Chapter 9
Blockchain and Digital Currency

9.1 What Is Digital Currency?

Digital currency is a form of money, which first emerged in the form of credit or debit cards stored on an electronic device or as balances held on a website. Now with the advent of Bitcoin and blockchain technology, digital currencies have taken on new meaning as a medium for value exchange across technology platforms and open markets. Digital currencies come in different forms, with cryptocurrency and virtual currency being the most popular. Cryptocurrency involves the decentralized control of a network, while the virtual currency is used as a method to save and perform transactions. The most common form of digital currency is central bank digital currency, which is inflationary and directly issued by central banks.

Digital currency is an electronic representation of value used as a method of exchange. It's not a physical currency, but its properties are dissimilar to those of traditional currencies in that it has no physical form, is not printed or minted, and enables instantaneous transactions.

Digital money comes in two varieties: centralized and decentralized. Centralized digital money involves the issuing of tokens by a single entity (e.g., a bank). These tokens can be traded to others who are in turn able to spend them with that same entity. Decentralized digital money, on the other hand, features no central issuer or controller over the supply of tokens, and all users are given equal privileges as owners of the system.

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9.2 What Is Cryptocurrency?

A cryptocurrency is a type of electronic currency that can be used for financial transactions. Cryptocurrencies are classified as a subset of digital currencies. A cryptocurrency is a set of encrypted data that has been engineered to operate as a medium of exchange. Through the use of cryptography and blockchain technology, each unit of currency is unique and highly secure, ensuring accurate transaction record-keeping.

Cryptocurrency is not backed by a commodity or a government. Instead, it is created as coins and tokens through a process called mining, in which computers solve cryptographic puzzles to unlock the coins. Because the coins are not directly tied to something that has value, their worth is determined on the open market. As their value fluctuates, people are attracted to cryptocurrency because of its potential for short-term gains.

Cryptocurrencies represent a new form of digital currency that utilizes algorithms to secure transactions and control the creation of new units. Cryptocurrency uses decentralized control, as opposed to centralized banking systems, where operations are conducted by a central entity. It is not managed or issued by one entity but rather a network of computers across the globe. Cryptocurrency is not backed by any government or monitored by a single regulating body or authority. Minting a cryptocurrency would mean that it is considered centralized. The same goes for

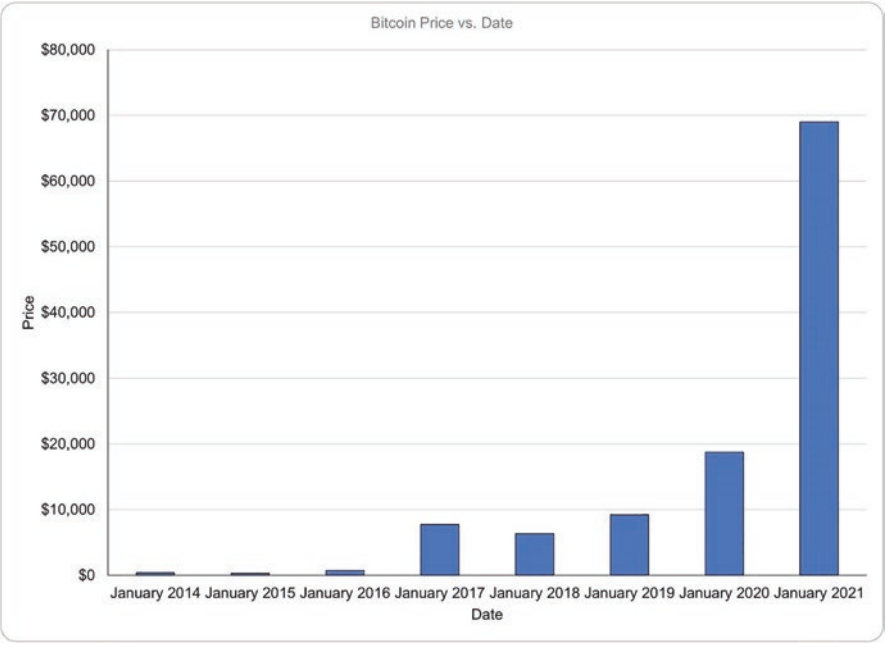

Fig. 9.1 Bitcoin price history

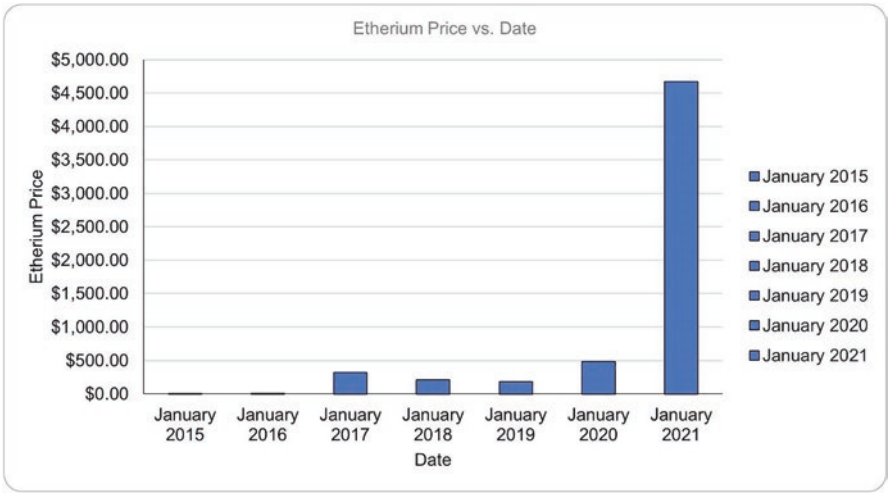

Fig. 9.2 Ethereum price history

when it is created before issuance or can only be issued by a single issuer. On the other hand, implementation of the Cryptocurrencies are digitized assets [2], used as a tradable form of money. They are issued and maintained by a decentralized network, making them impervious to the fraud and political interference common in modern industries. There are over a thousand different cryptocurrencies in circulation today—many of which can be found on well-organized exchanges with diligent security protocols. Cryptocurrency is believed to be the key to the establishment of a smart economy (Figs. 9.1 and 9.2).

9.3 Digital Currency Versus Cryptocurrency

Cryptocurrency is not all there is to digital currency. It utilizes cryptography to function. A very essential feature of cryptocurrencies is the decentralization of electronic money systems. The first and most popular of such systems is Bitcoin, based on cryptography.

David Chaum [1] introduced the digital cash idea through a research paper in 1983. In 1989, Amsterdam witnessed the implementation of the ideas in Chaum's paper in DigiCash, an electronic currency company for commercial purposes. However, 1998 saw the company filing for bankruptcy.

In the same 1998, PayPal launched service. The year before (1997), Coca-Cola launched mobile payments from vending machines. Even though the US government shut down e-gold in 2008, it had attracted several million users before then. Academia and US officials have referred to e-gold as "digital currency." Not long after the US government shut down e-gold, Bitcoin was launched (in 2009).

Attempts by the government to regulate the currency proved abortive because there was no central person or organization in control of it. The introduction of Bitcoin was the beginning of decentralized electronic currency.

The origin of digital currencies can always be traced to the 1990s Internet bubble. Digital currencies also have a history of being used for money laundering and Ponzi schemes. Such digital currencies were prosecuted for operating without MSB licenses by the US government. In China, Q coins—or QQ coins—emerged during the year 2005. Renewed interest in digital currencies has also been sparked by recent interest in cryptocurrencies.

9.4 Understanding Digital Currencies

Digital currencies are not tangible and exist only digitally. No physical form of the currency exists, meaning that it can only be held electronically.

On the other hand, dollar bills have physical attributes, such as banknotes and minted coins. Transactions involving these currencies can only take place between the people who have them.

Digital currency transactions can be executed instantly and are not subject to the same geographical limitations as traditional financial transactions. This means that, for example, a seller in San Francisco can accept payment from a buyer in Singapore without worrying about foreign exchange fees or currency conversions.

9.4.1 Characteristics of Digital Currencies

1. Digital currencies are not backed by any government or bank, and they are not physical money but rather a form of computerized payment.
2. Digital currencies can be centralized or decentralized. Centralized digital currencies can be issued by governments, such as fiat currency. Decentralized digital currencies, such as Bitcoin and Ethereum, are issued by a network of computers with no central authority.
3. The digital currency has made it possible to transfer value instantly and cheaply, regardless of location.

9.5 Types of Digital Currencies

There are several types of digital currencies, and we describe a few here.

9.5.1 Cryptocurrencies

Cryptocurrency payments are secure and can't be forged, but each transaction is recorded in the blockchain, the public ledger of all transactions. Due to the anonymous nature of these currencies, it can be difficult for governments to track transactions for tax purposes.

1. *Virtual Currencies*
   Virtual currencies are digital assets that can be used to make transactions with fluctuating tradable values, much like a commodity. They are tied to virtual goods, services, or other forms of value within social networks.
2. *Central Bank Digital Currencies (CBDCs)*
   These types of currencies are digital versions maintained and issued by central banks. Though they may be used like regular crypto assets in some cases, they are not necessarily decentralized. Several central banks including those in Canada, Australia, England, and Japan have considered or are considering ways to issue CBDCs; in Canada, the Bank of Montreal has started a pilot program [2].

9.6 Advantages of Digital Currencies

1. *They have fast transfer and transaction times*
   The speed at which digital currency exchanges can process transactions is a significant advantage over traditional payment networks. Because digital currencies transfer across the same network in which they are created, there is no need for intermediaries to process payments and clearing and settling transactions in a very short time frame with relatively low fees. These new methods of payment offer many benefits over traditional methods, including lower processing fees and a higher level of transparency in transactions. The use of digital currency can also make it easier to record and keep records of purchases, as well as audit information.
2. *They do not require physical manufacturing*
   Digital currencies have no physical version, so there is no need for manufacturing facilities, which makes them more cost-effective. Digital currencies are also immune to physical problems like creases, folds, or dirt that may appear in a normal dollar bill.
3. *Ease of use*
   The current monetary system enables the Fed to circulate money through a series of banks and institutions. Banks can avoid this system, however, by issuing their currency directly to citizens.
4. Cheaper Transactions
   Electronic currencies allow for smoother transactions between parties. For instance, you can buy a product from a third-party vendor without the need of going through a retailer or payment processor. Because of this transaction model,

the overall cost of making a transaction is reduced and it becomes cheaper to use such a network, as opposed to fiat currencies or other payment methods.

9.7 Disadvantages of Digital Currencies

1. *They can have storage and transaction processing issues*
   Digital currencies have different requirements from paper money. For instance, an Internet connection is necessary for any digital currency like Bitcoin because users need to access the blockchain, or public ledger, to view the balance of their accounts and complete transactions.
2. *They are susceptible to hacking*
   Digital currencies are susceptible to attacks and scams. While digital currency wallets can prevent some hacks and protect your currency, there is no guarantee that any digital currency is safe from attacks. Online wallet services can be hacked, and attackers can make changes to the underlying blockchain technology to steal funds or create a new currency that leaves you with nothing.
3. *Volatility in value*
   Digital currencies are often prone to sudden changes in price because of their decentralized nature. While this makes digital currencies appealing to investors, it also means that there is a wider range of prices for consumers to choose from when transacting. For instance, one Bitcoin was worth about $100 in 2013, but by December of that year, the same Bitcoin was worth more than $1000.

9.8 Understanding Cryptocurrency

Cryptocurrencies are digital tokens that are accepted as a form of payment. These tokens are based on cryptographic protocols, which are mathematical sets of rules used to verify the transfer of assets. The first cryptocurrency was Bitcoin, created in 2009. Over the past few years, cryptocurrencies have gained significant traction, particularly among businesses looking to save on transaction costs and individuals who want to make payments across borders without using a bank or credit card.

Cryptocurrencies can be mined or purchased from online cryptocurrency exchanges. Only a few online e-commerce sites allow customers to transact using cryptocurrencies, primarily Bitcoin, because of its popularity. However, the market value of cryptocurrencies has increased dramatically since they were introduced, and they are becoming popular among investors as potentially lucrative trading instruments.

9.8.1 Types of Cryptocurrencies

There are thousands of cryptocurrencies on the market today, with Bitcoin being the world's largest in terms of media coverage, market capitalization, and general popularity. While it was originally designed to function as a decentralized and peer-to-peer alternative to fiat currency, it has grown into a full-fledged remittance system, peer-to-peer payment platform, and investment strategy.

Cryptocurrencies, which are utilities that run on blockchain technology, claim a variety of functions. For instance, Ethereum's ether runs the code of decentralized applications. Ripple's XRP is used to facilitate international bank transfers.

The success of Bitcoin has led to the introduction of new cryptocurrencies. Some of these cryptocurrencies aim to become a better form of bitcoin (e.g., valuing faster transaction times or lower fees over decentralization), while others are entirely novel and use the technology for different use cases than bitcoin. These include Ethereum, Ripple, Cardano, Stellar, IOTA, and EOS.

9.9 Advantages and Disadvantages of Cryptocurrency

Tradeoffs come with every revolution, and cryptocurrencies are no different given that the revolution of financial infrastructure is at the heart of the introduction of cryptocurrencies. At present, major differences exist between what should be and what is in terms of the theoretical ideal and practical implementation of a decentralized cryptocurrency system.

9.9.1 Advantages of Cryptocurrency

1. Cryptocurrencies mean a new era of decentralization in the money system. Banks and monetary institutions which act as centralized "middlemen" to enforce trust and monitor transactions between two parties are no longer a necessity within this system. In this regard, the possibility of a single point of failure (like a large bank) causing a spiral of crises such as the 2008 chain reactions in the United States caused by the failure of institutions is eliminated.
2. With the decentralization of the money system in the works and the elimination of a third party such as banks or a credit card company, direct fund transfer between two parties is easier. The security of such decentralized transfers can be guaranteed by the use of transaction keys and different forms of incentive systems such as proof of work or proof of stake.
3. Cryptocurrencies like Bitcoin are used as intermediaries in the remittance economy. As more people move around the world, it becomes increasingly difficult to transfer money across borders through fiat currencies. However, by converting

a fiat currency to a cryptocurrency and then to another fiat currency at the destination, individuals can avoid the expensive conversion fees.

9.9.2 Disadvantages of Cryptocurrency

1. While digital currencies claim to be anonymous and private, they aren't. Every transaction can be traced by the agencies.
2. Cryptocurrencies are popular with criminals, who use them for money laundering and nefarious activities. The Dread Pirate Roberts case is famous, as he ran a marketplace to sell hard drugs on the Dark Web. Cryptocurrencies are also popular with hackers who use them in ransomware attacks.
3. Theoretically, cryptocurrencies should be decentralized. But in reality, they are highly concentrated. For instance, an MIT study found that 45% of Bitcoin was held by just 11,000 investors.
4. One of the biggest problems with popular cryptocurrencies such as Bitcoin is that they are mined using enormous amounts of energy. That energy consumption is a big contributor to climate change, and it also accounts for a large amount of electricity spent by miners who compete against each other to solve complex math problems. Because of the high costs involved with mining and the unpredictability of rewards, most miners, who are often multi-billion-dollar firms, pool all their resources together to ensure they have the biggest piece of the pie.
5. While blockchain technology is highly secure, companies in the crypto industry can still be hacked. Not only have numerous exchanges been hacked over the years, but even people's private keys can be stolen.
6. Cryptocurrency's price volatility cannot be avoided. Its value can fluctuate [3] considerably in the short term, and this affects the price of goods and services offered in bitcoin. When purchasing different goods and services on bitcoin, it's important to stay abreast of the value fluctuations and act accordingly.

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