

1. INTRODUCTION TO CRYPTOCURRENCIES

Cryptocurrencies are subject to a continuous research, The European Central Bank defining them as a subset of the virtual currencies, which are bilaterally linked to the real economy. The cryptocurrencies can be bought with traditional money and, on the same time, can be sold against traditional money. Moreover, cryptocurrencies can be used in transactions for both real goods/services and digital assets. The International Monetary Fund defines cryptocurrencies as digital representations of values, while the World Bank include them into the group of digital currencies that use cryptographic techniques in order to reach consensus.

The emergence of cryptocurrencies is linked to the Bitcoin development, which was the birth of the blockchain technology. But Bitcoin is just one of the many applications of blockchain in practice, providing the means for the efficient recording of transactions. Despite the traditional methods of tracking assets, the blockchain technology has the potential to revolutionize the business network due to three main advantages:

- ✓ **Reduced vulnerabilities** – The central system is replaced by a peer-to-peer replication model, using the consensus principle to validate data. Each node receives a synchronized version of the ledger, in a way that eliminates duplication of effort and ensures immutability;
- ✓ **Cost savings** – Blockchain eliminates the need for a third-party authority, executing transactions without the corresponding fees charged by the intermediaries. Using a decentralized system can reduce risks with data concentration and technical failure, disrupting in the same time third parties' monopolies;
- ✓ **Improved trust** – The blockchain implementation increase trust between stakeholders, with high benefits on business cohesion, offering a single version of the event.

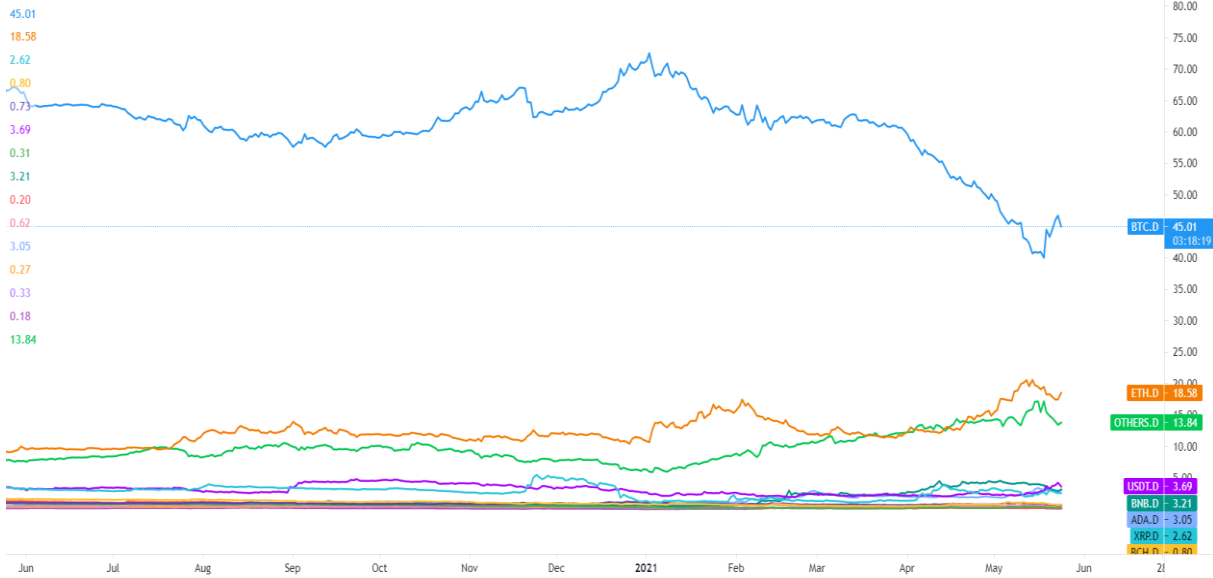
Table 1. Characteristics of selected cryptocurrencies

Name	Symbol	Start date	Algorithm	Proof Type	Max. supply	Current supply
Bitcoin	BTC	13.01.2009	SHA-256	PoW	20,999,999.98	18,713,700.00
Bitcoin Cash	BCH	01.08.2017	SHA-256	PoW	20,999,999.98	18,746,168.65
Ethereum	ETH	30.07.2015	Ethash	PoW	-	116,016,635.25
Ethereum Classic	ETC	23.07.2016	Ethash	PoW	210,700,000.00	127,474,289.74
Tether	USDT	06.10.2014	-	-	-	60,237,608,885.52
Binance Coin	BNB	27.06.2017	BEP-2	PoSA	-	169,433,763.90
Cardano	ADA	05.10.2017	Ouroboros	PoS	45,000,000,000.00	32,119,860,463.01
Ripple	XRP	01.01.2013	-	Federated Consensus	100,000,000,000.00	99,990,424,619.00
Dogecoin	DOGE	06.12.2013	Scrypt	PoW	-	129,608,176,383.70
Litecoin	LTC	13.10.2011	Scrypt	PoW	84,000,000.00	67,726,620.73

Source: <https://www.cryptocompare.com/>

The global capitalization of the cryptocurrency market was USD 1.66T (24.05.2021), with the dominance of Bitcoin (USD 732,239,194,829), Ethereum (USD 303,950,202,454) and Tether (USD 59,808,855,435). **Bitcoin (BTC)**, which was the pioneer of the blockchain technology, is based on encryption and protocols, providing secure solutions to unlock the value through private and public keys, in order to spend it or transfer it to a new owner. Bitcoin has gained an important position on the international financial market, its initially success being related to the peer-to-peer mechanism that solves the double-spending problem. The other cryptocurrencies (Figure 1.1) created afterward, have similar parameters, but less media coverage, shaping a particular unpredictable landscape due to their speculative premises. However, many investors and hedge funds began to structure their portfolios according to the cryptocurrencies' trends, while academics spent significant efforts to analyze the cryptocurrency trading, with a special emphasis on machine learning techniques.

Figure 1.1. The cryptocurrency market (May 2020 – May 2021)



Source: <https://www.tradingview.com/markets/cryptocurrencies/global-charts/>

Bitcoin Cash (BCH) was generated in August 2017, when the Bitcoin system was split into Bitcoin Cash (BCH) and the original Bitcoin (BTC), by incorporating Segregated Witness to reduce the amount of data verified in each block. In technical terms, SegWit activation caused a hard fork, BCH becoming the original Bitcoin blockchain for the ones who did not want to change. Miners can freely alternate between Bitcoin and Bitcoin Cash, which have different block size limits and compatible consensus algorithms based on the proof-of-work mechanism (Figure 1.2. – BCH transaction example).

Figure 1.2. BCH transaction



Source: <https://explorer.bitcoin.com/bch/address/bitcoincash:qqvvh47us34c2xxj3tnrww2td0f0tf8m3cw87187gq>

The emergence of the alternative virtual currencies (altcoins) was in line with the objective of complementing Bitcoin, by improving its main features. **Litecoin (LTC)** was introduced in October 2011 and differs heavily from BTC, using script algorithms (instead of SHA-256) and open source protocols to provide an improved storage efficiency and faster transactions (four time faster than BTC), reducing significantly the mean block time. There is a larger coin limit for Litecoin (84 million), while the Bitcoin limit is 21 million, from which over 18,713,700 BTC were already mined. Due to the dominant position of Bitcoin on the cryptocurrency market, scholars have found similar patterns in BTC and altcoins price developments, suggesting that the altcoin prices and BTC might be interdependent (Ciaian at al., 2018).

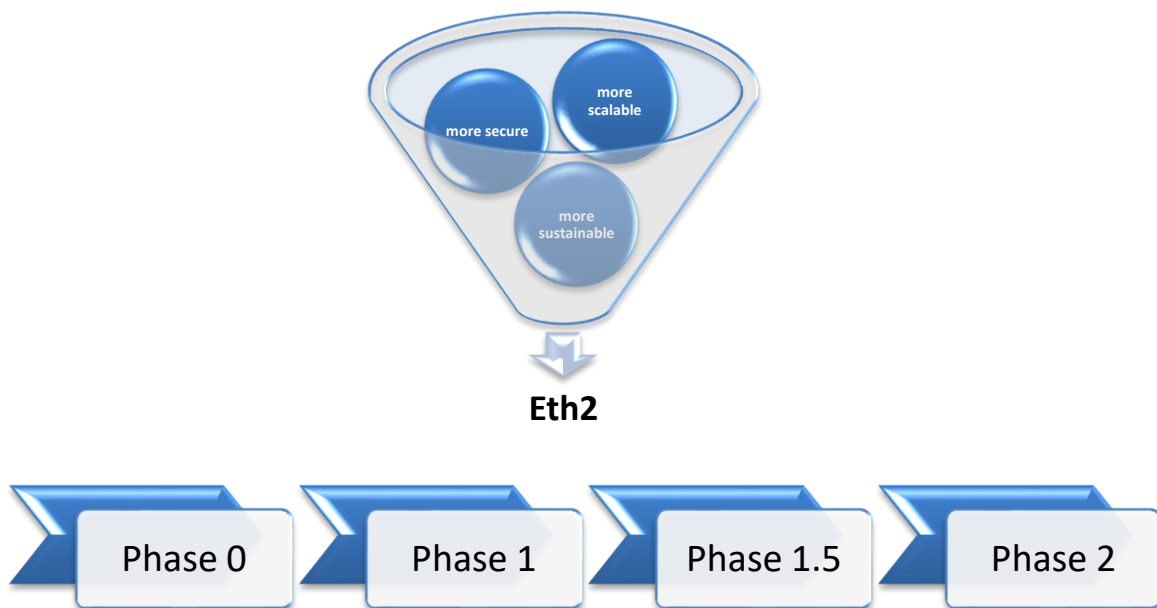
Dogecoin (DOGE), a cryptocurrency designed initially as a joke with a Shibu Inu as logo (2013), allows very fast payments and low transaction fees. Due to the particular large popularity, Dogecoin has continued its bullish trend during 2021, outperforming other cryptocurrencies. The price plunged to \$0,722320 on May 8, 2021 after an increase of demand from the retail traders. Dogecoin position has changed during last month, the price peaking to \$0,303625 (May 31, 2021), being still up by approx. 7,000% since the first month of the year.

Ethereum is an globally decentralized computing infrastructure based on smart contracts, using blockchain technology to synchronize data. Smart contracts are computer programs that implement logical sequences of phases in accordance with codes expressing certain rules and clauses. The event that activates the smart contract is transposed into a set of messages received by the program, causing the reactions in line with the contractual logic through a determined set of methods. Ethereum development comprises four main stages* and several intermediate hard forks**, which were registered according to the block number:

- **Block #0 – Frontier* (July 30, 2015)**
- Block #200,000 – Ice Age** (September 8, 2015)
- **Block #1,150,000 – Homestead* (March 14, 2016)**
- Block #1,920,000 – DAO** (July 20, 2016)
- Block #2,463,000 – Tangerine Whistle** (October 18, 2016)
- Block #2,675,000 – Spurious Dragon** (November 23, 2016)
- **Block #4,370,000 – Metropolis * (October 16, 2017)**

- Block #4,370,000 - Byzantium** (October 16, 2017)
- Block #7,280,000 - Constantinople** (February 28, 2019)
- Block #7,280,000 – Petersburg** (February 28, 2019)
- Block #9,069,000 - Istanbul** (December 8, 2019)
- Block # 9,200,000 - Muir Glacier** (January 1, 2020)
- Block # 12,244,000 – Berlin** (April 15, 2021)
- London** - planned for July 2021
- **Serenity***

Figure 1.3. Eth2.0 roadmap



The major change of the last stage of development (Serenity) refers to the replacement of the Proof of Work method (PoW) with Proof of Stake (PoS) in order to reduce the energy consumption. The next evolution of Ethereum blockchain is Eth2.0, including four phases outlined in the Fig. 1.3. Phase 0 is linked to the launch of the Beacon Chain, while Phase 1 address the scalability issues by implementing the shard chains. The main objective of the Phase 1.5 is to merge PoW blockchain with PoS blockchain, offering the transition framework to improve the mechanism: a greener Ethereum, more sustainable. Phase 2.0 will bring valuable contributions in terms of security, scalability and sustainability, providing significant improvements to Ether transactions and the execution of the smart contracts.

To find more about How does Ethereum's PoS work, please access this link: <https://ethereum.org/en/developers/docs/consensus-mechanisms/pos/#how-does-pos-work>

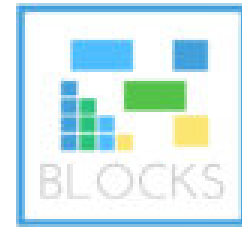
Ethereum has also a coin component, Ether (ETH), the second cryptocurrency in terms of market capitalization after Bitcoin. According to the Figure 1.4, ETH climbed to \$4,382.73 (all time high) and has jumped about 470% against USD in 2021, setting its ambitious target for the end of the year at \$10,000. Ethereum progress with the Beacon Chain sustains this movement, but the ETH price has retreated at the end of May 2021, declining at \$2 774,54, which was substantially below the record high. ETH value crashed sharply due to the intensified selling pressures, while Bitcoin has fallen roughly more than 55% after its peak. However, Ether surged to a fresh recovery on the last week of May, amplified by the position of the European Investment Bank and its announcement about the launch of its first digital bond issuance on the Ethereum blockchain.

Figure 1.4. ETH price evolution



Source: <https://www.coindesk.com/price/ethereum>

Both Bitcoin and Ether have had stunning rally this year based on the increased interest of corporate buyers and institutional investors, rather than retail investors. The CEO of Tesla, Elon Musk, was an important influencer on the crypto market, its favorable tweets about Bitcoin investments or Tesla accepting payments in BTC being received with enthusiasm by the crypto community. But Tesla has also caused panic among investors with the sale of 10% of the BTC holdings and another tweet questioning the BTC environmental impact. After sending the Bitcoin price into a downward spiral, Elon Musk spoke with bitcoin miners about the sustainability of the process, contributing to a new increase of the crypto market.



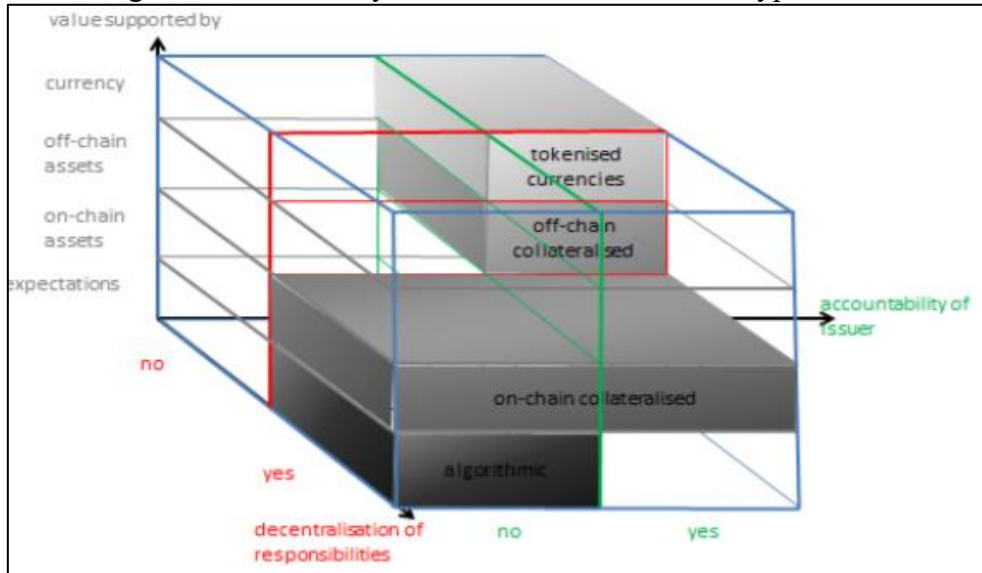
The recent decline of cryptocurrencies can be also linked to the Chinese authorities' announcements about crypto regulations, together with the unprecedented decision to adopt its own digital currency. On the other hand, the evolution of the BTC price can be explained by the sequence of phases specific for the price cycle of any asset: (1) accumulation, (2) markup, (3) distribution, and (4) markdown. Extreme volatility of Bitcoin and the impact of governments' announcements influencing the investors' sentiments were just some reasons that emphasize the reduced Bitcoin dominance, offering new possibilities to diversify their exposure through altcoins.

Ethereum Classic (ETC), which is originated at the Ethereum hard fork after the DAO hack, is the continuation of the renamed and unaltered history of the original Ethereum chain used by those that ignored the attempt to rewrite history. ETC is an open-source and blockchain-based distributed cryptocurrency platform, which runs smart contracts. The split version of Ethereum was performed in June 2016, when the Ethereum blockchain was hacked. In order to return the stolen funds (\$50 million) to the original owners, a split was performed to secure the platform, leading to the older network (renamed Ethereum Classic, using ETC) and the newer network (Ethereum, using ETH). The main concerns of ETC remains the scalability of its payment systems and the security issues, even if many software upgrades were employed, the Ethereum version being considered more legitimate than Ethereum Classic.

Stablecoins, which can be described as digital units of value that rely on stabilization tools, were designed as an alternative to the traditional cryptocurrencies due to the substantial differences in terms of investors' perceptions. First, a stablecoin is not a form of currency and can be traded without a direct interaction with the issuer. Second, stablecoins can be exchanged on a secondary market and has low price volatility. The stabilisation mechanism is the main pillar of development, being distinguished:

- (1) off-chain collateralised stablecoins;
- (2) on-chain collateralised stablecoins;
- (3) algorithmic stablecoins;
- (4) tokenised funds (Fig. 1.5).

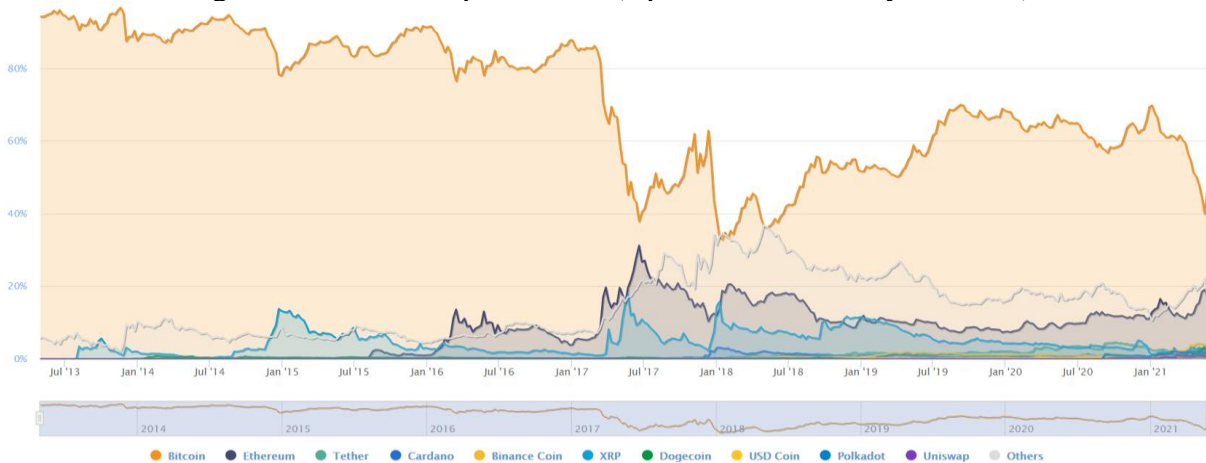
Figure 1.5. Taxonomy of stablecoins within the “crypto-cube”



Source: Bullmann, D., Klemm, J., Pinna, A., (2019). In search for stability in crypto-assets: are stablecoins the solution?, *ECB Occasional Paper Series*, 230.

Tether (USDT) dominates the stablecoin market both by market capitalisation and trading volume, being one of the USD-pegged stablecoins active on the market. According to the Fig. 1.6, Tether is on the third place by market capitalisation (4%, 31.05.2021), after BTC (43,06%) and ETH (17,88%). Tether’s quasi-monopoly in terms of trading volume (\$71,725,680,344 – volume 24h) at the end of May 2021 suggests its competitive position on the stablecoins market, being followed by USD Coin (\$2,012,958,775) and Binance USD (\$4,469,048,067).

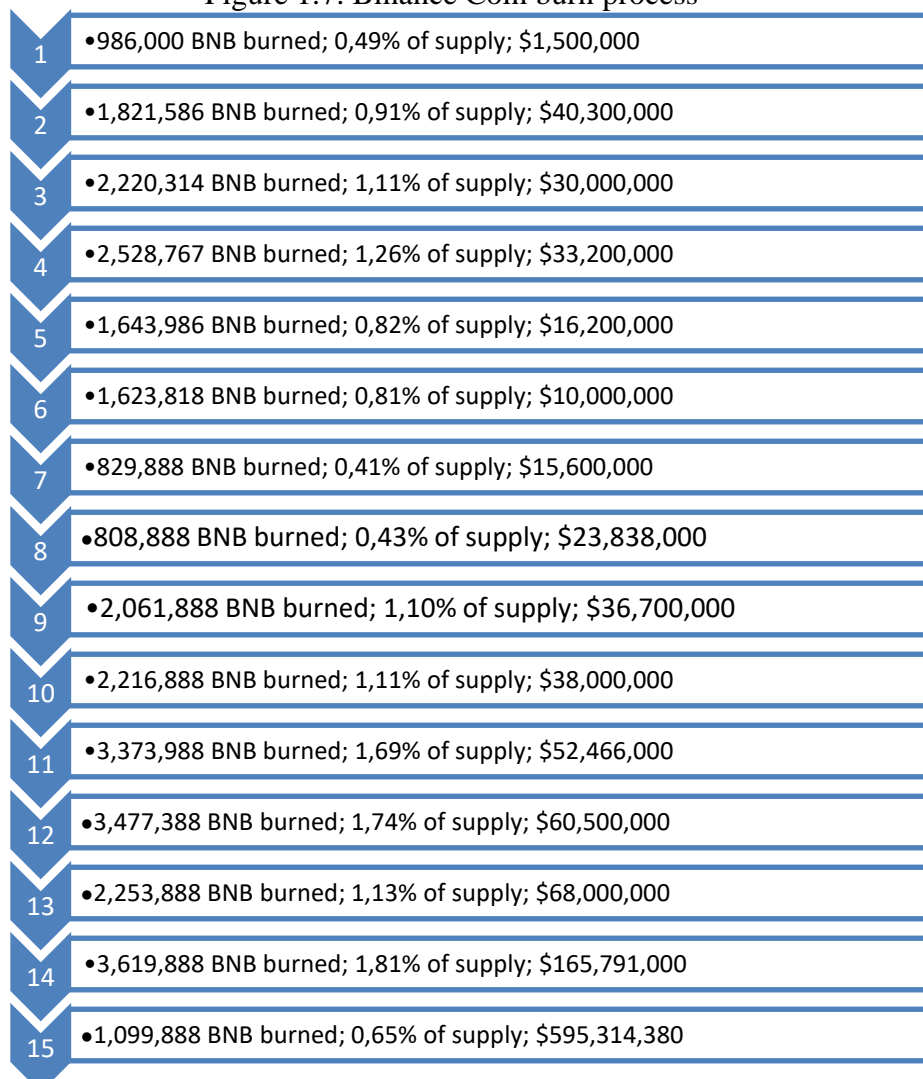
Figure 1.6. Market capitalisation (April 29, 2013 – May 31, 2021)



Source: <https://coinmarketcap.com/ro/charts/>

One of the most promising cryptocurrencies is **ADA**, which is operated in the Cardano network. During the current year, the price of Cardano has jumped up to its all-time high, being followed by a crash on May 19, 2021. Its valuable potential is driven by the recent growth pattern and the plans to integrate smart contracts on the blockchain, generating a price salt from \$0.180171 (January 1, 2021) to \$1.58 (May 31, 2021). Its development journey is divided into five themes (Byron, Shelley, Goguen, Basho and Voltaire) strongly associated to a set of functionalities. To find more about Cardano roadmap, please see Cardano whiteboard. Overview with Charles Hoskinson: <https://roadmap.cardano.org/en/>

Figure 1.7. Binance Coin burn process



Source: <https://www.binance.com/>

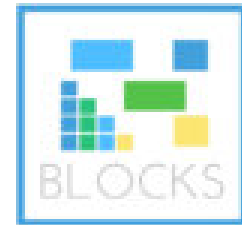
Binance Coin (BNB) was issued by Binance exchange in July 2017, running initially on the Ethereum platform. Now, BNB is the native currency of the Binance own chain and is ranking third by market capitalisation after BTC and ETH (May 2021). Binance Coin can be used for a wide range of use cases: process payments, credit card payments, gaming, shopping, donate to charity, investments and transfers. Its impressive performance in 2021 has also revealed its extreme volatility, doubling its price and falling back to the start level after the major crash at the middle of May.

The burning system, which is a scheduled program based on the commitment to burn 100 million BNB (half of BNB supply), aims to permanently remove coins from circulation and reduce the total supply. The 15th quarterly BNB burn is the largest ever burn in dollar terms, with 1,099,888 BNB burned, totalizing approx. \$593,939,520. The complete scheme of previous burns is outlined in Fig. 1.7., the process being based on the BNB trading volumes for the previous quarter and the BNB price. The figures suggest that 15.47% of the total BNB supply was burned until May 2021 and approx. 35% of BNB are yet to be burned in the next period. The 14th burn was also an impressive process, with 3,619,888 BNB burned, equivalent to \$165,791,000.

Figure 1.8. XRP price evolution (2021)



Source: <https://coinmarketcap.com/currencies/xrp/>



Ripple, the company that developed **XRP** in 2012, uses a less complicated mining method than Bitcoin, validating transactions through a unique distributed consensus mechanism, where the authenticity of a transaction is verified by participating nodes in faster and more sustainable ways. Initially designed as a replacement for SWIFT, being associated with low transaction costs, XRP was „pre-mined” at the amount of 100 bln XRP tokens which are periodically released. While the Bitcoin transactions confirmation time is about 10 minutes, for XRP it is 5 seconds on average. Ripple sustains its mechanism on the Ripple protocol consensus algorithm (RPCA), the price being driven by several factors that influence its progress (Figure 1.8): Ripple technology, the XRP supply and offer, media coverage and popularity, but also the bank’s cooperation.

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