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CRYPTOCURRENCIES AS A FUTURE PAY- MENT METHOD

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TIIVISTELMÄ

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Tutkimuksen tavoitteena on tarkastella kryptovaluuttoja niin maksutapana sekä mahdollisuutta tulla yleisesti käytetyksi valuutaksi, kuten euro ja dollari. Tutkimus hakee vastausta kysymykseen ”Voiko kryptovaluutoista tulla laajalti käytetty maksutapa?”

Työ on kartoittava sekä ennustava tutkimus, joka kartoittaa kirjallisuutta ja sen sisältöä tietyllä aihealueella sekä pyrkii arvioimaan kryptovaluuttojen ilmenemis-
muotoja tulevaisuudessa. Teoriaosuuden materiaali on kerätty kirjallisuudesta sekä internet-lähteistä. Teoria koostuu viidestä osuudesta kryptovaluutat, lohko-
ketju, lompakot, maksutavat ja säännökset. Bitcoin oli ensimmäinen kryptova-
luutta, jonka jälkeen on tullut tuhansia muita. Kaikkien kryptovaluuttojen yhteen-
laskettu arvo on ylittänyt 2 biljoonaa dollaria.

Tutkimuksen tuloksista saadaan selville, että kryptovaluutoista voi tulla laajasti
käytetty maksuväline tulevaisuudessa. Tämä vaatii kuitenkin valtioilta tarkkaa
sääntelyä niihin liittyen, jotta kryptovaluuttojen tarjoajilla sekä käyttäjillä on selvät
säännöt. Kryptovaluutat ovat yleistyneet maailmalla, mutta niillä on vielä haas-
teita ylitettävänä yleisesti käytetyksi maksutavaksi.

ABSTRACT

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The study aimed to look at cryptocurrencies as a method of payment and the possibility of cryptocurrencies to become a commonly used currency, such as the euro and the dollar are. The study sought an answer to the question, "Can cryptocurrencies become a widely used payment method?"

The work is a mapping and predictive study that maps the literature and its content in a specific topic area and seeks to evaluate the manifestations of cryptocurrencies in the future. The material of the theoretical section was collected from the literature and internet sources. The theory consists of five topic areas: cryptocurrencies, blockchain, cryptocurrency wallets, payment methods, and regulations. Bitcoin was the first cryptocurrency and was followed by thousands of others. The total market cap of all cryptocurrencies is 2 trillion dollars.

The study results showed that cryptocurrencies may become a widely used means of payment in the future. However, it will require precise regulation from the countries to have clear rules for cryptocurrency providers and users. Cryptocurrencies have become more widespread worldwide, but they still have challenges to overcome before becoming a commonly used payment method.

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1 INTRODUCTION

In 2021 many significant announcements were made in the world of cryptocurrency. The year will be remembered as the defining year of cryptocurrency across the globe because of mainstream acceptance, the emergence of new cryptocurrencies, and the challenging central authorities over the notion of currency. El Salvador accepted Bitcoin as legal currency and became the first to do so. Elon Musk's company Tesla Inc invested \$1.5 billion in bitcoin. Paypal allowed customers to use bitcoin on its network. Microstrategy bought \$600 million worth of bitcoin, bringing its total investment value to around \$3.6 billion. There were also some hurdles along the way. India proposed to ban crypto as a currency and payment system. The Chinese government published a memo that stated Bitcoin trading and mining crackdown. China's central bank said all cryptocurrency-related transactions are illegal and must be banned. (Prasad 2021)

Many companies embrace cryptocurrencies as an official payment method, from big tech to airlines. Mastercard said in November 2021 that it would allow partners to enable their customers to buy, sell and hold cryptocurrency using a digital wallet. The first international hotel chain Pavilion Hotels & Resorts group embraces virtual currency payments. Microsoft is one of the largest software companies globally, and they accept bitcoin payments. In late March, Microsoft launched ION, a two-layered authentication platform on the Bitcoin network. At the end of March, Visa confirmed that it was piloting a program with crypto.com platform to accept cryptocurrency to settle transactions on its payment network. (Walsh 2021)

1.1 Background of Research

The idea for this thesis came from my interest in cryptocurrencies which started in early 2021. In early 2021 I started investing in cryptocurrencies, and around September 2021, I switched from an app called Coinmotion to Crypto.com. Crypto.com offers a prepaid card with Visa, which needs to be topped up. Using

bank account transfers, other credit/debit cards, or cryptocurrency, you can top up this card. The card has many benefits, including payback from your purchases with the card, and rebates from different services, including Netflix and Spotify. This possibility grew my interest in cryptocurrencies as a currency and payment method. I thought I did not know any place in Finland that accepts cryptocurrencies as a payment method. So, I started researching it and found out that countless companies worldwide accept cryptocurrencies as payment. I talked about some of these in the introduction chapter.

Merchants could replace credit cards with bitcoin because of the high fees of credit card companies which cut off a portion of their profit margins. For merchants with low-profit margins, that fee could be up to half or more of their profits. Kris Marszalek, co-founder, and CEO of crypto.com, says, "the banking and payment sector is ripe for disruption. The credit card business model takes money from people with late fees, penalties, and high-interest rates. Blockchain and cryptocurrencies can provide a way to shift the balance of power back towards consumers". Arran Stewart, co-owner and CVO of Job.com, says "credit cards could be replaced with wallet verification that could be confirmed with a fingerprint. This is far more secure and efficient as it would allow retailers to receive payment for goods and services much faster. The only roadblock to this becoming reality is the stability of the crypto market". (Mourdoukoutas 2018)

1.2 Methodology

This thesis is a literature review that collects information from different online articles and literature. As a literature review, this thesis aims to understand the possibility of cryptocurrencies as the future payment method.

An ambitious goal of the literature review is to develop an existing theory and build a new idea. Second, it can be used to evaluate a current approach. Third, a literature review makes an overall picture of a particular issue. Fourth, the study

seeks to identify problems, and fifth, it provides an opportunity to describe the development of a specific theory historically. (Salminen 2011)

Five critical steps for the literature review are: searching for relevant literature, evaluating sources, identifying themes, debates, and gaps, outlining the structure, and writing a literature review. A good literature review does not just summarize sources. It analyzes, critically evaluates, and synthesizes to give a picture of the state of knowledge on the subject. The literature review provides a chance to demonstrate familiarity with the topic and scholarly context. Also, it allows showing how research addresses a gap or contributes to a debate. (McCombes 2021)

1.3 Research Question

The phenomenon of cryptocurrencies is researched in the thesis as a possible payment method. The research question for the problem is:

Can cryptocurrencies become a widely used method of payment?

A second research question is: What are the barriers to cryptocurrencies becoming widely used currencies?

1.4 Structure of The Thesis

The thesis starts with the theory part, and information is gathered from literature and online articles. The theory consists of five chapters: cryptocurrencies, blockchain, cryptocurrency wallets, digital payments, and regulations worldwide. The cryptocurrency chapter gives a general idea about popular cryptocurrencies like Bitcoin, Ethereum, Xrp, and stablecoins. The chapter about blockchain provides information about how blockchain works, different types of blockchain, and consensus mechanisms. The chapter about wallets gives the reader a general picture of how other wallets work. The chapter reader knows popular digital methods and how cryptocurrency payments work in digital payments. Regulations worldwide tell how regulators in the US, EU, and Finland have regulated cryptocurrencies.

1.5 Earlier studies

Cameron Harwick, in a journal article about cryptocurrency and the problem of intermediation, published in 2016, that "risk in cryptocurrencies is the obverse of trust, and a trustless protocol will be severely limited in dealing with it. This fact appears to limit the financial sophistication a cryptocurrency can support without a supportive legal climate". He also states that to stabilize the value of the currency it will have to fight in the marketplace for general acceptance separately from the base money and in the political realm for the privilege of operating unmolested. Without governments accepting cryptocurrencies as currency, the hurdles cryptocurrencies face to supplanting more legally privileged and centrally issued coins appear to be insurmountable. (Harwick 2016)

Iwamura (2019) et al. states that Bitcoin was designed as a payment method and as a store of value; it seems unlikely that currencies provided by central banks are at risk of being replaced, primarily because of the market price instability Bitcoin. (Iwamura, Kitamura, Matsumoto, Saito 2019, 41) They analyzed the Bitcoin system in general and the role of the mining as the proof of work. They also proposed improved Bitcoin (IBC), an alternative to Bitcoin which would overcome the inherent instability of Bitcoin. Producing cryptocurrencies is more expensive because they cannot be absorbed once created, and production costs are hard to retrieve. Do they ask if we shall prefer banknotes or a cryptocurrency? There is not an unconditional answer. Bitcoin-type cryptocurrencies can be reasonably competitive with central banknotes regarding price/value stability. Competition between currencies like central banknotes and a cryptocurrency must be encouraged between prominent banknotes and among different cryptocurrencies. (Iwamura et al. 2019, 58)

According to Huberman (2021) et al., Bitcoin presents a computer science breakthrough, showing the possibility of a decentralized payment system that relies on a collection of unrelated parties without a central intermediary. Article from Huberman et al. shows that Bitcoin also provides an economic innovation that can

address worries of the damage of monopoly power of platforms. The Bitcoin payment service (BPS) offers the feasibility of a decentralized platform in which users are safe from the harms of monopoly pricing, even if users have no alternative to the platform. Unlike traditional systems, the BPS does not require trust in any entity. Still, it also cannot provide some services like transactions cannot be reversed in case of fraud or error, and users who lose the credentials to their accounts cannot retrieve their balances. The protocol is another feature that sets Bitcoin apart. Unlike a managing organization, a protocol lacks an easily workable mechanism to change prices, offerings, and rules, implying the stability of these attributes. This stability can be considered an asset or a liability of the system. Daily transactions are worth several billion dollars on BPS, which can be a compelling proof of concept that further encourages economists to study this structure and its descendants. (Huberman, Leshno, Moallemi 2021)

According to Visa (2021), consumers are most interested in cryptocurrency as an investment or store of value rather than a medium of exchange. However, interest in crypto-linked cards indicates that this may soon change. Many believe that it will have permeated most types of transactions within five years, and within ten years, most consumers will use it. A significant factor in driving engagement is the stability of a market's national economy. Interested consumers are primed for cryptocurrency adoption, and additional services offered by trusted financial institutions could cause them to become more connected. Cards linked to crypto and rewards can become low-friction gateways to engagement. (Visa 2021)

2 CRYPTOCURRENCIES

Cryptocurrency can be seen as the same as paper money. Generally, possession is ownership, and transferring it often involves less overhead than credit cards, electronic transfers, and checks. While cryptocurrencies like Bitcoin or Ethereum are represented only electronically, so is a significant part of currency issued by central banks. What is the difference between 90% of America's M2 money supply, represented as bits, and 100% of bitcoin virtual coins, represented by bits? (Fleishman 2021)

A cryptocurrency is a digital currency that is protected by cryptography. This makes it nearly impossible to counterfeit or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology. Generally, any central authority is not issuing cryptocurrencies, which makes them immune to government interference or manipulation. (Frankenfield 2022)

2.1 Bitcoin

A paper titled Bitcoin: A peer-to-peer electronic cash system was posted on Oct. 31, 2008. Bitcoin was introduced by the author known as "Satoshi Nakamoto". (Frankenfield 2021) Bitcoin is a unit of currency used to store and transfer value among participants in the bitcoin network. Users communicate using the bitcoin protocol via the Internet or other transport networks. As open-source software, bitcoin can be run via a wide range of computing devices like laptops and smartphones; it is easily accessible. Bitcoins can be used the same way as conventional currencies, including buying, and selling goods, sending money to people and organizations, or extending credit. Bitcoin can be purchased, sold, and exchanged at specialized currency exchanges. Bitcoin is fast, secure, and borderless, making it a great form of money for the Internet. (Antonopoulos 2014, chapter 1)

Bitcoin is a digital cash system that allows people to move bitcoins between each other without using a bank or any other trusted third party. It has the same characteristics as traditional banknotes and coins, but it's used over the internet and is purely digital. It isn't tied to any specific fiat currency like the US dollar; it has free-floating exchange rates against most fiat currencies. No government or company controls Bitcoin. Instead, thousands of computers around the globe keep the system working 24/7. (Rosenbaum 2019, chapter 1)



Figure 1. Price of Bitcoin (Coinmarketcap 2022b.)

2.2 Alternative coins

Altcoins are short-term alternative coins, which are cryptocurrencies other than Bitcoin. They resemble Bitcoin but are also different in other ways. Some altcoins use a different consensus mechanism to produce blocks, validate transactions, or provide new or additional capabilities such as smart contracts or low-price volatility. As of November 2021, there are over 14,000 cryptocurrencies, according to CoinMarketCap. (Frankenfield 2021.)

2.2.1 Ethereum

Ethereum was first introduced in 2013 through a white paper by Vitalik Buterin. Ethereum is a decentralized, open-source, dynamic service that works on the properties of the blockchain. Ethereum revolves primarily around smart contracts, which are small blocks of code in the blockchain. The system went online in July 2015. The platform's primary purpose is to run on DApps to create a more global, accessible, mature internet, Web 3.0. Ethereum intends to give users and creators more control when developing their apps. It runs on the proof of work (PoW) protocol, the same as Bitcoin. (Shrivastava, Le & Sharma 2020, chapter 1.4)

The Ethereum network is primarily related to money transfer and data storage. The network allows us to build diverse, exciting applications possible with ether cryptocurrency. Ether is a fuel of the Ethereum ecosystem, and there are multiple different networks within Ethereum. Some of which are: Main Network which allows us to produce applications and turn our ether coins into U.S. dollars. Rinkeby, Kovan, and Ropsten Test Network provide free ether coins to test code and contracts before deploying them to the leading network. JSON RPC API allows us to connect to the local Ethereum test network. (Shrivastava, Le & Sharma 2020, chapter 1.4.1)

To make transactions in the Ethereum network, you need to have a MetaMask account and some others. The user will automatically be redirected to a payment gateway to confirm and pay with ethers when making an order. Then back-end server will check its balance to verify whether it meets the requirements. Transaction of ethers will take place when conditions are met. When the user pushes the submit button, it sends the Ethereum address to the back-end server for validation. After this back-end server uses the web3 library to create a transaction object. After a successful transaction, the back-end server pushes the success message onto the user screen. It takes a few seconds for generated transaction object

to be added to the network. Miners must approve transaction objects and randomly generate a nonce value-added as a new block in the network. (Shrivastava, Le & Sharma 2020, chapter 1.4.4)



Figure 2. Price of Ethereum (Coinmarketcap 2022a.)

2.2.2 Ripple and Xrp

Ripple was co-founded by Chris Larsen and Jed McCaleb and released in 2012. Ripple is both a cryptocurrency and a digital payment network for financial transactions. Payment settlement asset exchange and remittance system are Ripple's leading processes, like the SWIFT system for international money and security transfers. Xrp is the token used for the cryptocurrency, which is pre-mined. Xrp's purpose is to serve as an intermediate exchange mechanism between two currencies or networks. It does not discriminate between fiat and cryptocurrency, making it possible to exchange any currency for another. (Frankenfield 2021a)

Ripple operates on an open-source and peer-to-peer decentralized platform that allows for a smooth transfer of money, whether cryptocurrencies, like ether or bitcoin, or traditional currencies like dollars and euros. Ripple has central banks and financial services customers, as a global payments network. (Frankenfield

2021a) Ripple’s customers include Bank of America, American Express, and Santander (Ripple.com).

Transactions on the Ripple network rely on a consensus protocol to authenticate account balances and trades on the system. It improves the integrity of the system by preventing double-spending. The Ripple platform is decentralized because no central authority decides who can set up a node and validate transactions. Ripple improves on some of the drawbacks attributed to traditional banks. For example, transactions are settled within seconds on the Ripple network. Completing simple wire transfers in banks could take days or weeks. Also, the fee to conduct transactions on Ripple is minimal. A standard transaction is set to 0,00001 xrp, compared to the enormous fees charged by banks for cross-border payments. (Frankenfield 2021a)



Figure 3. Price of XRP (Coinmarketcap 2022)

2.2.3 Stable coins

Stable coins are a cryptocurrency whose value is tied to another currency or asset like the U.S. dollar or gold’s price. This makes them different from cryptocurrencies like Ethereum or Bitcoin, tied to being “mined”. Bitcoin and other cryptocur-

rencies have a reputation for being volatile; stable coins are popular among companies and investors because of their supposed price stability. A stable coin's primary function is to be used to buy and sell other cryptocurrencies on exchanges. Like the U.S. dollar, government-issued currencies can be converted to stable coins, then used to purchase other cryptocurrencies. (Hou 2021)

Stable coins aim to gain the potential benefits of cryptocurrencies like transparency, immutability, security, and decentralized control. Early on, crypto holders used stable coins as a safe haven from market decline or crash. If bitcoin's price drops rapidly, a holder could convert their bitcoin to a stable coin, avoiding potentially massive losses. Stable coins show promise in other emerging applications. They could benefit industries and individuals that need to make international payments quickly and securely. For example, big businesses are looking for a cheaper way to pay overseas suppliers. There are other potential uses across the financial services ecosystem. Stable coins could help provide a secure, online environment for peer-to-peer (P2P) transactions. (Cbinsights 2022)

Leading stable coins currently includes Tether, which is presently involved in half of the Bitcoin trades occurring across the world. It claims to be 100% backed by cash and equivalents. USDC is an open-source project run by a consortium called Centre. USDC claims to be supported by a combination of certificates of deposit with foreign banks, corporate bonds, commercial paper, treasury bonds, and cash. The appeal of USDC is the ability to redeem 1 USDC for 1 U.S. dollar. Binance issues its own Binance USD coin, which also claims to be backed 1:1 in USD. (Hou 2021)

2.3 Central bank digital currency (CBDC)

Central bank digital currencies are like cryptocurrencies but issued by a central bank. They are tied to the price of that country's fiat currency. Many countries are researching ways to transition to digital currencies, and some have even implemented them. CBDCs are the digital form of a country's fiat currency, and they are

issued and regulated by a nation's monetary authority or central bank. They promote financial inclusion and simplify the implementation of monetary and fiscal policy. These currencies are not decentralized, so they may not anonymize transactions as some cryptocurrencies do. (Seth 2022)

The main goals of CBDCs are to provide consumers and businesses with financial security, accessibility, convenience, transferability, and privacy. They could also reduce cross-border transaction costs, feed those using alternative money transfer methods with lower-cost options and decrease the complex financial system's maintenance. Current digital currencies carry a risk with their value constantly fluctuating. With volatility, they could cause severe financial stress in many households and affect the overall stability of an economy. CBDCs are backed by a government and controlled by a central bank. This provides families, consumers, and businesses with a stable means of exchanging digital currency. (Seth 2022)

There are already countries that have launched CBDCs. The Bahamas issued the sand dollar in October 2020, and it was the first nationwide CBDC in the world. The first country in Africa to launch a CBDC last October was Nigeria. The eNaira can be used for contactless in-store payments and transferring money, and it's stored in a digital wallet. The eNaira wallet had been downloaded almost 700,000 times by January 2021. Eastern Caribbean Union created its digital currency to help speed transactions and serve people without bank accounts. Countries involved are Antigua and Barbuda, Dominica, Grenada, St. Vincent and the Grenadines, Saint Lucia, St. Kitts and Nevis, and Montserrat. Some countries are testing CBDCs in pilot projects. Some of these are Sweden, China, Jamaica, and Ukraine. Countries where CBDCs are in development, include India, Eurozone, and the US. (Smith 2022)

Interest in Central Bank Digital Currencies (CBDCs) has been increasing because of the fast European broad digitization of payments during the pandemic and increasing interest and competition from cryptocurrencies (i.e., Bitcoin) and stable

coins (i.e., Tether). National and Central banks issued digital currencies are arriving. The essential technology for digital currencies like the e-Euro already exists. Digital currencies need regulation to catch up and ensure the supporting technology doesn't ignore anyone. They will fundamentally change the global payments landscape, and it will be the biggest shake-up to money in a generation. (Hoffmann 2022)

3 BLOCKCHAIN

Blockchain is often called a distributed ledger. It's maintained by the participation of everyone in a cryptocurrency system. Subsequent entries are cryptographically linked to earlier ones, which makes those earlier ones effectively not possible to switch after a short period following their addition to the blockchain. The blockchain is a series of blocks, and each block contains several transactions that people have conducted over the cryptocurrency network. (Fleishman 2021)

Cryptography is behind the whole process. The mining process validates the unique set of transactions in a block by generating a sort of signature that can't be forged or counterfeited. The block is also cryptographically bound to the previous block, hence the term blockchain. Manipulation of a block prevents the validation of all blocks that follows the previous one. Typically, cryptocurrencies rely on the rule that the longest blockchain is the best. When blocks are added faster to one potential blockchain versus others, it quickly becomes apparent which is the longest. (Fleishman 2021)

3.1 Types of blockchain systems

Public blockchains are used for exchanging and mining cryptocurrency. Public blockchains are entirely decentralized and allow anyone to join. This kind of blockchain allows all blockchain nodes to have equal rights to access the blockchain, create new blocks of data, and validate blocks of data. Popular public blockchains are Bitcoin, Ethereum, and Litecoin. The nodes mine for cryptocurrency on these blockchains by creating blocks for the transactions requested on the network by solving cryptographic equations. The miner nodes earn a small amount of cryptocurrency for this hard work. Essentially miners act as new-era bank tellers that formulate a transaction and receive a fee for their efforts. (Wegrzyn, Wang 2021)

Private blockchains are permissioned blockchains controlled by a single organization. The central authority determines who can be a node and does not necessarily

grant each node equal rights to perform functions. Public access to these blockchains is restricted, making them only partially decentralized. An example of private blockchains is the B2B virtual currency exchange network Ripple. (Wegrzyn, Wang 2021)

Consortium blockchains are permissioned blockchains governed by a group of organizations. Consortium blockchains have more decentralization than private blockchains, resulting in higher levels of security. Setting up consortiums requires cooperation between several organizations, presenting logistical challenges and potential antitrust risk. Also, members of supply chains may not have the needed technology or the infrastructure to implement blockchain tools. Some may decide the upfront costs are too steep to pay to digitize their data and connect to other supply chain members. Enterprise software firm R3 has developed a popular consortium blockchain solutions for the financial services industry. (Wegrzyn, Wang 2021)

The hybrid blockchain attempts to use the best part of both private and public blockchain solutions. A hybrid blockchain simultaneously means controlled access and freedom in a perfect world. The hybrid blockchain architecture implies that they are not open to everyone but still offer blockchain features such as integrity, transparency, and security. Hybrid blockchain architecture is entirely customizable, and members can decide who can participate in the blockchain or which transactions are made public. The best of both worlds is combined and ensure that a company can work with its stakeholders in the best possible way. (Geroni 2021)

3.2 Consensus mechanism

Every cryptocurrency like Bitcoin and Ethereum uses a consensus mechanism system that validates the authenticity of transactions and maintains the underlying blockchain's security. It ensures that all legitimate transactions are recorded on the blockchain and that each copy of the blockchain contains all valid transactions.

The consensus mechanism leads to a secure, trusted blockchain experience for all participants. (Rosenberg 2021)

A consensus mechanism is a system that users of a blockchain network follow to agree on the legitimacy of transactions. The transaction needs to be validated before it's recorded on the blockchain. An example of how this works; is when you buy one bitcoin and transfer it to your cryptocurrency wallet, everyone else must agree that you own the bitcoin. Without an agreement, your cryptocurrency would be worthless. Bitcoin's proof of work method was the first consensus mechanism. The consensus mechanism is essential to the blockchain network. It influences how transactions are verified, how much energy is used, network fees, transaction speed, and other details for the cryptocurrency and network applications. (Rosenberg 2021)

The two largest cryptocurrencies, Bitcoin and Ethereum, are powered by proof of work, but it's not the only ones. Few main types of consensus mechanisms used today are Proof of Stake, Proof of Work, Proof of capacity, delegated proof of stake, and proof of authority. (Rosenberg 2021) This thesis explains two of the most prevalent consensus mechanisms: proof of stake and proof of work.

3.2.1 Proof of work

How does Bitcoin guarantee that nobody manipulates the blockchain without a central authority? The answer is proof of work. Proof of work (Pow) is a consensus mechanism used to verify that miners calculate valid alphanumeric codes, called hashes, to verify Bitcoin transactions and add the following block to the blockchain. This happens by other participants in the network, confirming the miner's required amount of computing power. Proof of work creates a positive reason for people to invest resources to add valid blocks to a cryptocurrency's blockchain. Participants invest significant amounts of money in computing resources. The proof of work mechanism creates a disincentive against trying to undermine the

blockchain's integrity. This reduces the potential for a single Bitcoin being spent simultaneously more than once, also called double-spending. (Chandler 2021)

Bitcoin mining is essentially a competition where miners race to be the first to solve complex cryptographic puzzles, enabling them to add the next block to the blockchain and receive payment in the form of new Bitcoins. Before receiving the reward, the other systems in the network must validate that the solution is correct and valid. This involves serious number-crunching by miners having to go through much trial and error before locating the right hash. Verifying Bitcoin transactions takes much work because most candidate blocks do not include the right hash. (Chandler 2021)

Proof of work arguably provides a higher level of security than other means of consensus. Bitcoin is now running for more than a decade without a significant outage or compromise. Proof of work affords an optimal level of security and decentralization, but it imposes one substantial cost and consumes a considerable amount of energy. A large amount of electronic waste is produced from mining units being discarded for more powerful models. (Chandler 2021)

3.2.2 Proof of stake

Proof of stake is another consensus mechanism used to validate cryptocurrency transactions. Owners of the cryptocurrency can stake their coins, which gives them the right to check new blocks of transactions and add them to the blockchain. Proof of stake is more energy-efficient, so it has gotten more popular as attention has turned to how crypto mining affects the planet. (Daly 2022)

Staking happens when you pledge your coins to be used for verifying transactions. Your staked coins are locked up, but you can unstake them if you want to trade them. Proof of stake protocol will choose a validator node to evaluate the block when a block of transactions is ready to be processed. The validator will check if

the transactions in the block are accurate. If so, they add the block to the blockchain. For this, they will receive crypto rewards for their contribution. However, if a validator proposes adding a block with inaccurate information, they lose a certain amount of their staked holdings. One major cryptocurrency which uses proof of stake is Cardano. A person who owns some Cardano can stake it and set up their validator node. When Cardano needs to validate blocks of transactions, its Ouroboros protocol selects a validator. The validator checks the block, adds it if it's accurate, and receives more Cardano for their trouble. (Daly 2022)

Proof of stake's mining power depends on the amount of coins a validator is staking. The more you stake better the chances to be chosen to add new blocks. Each proof of stake protocol chooses validators in a different way. Usually, there's an element of randomization involved; the selection process can also depend on other factors, such as how long validators have been staking their coins. Anyone staking crypto could be chosen as a validator, but the chances are very low if you're staking a small amount. (Daly 2022)

4 CRYPTOCURRENCY WALLETS

A cryptocurrency wallet is a software program that helps you manage your digital money. To use cryptocurrency, you must have a digital cryptocurrency wallet. Traditional assets such as gold and cash are stored in a bank reserve, but cryptocurrencies are not. Crypto wallets don't hold the cryptocurrency. Instead, they keep the private and public keys of cryptocurrencies. These keys are comparable to the PIN code to access your bank account. Wallet addresses cannot ever be the same because you can compare them to fingerprints. This means there is a very small chance that somebody else can get your assets by mistake. An example of how cryptocurrency address looks like this: 1A1zP1eP5QGefi2DMPTfTL5SLmv7DivfNa (Danial 2019, chapter 7).

Cryptocurrency Wallet uses a combination of numbers and letters, both uppercase and lowercase. If you have a safe and secure wallet, you do not have to memorize your crypto wallet address. A private key is a unique personal password to your crypto wallet address. A public key adds an extra layer of security and ensures that your wallet can not be hacked. Cryptocurrency wallets come in several different types catering to different needs. (Danial 2019, chapter 7)

Following are some terms that you may encounter as you explore the world of crypto wallets. A hot wallet is a wallet connected to the Internet. A cold wallet isn't connected to the Internet. A wallet address is a number that functions something like a traditional bank account number. The public key is a code that allows you to receive cryptocurrencies into your account or wallet. The private key is a code coupled with the public key to ensure your security. (Danial 2019, chapter 7)

4.1 Online wallet

Online wallets are less secure, but they have advantages for small amounts of cryptocurrencies. An online wallet gives you access to your cryptos via the Internet. If you are connected to the Internet, you can reach and store your coins and

make payments—the provider of the online wallet stores your wallet’s private key on its server. The provider might send you the crypto code but store your keys and gives you the ability to access your keys. Different providers offer various features, with some linking to multiple devices such as your computer, tablet, and mobile phone. (Danial 2019, chapter 7)

The advantages of online wallets are fast transactions, may be able to manage multiple cryptocurrencies, and are convenient for use on the go and active trading. However, there are disadvantages: the risk of online security because of potential vulnerability to hacks and scams, personal protection because of possible exposure to computer viruses, and a third party storing your cryptos. (Danial 2019, chapter 7)

4.2 Mobile wallet

Mobile wallets are categorized as software wallets. These kinds of wallets are available on your cellphone through an app. The mobile wallet lets you use them when shopping in physical stores as cryptocurrencies become more acceptable. Online wallets offer mobile versions, but some wallets are specifically and only used for mobile phones. (Danial 2019, chapter 7)

Mobile wallets have their advantages and disadvantages as well. Advantages are the possibility to be safer than online wallets, convenient to use on the go, and offering additional features such as QR code scanning. Disadvantages are the risk of losing your crypto assets if your phone is lost or damaged and getting mobile viruses and malware. (Danial 2019, chapter 7)

4.3 Desktop wallet

Desktop wallets are categorized as software wallets. You can download and install the desktop wallet on your computer. Desktop wallets may be safer if your computer isn’t or has never been connected to the internet. If your computer has never been linked to the Internet, a wallet essentially becomes a cold wallet. On

the other hand, a computer that hasn't been linked to the Internet may expose malware that may automatically move from the wallet drive that you connect to the computer and infect the desktop since it has never been patched with software updates. (Danial 2019, chapter 7)

Advantages of desktop wallets are a convenient choice if you trade cryptos from your computer, your private keys aren't on a third-party server, and if the computer has never been connected to the Internet, a desktop wallet can be safer than an online wallet. Disadvantages are using crypto assets on the go is more complex, less secure hot wallet is connected to the Internet, and without the backup of your computer and it dies, you lose your cryptos. (Danial 2019, chapter 7)

4.4 Hardware wallet

A hardware wallet can be one of the safest types of crypto wallets. These wallets store your private keys on a device like a portable hard drive. Online transactions are still possible, but the wallets are offline most of the time, making them practically cold wallets. For security purposes, a hardware wallet is recommended for large crypto amounts. Less secure types of wallets increase your risk of unrecoverable hacking attacks. (Danial 2019, chapter 7)

Advantages of hardware wallets are one of the safest crypto wallet options. Great for storing large amounts of cryptocurrencies, which you don't want to use daily. Disadvantages are: Most expensive type of wallet and aren't as user-friendly as other wallets, especially for beginners. (Danial 2019, chapter 7)

4.5 Paper wallet

A paper wallet is a cold crypto wallet. You print your private and public keys. You can send funds by transferring money to the wallet's public address. You can also withdraw or send your currencies by entering private keys or scanning the QR code on the paper wallet. (Danial 2019, chapter 7)

Paper wallets are hacker-proof because you don't store them on a computer, mobile phone, or third-party server. Some disadvantages are they aren't user-friendly and are harder to use for day-to-day transactions. Paper wallets can also catch fire, or you can lose them quickly. (Danial 2019, chapter 7)

5 DIGITAL PAYMENTS

In an increasingly cashless society, digital payments are becoming the new norm. The term refers to any payment made through digital means, simple to the consumer, but plenty of activity goes on in the background. Digital payments use end-to-end security, including encryption and the fact that you don't need to enter a recipient's bank details. Benefits of digital payments include an effective way to transfer funds globally and transfers that occur in a real-time, low-cost alternative to wire transfers. Digital payment providers use different networks to access payment trails. A few of these are credit cards, the SWIFT network, blockchain, and bank accounts. (Square)

Digitization of payments has been accelerated across peer-to-peer (P2P), business-to-business (B2B), and business-to-consumer (B2C) transactions beginning in 2020. Still, the second full year of the pandemic made it clear that they are here to stay, even as spending normalizes. Rapid digitization puts pressure on merchants so customers can use their preferred payment method. This also puts pressure on point-of-sale (POS) providers to develop multichannel solutions that meet the front- and back-end needs. Payment industry providers are racing to explore new transaction flows, reach new subsets of businesses and consumers, and embrace new devices and transaction technologies. (Yuen 2022)

Real-time mobile P2P payments, digital remittances, and digital payments continue to blossom as a change to digitization spread through the ecosystem. Over 7 in 10 smartphone owners will be mobile P2P payment users by 2025. Consumers won't be the only ones to embrace change to digitization. US B2B payments are set for a second consecutive year of growth in 2022, with volume forecast to reach \$28.611 trillion. Payment providers will capitalize on the opportunity by deepening their push into the B2B space, catering primarily to small businesses. (Yuen 2022)

China oversees the digital payment revolution. With a global market of \$5.4 trillion in digital commerce and mobile payments transactions. China generated an estimated \$2.9 trillion in transaction value in 2020, while the US came second with \$1.3 trillion. The system of China is built on digital wallets and QR codes. It runs through the country's two major big tech firms, Alipay and WeChat Pay. China has close to a billion digital consumers, allowing digital payment firms to rapidly build their platforms, making it easy to target overseas markets. Investments in physical infrastructure and connectivity abroad complement Chinese digital payments market leadership. (Bandura, Ramanujam 2021)

5.1 digital payment methods

Buy now, pay later (BNPL). For merchants, the benefits are vast. It boosts sales and drives conversion rates and attracts consumers with more flexible payment options. It also increases basket value, trust, and loyalty. Millennials and Generation Z consumers are used to more flexible digital payment methods, so successful start-ups and incumbents have increasingly offered this solution. Businesses gain an advantage when they alter the entire purchase journey to leverage the strengths of BNPL and the preferences of customers in different markets. (Hoffmann 2022) BNPL providers such as Klarna, Affirm, Afterpay, and Sezzle compete with digital payments behemoth PayPal, card giants, and large and mid-tier banks. (Berr, Mullen Marek 2022)

A mobile wallet involves any technology that turns your smartphone into a wallet capable of making financial transactions. Other opportunities include making credit card payments, relying on near-field communication technology (tap to pay), and can consist of incentives for consumers like loyalty programs. With NFC technology, you don't have to swipe a credit card. You simply place the phone on a reader that scans the QR code for the customer's card. Customers can link bank cards or credit cards to a mobile wallet. Sensitive card data is replaced with encrypted tokens for extra security. Benefits of mobile wallets for businesses include growing popularity with consumers, quicker transactions, slowly replacing debit

cards, and additional protection. Popular mobile wallet providers include Apple pay, PayPal, and Google Pay. (Fuscaldo 2021)

5.2 Cryptocurrency payments

Digital payment methods can significantly influence the economic prosperity of many first world and third-world countries, impacting everything from remittances to transferring funds via cryptocurrency backed by blockchain technology. Countries such as El Salvador, Ukraine, and others have adopted Bitcoin as legal tender, signifying the growing adoption of this new technology. (Expert Panel 2022)

Digital ledgers, also known as a “blockchain”, can ease the transformation to low-friction, digital cash payments, and record transactions. It makes a valuable platform for new currencies and payments, sharing transaction data but not copying. Blockchain technology was first employed to support Bitcoin and other cryptocurrencies. It will be expanded if consumers accept it and if it can generate value on a larger scale. The use cases for blockchain will span commercial and consumer applications. The protocol behind distributed ledger provides a secure, borderless mechanism to build complex transactions and value exchanges. Central banks are also interested in this technology and are issuing digitally minted currencies. Distributed ledgers will help accelerate the shift to a cashless future. (Visa 2017, page 14)

Accepting crypto payments is easy. You will start by setting up a crypto wallet, which works like a bank account. There are a lot of different cryptocurrencies, so it is best to go for a wallet that supports several other cryptocurrencies. This saves you the time and effort of opening many crypto wallets for different cryptocurrencies. After setting up your crypto wallet/s, you can organize direct payment with your customers. They need your wallet address or your QR code, which you can generate from your wallet. Your customers will enter your address or scan your QR code to make payments. (Sophy 2022)

A cryptocurrency payment gateway is a payment processor for digital currencies, like the payment gateways, processors, and acquiring bank credit cards. These gateways enable you to accept digital payments and receive fiat currency immediately. Payment gateways allow you to accept them as payment and receive fiat currency in exchange. (Seth 2022a) Payment works as follows:

- 1) Your customer opts to make payment in cryptocurrency at checkout
- 2) They pay you an amount equivalent to the digital currency's fair market value at the moment of the transaction
- 3) Payment service instantly converts the payment into the currency you choose
- 4) The money is added to your account with the provider; it is deposited to your bank account in intervals decided on in your service contract. (Seth 2022a)

Some of the advantages of cryptocurrency payment gateways are the removal of anonymity, the possibility to contact someone in case of payment issues, accepting payments anywhere in the world, and no need to understand cryptocurrency. There are also disadvantages: the payment gateway is a third party, which cryptocurrencies were originally designed to bypass. Normally, you pay small transaction fees when using a cryptocurrency wallet, but you pay more with a payment gateway. In case of payment gateway gets hacked, you will lose any funds you have in your account with the provider while you are waiting for them to be transferred. (Seth 2022a)

5.3 Benefits and drawbacks of accepting cryptocurrency

Cryptocurrency is considered more secure than credit and debit card payments because they don't need third-party verification. The data is not stored in a centralized hub where data breaches generally occur. Information is kept in a crypto wallet, and a blockchain general ledger is used to verify and record every transac-

tion, making it difficult, if not impossible, to steal someone's identity. Cryptocurrencies charge lower fees. Some exchanges offer fees under 1% compared to PayPal, which charges close to 4%. They can also help avoid international currency payment fees because cryptocurrencies are not bound to a country of origin or national bank. (Heaslip 2021)

Cryptocurrency transactions are irreversible, and this can be a double-edged sword. The party that receives the funds is the only one able to refund the transaction. Companies that accept Bitcoin should be ready for the possibility of customers requesting refunds. The IRS considers cryptocurrency to be property for tax purposes which result in receiving cryptocurrency. When received, you must report it as gross income based on its fair market value. Each time you buy, use, or sell Bitcoin, you are subject to a capital gains tax. (Heaslip 2021) Finnish tax administration says that income from the use or exchange of virtual currency is taxed as capital gains, which are capital income. The taxable income arises when you exchange virtual currency for other currency, exchange virtual currency for other virtual currency, pay bills with virtual currency or buy goods or services. (Vero 2022)

6 REGULATIONS AROUND THE WORLD

The transformation of cryptocurrencies from speculative investment to a balanced portfolio stablemate continues to grow, and governments around the world remain divided on how to regulate the developing asset class. Cryptocurrency has become a more substantial factor in the global investment landscape. Countries have taken different approaches to regulating the asset class. (Smith 2022)

6.1 The United States

Bitcoin as an asset is largely unregulated in the US. Further legislation may ease some investor and regulatory fears over the volatility of crypto and the potential for crime-related transactions. For now, bitcoin is mainly disconnected from government and conventional financial systems. Most cryptocurrencies are decentralized and autonomous. Bitcoin's ability to transfer value without verification from a bank or government and the sheer amount of money involved has aroused lawmakers' interest. The speed at which crypto is absorbing the interest and capital of investors in America is pushing the issue to the forefront in Washington. (Dossett 2022)

Some crypto laws are in place despite the lack of comprehensive federal or international regulations. For making a profit on cryptocurrencies, you must pay taxes on capital gains. The US Commodity Futures Trading Commission sees it has the authority to regulate derivatives, regardless of whether the underlying assets are cryptocurrencies or not. New York State requires BitLicense from commercial and nonprofit entities holding and/or trading crypto. Louisiana has passed the Virtual Currency Business Act, which requires crypto operators to apply for a license. Wyoming has passed and implemented more than 20 cryptocurrency laws, including 2019's HB584. The law exempts crypto assets from most local securities laws, which may eventually conflict with more sweeping federal laws. (Dossett 2022)

6.2 European Union

Cryptocurrencies in the EU are legal, but Euro-backed member-states may be restricted from introducing their cryptocurrencies. Cryptocurrency exchange regulations vary by member-state and by compliance with the European Banking Authority (EBA), European Commission (EC), European Central Bank (ECB), European Insurance & Pension (EIOPA), and European Supervisory Authority for Securities (ESMA). Crypto is broadly considered legal across the European Union, but regulations vary depending on individual member states. Taxation also varies, but many member-states charge capital gains tax on profits at 0-50% rates. The Court of Justice of the European Union in 2015 ruled that exchanges of traditional currency for crypto or virtual currency (and vice versa) constitute a supply of services but should be exempt from VAT. In January 2020, the EU's fifth anti-money laundering directive (5AMLD) came into effect. It brought exchanges under the scope of EU anti-money laundering legislation, requiring exchanges to perform KYC / customer due diligence on clients and fulfill standard reporting requirements. In December 2020, 6AMLD came, and the directive made cryptocurrency compliance stricter by adding cybercrime to the list of money laundering predicate offenses. (Complyadvantage 2022)

Europe's Markets in Crypto-Assets (MiCA) was introduced in September 2020 by the European Commission. The MiCA framework is part of a greater digital finance strategy that aims to adapt Europe to the digital age. (Handagama 2021) The objective of the regulation is to establish rules for cryptocurrencies. Disclosure and transparency requirements for the admission and issuance of trading crypto assets. The supervision and authorization of crypto-asset service providers. The governance, organization, and operation of asset-based token issuers. User protection rules for the issuance, trading, exchange, and custody of crypto assets. Ways to prevent market abuse to ensure the integrity of the crypto-asset markets. (Verbiest 2022)

6.3 Finland

The virtual currencies act (572/2019), later the virtual currencies act, regulates virtual currencies. According to section 2§ first clause first paragraph of the virtual currency act, virtual currencies are a type of asset with a digital value that has not been issued by a central bank or other authority and is not a legal tender but can be used, transferred, stored, and exchanged electronically. Legal tender refers to currencies issued by a central bank, such as the euro. Virtual currencies are most precisely defined in tax legislation. According to the latest tax administration guidelines (VH/5083/00.01.00/2019,22.10.2020), all virtual, crypto, and peer-to-peer currencies or bit currencies and game currencies are referred to as virtual currency and various in-game virtual currencies used in online games, except gambling organized by gaming companies. (VH/5083/00.01.00/2019. Reticle 1-2). (Väkeväinen 2022)

In national tax law, both cryptocurrencies and game currencies are equated under one virtual currency term. Therefore, clarifications on their definition are expected. In Finnish tax case law (KHO 2019:42), virtual currencies are classified as assets, in which case the provisions concerning income from capital gains tax apply to their transfer. However, according to the Supreme Court, virtual currencies are not securities. However, the draft law states that a virtual currency may meet the definition of a financial instrument referred to in Chapter 2, Section 2 of the Securities Markets Act, in which case the provisions of the law concerning, for example, the obligation to prepare a prospectus to apply to it. (Väkeväinen 2022)

7 CONCLUSION

This chapter presents the study's conclusion derived from the work's theoretical framework, and the chapter looks at the reliability of the study. This research aimed to find out if cryptocurrencies can become a payment method. The research question of the thesis is: Can cryptocurrencies become a widely used payment method? Other research problems to observe in the view are: What are the barriers to cryptocurrencies becoming widely used currencies?

Digital payments grew exponentially during the covid pandemic across peer-to-peer, business-to-business, and business-to-consumer. Rapid digitization puts pressure on point-of-sale providers and merchants so customers can pay with their chosen payment method. Cryptocurrencies have not yet been widely adopted, but companies like Mastercard and Visa have shown a growing interest in them and blockchain applications. Companies like Tesla accepted Bitcoin as a payment in 2021 for a while. Countries have started adopting Bitcoin as legal tender, which signifies the growing adoption of cryptocurrencies. Some countries have begun producing their CBDCs and are looking for ways to develop them. Cryptocurrencies have the potential to become a widely used method of payment, but there are many different possibilities for which one it will be. It could be Bitcoin, a stable coin like UCDC or central bank digital currency.

Problems with cryptocurrencies becoming a widely used currency are regulations of the world. The United States and European Union do not have comprehensive rules for cryptocurrencies. The United States does not have comprehensive federal or international laws or regulations. They have some limitations in some states, but it needs to have clear rules to work under for cryptocurrency to become a widely used currency. The same goes for European Union, but that's why MiCA is under development. MiCA will help cryptocurrency providers and users with clear regulations and laws.

7.1 Questions for Future Research

The research tried to find an answer for cryptocurrencies becoming a widely used payment method. There has been some adaptation from large companies, but cryptocurrencies have not gained momentum as a payment method by the general population. The research could be done again at a different time, for example, in a couple of years. Similar research could be done as quantitative research via surveys. Surveys could ask banks and financial services professionals about cryptocurrencies as a payment method. Surveys could give more authenticity to research.

Questions for future research can be the same as in this thesis. Another question for the future could be what financial institutions' attitudes towards cryptocurrencies are.

7.2 Validity and Reliability

Reliability: the extent to which the results can be reproduced when the research is repeated under the same conditions (Middleton 2022). In the thesis, reliability is ensured by using the most recent as well as a wide selection of sources. Sources have been gathered from books and websites. However, if this research is done again, it cannot be proven that the answers are the same.

Validity: the extent to which the results measure what they are supposed to measure (Middleton 2022). Validity could have been improved, for example, through interviews. Still, sources gathered from different materials are valid for this thesis and sources have been gathered precisely.

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