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QUALIFYING MASTER'S THESIS

on the topic: «Prospects of using cryptocurrencies in the context of global financial market development»

Completed by 2nd year student of academic
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ABSTRACT

on master's thesis on the topic

«Prospects of using cryptocurrencies in the context of global financial market development»

by the student Oleksandr I. Polishchuk

The relevance of the topic chosen for the study is determined by the fact that the history of the global financial system, the study of its crises shows that in its critical times it does not meet the requirements of modernity. The First World War led to a partial rejection of the gold standard in favor of the British pound and the American dollar, and by 1931 the latter had become the only currency converted into gold for operations between central banks. During the Second World War, and more specifically one year before it ended, in 1944, the Bretton Woods system partially changed the financial system based on the gold standard. Later, with the Jamaican monetary system, the gold standard was officially abolished. Today we are on the verge of another update of the global financial system. The established order of things requires a revision and restructuring of the functioning of global finance.

Among poorly investigated issues, the most valuable are: blockchain scalability, blockchains interoperability, conformity of cryptocurrencies to money functions, correlation of blockchains energy consumption to its scale, optimization of blockchains by development of consensus algorithms, regulation and risks of initial coins offerings.

Thus, the aim of current research is to provide implications on poorly investigated issues in cryptocurrency and blockchain sectors.

The object of current research is blockchain applications in the context of global financial system development. Correspondingly, the subject of paper is cryptocurrency potential as new driver of global financial system.

Solution of diploma thesis tasks was based on usage of numerous methodological approaches of research. Diploma thesis was realized with the

methods of logical generalization of the information within the work on regulation approaches in ICOs and cryptocurrencies; comparative analysis was used while comparing different cryptocurrencies on the market by main indicators dynamics. Also, legislation comparison was done within different countries in its attitude to blockchain applications. Comparative analysis was made for traditional money and cryptocurrency within the money functions. Chapter 2 was mainly based on graphical data and tables prepared through special software. Analysis of graphical data and main figures within cryptocurrencies interdependencies was done by economic and statistical methods. Also, the use of methods of grouping indicators and argumentation of conclusions and proposals were used.

The web-based statistical resources mostly served as a statistical information base: a world bank database, a coinmarketcap.com database. The primary informational bases – the sites of the largest cryptocurrencies: Ethereum.com, Bitcoin.com, Ripple.com and also the sites of popular cryptocurrency exchanges: Binance, OKEx, BIT-z, Huobi.

The development of the project also laid out the information based on the publications of recognized world rating agencies (Deloitte, Ernst & Young, pwa), national banks of the European Union countries and Ukraine, the SEC website, legislative portals of the EU and Ukraine.

The novelty of the research lies in the following directions: new approaches are proposed in the interpretation of information by grouping indicators and observing correlations, not discovered in the past (correlation between capitalization, price and energy consumption of cryptocurrencies blockchains), the use of consensus algorithms from the energy saving and increasing the blockchain scaling ability points of view, the issues of standardizing blockchains of different systems for their interaction without intermediaries from the point of view of the contribution to blockchain scalability without involving the development of consensus algorithms what lowering monetary costs and implementation period, analyzed the essence, risks and approaches of regulation of ICO - recommendations for implementation were suggested.

The importance of the results obtained in the process of research consists in the possibility of their practical implementation immediately.

The research results could be used in practice by numerous companies working within the blockchain industry. Among them, we should mention Kuna as biggest Ukrainian cryptocurrency exchange, which can enhance and accelerate the development process of the company on a global market.

From the other side, the implications of the current diploma thesis can be used by governments to maintain the process of blockchain integration to gain maximum plusses from the modern technology in sectors of ICOs holding and cryptocurrencies operations control.

The results of the core statements designed within the master's thesis were approved through the participation and further publication of scientific papers in digest of:

1) Online-conference «Problems and prospects of Ukrainian financial and credit system development» (November 22nd – 23rd, 2018)

2) International scientific and practical conference "Priorities of modern science", October 27th – 28th, 2017

Keywords: blockchain, cryptocurrencies trilemma, Bitcoin, Ethereum, monetary system, initial coins offering, regulation, consensus mechanism.

The content of the qualifying work is set out on 82 pages, in particular a list of used sources consists of 73 titles, placed on 7 pages. The work contains 3 tables, 21 pictures, as well as 10 annexes, placed on 14 pages.

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7. Орієнтовний план кваліфікаційної магістерської роботи, терміни подання розділів керівникові та зміст завдань для виконання поставленої мети
Розділ 1 *«Theoretical and methodical basis of cryptocurrencies in the context of global financial market development»* – «__» _____ 2018 року

У розділі 1 *необхідно провести аналіз поняття криптовалюта, з'ясувати значення поняття блокчейн та охарактеризувати теоретичні основи функціонування цієї технології блокчейн на прикладі криптовалют; дослідити поняття первинного випуску монет в контексті розвитку технології розподілених реєстрів; порівняти різні підходи до регулювання криптовалют.*

Розділ 2 «*Modern challenges cryptocurrencies are facing within the context of global financial market development*» – «__» _____ 2018 року

У розділі 2 необхідно провести аналіз криптовалют з точки зору фінансового активу та основи монетарної системи нового покоління, виокремити обмеження технології блокчейн, які не блокують розвиток ринку криптовалют, надати комплексні рекомендації по усуненню виявлених сповільнюючих факторів розвитку криптовалют на глобальному фінансовому ринку.

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INTRODUCTION

The history of the global financial system, the study of its crises shows that in its critical times it does not meet the requirements of modernity. The First World War led to a partial rejection of the gold standard in favor of the British pound and the American dollar, and by 1931 the latter had become the only currency converted into gold for operations between central banks. During the Second World War, and more specifically one year before it ended, in 1944, the Bretton Woods system partially changed the financial system based on the gold standard. Later, with the Jamaican monetary system, the gold standard was officially abolished. Today we are on the verge of another update of the global financial system. The established order of things requires a revision and restructuring of the functioning of global finance.

There are around 10 large cryptocurrencies used throughout the world. They are based on blockchain technology. In general, the number of cryptocurrencies is more than 2000. The most popular among them is Bitcoin. In fact, many cryptocurrencies are forks of Bitcoin, but some are based on another technology, providing more functions and using less sources.

According to various estimates, the volume of investments attracted by Initial Coin Offering (ICO) in 2017 exceeded 5 billion of USD. Attracting investment through ICO gained wide popularity in the world. Low entry thresholds and relatively quick capital returns are the main reasons for market development. The relevant state and international regulations are expected to raise this way of attracting investment to a qualitatively new level.

The topic of cryptocurrencies in the context of global financial system development is currently not developed deeply. The Bitcoin system appeared in 2009, and became known to a wide audience only in 2012. Most of the published materials on economic topics from that time are mainly short extracts from the main protocol of the Bitcoin system and are general. Also, currently there are more literature based on regulation approaches concerning ICOs, exchanges, taxation.

Many of scientific papers discover cryptocurrency as financial asset and trying to give analysis of its conformity to money functions. Among discovered scientific literature, there were no researches concerning electricity usage of different blockchains, its correlation to market capitalization of that blockchain based cryptocurrency. Also, the topic of blockchain trilemma were not discovered deeply yet. Current relevant problems such as interoperability do not have global approach to discovering in terms of cryptocurrencies development.

Relevancy of the current diploma thesis is proved by: growing demand on cryptocurrency; increasing of the blockchain functionality, adaptability to different sectors of public life; speculative tendencies on cryptocurrencies market in January, 2018; increasing role of initial coins offerings as tool to substitute IPOs and crowdfunding; absence of standards of governments attitude to the sense of blockchain and cryptocurrencies projects; uncertainty in definition of cryptocurrency from the usage point of view: financial asset or money; decreasing value of current most influential currency USD; transformation of society requests to financial system; environment shift of global retail markets to Internet; increasing role of cashless payments.

Among poorly investigated issues, the most valuable are: blockchain scalability, blockchains interoperability, conformity of cryptocurrencies to money functions, correlation of blockchains energy consumption to its scale, optimization of blockchains by development of consensus algorithms, regulation and risks of initial coins offerings.

Thus, the aim of current research is to provide implications on poorly investigated issues in cryptocurrency and blockchain sectors.

According to the specified aim we may highlight the tasks for current research:

- define the role of cryptocurrency on financial market and as a basis for monetary system operation;

- make research on implications for blockchain technologies in the context of cryptocurrencies development: consensus algorithms, blockchain energy consumption optimization, standardization;
- determine factors influencing cryptocurrencies price dynamics, including speculations;
- define limitation factors of blockchain that frame cryptocurrencies usage possibilities as global money;
- identify the best regulations practices in cryptocurrencies and ICOs sectors;
- determine advantages of monetary system based on blockchain against traditional money.

The object of current research is blockchain applications in the context of global financial system development. Correspondingly, the subject of paper is cryptocurrency potential as new driver of global financial system.

Solution of diploma thesis tasks was based on usage of numerous methodological approaches of research. Diploma thesis was realized with the methods of logical generalization of the information within the work on regulation approaches in ICOs and cryptocurrencies; comparative analysis was used while comparing different cryptocurrencies on the market by main indicators dynamics. Also, legislation comparison was done within different countries in its attitude to blockchain applications. Comparative analysis was made for traditional money and cryptocurrency within the money functions. Chapter 2 was mainly based on graphical data and tables prepared through special software. Analysis of graphical data and main figures within cryptocurrencies interdependencies was done by economic and statistical methods. Also, the use of methods of grouping indicators and argumentation of conclusions and proposals were used.

The web-based statistical resources mostly served as a statistical information base: a world bank database, a coinmarketcap.com database. The primary informational bases – the sites of the largest cryptocurrencies: Ethereum.com, Bitcoin.com, Ripple.com and also the sites of popular cryptocurrency exchanges: Binance, OKEx, BIT-z, Huobi.

The development of the project also laid out the information based on the publications of recognized world rating agencies (Deloitte, Ernst & Young, pwa), national banks of the European Union countries and Ukraine, the SEC website, legislative portals of the EU and Ukraine.

The novelty of the research lies in the following directions: new approaches are proposed in the interpretation of information by grouping indicators and observing correlations, not discovered in the past (correlation between capitalization, price and energy consumption of cryptocurrencies blockchains), the use of consensus algorithms from the energy saving and increasing the blockchain scaling ability points of view, the issues of standardizing blockchains of different systems for their interaction without intermediaries from the point of view of the contribution to blockchain scalability without involving the development of consensus algorithms what lowering monetary costs and implementation period, analyzed the essence, risks and approaches of regulation of ICO - recommendations for implementation were suggested.

The importance of the results obtained in the process of research consists in the possibility of their practical implementation immediately.

CHAPTER 1

THEORETICAL AND METHODOLOGICAL BASIS OF CRYPTOCURRENCIES IN THE CONTEXT OF GLOBAL FINANCIAL MARKET DEVELOPMENT

1.1 The blockchain and cryptocurrencies essence

Modern world monetary system was formed on the basis of 4 key events of the 20th century: the cancellation of gold standard in the USA (1933), the conclusion of Bretton Woods Agreement, which granted the US dollar status of the world reserve currency (1944), the refusal of USA to exchange dollars for gold (1971), the formation of Jamaican monetary system (1976-1978), which put an end to Bretton Woods international agreement. Currently, currency price is determined on the free Forex market, although the US dollar dominates in financial transactions

The value of money is based on trust. The 2008 financial crisis undermined confidence in leading world currencies, USD and EUR. The current monetary system is criticized for the possibility of printing money without control. There is even the opinion that the existing predatory monetary system is the greatest threat to human freedom, peace and harmony with the environment, and should be abolished, and replaced with tools already tested by time or something fundamentally new.

Someone called for a return to the gold standard, others considered the interest-free currency issued by the Ministry of Finance without the participation of central banks (for example, J.F. Kennedy directive 11110 of July 4, 1963). Advocates of gold insist that paper currency (which, in their opinion, is not secured in any way) is not money, because does not have a raw value. Gold and silver coins (commodity money) and 100% gold deposits (receipts) exchanged for gold are considered by many to be the only correct and honest monetary system.

The critical response of gold critics is that its reserves are not infinite, and they can also be manipulated. But everything depends on the price of gold, as well as on the possibility of attracting jewelry gold into circulation, as it was in the United States during the Great Depression.

To ensure the objective stability of the monetary system, it is necessary for the currency to have a measure of value. This is a necessary strategic condition. Without this, trust will be lost after a while.

As time has shown, the most important property of money is not who released it, or even how portable or durable it is, but the number of people willing to use it. In the 20th century, the dollar received and retained the status of a world currency largely because most people in the world believed that the United States and its financial system have better chances to withstand any crisis than other countries. This explains why many people prefer to keep their savings in dollars.

Initially, cryptocurrencies were conceived precisely as an independent, fully-fledged virtual monetary unit, independent from state, as a new model of social organization, deprived of central control, functioning by forces of people who joined it.

This term has a wide variety of definitions and interpretations. The most common of these are given in table 1.1. In general, “electronic money” refers to money or financial obligations where the exchange and mutual settlements are carried out by using information technology.

Table 1.1. – Comparison of the definition of the concept of «cryptocurrency»

[1]

Term definition	Source
Cryptocurrency is a fast and reliable system of payments and money transfer, based on the latest technology and not controlled by any government.	Bitcoin Security
Cryptocurrency is a kind of digital money that uses distributed networks and publicly available transaction logs, and the key ideas of cryptography are combined with them within a monetary system to create a secure, anonymous and potentially stable virtual currency.	Insider.pro
Cryptocurrency is a kind of digital currency, based on complex calculations of some function, which is easy to verify by reverse mathematical actions, the basis of which is the principle of proof of the performance of work «Proof-of-work».	I. Lubenets'

Continuation of table 1.1

Cryptocurrency is an exchange tool like ordinary currency but is intended for the exchange of digital information, which has become possible due to certain principles of cryptography (used to provide operations and control the creation of new coins).	CryptoCoins News
Cryptocurrency is a decentralized convertible currency based on mathematical principles that uses cryptography to create a decentralized and secure information economy.	Financial Action Task Force on Money Laundering

In March 2012, the US Federal Reserve System (FRS) held a one-day conference on the topic of remittances, during which it was clearly delineated: the system of national transfers is based on the developments of the 1960s. Any payment took place at least 1 banking day. For most Americans, the simplest and fastest way to transfer money was a checkbook. And this problem applies not only to the United States.

The failure of the traditional payment system became particularly apparent during the financial crisis, when Morgan Stanley, a bank serving Wall Street, arranged a loan of \$ 9 billion with a Japanese bank. The loan agreement was signed on Sunday, but it was impossible to make a transfer in the coming days, because the payment system did not work on weekends, and a holiday fell on Monday. So it turned out that even banks are not able to send money to each other on weekends. In order to circumvent this restriction, the Japanese bank had to go for absurd actions – write a paper check for \$ 9 billion [22].

In real life, humanity at one time found the universal equivalent of commodity-money exchange in the form of gold. Since bitcoin-coins are made of pure mathematics and cryptography, the idea of the creator of Bitcoin manifested itself in the fact that it was possible to invent a mathematical equivalent to the process of mining gold from the depths of the earth.

Anyone who wishes can try his luck in “mining” several new coins – by giving the computing power of his computers to solve a mathematical problem with constantly-increasing complexity.

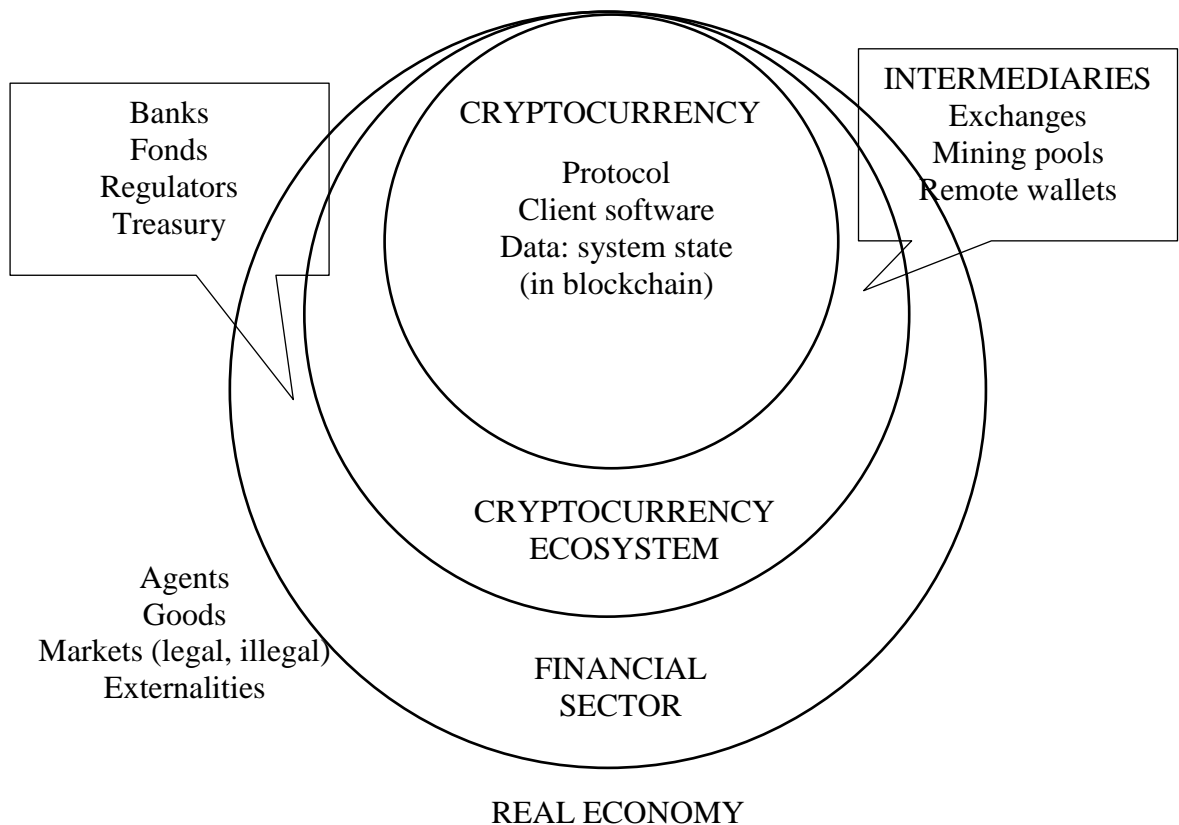
The emission of new bitcoin-coins is made automatically. But its volume is algorithmically limited so that the total number of emitted bitcoins does not exceed 21 million. This property is incorporated into the system by its developer: it was designed so that, like gold, bitcoins would be rare and no one could fake them. Currently, the total number of digital coins reaches over 17.39 million [3].

One of the most interesting and fundamental moments in the Bitcoin system is the decentralized emission of new coins, which anyone can do, but in strictly limited quantities and only through the use of computing power. In other words, bitcoin does not depend on central banks and printing presses, has no binding to the issuing center. This is its fundamental difference from traditional monetary systems. The entire system operates solely due to the infrastructure of equal user computers. The peer-to-peer network is distributed around the globe and is always open that everyone can connect to this system at any time or, on the contrary, disconnect from it as soon as they need it. Therefore, the Bitcoin system is completely decentralized, it does not have a central administrator or any equivalent.

Today there is a very large number of cryptography-based currencies. Cryptomarket is functioning successfully and provides an opportunity to analyze the dynamics of value, demand and supply of 2071 different cryptocurrencies. Among the largest in terms of capitalization are cryptographic products such as: Bitcoin, Bitcoin Gold, Ethereum, Ethereum Classic, Dash, Ripple, Monero, Litecoin, NEM, Augur, MaidSafeCoin and others [3].

For 10 years of existence, bitcoin has become widespread in the Internet. The number of companies that accept bitcoin payments is increasing every day. Among them are VirginGalactic, The New York Times, CNN, Reuters, Zynga, Overstock and Tiger Direct, as well as American divisions of Red Cross, who take donations in bitcoins. A fairly powerful impetus to the development of the Bitcoin system was its inclusion as one of the payment methods for the largest eBay online store in April 2015 [1]. Today, besides exchanges, exchangers and Internet resources, operations with bitcoins are carried out by some stores and service centers. They are accepted for payment in many restaurants and hotels in a number of countries around the

world. Even cases of salary payments to US civil servants in bitcoins are known. In several Asian countries, bitcoins are used as an alternative to bank accounts and plastic cards, as banking services in these countries are quite expensive [2]. The interaction of cryptocurrency with the real economy could be generalized by scheme given in Picture 1.1.



Picture 1.1 – Generalized scheme of cryptocurrencies system objects interaction with the real economy and its ecosystem [created on the basis of 29]

The majority of cryptographic networks are based on the blockchain technology and is a public register that stores data about all system transactions. Blockchain is the core technology for major part of cryptocurrency market as it fulfills the criteria, designed for cryptocurrencies: decentralized system, anonymous transactions, secure payments.

With start of Ethereum in 2014, blockchain started to be a way to support other kinds of transactions through smart contracts. Thus, it started to show broader possibilities for blockchain usage [23].

A blockchain is a distributed ledger where agents (also called writers or nodes) are recording information – creating blocks. Such information can consist payment details, ownership data, contract outlining wagers (when it is prioritized to have anonymous contract). There are many ways to record the information into the chain. They are called protocols. And depending on final goal, protocols are chosen: for some it is better to have anonymously made operation, for others security will be more relevant. Still, there are no best protocol developed to write information into different blockchain systems. In general, while approving a block ledger readers and writers are searching for consensus to validate the block for implementing it into the chain. For this operation, empowered for writing data to the chain nodes are rewarded by fee.

If some of the writers decide to change the governing rules inside the blockchain, they agree to ignore those who do not follow developed rules. Also, writers who agree with the old rules are ignoring modernized rules chain and its participants. Thus, two new blockchain are created in this way. The new blockchain is called fork, as it is origins from the old one and made changes into governance. In 2018, there are more than 2000 cryptocurrencies [3]. Lots of them are made as forks of Bitcoin.

One of the examples can be presented by Ethereum and its case in 2016, when the system was hacked and 55 million of USD was stolen from investors. Some of the users claimed Ethereum blockchain to pay back the amount of hacked money to investors. Then, users were divided into two communities by ignoring blocks of each other and new blockchain created in the way as shown above.

Above all, there are three types of blockchain to be build: private, permissioned and public.

Private blockchain is mostly centralized, as issuing entity control all the transactions that are written to the ledger. It is commonly used by companies, who wanted to create their own cryptocurrency for trading it on financial market by using initial coin offering tool as substitute of shares emission and IPO.

As for permissioned (or consortium) blockchain it is characterized by predefined writers, who have rights to validate the records in ledger. It is not decentralized blockchain in a classical way, but it gives opportunity to increase security of the system. Ripple labs are good example of such blockchain. While other cryptocurrencies have barriers in interaction with banks and other institutions, their protocol is successfully used for international payments because of its relative anonymous, security and transaction fees. During 2014 – 2017 it started to be used in UniCredit, UBS, Santander, Axis Bank, Deloitte. By the way, Ripple is the second cryptocurrency on the market by capitalization after Bitcoin.

Public blockchain is the best way to decentralize system. It is the most popular way to organize cryptocurrency blockchain. This is anonymous and decentralized. However, there are some need in information to identify writer, who will validate the block and make record into the ledger. Typical approach for that is Proof-of-Work method, when writer is able to make record to the ledger after performing difficult computational task. There is another popular method which was designed in 2012 and called Proof-of-Stake specially to solve the cryptocurrencies dilemma, as PoW method was not suiting best. Among pros of PoS are: expensive (because of need to compute tasks, correspondingly use electricity), attack of 51% is not possible (as computing power is ignored. Members of blockchain were PoS is used are trying to get biggest share of coins, as rewards for recording the ledger is also higher and corresponds with it.

1.2 The legal status and regulation of cryptocurrencies

Cryptocurrency is a relatively new phenomenon for global finance. Despite the absence of any state support, such a system gained great popularity in a very short time. There are many large players who are actively blocking this cryptocurrency, but there are also a sufficient number of financial institutions that

support the new phenomenon and want to be at the forefront at the time of the reorganization of the global financial system. In the financial and economic press there are a lot of opinions and conclusions of experts about this. The situation with the recognition of Bitcoins in the world differs from state to state, as well as the position of experts.

The legal status of private cryptocurrencies varies from country to country (digital product, digital asset, financial instrument, virtual currency). The most common introduction of the legal status of cryptocurrency as a digital asset, product or other property that exists in electronic form (Japan, China, the Philippines, Switzerland, some US states). Possible approaches to cryptocurrency regulation:

- absence of regulation. Observation from the regulator, informing citizens about the risks of participation in the cryptocurrency turnover. At the same time, the regulator or government authorities often make statements about the proposed determination or the status of cryptocurrency, the risks associated with them and the possibility of their use, but they do not fix them at the legislative level. As a rule, the lack of regulation is an interim measure until a decision is made to introduce appropriate measures;

- ban on the use of cryptocurrency. Was used by China, Bangladesh, Bolivia, Venezuela, Vietnam, Egypt, Iceland, Kyrgyzstan, Ecuador;

- regulation of cryptocurrency. Japan, Philippines, some states of the USA, Germany, Switzerland, United Arab Emirates, Australia, Canada made decision on that way to interact with cryptocurrency. Regulatory measures in most cases include registration / licensing of exchange sites, user identification for AML / CFT purposes (may be in accordance with established limits), taxation of participants in turnover, reporting on exchange site operations, consumer protection measures, minimum capital amount for exchange sites (optional), the responsibility for the violation of the established requirements.

In Japan, cryptocurrency is defined as “digital property value”, accepted as a means of payment, which is not equal to currency or electronic money. For exchange sites, a separate type of license from the Financial Services Agency (FSA) has been

introduced, for which the site must meet the minimum capital requirements. User identification is carried out when opening an account on the site, as well as when conducting transactions above the established limit.

In November 2013, the US Senate recognized the use of virtual currencies as a “legitimate financial service” [12], the Ministry of Finance of Germany called the Bitcoins “a variant of private money” [13] and that it can be used in “multilateral clearing operations”. Singapore believes that bitcoin transactions may be subject to tax on goods and services. Thus, the government of Singapore recognize not only the existence of Bitcoin, but also the legitimacy of the business using this cryptocurrency. The certainty of the legal status and especially taxation of business associated with virtual currency increases the potential of jurisdiction and its attractiveness for both startups and companies that have already gained recognition and popularity in this area [14]. But opinions differ, and in December, 2017 former US Federal Reserve Chairman A. Greenspan announced the entire Bitcoin system as another bubble [3]. In the spring of 2013, the United States introduced anti money laundering rates for virtual currencies: companies issuing them or settling in them should keep appropriate records and report on transactions in excess of \$ 10,000 [15]. The financial crimes investigation unit of the US Treasury also promised that all companies receiving real money in exchange for virtual ones, as well as carrying out transactions on behalf of third parties, will be subject to additional checks. For individuals who simply use virtual currency to pay for goods and services, anti-money laundering rates are not applied. In China, the People's Bank of China banned financial companies from conducting operations with Bitcoins, after its value increase by 89 times it aroused heightened interest among Chinese investors in such alternative means of payment [15]. Norway has announced that it does not recognize Bitcoin as a real currency or means of payment, which is consonant with the statement of the National Bank of China. However, the Norwegian tax authority did not fail to benefit from the popularity of the Bitcoin system: according to its head, H.K. Holte, a cryptocurrency will be treated as a financial asset and transactions with it will be subject to appropriate tax. Denmark is preparing new standards to protect

consumers from the risks associated with the use of virtual currencies. The Danish Financial Supervision Authority discovered that it does not have the authority to fully regulate transactions with them and is unable to prevent the creation of a stock exchange for cryptocurrencies in the country [16].

At the beginning of 2017, the world's first bitcoin bank (Bitcoin Bank) [6] was officially opened in Vienna (Austria), and meanwhile in Japan bitcoin began to function as a full-fledged currency [4]. Spanish is preparing to opening of 7 thousand ATMs for the exchange of bitcoins in euros, 3 thousand of these ATMs are also available in Poland [8]. Another trend is observed in such countries as Russia, Ecuador, Kyrgyzstan, where the use of bitcoins was prohibited [9]. But countries are changing their point very actively and can shift from cryptocurrency-banned country to totally different point in one year. It is simple to understand as cryptocurrency gives additional motivation for investments attractiveness.

EU Directive 2009/110 / EC defines electronic money on the basis of three criteria: electronic storage, transfer to the recipient only after they are received by the bank, and the payer cannot be their issuer. In Ukraine, in accordance with clause 15.1, Art. 15 of the Law «On Payment Systems and Transfer of Funds in Ukraine», electronic money is defined as unit of cost, which is aligned on an electronic device, is accepted as a means of payment by other persons than the person who emits them and is the monetary obligation of this person, which is fulfilled in cash or in cashless form [10]. From a legal point of view, the determining personality of electronic money is that on the one hand, they are a means of payment, and on the other – on obligations emit, which must be executed in the form of electronic money, in any case, stands either bank or bank account with real cash.

In Kazakhstan, there is also no single point of view among experts. «Bitcoin currency may pose a threat to the financial system of Kazakhstan» – said the Deputy Minister of Finance of the Republic of Kazakhstan R. Dalenov [18]. According to A. Smagulov, Deputy Chairman of the Board of Peoples Bank of Kazakhstan, if it is properly regulated, cryptocurrency is not dangerous. “If the structure of the

shadow currency, such as Bitcoin, is small and regulators understand how to control it – it does not constitute a threat” [17].

As in other post-Soviet states, bitcoin has not been widely used in Ukraine, but it is used in the Internet industry quite actively from Ukrainian IP’s. In our country, it is quite problematic to use this currency in everyday activities, because it is impossible to pay for goods or services. Only a few Ukrainian online stores and businesses indicate on their sites that they accept cryptographically secured currency as a form of payment.

In a letter to the NBU No. 29-208 / 72889 dated 08.12.2014, it is stated that Bitcoin's currency issue is not guaranteed and legally binding on persons, it is not controlled by the state authorities of any country. The NBU also emphasizes that authorized banks have no legal grounds for enrolling foreign currency received from the sale of bitcoins abroad and warns individuals and legal entities against the use of this currency. The National Bank is also guided by the fact that the European Banking Authority has urged EU banks to refrain from operations with cryptocurrencies, including bitcoins, until a system of rules is created that can prevent potential abuse [11].

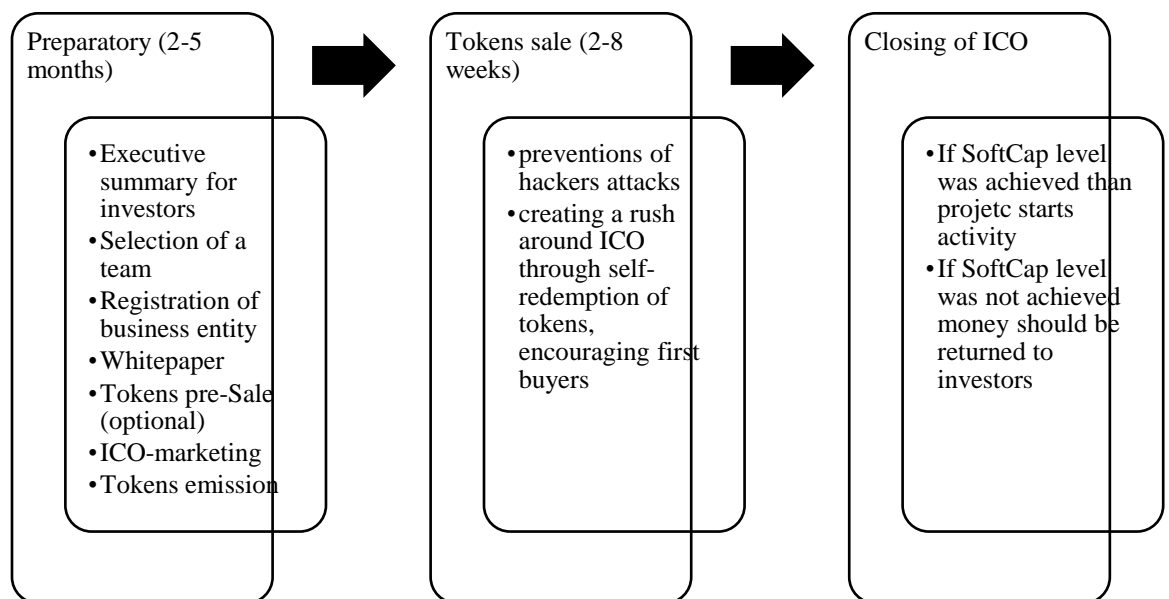
In general, the number of states that approve or refrain from a total ban on the use of cryptocurrency is growing. It can be noted that the number of enterprises that accept cryptocurrencies as payment increases, partially abandoning traditional fiat money. The trend to replace traditional markets, where it is possible by physical characteristics, its online version, is obvious. We assume that being more popular in the Internet circulation of cryptocurrency, with all their types and branches, new forms of currencies will eventually force out their fiat counterparts in this segment. A development scenario is possible, in which two independent forms of currencies will function in global finance context: cryptocurrency on the Internet, fiat money on other markets.

1.3 Initial coins offerings: way to enter the market

ICO (Initial Coin Offering) – a form of attracting investments through the release and sale to investors of digital tokens for fiat money or other cryptocurrencies. ICO contains elements of various forms of raising capital:

- in most cases, as a result of investing in a project, an investor receives an asset that is traded on public trading platforms, as in the case of a public offering of securities (IPO);
- as a rule, the sale of tokens is associated with a public PR campaign inherent in crowdfunding;
- project is at an early stage, typical for venture capital investment.

The general ICO process stages could be seen on Picture 1.2.



Picture 1.2 – Stages of ICO [created on the basis of 52]

The first such project – Mastercoin – was carried out in 2013. Its idea was to develop a protocol that allows user to create his own cryptocurrency based on

Bitcoin. As a result, ICO collected about 5,000 bitcoins, which at that time amounted to \$ 500,000. Invested Bitcoins holders received in return digital UpToken tokens.

The active development of the market started after the implementation in 2014 of the Ethereum project, a platform for creating decentralized online services based on blockchain operating on the basis of smart contracts (a computer algorithm designed to enter into and maintain self-executable contracts executed in the blockchain environment). The project attracted 31,591 bitcoins, which at that time amounted to \$ 18.4 million and is still considered one of the most popular and successful. In 2017, about 77% of ICO-projects were carried out on the basis of Ethereum, and according to the capitalization of cryptocurrency (ether), it always stays in top five.

On the one hand, the use of ICO as a form of attracting investments facilitates the possibility for companies to attract financing, since this mechanism does not provide for strict regulatory requirements for its implementation, on the other, risks for investors are significantly increased.

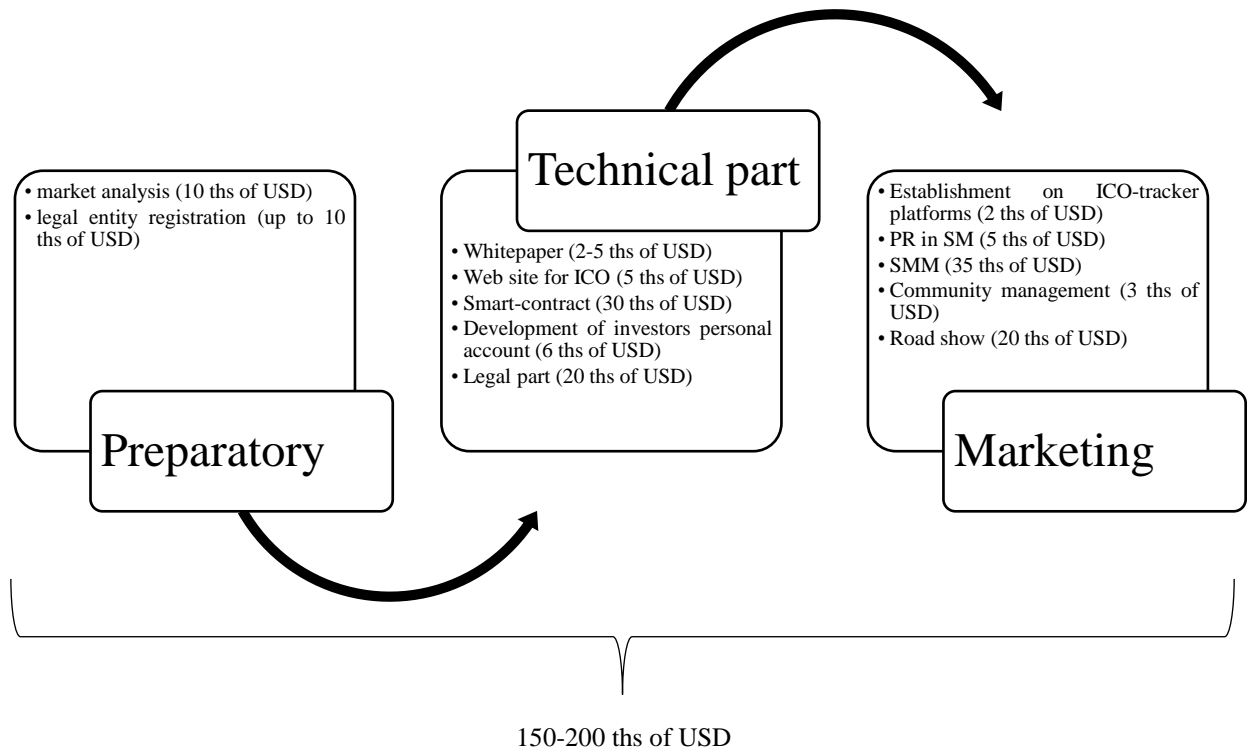
At the initial stage of the ICO, the company discloses all key and technical information about the project (in the so-called “whitepaper”): number of tokens produced, purpose and timeframe of ICO, team, roadmap of project, its features and other. Issued tokens can later be traded on cryptocurrency exchanges.

A feature of ICO is fact that organizer can be both a legal entity and an indefinite group of individuals.

During the ICO, company creates its own digital tokens most often on one of the existing blockchain platforms, for example, Ethereum, Waves. Next, the tokens are sold out to everyone, thus providing an inflow of funds to project that conducts the ICO. Subsequently, the organizer of ICO monitors the turnover of tokens in accordance with the conditions of release.

As a result, investors, acquiring tokens offered on ICO, primarily expect to benefit from selling them at a higher price in the future.

Within the financial issues, the ICO can be described as it is shown on picture 1.3.



Picture 1.3 – Structure of ICO from the financial point of view [created on the basis of 52]

Currently, non-professional investors are mainly involved in the ICO. As a rule, in most cases, ICO participants acquire tokens for speculative purposes, less often for long-term investments. However, the market is interesting for institutional investors as well.

The main risks of an ICO include:

- lack of guarantees for investors and protection of their rights. The absence of contractual relations between the investor and the project initiator under any legal field, as well as any minimum requirements for disclosing information about the project and criteria for their evaluation does not guarantee that the project initiators fulfill their obligations, entails the risks of abuse by its creators and not protects the rights of investors in the event of liquidation or bankruptcy of the project. The acquisition of a digital token, in contrast to, for example, securities, does not grant its owner a corresponding set of rights in relation to the funded project;

– high proportion of fraudulent schemes. According to the company Chainalysis, which develops software for tracking transactions using cryptocurrency (the company cooperates with Europol and the US Internal Revenue Service), participation in the primary placement of tokens on the Ethereum platform suggests that in one out of ten cases the investor becomes a victim of fraud. At the same time, losses from fraud on this platform by September 2017 already reached \$ 225 million.

According to various estimates, the volume of investments attracted by Initial Coin Offering (ICO) in 2017 exceeded \$ 5 billion. Among the most profitable EOS projects, which brought the company \$ 883.4 million, Filecoin – \$ 257 million, Tezos – \$ 232 million. But besides capital, ICO-startups also attracted the attention of crime. When conducting an ICO in 2017, cybercriminals stole about \$ 300 million, which amounted to about 7% of all funds earned by ICO this year. In order to avoid financial losses during an ICO, careful preparation is necessary, especially in terms of cybersecurity.

In 2017, Positive Technologies specialists implemented a number of security analysis projects and protection against cybercriminals, such as the ICO procedure and the introduction of blockchain technologies in banks of post-soviet countries. The projects covered the analysis of the security of infrastructure, web resources, protection against attacks on organizers and social engineering against investors, the search for vulnerabilities in smart contracts and authentication methods.

In accordance with the position of the People's Bank of China, a complete ban on ICOs in China in September 2017 was introduced due to the fact that recently a large number of tokens were issued in the country that could act as “surrogate money”. Such activities were speculative and illegal, which adversely affected the economic and financial situation in China.

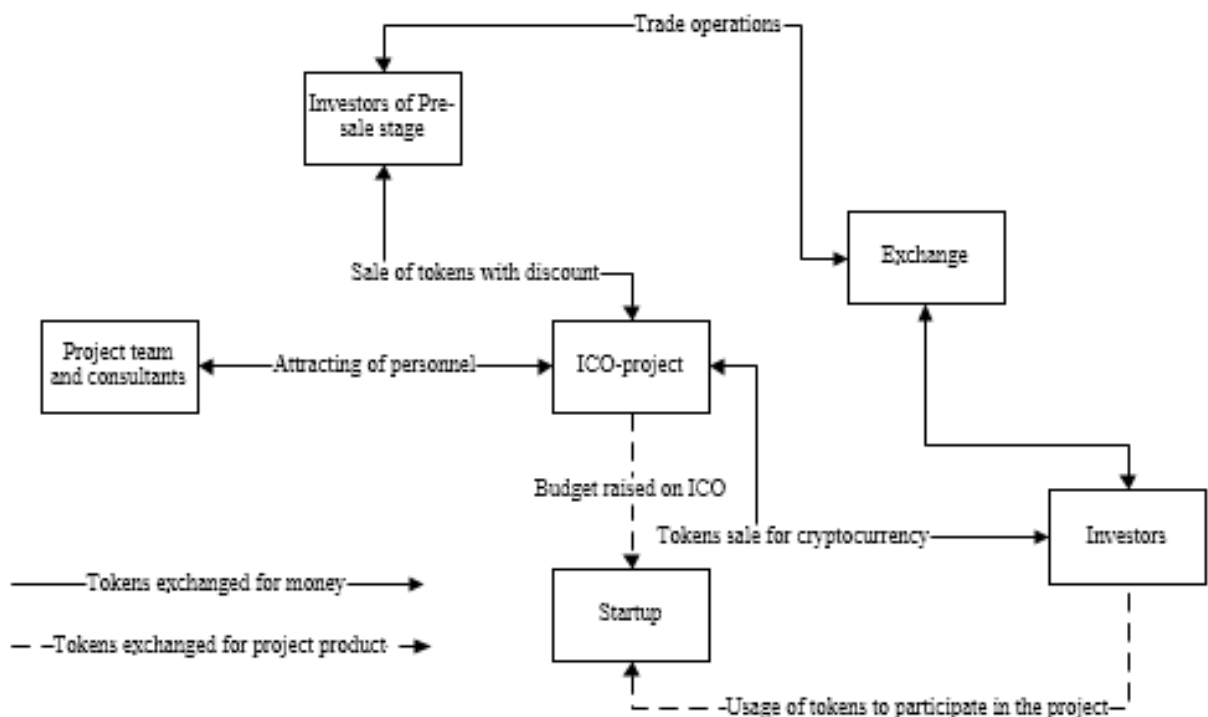
In accordance with the official statement of the People's Bank of China, involving investors in the circulation of “virtual currencies”, issuing cryptocurrencies, as well as “digital tokens” is in essence legalizing financial

activities for the illegal sale of bills of exchange, issuance of securities and means of payment through fraud and the creation of criminal financial pyramids.

In addition to China, a total ban on ICO is also set in South Korea. A number of financial regulators also impose restrictions on the implementation of ICO by defining requirements by analogy with the regulation of securities or other financial instruments, for example, in the USA, Canada, Singapore, Hong Kong, the United Arab Emirates, Brazil. In this case, it is planned that the assignment of digital tokens to financial instruments will occur separately in each specific case in accordance with certain criteria.

Given the potential risk of extraterritorial application of securities laws, often the exchanges themselves and the organizers of ICO exclude investors from certain jurisdictions, primarily in the United States and Singapore, from participating. For example, such conditions were contained in the whitepaper of the project TenX, which collected more than 80 million US dollars.

At the moment ICO participants are interacting with each other as it is shown on the Picture 1.4.



Picture 1.4 – The scheme of relations between the participants of the ICO-project [created on the basis of 52]

Due to the lack of legal regulation in some countries at the current stage, the informal rules of «good practices» that have been formed during the ICO:

- the most detailed and understandable to potential investors «white paper», containing: 1) the principle of operation of the technology; 2) value and value of the token; 3) conditions for issuing tokens and raising funds from investors; 4) information about the organizer of the ICO, including the professional experience of the team members;
- a detailed project development plan (roadmap), including a plan for spending borrowed funds and distribution of profits;
- limiting the amount of funds raised and ending the ICO upon its achievement;
- indication of the percentage of the total number of tokens to be placed, which will be distributed between the development team and the organizers of the ICO;
- independent evaluation of the project by external experts;
- fair PR campaign of the project.

Conclusions to 1 chapter

First part of the study gives clear definition on what is cryptocurrency and blockchain from technological and financial point of view. We also see analytics of major events which lead people increase their trust to substitutional monetary systems as dollar, in which people trusted, led many of them to lose money. Also, current settlements system shows its disability to fulfill modern financial and business sector needs. Some points of view state that gold was only one fair monetary system as it characterizes by real value. The most popular cryptocurrency – Bitcoin, as we can see from the first part, is “gold of 21st century”. It has very

similar limitations and specification. Everybody can try to mine coins; in general, at the moment, coins are limited; its value is calculated by supply and demand curves and is not strongly influenced by many risks' despite of fiat money. Also, as financial market actors see acceptance by market the phenomena of cryptocurrency, many of them try to enter the market with their own cryptocurrencies. It also stimulates development of technology, as competition is growing very fast.

We consider different views of the scientists on the topic which monetary system suits mostly and is fair to participants, but in our study, we assume that gold-based system (correspondingly cryptocurrency) is fairer.

From the other side, we include to the study the basis of major part from cryptocurrencies list – blockchain technology. It is very perspective point to discover as it gives lots new options to realize old tasks of human-being, not only cryptocurrencies: elections, smart contracts, property rights, domain name systems for example. Of course, many people know about technology from the Bitcoin mainly, but there are lots of opportunities to use it alternatively in other parts of our life.

While discovering phenomena of blockchain we state three traditional methods to add blocks to the chain: private, public, permissioned. The decision which of these methods suits to the project, it is important to know the tasks future blockchain system is going to realize.

Part 2 shows us 3 typical and mostly used approaches to regulate the cryptocurrencies turnover: total ban on cryptocurrency, absence of any regulation and general regulation of cryptocurrency. It is clear that cryptocurrencies will exist anyway and there are no way to ban it totally as in many countries it is forbidden to enter private life of people by government – investigate on their computers and internet activity what is the only one way to ban cryptocurrency totally. Many people started to use it and the turnover figures shows to governors that cryptocurrencies are useful for modern society and makes peoples life more comfortable by providing new tools for realization of financial needs. Its advantages such as anonymity,

reduces transactional costs, absence of control from government makes this tool relevant and market already accepted it.

From the other side, “wait and see” approach increases the risks for users and also for financial system inside the country.

Principally developed countries show us the approach whose core element is development of regulation. As trading amounts shows significant influence on the financial market, there should be and regulatory issues from government side to avoid supplemented risks.

As it was discussed in part 3, ICO procedure is short-term, it is extremely important to consider attack vectors before it starts, otherwise the risk of financial losses is high. Timely detection of vulnerabilities allows organizers to take all necessary protection measures in advance, and within the ICO to focus their attention on the business. In 2017, attracting investment through ICO gained wide popularity in the world. Low entry thresholds and relatively quick capital returns are the main reasons for market development.

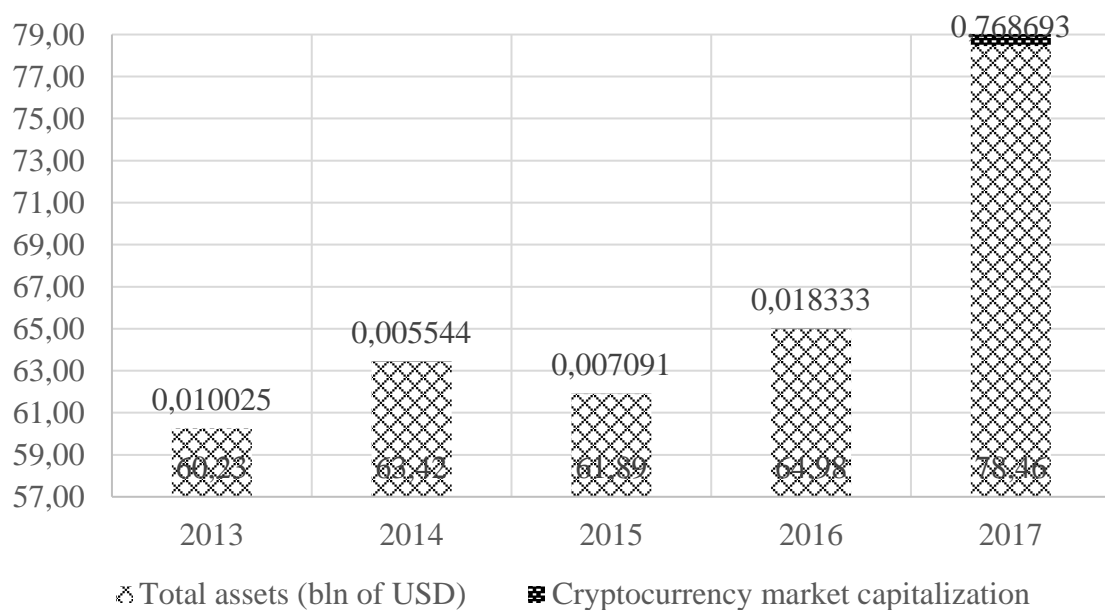
The rapid development of this area gives us the opportunity to talk about the relevance of further research on this topic on the example of particular countries, companies and analytics.

CHAPTER 2

MODERN CHALLENGES CRYPTOCURRENCIES ARE FACING WITHIN THE CONTEXT OF GLOBAL FINANCIAL MARKET DEVELOPMENT

2.1 Analysis of cryptocurrencies as monetary system draft

Over the last five years cryptocurrencies capitalization shows its possibility to influence the global financial market what makes it valuable for major players as governments and corporations as well as hedge funds and trading platforms. Actually, all market participants are currently trying to meet up their business interest with cryptocurrency. Still the major part of investors within cryptocurrencies are individuals with small capital, who have no knowledge or technical opportunities for professional analysis of the specified market field. The picture 2.1 shows us current market state.



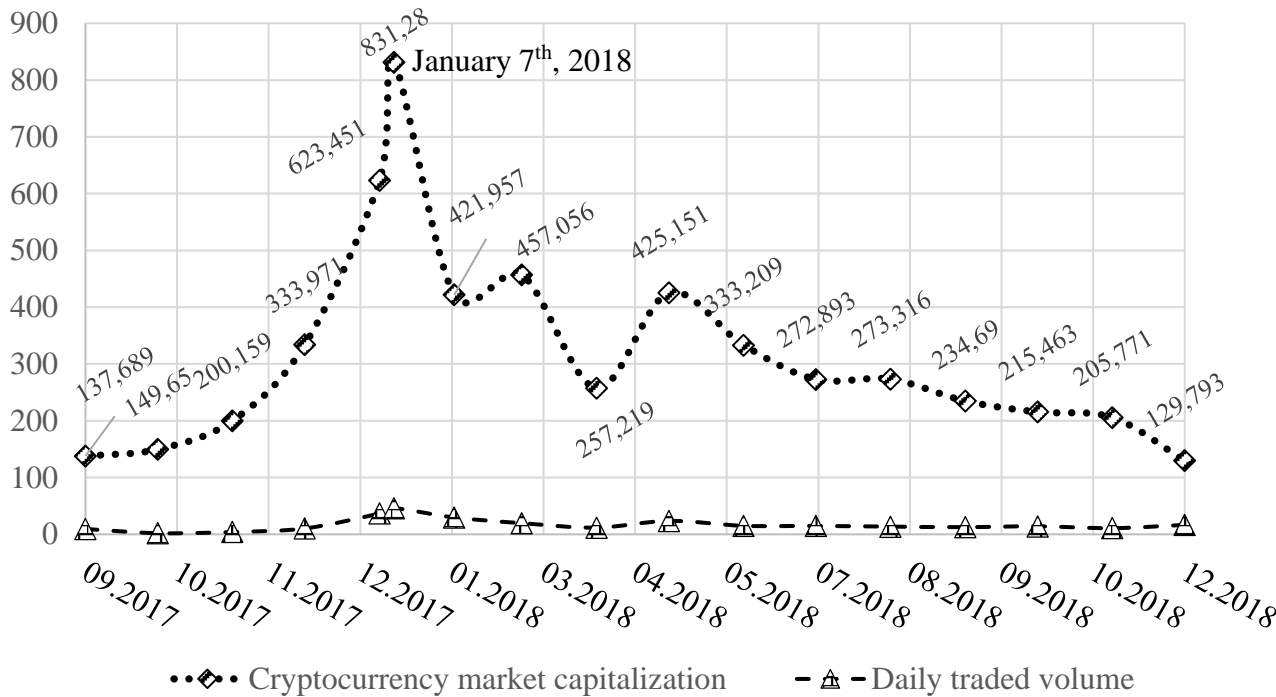
Picture 2.1 - Cryptocurrency market capitalization within the capitalization of world stock market in 2013-2017, trln of USD [based on 3, 71]

As it is show on the graph, 2013-2017 characterizes by growth in world stock market. It is also contributed by growth of cryptocurrencies market. For example, in

2013-2016 the share of cryptocurrencies market capitalization in total amount of world stock market capitalization is between 0,0027% - 0,0123% and for 2017 the same figure is 0,58%. The regulatory issues were not relevant in 2013-2016 what can be proved by calculated percentages. The peak on cryptocurrency market capitalization was on 7th of January, 2018 when total capitalization reached 831,28 bln of USD and was 1,061% from the total world market capitalization.

This unpredictable and speculative growth had shown its danger to fluctuations on the world stock market. There was strong need on issuing regulations by governments and platforms where crypto-assets are traded.

Thus, recent market changes on cryptocurrency should be discovered deeper, as it is show on the picture 2.2.



Picture 2.2 - Cryptocurrency market capitalization and daily traded volume fluctuations during September, 2017 – December, 2018 in bln of USD [based on 3]

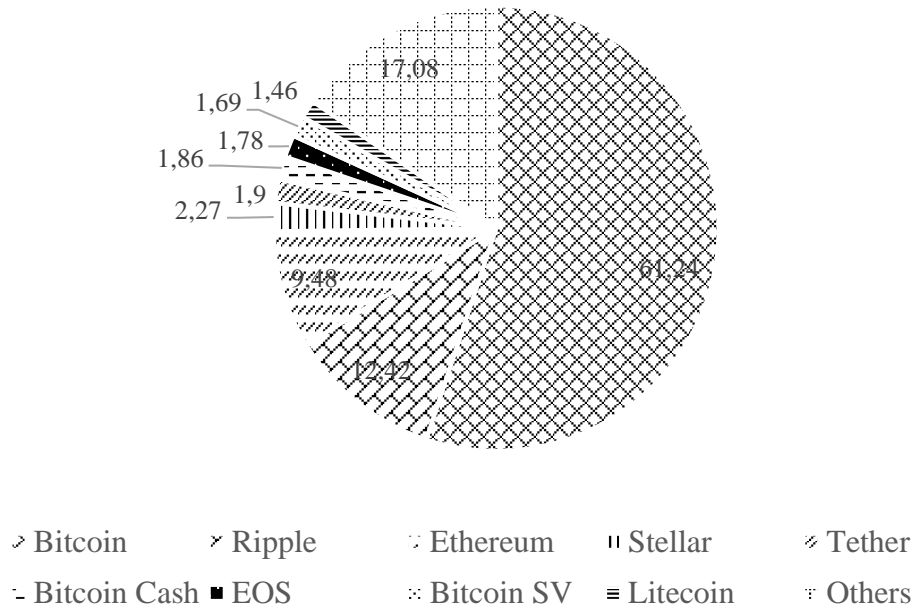
Cryptocurrencies bubble burned in January 7th, 2018 as it is shown on the graph. Till that time cryptocurrency was very profitable to trade but also very risky. Internet platforms who offered trading on cryptocurrency charged largest fees for it.

For example, IQOption charged 10% commission for opening the market position in 2017. After January 7th many of platforms stopped to offer cryptocurrency trading as many of them met losses concerning fluctuations on market. Currently market is quite stable and less risky to trade as we can see from the graph. Also, there is potential to increase capitalization as daily traded volume in average ranges from 3% to 6,5% of market capitalization and currently this figure shows 12%. It means that trading volume increases and market capitalization has opportunity to grow but with sensitive background, not like in 2016-2017 as speculation.

As we discussed in the first chapter, there are more than 2000 of cryptocurrencies. Most of them are Bitcoin forks and some are built differently with using of another technologies.

The main indicator for individuals on the market of cryptocurrencies is price. Correspondingly, the price for most of currencies had similar fluctuations as capitalization.

With this in mind let us consider Annex C (Picture C.1, C.2, C.3), showing us the dynamics of the price for major cryptocurrencies by market capitalization: Bitcoin, Ethereum, Ripple – picture 2.3 (as on the December, 2018). The same structure in dynamics could be found in Annex E. Picture E.1 shows us the recent changes during 2013 – 2018: structure on cryptocurrencies market changed dramatically for Bitcoin as new cryptocurrencies entered the market which have better and cheaper technologies, able to carry more operations and provide higher percent of anonymity.



Picture 2.3 – Cryptocurrency market capitalization structure (in USD bln as on the December 10th, 2018) [based on 42]

The graphs in Annex C were built up on daily basis from January 9th, 2017 till February 2nd, 2018. There is a sense to discover fluctuations and correlation within the period of bubble growth and crash. During the discovered period there are strong correlation between capitalization of the market and price per token (or coin).

The fact of growth of forks such as Ripple and Ethereum for over 3000% in 2017 shows its speculative sense. Also, the amount of decrease within specified currencies is very high. In comparison with Bitcoin, talking about the price and capitalization, reduce was shown on the level of 450%, Ethereum had 780% of decrease and Ripple – 900%. Calculation was made with taking into consideration the peak price (capitalization) and dividing it to lowest level of figure after bubble crash.

Despite the corresponding with capitalization, we should consider others while talking about cryptocurrency price. As in the case of classical currencies, the price of cryptocurrencies is set on the basis of a floating exchange rate, which is

determined during direct trading on cryptocurrency exchanges. Except this fact, there are certain differences that makes cryptocurrency price settlement other way:

- one of the basic properties of cryptocurrency is decentralization. This means that there are no direct regulators, such as central banks, that can influence the price of a currency, reduce its daily volatility, and also determine base interest rates;

- absence of a legislative base that prevents various speculations;

- parity of purchasing power in different countries can vary greatly. For example, in countries that have significant problems with the possibility of the implementation of commodity relations with the help of domestic currency, cryptocurrency can cost many times more expensive than “average” prices.

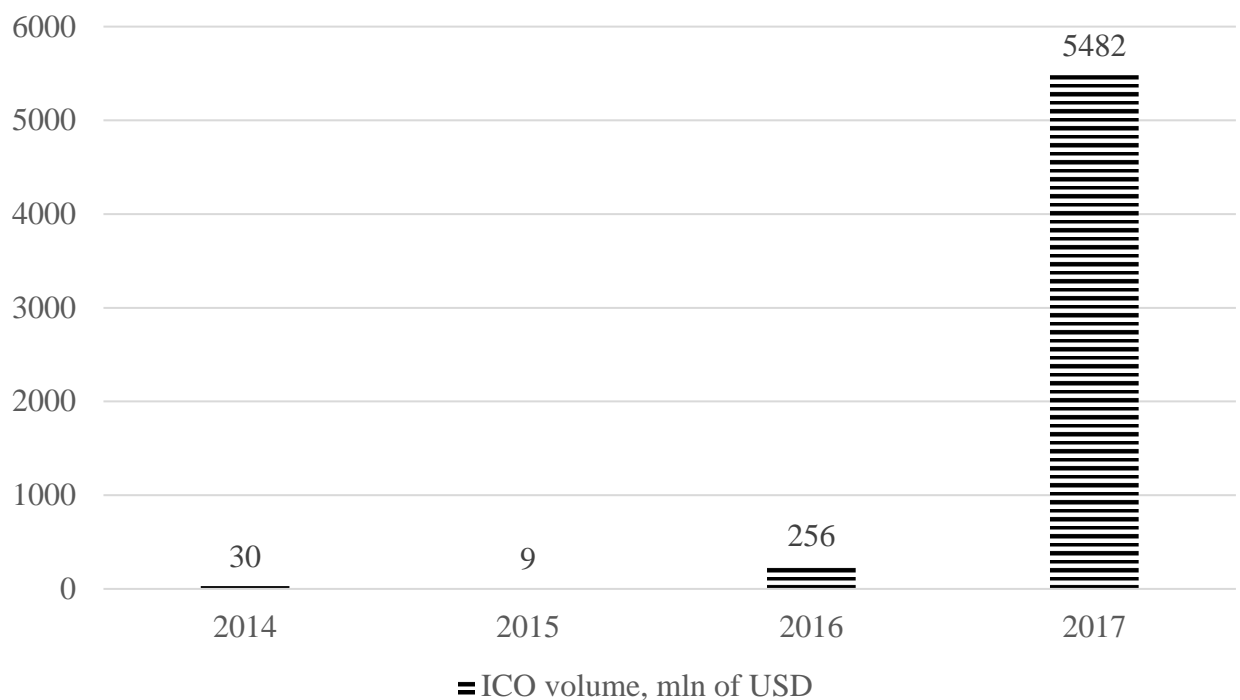
Talking about interdependencies of cryptocurrencies there are strong psychological connection. Traders behavior in most cases is the same, e.g. if Bitcoin price speculatively falls, Ripple price will also decrease and with this in mind traders will sell cryptocurrency. This activity will be followed by increase in supply and decrease in demand and price will fall. Annex C shows the correlation between cryptocurrencies. From technological point of view, cryptocurrencies prices are not strongly influencing each other, as the trading volumes in pairs cryptoasset – cryptoasset are much lower than volumes traded in pairs cryptoasset – national currency.

Talking about cryptocurrency as financial asset, we should also consider the IPO of 21st century – initial coin offering makes cryptocurrencies a way to attract funding for the project without strictly framed regulatory rules for issuer of new cryptocurrency as we discussed in Chapter 1. This tool became much popular in 2017 with growth of cryptocurrencies market capitalization.

Companies chose ICO instead of Crowdfunding and IPO because it has wide range of subjects who can hold the operation; no requirements for investor; possibility to scale the funding activity in global; token is issued as asset – easy to use for payments within the project or sell on exchange; specific investors are usually engaged – enthusiasts of blockchain-based projects; regulation is

implemented only in some countries, no global attitude (table I.1); no requirement for prototype; personalization of investor is optional; short term of investments return.

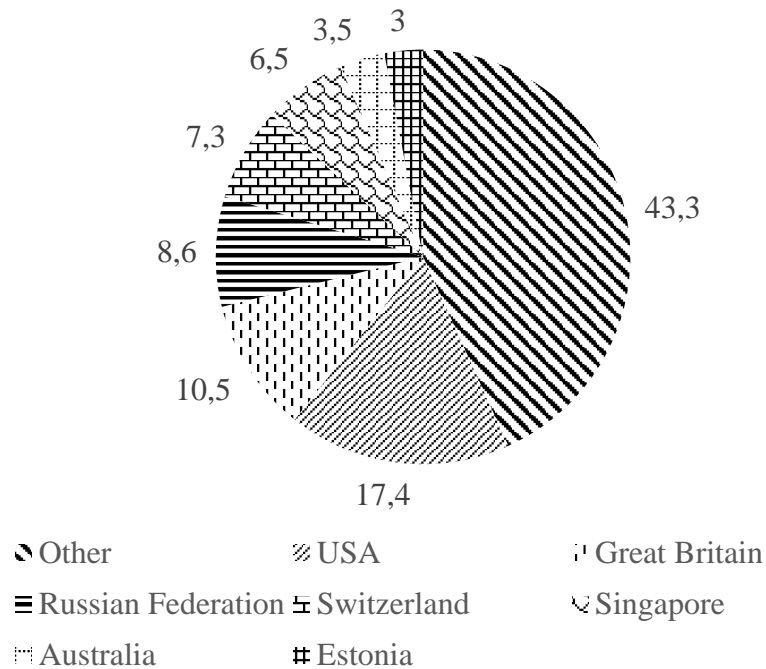
As we can see, ICO turned out to be a relatively simple form of attracting investments without significant restrictions from both project developers and investors, which became the main growth driver. Picture 2.4 represents the above statement.



Picture 2.4 – Dynamics of funds raised through ICO, million US dollars, 2014-2017 [based on 51]

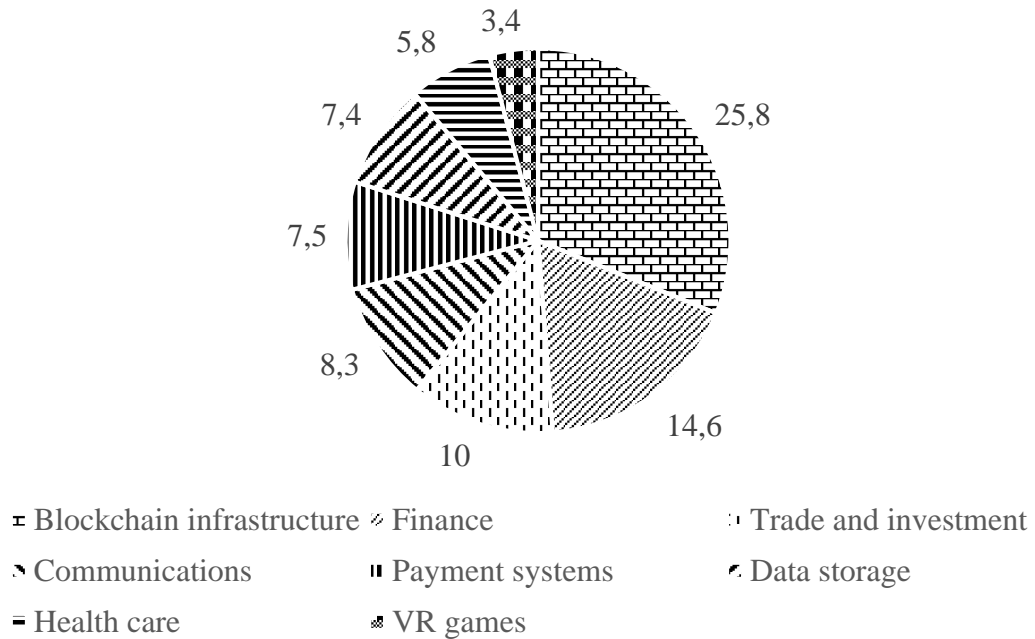
In 2017, the ICO market showed a dynamic growth - according to the Coindesk portal, the volume of attracted investments through such projects amounted to 5,482 bln of USD with 382 implemented projects. As for the quantitative structure of implemented projects in the regional context, the top three are the United States with an indicator of 17,4%, the United Kingdom – 10,5% and the Russian Federation – 8,6% (Picture 2.5). In 2017, Ukraine became in the list of top-5 ICO holding countries in Central and Eastern Europe with 12 projects. Annex

D shows the structure of Ukrainian ICO projects that raised highest amount of investments: DMarket (19,07 mln of USD), TAAS (7,963 mln of USD).



Picture 2.5 – Geographical structure of the market by the number of projects, 2014-2017, % [based on 51]

As it is show picture 2.6 blockchain-infrastructure and finance dominate in the structure of investment through ICO by sector with shares of 25.8% and 14.6%, respectively. Projects are heterogeneous in size: 10 projects accounted for about 30% of investments attracted in 2017.



Picture 2.6 – Structure of ICO projects, 2014-2017, % [based on 50]

The overwhelming majority (84%) of projects enter the ICO at the idea stage, while only 5% of projects have a finished product model. As it was discovered in Chapter 1 assessing the success of ICO depends on soft and hard cap indicators: fundraising goals, because in case of not reaching the minimum required level of attracted funds, developers will have to return investments and work on the project will not be started. By December 2017, the share of ICOs that reached the soft-cap stage was only 23% of the total, whereas in June of the same year the corresponding figure was 93%.

However, not all successful ICO projects plan further implementation of their product - according to MIT, 25% of projects that reached the soft cap stage turned out to be so-called scam startups, whose participants did not plan to develop the project after receiving investments. At the same time, according to Satis Group LLC, among projects that raised more than \$ 50 million, this figure was 80%. For this reason, a number of search engines (Google, Yandex, Baidu) and social networks (Instagram, Twitter, Snapchat). imposed a ban on advertising campaigns on cryptocurrency and ICO.

Correspondingly, this events of increasing ICO role, supplemented risks and cryptocurrency price fluctuations with speculative manner on market effected governments attitude as it is shown in Annex I, Table I.1.

Talking about EU member states, among developed countries, there are certain implications for cryptocurrency regulation. For example, Germany classifies cryptocurrency as unit of account and applies 25% tax on capital (if coins held more than 1 year), mining activity does not require special license. As for France, it was classified as unit of account till 27th of April, then the determination was changed to moveable property and correspondingly the taxation applied is – 19%. One another case – the most automated country Estonia does not apply regulation except traders who trade over 1000 EUR per month. Also, it stands for ICOs and blockchain startups development as there are lower costs for start. [Terzo; Dotta; Helms; Santos; Tassev; Copay; Ecovis; Debitum; Arjun B; Stojaspal; Nomoretax; Galea; Levring and Pohjanpalo; Library of Congress; Wikipedia; Schwarz; Srdoč; Reese; Thomson Reuters; Redman; Tassev; Arjun B; Zuckerman; Tasca et al. 51-57]

As for Ukraine, there are few law projects that contribute regulation of cryptoassets market in country (table 2.2).

Table 2.2 – Bills defining the legal status of cryptocurrency and the primary placement of coins [based on 10]

Bill	Sense
Draft law the essence of «On the circulation of cryptocurrency in Ukraine» dated 10/06/2017 No. 7183	It defines the basic concepts and equates cryptocurrency to the object of ownership, and not to the means of payment, with appropriate taxation in accordance with the current legislation.
«On the promotion of the market of cryptocurrency and their derivatives in Ukraine» dated 10.10.2017 No. 7183-1	Assigns crypto counties to obtain the status of financial institutions with the subsequent receipt of a license to operate and reduction of electricity tariffs at night for miners.
«On Amendments to the Tax Code of Ukraine (regarding the promotion of the market for cryptocurrencies and their derivatives in Ukraine)» dated 10.30.2017 No. 7246	Provides for exemption from taxation of profits from the implementation of operations for the purchase and sale of cryptocurrency, as well as its production.

It is meaningful to mention that among discovered regulations within the countries there are some leaders in volumes of trading by national currency.

According to [74] the most traded national currencies for Bitcoin as for 10th of December, 2018 are USD with 49,25% of total volume; Japanese Yen – 40,46%; Korean Won – 6,32 %; EUR – 3,11 %; PLN – 0,16 % and RUB (RUR) with 0,16 %. Annex F shows the structure of traded volumes by national currencies. Due to recent regulations in 2017 in China, we could see the outcome and market effect in Bitcoin trading volumes as Chinese yuan lost its leadership and from the other side Japanese Yen increased the amount of traded volumes. Second currency in the list is US dollar. The market changes may be explained by moving crypto assets to Japan and USA after ban in China.

While part of subjects are trading cryptocurrency on financial markets to gain profit from it as from financial asset there is other side, cryptocurrencies are called to facilitate market as measure of value – as money.

To analyze this issue, we should pay our attention to functions that should be fulfilled by money to drive the value exchange process between parties in economy. Empirical research of this issue could be localized to the most popular cryptocurrency – Bitcoin.

While considering cryptocurrency as money, it is important to analyze it for compliance with its functions.

As a means of circulation, cryptocurrency is in direct circulation, although limited to the Internet market.

As a measure of value: when disparate goods are equated and exchanged among themselves on the basis of price, i.e. exchange rate, the value of these goods are expressed in the amount of money. Due to their high volatility, it is difficult to say whether cryptocurrencies correspond to such a property of money as a measure of value. However, if we take into account that in online sales any goods are accepted for bitcoins, and their holders are ready to exchange them for a certain product, the function of money as a measure of value is obviously fulfilled in this context. Moreover, as A. Pigou states in his works on the theory of production and employment: “money does not play an independent role in economic life. They cost

exactly as much as they are given with wealth instead” [19]. Thus, the cryptocurrency fully meets the requirements of a simple system of currency value.

As a means of payment, this function of cryptocurrencies has not yet been sufficiently mastered; they do not issue loans and credit payments are not made. But in the future, when cryptocurrencies become legal tender at the level of states and the world economy, they will also be able to service credit relations. This implies the use of cryptocurrency in the repayment of debt obligations, the provision and repayment of loans, payment of wages, payment of taxes, utility bills, etc.

Moving further along the functions of money, we consider cryptocurrency as a means of accumulation. This function is performed when money are temporarily not participating in the current turnover. This is often the case when foreign currency is less subject to inflation. Here crypto units are in a very convenient position. The vast majority of clients of the Bitcoin system are more holders than active users. But recent trends in reducing the price of cryptocurrency several times threaten the implementation of this function.

Next, we consider cryptocurrency as world money. Bitcoin definitely has the ability to replace the dollar in the world market, thus changing the entire monetary system of the world, making it more similar to the one that functioned with the gold standard. At the moment, none of the cryptocurrency does not perform this function. The reason for this is the lack of regulation, high risks of use and speculation. In addition, the United States government and businesses are not interested in reducing its impact on the world economy through the main instrument - the dollar as world money.

Many scientists claim existing global monetary system because of unfairness, e.g. Federal Reserve System in case of need can print out as much currency as it needs and currency will not be secured except printed government bonds, bought oftenly by China – largest USA creditor. With this in mind, we can assume that such unsecured currency inflows effect not only inhabitants of USA but also other countries. According to [72] purchasing power of the consumer dollar decreased by

96% till 2017 from 1913 when Federal Reserve was created. The power of Dollar as global currency enables it to export inflation around the world.

Talking about most popular cryptocurrency – Bitcoin, we meet the theory of coming back to unique standard as it was with gold. There is some correlation seen between price fluctuations of gold in 1970s when the gold standard was approved and Bitcoin in 2010s. Annex G shows it.

Gold is limited and varies at its price (Annex G, Picture G.1). Comparing the dynamics of gold prices with the bitcoin rate (Annex G, Picture G.2), it can be noted that they have a graphical visual similarity, but the increase in the value of gold took more time than Bitcoin. Lots of expert's state that cryptocurrency is best substitution of gold in 21st century as it has more functions, can be used as money and has higher liquidity. But cryptocurrencies speculative price volatility establishes this asset to list of distrustful assets while major market players decide what to hold in portfolio.

2.2 Blockchain technological issues in the context of cryptocurrencies development

As we discussed in chapter 1, the basis of cryptocurrencies is blockchain. The sense of technology is totally different from what payment systems suggest within their operations. As traditional technologies, blockchain and decentralized ledgers systems have its disadvantages and limitations. These limitations reduce chances of cryptocurrencies to become world new currency and basis for global monetary system. Thus, many of experts and CEOs of blockchain projects are working on solving such issues to empower further development.

Bitcoin and Ethereum, the most widely used blockchains, are currently unsuitable for bulk transactions. Today they are used for investments mainly, but if blockchains ever become useful for something other than investment, solutions are needed to enable them to maintain performance with an increase in bandwidth.

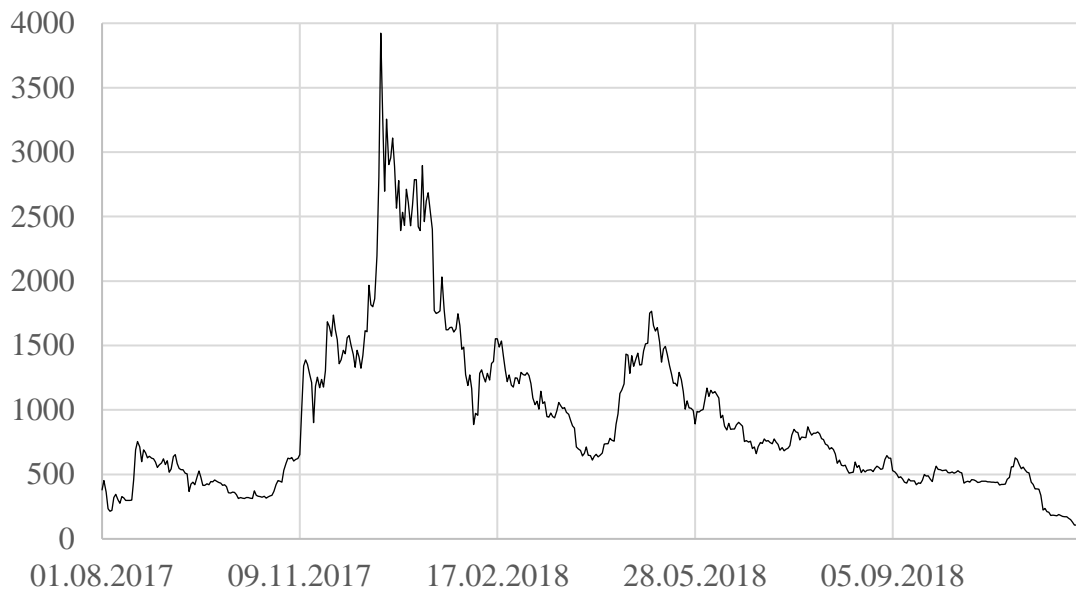
From a technical point of view, creating a centralized network that supports transaction scalability is not difficult. This has already been done by PayPal, Visa, MasterCard and many others. But create a blockchain system that offers users the best combination of scalability, decentralization and security is a today's main issue for blockchain-projects developers. This problem is called trilemma of blockchain:

- Decentralization: defined as the ability of a system to operate under scenarios where each participant has access only to $O(c)$ resources, that is, a regular laptop or a small VPS;
- Scalability: defined as the ability to handle $O(n) > O(c)$ transactions;
- Security: defined as protection from attackers with up to $O(n)$ resources.

Bitcoin and Ethereum were primarily created for the sake of decentralization and security, sacrificing scalability (Bitcoin supports ~ 3 transactions per second, and Ethereum supports ~ 12). This proved to be an effective way to promote the system, but as the network grows, limitations begin to be discovered. There are various new blockchains that sacrifice decentralization or security in favor of scalability and thus try to expand the network.

Among the projects that are oriented on scalability issue resolving are: Lightning Network (Bitcoin), Plasma (Ethereum) and Casper (Ethereum). There are also less-known projects that are engaged in developments at the second level of Ethereum (TrueBit, Raiden and Counterfactual) and at the peer-to-peer network level for all blockchains (bloXroute).

A number of new blockchains with a priority of scalability appeared, serving users and developers as more scalable payment networks (Bitcoin Cash, Algorand) and platforms for decentralized applications (Cosmos, Dfinity, EOS, etc.). Notably, that such platforms gained popularity in much shorter period than Bitcoin and Ethereum (Picture 2.7). The growth of Bitcoin Cash was realized in a very short period comparing with older cryptocurrencies (Bitcoin Cash entered the market on 1st of August, 2017).



Picture 2.7 – Bitcoin Cash price dynamics on daily basis August 1st, 2017 – December 11th, 2018, USD [based on 3]

In May, 2018 Ethereum founder Vitalik Buterin announced the technology which will allow cryptocurrency to reduce number for staking from 1500 ETH to 32 ETH – «sharding». It is modernized PoS mechanism discovered in chapter 1. The methodology of sharding is shown in Annex H. The advantage of sharding: more individuals can provide their wallets as open to become a writer in Ethereum blockchain as instead of 900 ths of USD they can have just 18 ths of USD. Thus, scalability will be possible, as number of transactions per second will increase.

If solutions that help Bitcoin and Ethereum scale up will not be realised before the demand for transactions grow significantly, it is quite possible that users will switch to these new generation blockchains. For the moment, such alternatives do not exist but are believed to be.

Such tendencies of common problems within the same technology motivates different blockchains to interact with each other, while partially solving the scalability issue. Of course, this is not the core idea of interoperability: it is the ability of a product or system whose interfaces are fully open to interact and function with other products or systems without any restrictions of access and implementation. It has wide range of reasons and is relevant for cryptocurrency market participants.

To become such a unified system blockchains must suit to certain criteria of standards:

- reference architecture;
- legally binding smart contracts;
- overview of and interactions between smart contracts in blockchain and distributed ledger technology systems;
- terminology and concepts;
- taxonomy and ontology;
- overview identifiable information (PII) protection;
- overview of identity;
- security risks and vulnerabilities [73].

Nowadays, interoperability of blockchain is partially solved by centralized exchange platforms, but the scalability of such platforms is very low as well as core attributes of blockchain as anonymity and security are neglected. Thus, there are strong need on the market in direct communication between blockchains. As an example of successful implementation of the task is Wanchain project that supports cross-chain transactions with Ethereum.

The main subject of standardization for now is ISO with draft of ISO/TC 307: Blockchain and distributed ledger technologies. Implementation of ISO for blockchain will allow blockchains and businesses cooperate in correct way with the basis of rules. According to ISO standardization principles are expected to be published in late 2021. The responsible country is Australia with 39 countries contributing the development of ISO and 13 countries observing. Ukraine is one among 39 countries who contribute development.

Through ISO/TC 307 11 standards are going to be developed in the following areas:

- ISO/CD 22739 – terminology;
- ISO/NP TR 23244 – privacy and personally identifiable information protection considerations;

- ISO/NP TR 23245 – security risks, threats and vulnerabilities;
- ISO/NP TR 23246 – overview of identity management using blockchain and distributed ledger technologies;
- ISO/AWI 23257 – reference architecture;
- ISO/AWI TS 23258 – taxonomy and ontology;
- ISO/AWI TS 23259 – legally binding smart contracts;
- ISO/CD TR 23455 – overview of and interactions between smart contracts in blockchain and distributed ledger technology systems;
- ISO/NP TR 23576 – security management of digital asset custodians;
- ISO/NP TR 23578 – discovery issues related to interoperability;
- ISO/NP TS 23635 – guidelines for governance.

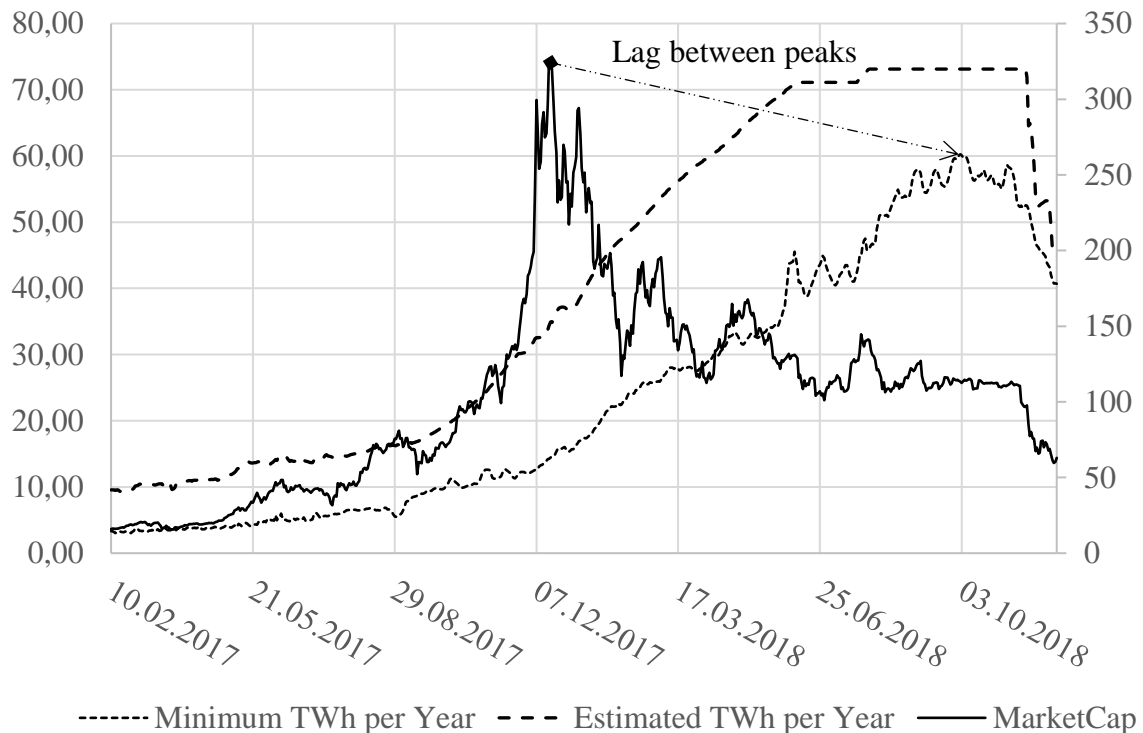
According to International harmonized stage codes most of projects are on 10.99 stage – new project approved (proposal final stage) or 20.00 – beginning of preparatory stage.

Such rules will definitely empower blockchains to be interoperable. Market participants will be acknowledged about principles of cooperation, thus development of blockchain will be stimulated.

On the other hand, blockchain has environmental issues that should be considered in near future to reduce effect on climate change. The main points within this issue are energy consumption and further heating emission. According to [40] calculations, Bitcoin blockchain consumes energy in very high amounts. It is notable that even if the capitalization and price decreases, blockchain electricity costs are not affected as much. Energy consumption fluctuation has much lower speed comparing to mentioned figures (Picture 2.8).

As we can assume from actual historical data there are lag between Bitcoin blockchain capacity and corresponding energy consumption. As we mentioned in previous points the peak of Bitcoin price was in January, 2018. In case of energy consumption peak was in October, 2018. It tells us about the lag around 10 months between discovered figures.

Given figures were calculated with use of the following methodology: (Total mining revenues – Non-electricity costs)/price per KWh.



Picture 2.8 – Comparison of dynamics of Bitcoin capitalization (right axis in bln of USD) and energy consumption (left axis in TWh per year) on a daily basis from 10th of February, 2017 till 9th of December, 2018 [based on 40, 3]

To consider other comparative indicators, Bitcoin is on the 53rd position in countries list by energy consumption. It means that 144 countries are using less energy than Bitcoin blockchain. Ethereum in the same list takes 108th position.

In the same time, Bitcoin blockchain uses as much electricity per 1 transaction as 294 000 VISA transactions.

Thus, we should consider the issue of energy consumption by blockchain as very important. At the moment, Bitcoin and Ethereum mining is unprofitable. Also, the statistics shows it high level of consumption of energy sources. Hence, there are need in improvement of technology to reduce these indicators of consumption.

2.3 Development of existing blockchain technologies on the example of cryptocurrencies

Blockchain is part of industrial revolution 4.0 with internet of things, artificial intelligence, neural networks, biotechnology, distributed production, sharing economy.

Few implications could be highlighted within the discovered issues on blockchain and cryptocurrencies.

Firstly, engagement of major investors to trade cryptocurrencies should be realized by market. Mostly, major investors are not interested in trading because of its high volatility, absence of regulation and difficult model for predictions. Decentralized cryptocurrency reflects mainly to regulatory decisions and news about new uses or trading opportunities of cryptocurrency. The same situation is with ICOs, where investors assets are not protected and governments instead of creation fair legislation claim all projects to be a scam. Thus, banning them. Correspondingly, development of the blockchain and based on it cryptocurrencies is slowed down. Engagement of institutional investors will turn back market trust to cryptocurrency as to the stable financial asset.

Blockchain technology is still very crude. Lots of developments should be made in as short time as possible, while cryptocurrencies are having support from society. Currently market is expecting new technological revolution within blockchain as it can be used in many spheres of people's life. There is urgent need in development of new technologies of consensus that will increase scalability potential of blockchains. Thus, decentralized ledgers will be used much wider than only serving cryptocurrency. But still, cryptocurrency should be used as a first step to show power of blockchain to society – kind of advertising company should be made through it. Many of algorithms are still on the soft level of development.

Among discovered algorithms to select blockchain writer, we assume that most platforms use such consensus algorithms as Proof-of-Work and Proof-of-

Stake, as well as their modifications. There are quite specific examples of consensus on the market, such as: Proof-of-Authority, Proof-of-Capacity or Proof-of-Burn. Interesting from the point of view of the platform's economy is Proof-of-Importance, as it involves the owners of crypto coins, not only collecting and storing them, but also be active user. One of the most optimal is the Delegated Proof-of-Stake algorithm. The advantages of this algorithm are: increased block signing speed and high energy efficiency, due to a limited number of signatories.

Still, market is looking for the new Ethereum blockchain – Ethereum 2.0, called a killer of Ethereum by its founder Vitalik Buterin, Ethereum 2.0 will use modified PoS consensus algorithm based on the sharding. Thus, if the project will succeed, the trilemma of cryptocurrencies will be solved and Ethereum will have possibility to serve people in world scale with low transactional fees. By collecting within one cryptocurrency three main attributes (decentralization, anonymity and scalability) cryptocurrency will become truly a global money.

From the other side, realization of projects contributing the interoperability of the blockchains should be carried faster. As the development of ISO started in 2016 and continues till now it shows unsatisfactory results in terms of blockchain development. Technologies in the sector are growing too fast to suit the criteria mentioned in ISO. Thus, slack work and issuance of standardized principles slows down the development of blockchain industry. Some technologies will be limited to grow in terms of old standards. Businesses will strive to survive and get profit – meet the criteria to operate widely according to old standards. From 2016 the cryptocurrency market managed to survive the crisis and speculative prices, changed and developed lots of technologies in search of the best one. Standards of 2016 are old.

Further development of Ethereum and Bitcoin as main representatives of cryptocurrency and most-used blockchains should also consider the fact of interoperability to reduce the need in intermediaries for exchange. It is the second important factor after trilemma solution development that will allow cryptocurrency exist on global scale.

As January, 2018 shown, there are lots of possibilities to influence market by speculations. That is one of the points also, why cryptocurrency can not fulfill the role of gold of 21st century. Usually gold is used as most stable asset to balance the risk for other assets. In case of loss in some units of assets portfolio investor uses gold to balance. Price speculations on the market makes cryptocurrencies distrustful asset, as major players plunder. Blockchain should reflect on such activity, when players try to volatile the market price. Nowadays, governments are fulfilling the role of regulator in speculations on national currencies, but in case with blockchain there should be self-regulatory modules to control.

This master thesis also stands for providing the global attitude by global financial organizations without claiming it or banning but implementing in daily life and supporting integration to world monetary system. Blockchain has potential to be a part of world monetary system, but it is not the advantage for market participants who get used to control the market. Governments should research on possibilities to implement cryptocurrency as money, without concerning private interest of particular countries or corporations. Decentralized world money will protect nationalities from high influence on each other. Crisis of 2008 shown the example how correlative are countries to USD and USA economy.

As for ICOs, this activity is closely connected to risks as many countries do not provide legislation of the process. There should be created an recommendations on the state level for ICO organizers.

Provide clear rules of ICO, create independent party, controlling related issues. It is meaningful to implement in legislation: minimum requirements for organizer of ICO; personalize the organizer (as it is experienced in EU).

Until the summer of 2017, cryptocurrencies did not have legal status in any country of the world, and all transactions with them, including ICO projects, from a legal point of view were in a gray zone. To a much greater extent than in other areas, transactions with cryptocurrency are built on trust. At the same time, the absence, until recently, of any legislative regulation, both at the international and national levels, has also become one of the powerful drivers for the development of

investment attraction through an ICO. At this stage in the national currency and financial legislation there are no mechanisms regulating the holding of ICO in Ukraine. As investigated in part 2 of the current Chapter, Ukraine has developed draft laws and amendments to the tax code, but has not yet been applied in practice.

ICOs are also great opportunity for the economy to attract new funds. Many parties are involved in the process: consultants, media resources, social networks, rating agencies, investors, blockchain platforms and project developers.

Thus, the ICOs projects should reflect following criteria:

- viability and technical feasibility of the idea;
- level on involvement into the project by members;
- sufficiency of project expertise;
- stage that project is currently standing on;
- correctness of data in the project documents;
- objective financial and investment expectations;
- demand for the project on the specified market;
- legal restrictions and collisions for implementation;
- risks including scam.

Currently ICO industry is not trusted by investors, as lots of projects after boom of ICOs in 2016 – 2017 were expected to presented product in 2018, but deadlines postponed or derailed.

Thus, further development of ICOs will be maintained by:

- strengthening the control of the market by the states and expanding the zones of this control;
- reduction of announced hard cap: among the participants in the ICO industry, there is already an opinion that an average of \$ 500,000 is enough for a successful launch of the project, in exceptional cases several million. Hard caps of more than \$ 10 million are no longer perceived by the market (while hard caps of \$ 40–250 million were typical for 2017);

- reorientation of projects to large private investors: thoughtful economy of token, high-quality whitepaper and highly qualified team;
- transition from collecting money for the project idea in favor of the finished product - the mandatory presence of a working prototype for entering the ICO;
- creating state ratings of projects.

Often ICOs and other crypto tools are hacked. We suggest to provide well-acknowledged cyber police, searching hackers and preventing ICO servers' attacks as well as individuals' wallets hacks. There should be educated personnel that is able to carry tasks of preventing attacks on: 1) vulnerabilities that allow an attack on the organizers of the ICO; 2) vulnerabilities in smart contracts; 3) web application vulnerabilities; 4) vulnerabilities that allow an attack on investors; 5) mobile application vulnerabilities.

One of the perspectives for sharing of cryptocurrencies successful experience among users is moving away from PoW and related consensuses that requires high capacity of computing to algorithms that do not require capacity, but considering other factors, that do not stimulate users to use electricity in high amounts. Current indicators show that there are high level of energy consumption by blockchains as we discovered in part 2 of the current chapter. Hence, environment pollution and global warming issues could be contributed less by avoiding such mechanisms. Also, PoW has lots of limitations and disadvantages comparing to major competitor PoS. Thus, there are ways to reduce pollution and consumption in the same time costs per transaction will be reduced and number of transactions will increase as more market participants will have opportunity to write the block into the chain.

Among discovered regulation approaches we would suggest to consider following recommendations: registration (licensing) of exchange sites, user identification for AML / CFT purposes (may be in accordance with limits), taxation of turnover participants, reporting on site operations, minimum site capital requirements (optional), consumer rights protection, liability for violation of established requirements.

Annex J outlines the sectors where implications of current diploma thesis could be applied. It also shows the systematical attitude of current thesis which leads to certain result.

Mentioned recommendations will allow cryptocurrencies to be considered by parties of economy as money. Also, it will increase possibilities for creation of new truly fair global monetary system based on cryptocurrency value.

Conclusions to chapter 2

Summing up the Chapter, we assume that in the future, when the price of cryptocurrency will be stable and the distinctive feature of autonomy of functioning, decentralization and independence from the requests of individual states will remain, cryptocurrency will be able to replace traditional money. This is one of the scenarios. There is the opinion that in a shorter period cryptocurrency will operate in parallel, limiting itself only to payments on the Internet.

As the strongest wins according to the laws of evolution, and in the case of the choice of the monetary system, the institutions that are able to quickly and conveniently solve the tasks will survive. Optimality today is the first principle that any instrument must comply with. In this case, the use of cryptocurrency meet the main criteria for successful functioning in the global network. The speed of the operation, confirmation of the transaction based on the overall involvement of all participants, the transparency of operations, the security of the program itself from external attacks as well as from external regulation, the security and irrevocability of the operations carried out ensure the protection of the system. These are the basic principles with which the Bitcoin system responds.

If we compare it with modern financial systems, we can see that not all of them fully meet the above principles. This makes cryptocurrency today more secure currency, although not recognized institutionally. The future of this electronic unit,

which is increasingly becoming a currency, is in the hands of its users. In this case, this is both the guild of programmers, and other active users who make transfers, and passive holders, investors, who follow its course. The audience is not limited to them. International and national institutions, scientists, experts and analysts are interested in this new tool.

We assume that skeptical predictions about a complete rejection of cryptocurrency are not justified. Technically, this is possible only if all users stop carrying out any operations with cryptocurrency and then there is no need to support this system. Closed decentralized circle: each transaction becomes an element of the chain, which is confirmed by the rest of its parts, which in turn continues the algorithm, confirming subsequent transactions.

It is important to note that the activity of the system was most disturbed by various political influences, both the opinions of authoritative experts and the sanctions of national banks, which had a negative effect on the cryptocurrency rate as a whole. But technically, the operation of the system has been and remains stable.

The initial code of the program and the help of programmers, the decentralization of the organization allow to maintain its integrity and stability.

Technological point of view from the second part of current chapter shows us some important limitations that also influencing market development by lowering growth dynamics. Still, as was discovered there are lots of projects competing with each other and working on technological solution which will allow cryptocurrency, as main blockchain practical implementation, to be: scalable, decentralized and anonymous from the first point; interoperable from the second; and low energy-consuming from the last.

Nevertheless, the blockchain technology has brought the world a significant number of new, more effective tools for solving old trivial human-being tasks. The new technology was faster and cheaper than all existing ones. Among the most well-known tools are ICO, which were actively used in 2016–2017, but currently require the attention of regulators to continue their effective functioning, thereby stimulating

the redistribution of capital and the growth of global GDP through the opening of new businesses.

Whatever the future of cryptocurrency, their existence will definitely affect the global monetary system, as it already affected the attitude of ordinary citizens of the world to it, who thought about the fairness of the functioning of fiat money, fully controlled and centralized in managerial aspects.

CONCLUSION

Information, communications technologies and the Internet create fundamentally new technological and infrastructural opportunities for the global financial and economic system. Cryptocurrency is a unique representative of liquidity instruments. In a legal sense, cryptocurrencies based on blockchain technology and representing distributed peer-to-peer payment systems are a controversial issue for the financial system, national and international financial regulators.

The anonymity of transactions and an almost unlimited number of issuers make cryptocurrency a very flexible and convenient means of payment. In addition, the lack of binding to any other liquidity instruments and currency standards, ideal divisibility and mobility, as well as a natural barrier against inflation, embedded in the emission principle itself, give cryptocurrency a number of parameters that are in great demand today in the context of reforming global financial system.

The study focused on aspects of cryptocurrency and distributed register technology – blockchain. This focus helped to derive a number of recommendations for optimizing the existing cryptocurrency system. Thus, the implementation of the recommendations will immediately contribute to: 1) an increase in the level of tolerance among users who have once been disappointed in cryptocurrencies due to speculation in January, 2018; 2) blockchain infrastructure development - scalability and system interoperability; 3) attracting institutional investors to the cryptocurrency market; 4) reducing costs, including energy, to maintain the network; 5) the development of economies of many nations through an analogue of the IPO - initial coin offerings; 6) reducing the level of speculation; 7) strengthening the ICO as the best way to raise funds for projects; 8) the development of a legislative framework in the field of cryptocurrency and blockchain technologies.

The rapid development of such products and technologies on a global scale poses a challenge for national financial systems and economies. Actually, the place where effective regulation of these innovative tools should be carried out, their

regulatory conjugation and incorporation into familiar technologies and institutional frameworks of financial mechanisms. It must be emphasized that the strictly prohibitive cryptocurrency regulation model carries high risks of inefficiency, since modern financial flows and systems are predominantly cross-border, and therefore the consequences of blockchain-based systems legalization will influence developed countries and jurisdictions like the US and EU countries. Thus, global financial system.

Analysis of cryptocurrency in terms of the functions of money, was held by method of scientific comparison. It discovered that modern world currencies are less consistent with the functions of money and, moreover, the needs of society and the economy.

In general, to increase the activity of using cryptocurrency as a financial asset and, subsequently, as money, it is necessary to:

- accelerate the process of developing international standards for blockchain technologies to create additional opportunities for scaling up blockchain projects, such as cryptocurrency. In addition, the possibility of interoperability of different blockchains will contribute to the development of new projects in new industries;
- develop consensus technologies based on blockchain, allowing to scale the system without losing the attributes of anonymity and decentralization, as well as reduce the energy consumption of the network;
- develop self-regulated methods within particular blockchains to prevent speculations for cryptocurrencies;
- develop a single approach to the regulation of cryptocurrency as a global financial asset that is not tied to a specific locality;
- reorient ICO to institutional investors by developing better projects;
- develop ICO regulations with mandatory product prototypes;
- develop protection programs for ICO organizers as part of the work of national cybercrime services;
- create government recommendations and corresponding ICO ratings.

Thus, the fundamental innovative and economic potential of the blockchain technology and products based on it, including cryptocurrency, looks indisputable. The implementation of the recommendations imposed in this study will contribute to the further integration of the blockchain into the everyday life of people, and the cryptocurrency – into the global financial system. At some point, effective integration can lead to the complete ousting of traditional money and transform global monetary system.

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Annexes

Annex A

SUMMARY

Polishchuk O. I. The prospect of using digital currencies in the context of global financial market development. – Masters-level Qualification Thesis. Sumy State University, Sumy, 2018.

The master's thesis focuses on research of poorly investigated issues in blockchain on the example of cryptocurrencies. Regulation approaches on ICO and cryptocurrencies turnover are also discovered. The issue of cryptocurrencies is researched through the current attitude to cryptocurrencies by financial market and monetary system. The issues of blockchain that limiting development of cryptocurrencies market are discovered. Research also provides implications on the investigated topics for cryptocurrencies and blockchain developers.

Keywords: blockchain, cryptocurrencies trilemma, Bitcoin, Ethereum, monetary system, initial coins offering, regulation, consensus mechanism.

АНОТАЦІЯ

Поліщук О. І. Перспектива використання цифрових валют у контексті розвитку світового фінансового ринку. – Кваліфікаційна магістерська робота. Сумський державний університет, Суми, 2018 р.

Магістерська робота присвячена дослідженню блокчейну на прикладі криптовалюти. В роботі проаналізовано та порівняно підходи до регулювання первинного випуску монет (ICO) та криптовалют в розрізі країн світу. Проаналізовано сприйняття фінансового ринку та грошово-кредитної системи такого явища як криптовалюти. Досліджено обмеження технології блокчейн, які сповільнюють розвиток криптовалютного ринку. Надано рекомендації розробникам криптовалют та систем, побудованих на блокчейні на основі проаналізованих проблем.

Ключові слова: блокчейн, трилема криптовалют, Біткоїн, Ефіріум, грошово-кредитна система, первинний випуск монет, регулювання, консенсусний механізм

Annex B

REFERENCES ON NON-UKRAINIAN SCIENTIFIC RESEARCHES, USED
FOR CURRENT DIPLOMA THESIS

1) P. Shurda, dr. Peter r. Haiss Economics of bitcoin: is bitcoin an alternative to fiat currencies and gold? – WU Vienna University of Economics and Business – Vienna, 2018 – 93 p.

This paper presents an economic analysis of Bitcoin from a libertarian point of view. The theoretical part analyses the applicability of the Austrian School of Economics at Bitcoin. Of particular interest are the evolution of money, competition among media of exchange, and the concept of money supply. The empirical part analyses the following variables: price, price volatility, liquidity, visibility and velocity. Bitcoin can be closer to the Austrian ideal of money than either fiat money or gold, and it is possible that it will evolve into that position. The results of the empirical analysis are consistent with Bitcoin being a medium of exchange.

Keywords: Bitcoin, digital cash, currency competition, Austrian business cycle theory, Mises' regression theorem

JEL Codes: E390, E410, E420, E510, G210

Highlights:

- Bitcoin emerged as a market (catallactic) process and is evolving;
- Bitcoin can evolve into money;
- Bitcoin can prevent business cycles through inelastic supply of money;
- Empirical analysis shows that Bitcoin may be an immature medium of exchange.

2) Joost van der Burgt Making Sense of Bitcoin Price Levels // Fintech Edge, Federal Reserve Bank of San Francisco – San Francisco, 2018.

Traditional asset valuation models fall short of effectively explaining recent developments in Bitcoin price. As far as these models do have some merit, they suggest that Bitcoin is currently overpriced, to say the least. Moreover, Minsky's

Continuation of Annex B

financial instability hypothesis seems better at explaining Bitcoin's recent price developments than any proven economic theory, as by now Bitcoin seems to bear most – if not all – hallmarks of a bubble.

Then again, maybe Bitcoin is different than anything we have seen before, and maybe a decade from now its market capitalization will be sky-high as it attains the status of a new global currency. Somewhat telling, perhaps, is that this is exactly the way of thinking that Minsky says characterizes the “Euphoria” phase that heralds the bursting of a bubble.

3) Discussion Paper: Virtual Currencies and Blockchain Technology // Department of Finance – Dublin, 2018 – 36 p.

This paper is designed:

- To provide an overview of what virtual currencies are and the blockchain technology that underpins them, providing use-cases as examples.
- To table considerations as to how virtual currencies impact consumers and companies on several fronts: consumer protection; EU FS regulations; data protection; taxation; contract law.
- To propose the creation of an intradepartmental Working Group to coordinate the approach to virtual currencies and monitor developments in blockchain technology, addressing considerations raised by consumers, industry, the EU, and governments worldwide.
- To instigate further research into the potential implications of virtual currencies and blockchain for the real economy, by engaging with industry, regulators and professional bodies if and as required.
- To further raise awareness of the possible risks to consumers and investors.

4) Joseph Poon, Thaddeus Dryja The Bitcoin Lightning Network: Scalable Off-Chain Instant Payments, 2016 [Electronic resource] / Lightning Network – 59 p. – Mode of access: <https://lightning.network/lightning-network-paper.pdf>.

The bitcoin protocol can encompass the global financial transaction volume in all electronic payment systems today, without a single custodial third-party

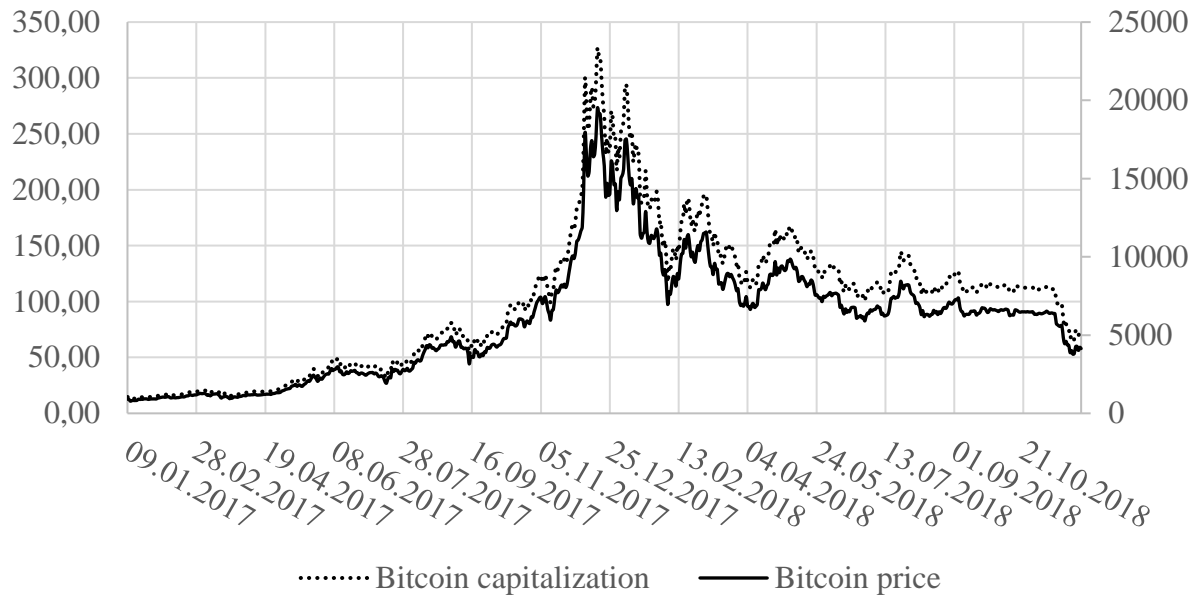
Continuation of Annex B

holding funds or requiring participants to have anything more than a computer using a broadband connection. A decentralized system is proposed whereby transactions are sent over a network of micropayment channels (a.k.a. payment channels or transaction channels) whose transfer of value occurs off-blockchain. If Bitcoin transactions can be signed with a new sighash type that addresses malleability, these transfers may occur between untrusted parties along the transfer route by contracts which, in the event of uncooperative or hostile participants, are enforceable via broadcast over the bitcoin blockchain in the event of uncooperative or hostile participants, through a series of decrementing timelocks.

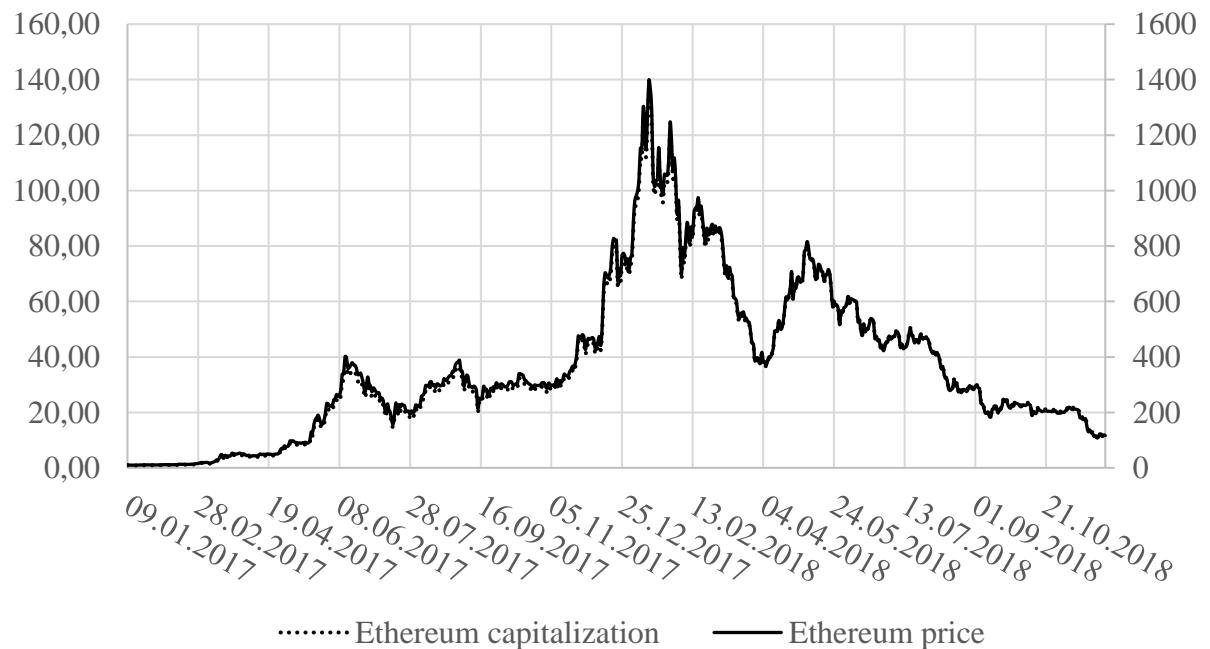
5) Arthur R. Bos, Dr. V. Scepanovic *Cryptocurrencies and Regulation* / University of Leiden – Leiden, 2018.

The three dimensions of regulation that will be discussed are: Consumer risks, taxation and classification. This thesis will explicate what types of risks plague cryptocurrencies and how they impact the aforementioned dimensions. Recommendations and proposals will be put forth in order to mitigate the risks that cryptocurrencies currently pose to the fullest extent that is possible. These recommendations and proposals will be in line with the possibilities, current infrastructure and the goals by laid out by the EU.

Annex C

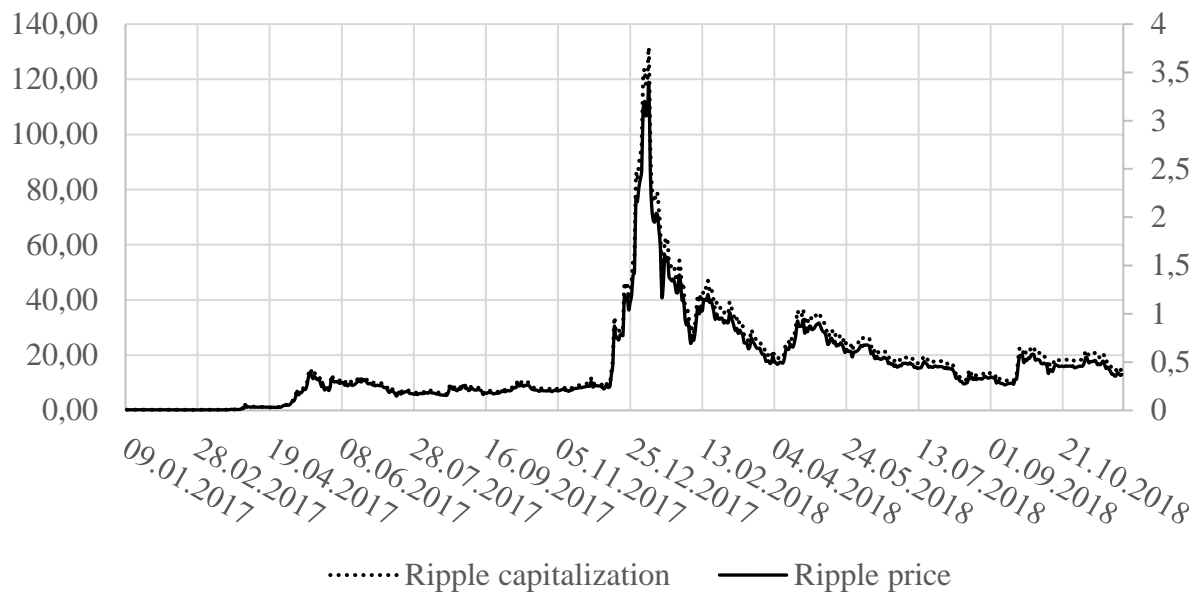


Picture C.1 – Bitcoin capitalization (left axis in bln of USD) and price (right axis in USD) dynamics during cryptocurrencies bubble most active growth, peak and crash [based on 3]



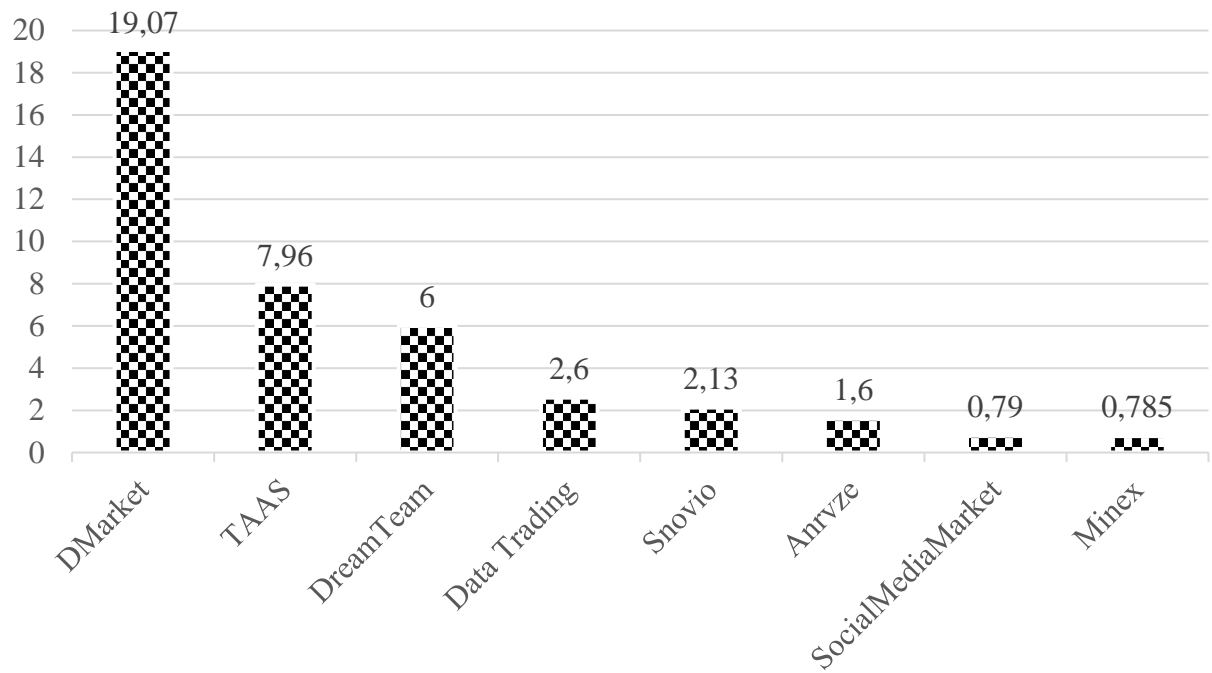
Picture C.2 – Ethereum capitalization (left axis in bln of USD) and price (right axis in USD) dynamics during cryptocurrencies bubble most active growth, peak and crash [based on 3]

Continuation of Annex C



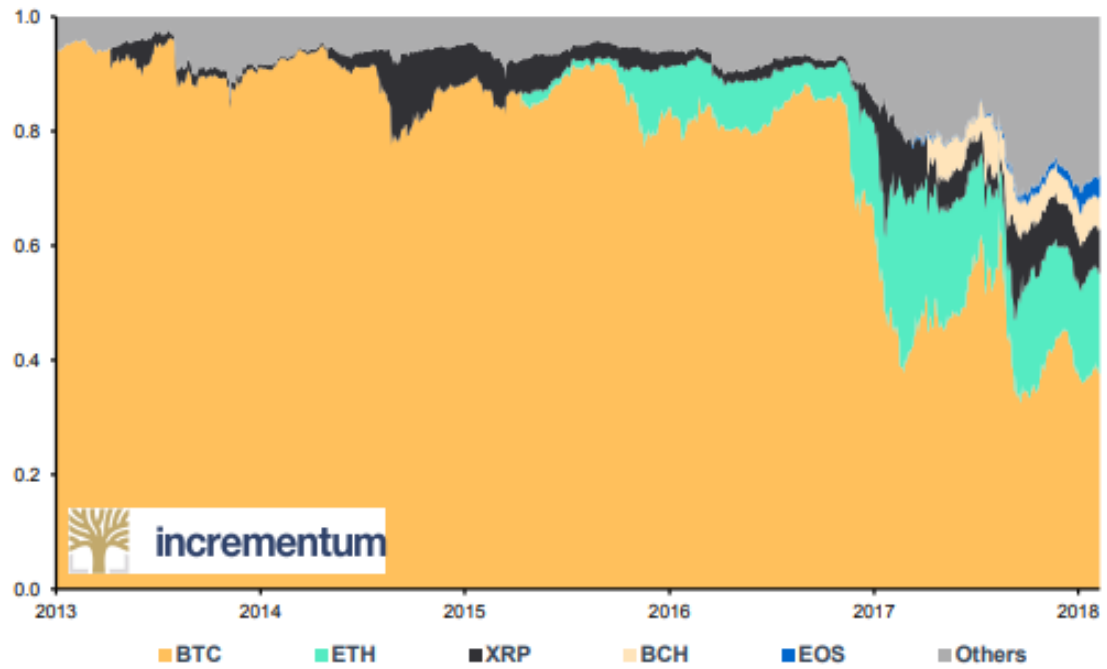
Picture C.3 – Ripple capitalization (left axis in bln of USD) and price (right axis in USD) dynamics during cryptocurrencies bubble most active growth, peak and crash [based on 3]

Annex D



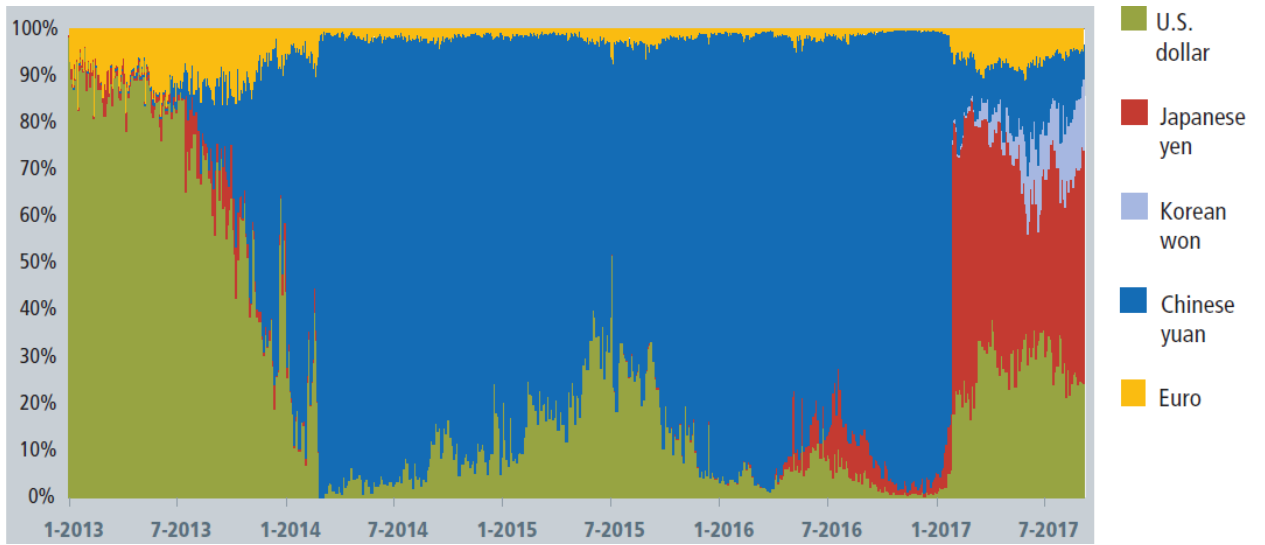
Picture D.1 – Ukrainian ICO-projects, which attracted the greatest amount of investment in 2017, in mln of USD [based on 52]

Annex E



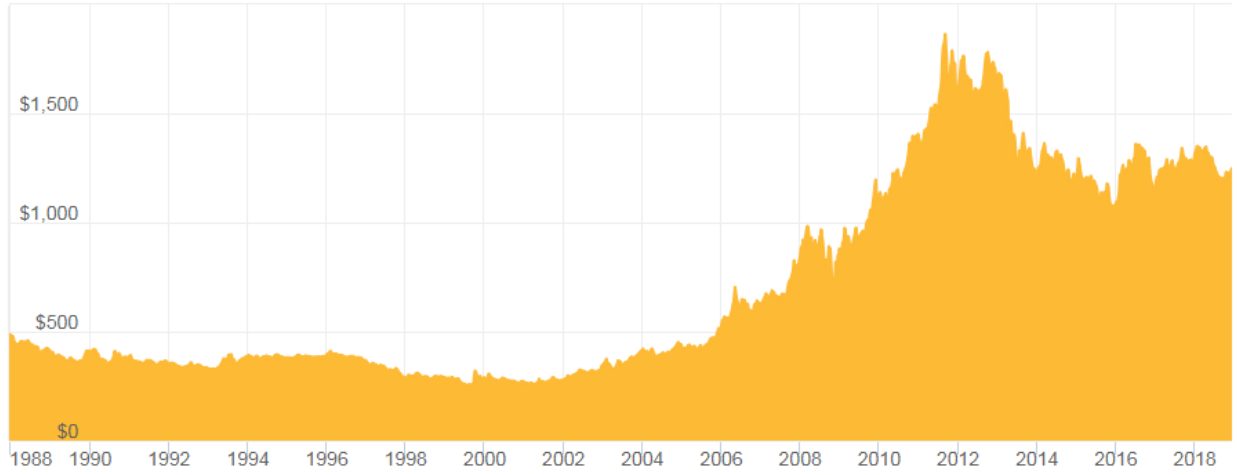
Picture E.1 – Structure of cryptocurrency market by capitalization during 2013 – 2018 [64]

Annex F



Picture F.1 – Structure of Bitcoin volume share by currency during 2013 – 2017 [41]

Annex G

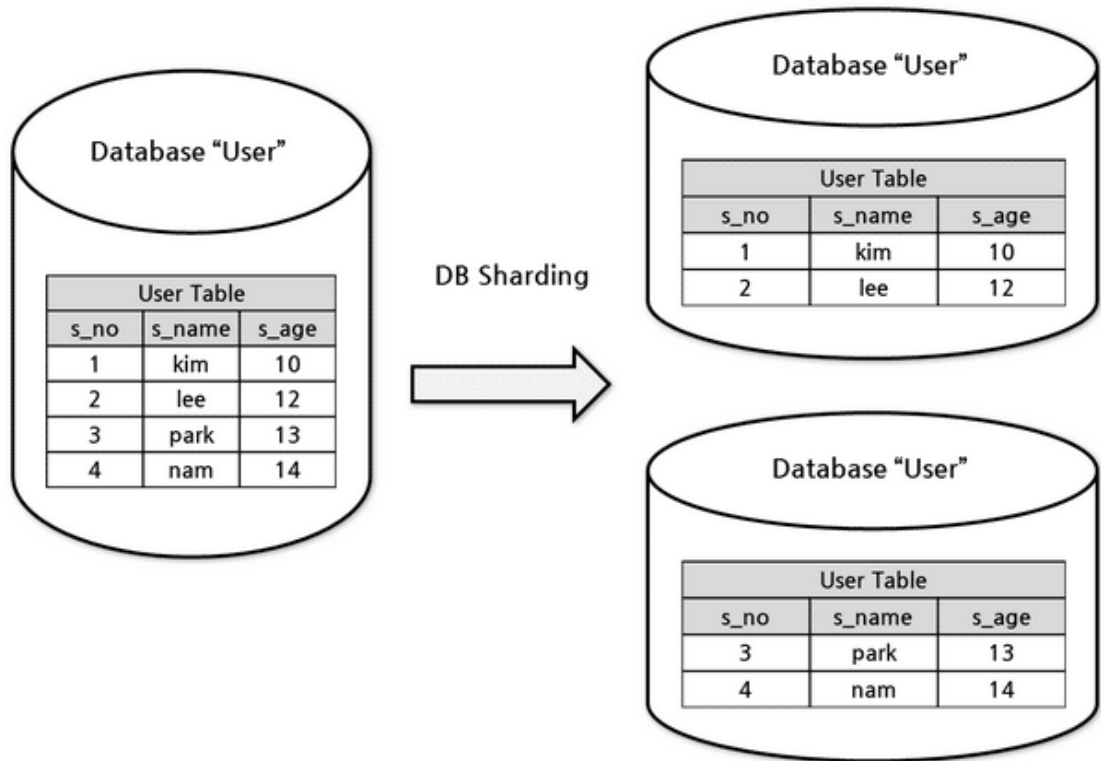


Picture G.1 – Gold ounce price dynamics in USD by www.apmex.com



Picture G.2 – Bitcoin main indicators dynamics by coinmarketcap.com

Annex H



Picture H.1 – Sharding technology scheme [72]

Annex I

Table I.1 – Global regulation principles [based on 28]

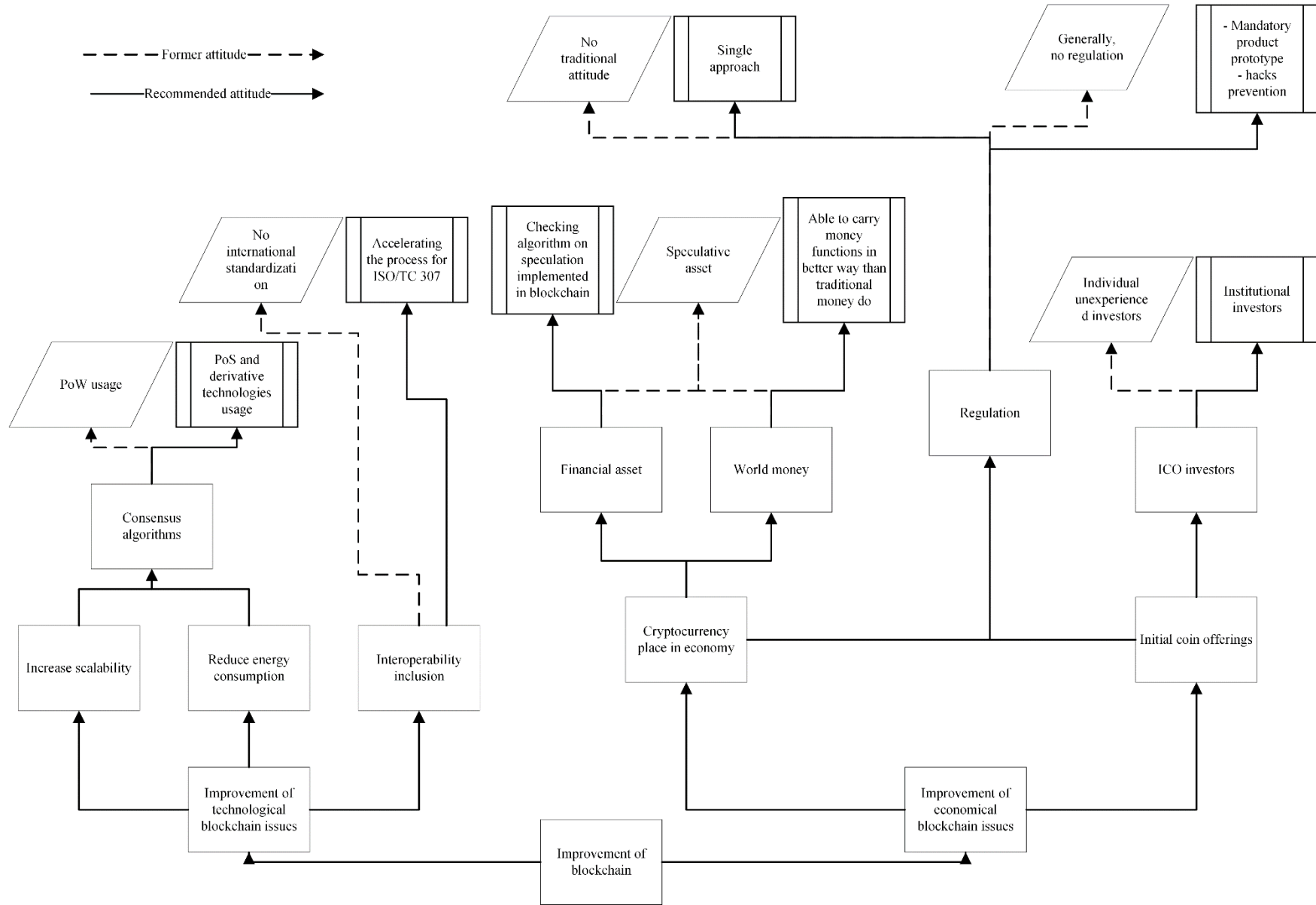
Country	Cryptocurrency	ICO
Bangladesh Bolivia, Venezuela, Vietnam, Egypt, Iceland, Kyrgyzstan, Ecuador	Banned	Banned
China	Banned; In 2017 trading platforms were closed, which previously had license to buy/sell cryptocurrency	Banned (in September 2017); Organizers of the already held ICO (up to Announce of a ban) are obliged to return the money to Chinese investors. Violation is valuable reason to punish: criminal or civil Entered after a significant increase in the number ICO projects (according to the People's Bank of China, 90% of them were cheated).
South Korea	Regulation is in processing. Some of the operations with cryptocurrency are forbidden.	Banned (in September, 2017); ICO is being considered as violation of law
Japan	Licensing requirements have been introduced for exchange sites as providers of payment services for the exchange of virtual currencies, subject to minimum capital (11 licenses issued in 2017), filing reports, user identification in accordance with the limits on operations (from April 2017). Cryptocurrencies can be used as a means of payment.	Regulation for financial instruments may be applied (from October 2017). For digital tokens, the regulation of payment services is also applied by analogy with the circulation of virtual currencies.
Canada	Introduced licensing requirements for exchange sites as companies providing financial services, user identification.	Regulation for financial instruments can be applied (from August 2017). Tokens can be recognized as financial instruments according to certain criteria.
USA	Permitted in the states of Washington, New York, South Carolina, Georgia, Pennsylvania, New Mexico, New Hampshire; in other	Regulation may be applied for financial instruments (from July 2017). Tokens may be recognized as financial instruments according to certain criteria. Unscrupulous

Continuation of table I.1

	states is not regulated. Requirements for licensing exchange sites as companies providing financial services and user identification have been introduced.	ICO projects are being closed. There are restrictions on investing in ICO for US citizens in accordance with the rules of taxation.
Australia	Currently, there is a code of conduct for cryptocurrency market participants (a self-regulatory organization has been created), which introduces requirements for registration of exchange sites and cryptocurrency wallets providers, and user identification. The development of the relevant bill.	Regulation for financial instruments, as well as common law and legislation in the field of consumer protection and corporate law (from September 2017) may be applied. Tokens may be recognized as financial instruments (shares, derivatives financial instruments, otherwise). The legal status of digital tokens is determined separately in each case.
UAE	Introduced licensing requirements for exchange sites, user identification.	Regulation for financial instruments may be applied (from October 2017).
European Union	It is planned to take measures for the mandatory identification of cryptocurrency users during the next 1.5 years and fixing them in the national legislation of EU countries.	Not regulated.
Switzerland, Germany	Licensing requirements have been introduced for trading companies as financial services companies (in Switzerland, alternatives are membership in a self-regulatory organization), as well as user identification.	In Switzerland, regulation for financial instruments, AML / CFT measures, banking law may be applied.
Philippines	Introduced requirements for registration of exchange sites as payment service providers, user identification, established administrative responsibility for violations of the law. Cryptocurrencies can be used as a means of payment.	Not regulated.
Great Britain	There are recommendations for licensing exchange sites and user identification.	Regulation for financial instruments may be applied (from September 2017).

Continuation of table I.1

Singapore	There are recommendations for licensing exchange sites and user identification.	Regulation for financial instruments can be applied (from August 2017). Tokens may be recognized as financial instruments (stocks, bonds, collective investment units, otherwise).
Hong Kong	Not regulated	Regulation for financial instruments (from September 2017) may be applied. Tokens may be recognized as financial instruments (debt securities, units in collective investment instruments). wording, otherwise).
Brazil	Not regulated	Regulation for financial instruments may apply (from October 2017)
Belorussia	December 22, 2017. President of Belarus A.G. Lukashenko signed a decree «On the development of digital Economy», which allows the use of cryptocurrency for the purposes of buying / selling, mining. Requirements for registration of exchange sites and cryptocurrency exchangers that are residents of the High-Tech Park (special economic zone with a special tax and legal regime) have been introduced, if they comply with the minimum capital requirements.	Residents of the High-Tech Park will be allowed to issue, buy and sell tokens on special exchange sites.



Picture J.1 – Systematical developments for blockchain in the context of cryptocurrency and ICOs within the global financial market requests