer Security Resource Center (CSRC). (2020). *Public key, glossary*. CSRC.

<sup>5</sup> National Institute of Standards and Technology (NIST), Computer Security Resource Center (CSRC). (2020). *Private key, glossary*. CSRC.

<sup>6</sup> Yaga, D., Mell, P., Roby, N., & Scarfone, K. (2018). *Blockchain technology overview* (NISTIR 8202). National Institute of Standards and Technology.

<sup>7</sup> PwC. (2021). *Central bank digital currencies (CBDC) index report: Focus Asia region*. PwC.

<sup>8</sup> Coinbase. (n.d.). *What is a blockchain?*



Figure 3: M-Pesa is a mobile payment system used by 50 million users in Kenya.

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## Digital Currency Use Cases

The use of Bitcoin and other cryptocurrencies may be more prominent and widespread in leading economies like the United States, but a narrative has emerged about its role in fostering financial inclusion in developing countries for services such as international remittance and support for small-scale businesses.<sup>9</sup> M-Pesa (Figure 3) is a mobile phone-based payment service which can run on a basic cell phone and does not rely on smartphone technology. In 2007, Safaricom—Kenya's largest mobile network operator—launched the service, making M-Pesa Kenya's first large-scale mobile currency. M-Pesa gives its customers the freedom and flexibility to make cryptocurrency transactions—including payments to mobile service providers and other companies—via text message. M-Pesa does not use blockchain, but its simple design made it accessible even to farmers in rural Kenya and contributed to its market penetration in Africa. BitPesa is a blockchain-based Kenyan digital currency exchange offering a faster and cheaper money transfer alternative to traditional services like Western Union. When BitPesa tried to leverage the existing network of M-Pesa agents, its efforts were blocked by Kenyan regulators. However, M-Pesa's decade-long success has enabled the adaptation of mobile phone-based financial transactions in Kenya and has paved the road for digital currency platforms like BitPesa.

Nakamoto envisioned cryptocurrency as a decentralized and private currency. Yet, the centrally controlled CBDCs could pave the way for wider adoption of cryptocurrency. The Bahamas is the first country to implement digital currency at the national level with its Bahamian Sand Dollar. Other countries—such as Cambodia, El Salvador, and China—have also been at the forefront of creating a centralized digital currency.<sup>10</sup>

In 2020, Accenture partnered with the Digital Dollar Foundation to create the Digital Dollar Project<sup>11</sup> to promote researching a U.S. central bank digital currency. Creating an electronic form of U.S. money could also make financial transactions more inclusive across the country, where transaction fees limit many Americans' access to standard financial services.

State and local governments can create digital currency-based platforms to deliver public services or effectively distribute public benefits to their most vulnerable citizens, while having more transparency on what the money is used for. The Angeleno Card initiative by the Los Angeles city government has been distributing public benefits to its vulnerable residents via prepaid debit cards. Its success makes it a strong candidate for creating a more transparent digital currency-based platform that will replace prepaid debit cards.

## Future Trajectory of Digital Currency

Digital currency is a major innovation in financial technology. It has the potential to overcome the problems of cash-based financial transactions and make payment systems faster and cheaper. Most types of digital currency—like cryptocurrencies—are decentralized by design. They must reinforce security and transparency to preempt vulnerabilities and build trust.

Research shows that digital financial services, including decentralized currency, can connect the unbanked to a richer set of financial services using technologies like mobile phones that are already available to the unbanked.

**International remittances:** According to a 2019 report by the World Bank,<sup>12</sup> cross-border remittances from family members working abroad can cost an average of \$14 for a \$200 transaction. There is a need to create a low-cost remittance channel for individuals who want to transfer small amounts of money via international transactions.

**Migration from mobile to digital:** Success of Kenya's M-Pesa has become a poster child of the digital financial inclusion movement, with its embrace by more than 48 million Kenyans.<sup>13</sup> Digital currencies like Bitcoin have the potential to complement, or compete with, mobile banking applications. To that end, digital payment platforms like BitPesa have tried to leverage the existing mobile agent network of M-Pesa but with limited success. Opportunities to partner with payment platforms like BitPesa to create solutions that can work on low bandwidth phones (non-smart phones) should be explored.

<sup>9</sup> Scott, B. (2016). *How can cryptocurrency and blockchain technology play a role in building social and solidarity finance?* (UNRISD working paper No. 2016-1). United Nations Research Institute for Social Development (UNRISD).

<sup>10</sup> Rahul, N. (2021). *Bahamas ranks first in CBDCs, China's digital yuan third: PwC report.*

<sup>11</sup> Digital Dollar Project. (2020). *About.*

<sup>12</sup> World Bank. (2019). *Migration and remittances report.* World Bank.

<sup>13</sup> O'Dea, S. (2021). *M-Pesa customer numbers from 2017 to 2021 Statista.*

## Development of open-source financial platforms:

M-Pesa's success has inspired other initiatives that focus on helping the public and private sectors develop digital financial services with low or no fees. Efforts should be focused on creating a digital tool that makes interoperability across financial platforms seamless, using an open-source software such as Mojaloop.<sup>14</sup>

Using blockchain to develop an open-source solution/platform is another possibility for future research and development. This platform would create transparency for humanitarian aid distributions.

**Cryptocurrency as investment:** A new cryptocurrency called CityCoins<sup>15</sup> is designed to be launched at the city level, and it can be bought by individuals who want to support their city. CityCoins can provide an ongoing crypto revenue stream for the city, which can be used to benefit the city and its constituents. MiamiCoin (MIA), launched in August 2021, is the first CityCoin.

## Benefits and Limitations of Digital Currency

Digital currencies offer a faster and cheaper alternative to current means of money transfer. These benefits are especially attractive for international money transfers that also involve currency conversion. Digital currency transactions operate at the same speed all of the time, which alleviates hardships that delays in processing financial transactions (e.g., clearing a paycheck after hours) may cause. In addition, introducing CBDC to expand digital currency can enable unbanked individuals to use or access their money when and how they want—including paying bills without extra charges. Digital currency can be a lifeline to countries in precarious settings like wars or natural disasters by providing an infrastructure for everyday local payments and a safer way to hold money.<sup>16</sup>

However, the early adaption of digital currency like Bitcoin may have been plagued with concerns like volatility, lack of accountability, and security vulnerabilities. In addition, there is a growing concern that computing resources required for blockchain processes like cryptocurrency mining may contribute to increased carbon emissions.

At the individual level, the setup and use of digital currency using artifacts like crypto wallets require a level of financial and digital literacy that many individuals, especially the unbanked, may not possess. This creates an information and skills gap that must be bridged through active efforts to enhance financial and digital literacy of these individuals. This is an area where policy intervention by central governments can help. Central governments can create CBDCs to supplement existing forms of money and payment systems. CBDCs can also reduce costs associated with cash management (e.g., printing money) and promote the idea of contestability in financial transaction (including retail payments). Lastly, CBDCs can foster financial inclusion by improving public confidence and participation in digital currencies.

However, the introduction of CBDCs must be preceded by a detailed cost/benefit analysis of its implications with a special focus on the potential risks and potential effects on existing money and payment systems. This careful analysis must address strategic aspects like scalability and outreach, in addition to considering key implementation factors like IT and cybersecurity.

Last but not least, there cannot be a one-size-fits-all approach to CBDCs. Instead, the case for CBDCs should be country-specific and should depend on economic, financial, cultural, and regional factors.<sup>17</sup>

Although digital currency is still in its early days, it will play an important part in the future of finance.

## Learn More About Lab 58

Thank you for your interest in our work! Our researchers and developers are actively exploring use cases for digital currency and blockchain, and we want to help you explore opportunities to work with the technology. Please email us at [Lab58@rti.org](mailto:Lab58@rti.org). We will set up a 30-minute, one-on-one chat to discuss opportunities and answer any questions. We are interested in partnering with you to find a solution that meets your needs.

**For more information, contact [Lab58@rti.org](mailto:Lab58@rti.org).**

<sup>14</sup> Mojaloop Foundation. (n.d.). *What is Mojaloop?*

<sup>15</sup> CityCoins. (2021). *Introducing CityCoins*.

<sup>16</sup> Scott, B. (2016). *How can cryptocurrency and blockchain technology play a role in building social and solidarity finance?* (UNRISD working paper No. 2016-1). United Nations Research Institute for Social Development (UNRISD).

<sup>17</sup> CBDC Working Group. (2019). *Key aspects around central bank digital currencies policy report*. FinTech.

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