

ФІНАНСИ І БУХГАЛТЕРСЬКИЙ ОБЛІК

УДК 336.1

DOI: 10.32342/2074-5354-2022-2-57-6

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## ADAPTATION MECHANISM OF THE CRYPTO INDUSTRY IN THE PROCESS OF VIRTUALIZATION OF FINANCIAL FLOWS

It has been found that the dynamics of the development of the digital media environment determines the emergence of the crypto industry based on the blockchain technologies and asymmetric encryption of transactions. The authors state that the crypto industry has been growing through the stages of adaptation, whose features are incredible dynamics and speed of transformations. It has been established that cryptocurrencies, introduced on the markets, function as a means of exchange, store of value and unit of account, are based on mathematical calculations, are a result of these calculations and have cryptographic protection. It has been noted that the basis of cryptocurrency is blockchain technology, considered as a distributed database created by electronic computing and representing a code, whose process of creation is called mining. The advantages and disadvantages hindering the development and use of cryptocurrency in the world have been outlined.

**Key words:** *crypto industry, cryptocurrency, blockchain, bitcoin.*

Вступ. Сучасні тенденції розвитку інформаційних технологій та цифровізації економічних процесів створюють інноваційну основу функціонування фінансового ринку. Динамічний розвиток цифрового медіасередовища зумовлений появою нової цифрової економіки – Індустрії 4.0, яка супроводжується віртуалізацією фінансових потоків через обіг криптовалюти в Інтернет-середовищі на основі нових технологій блокчейну та асиметричного шифрування.

Проблематика. Сучасні інформаційні комп'ютерні технології значно вплинули на світову економіку та фондовий ринок, створивши можливості їх віртуалізації. Сьогодні, незважаючи на цінність наукових результатів, чимало питань організаційного, правового, фінансового, інформаційного забезпечення, економічного стимулювання ринку криптовалют, а також адаптаційного механізму криптоіндустрії у процесі віртуалізації фінансових потоків залишаються невирішеними. Недостатньо розроблені методичні підходи до розв'язання проблем функціонування фінансового механізму, інтегрального оцінювання ефективності розвитку криптотехнологій. У такому контексті виникає необхідність теоретичного обґрунтування та формування цілісного уявлення про роль криптоіндустрії у процесі віртуалізації фінансових потоків як бази для побудови ефективної фінансової політики держави, що обумовлює актуальність даного дослідження.

Мета. Метою дослідження є виявлення основних проблем та окреслення напрямів розвитку криптовалюти у цифровій економіці.

Матеріали і методи. Адаптаційний механізм криптоіндустрії в умовах віртуалізації фінансових потоків досліджено у взаємозв'язку та взаємозалежності з використанням системного аналізу. Пізнання поставленої проблеми здійснено із застосуванням багаторівневої концепції, що включає спектр різноманітних наукових методів, зокрема діалектичний та загальнонаукові принципи комплексних досліджень, які включають: емпіричні (для виявлення наявних у світовій і вітчизняній практиці підходів, оцінки трендів криптовалютного обігу та ринку криптовалют – спостереження, порівняння, опис); теоретико-когнітивні (до розгляду сутності та обґрунтування особливостей криптовалюти – формалізація, висунення і тестування гіпотез); загальні логічні (для виявлення методологічних проблем інтеграції криптовалюти у фінансову систему та диференціації підходів до концепту криптовалюти – аналіз, синтез, наукова абстракція, узагальнення, індукція, дедукція, аналогія).

Результати. Досліджено, що поява криптовалют кардинально змінила уявлення про світ фінансів та ведення бізнесу. Проаналізовано витрати на видобування криптовалют та розглянута їх економічна доцільність, яка свідчить, що в даний момент класичний майнінг є вигідним для України, але більш ефективним рішенням може стати хмарний майнінг криптовалют, що спроможний диверсифікувати ризики та у майбутньому ефективно розподіляти інвестиційний портфель. Встановлено, що основними перевагами криптовалют є: можливість їх використання як інвестиційного інструменту, захищеність від інфляції, відсутність контролю та обмежень фінансових операцій, анонімність, висока швидкість операції та низька комісія. Проте існують й певні недоліки, а саме: можливість хакерської атаки, висока вартість криптовалюти, нестабільність її курсу, складність законодавчого регулювання, можливість ухилення від сплати податків та фінансування злочинних груп, спекуляція на ринку віртуальних валют.

Висновки. У сучасних умовах нестримного зростання грошових ринків, активного піднесення новітніх технологій та інновацій, динамічних трансформацій глобальних економічних процесів поруч з реальною економікою активно розвивається віртуальна, основою якої є обіг цифрової валюти. Аналіз ринку криптовалют виявив, що ціна фінансових активів залежить від розробки та впровадження додаткових технологій для обраної криптовалюти. Успіх інвестицій в криптовалюту залежить від правильного вибору цифрової валюти, яка має володіти такими властивостями: бути популярною (виявляти великий інтерес з боку користувачів, бути доступною на біржах, зростати у вартості); бути мобільною (переміщатися без втрат); бути безпечною (захищеною від шахраїв). Теоретично доведено, що незважаючи на різні думки стосовно криптовалют, їх поява на світовому фінансовому ринку є феноменом, який у теорії може докорінно змінити наявну в світі фінансову систему.

**Ключові слова:** криптоіндустрія, криптовалюта, блокчейн, біткойн.

**Introduction.** Modern trends in the development of information technologies and digitization of economic processes create an innovative basis for the functioning of the financial market. The dynamic development of the digital media environment is due to the birth of a new digital economy – Industry 4.0, which is accompanied by the virtualization of financial flows through the circulation of cryptocurrency in the Internet environment. These processes occur on the basis of the new blockchain technologies and asymmetric encryption, which contribute to the reliability of transactions and network operation. The changes in the format of functioning of financial systems consist in the gradual transfer of payment transactions to electronic form, the emergence of new payment systems and

means of payment. The realities indicate that issues regarding the formulation of responses to risks or threats to the domestic financial system, which may be caused by the rapid development of information technologies in this area, particularly in the development of the crypto industry, remain debatable.

**Statement of the problem (relevance).** Nowadays information and computer technologies significantly influence the world economy and the stock market, creating opportunities for their virtualization. Virtualization is a new process in the financial environment, gradually changing the picture of the financial world. It has positive and negative consequences. The positive effects of virtualization include, first of all, its efficiency, namely: a significant increase in the speed

of transactions with securities and the ability to access stock markets in real time from anywhere on the planet. And we consider the growth of fictitious speculative capital to be a negative consequence of virtualization, which causes the instability of the financial system. Today, stock exchange technologies allow creating virtual capital that grows without any real basis, which threatens its depreciation at any moment. And this will certainly lead to crisis phenomena in the global economy.

**Formulation of the goals of the article (statement of the task).** Unfortunately, today, despite the value of scientific results, many issues of organizational, legal, financial and information support, economic stimulation of the cryptocurrency market, as well as the adaptation mechanism of the crypto industry in the process of virtualization of financial flows remain unresolved. Although studies have been conducted by many authors, methodological approaches to solving the problems of the functioning of the financial mechanism and the integral assessment of the effectiveness of the development of cryptotechnologies are still insufficiently explored. In this context, there is a need for theoretical substantiation and the formation of a holistic view of the role of the crypto industry in the process of virtualization of financial flows as a basis for building an effective financial policy of the state, which has determined the relevance of the research topic.

Globalization, the rapid growth of money markets, the general computerization and development of IT-technologies have led to the emergence of a huge number of additional institutions, financial instruments and new forms of interaction between people. The increase in the share of financial instruments which in the process of circulation detach from the production process and start to develop on their own reproductive basis, determines the specifics of modern transformations – virtualization and financialization of economic processes. The specifics of the virtualization of the modern economy are determined by the fact that it begins to be dominated by irrational rather than rational

preconditions associated with the production of ideal (information and knowledge) rather than material values. It is based on the creative work that cannot be standardized, work that is associated with self-enrichment of the individual, with the “production of oneself” [16].

**Review of the literature with a summary of the contributions of the authors.**

The scientific works of Ukrainian and foreign authors are devoted to the study of the role of the crypto industry in the process of virtualization of financial flows. Thus, recent studies by M. Abramovich [1], E. Galushka, O. Pakon [19], V. Kravchuk, D. Naumenko, A. Hlybovets [7], B. Danylyshyn [20], V. Lukyanova [30], T. Jacyk, V. Shvets [37] have discussed the preconditions of the origin and economic essence of cryptocurrencies as electronic money. Also there exists a considerable body of literature on the functions of cryptocurrencies, the mechanism of their functioning, the process of their development and formation. It is worth mentioning Ruben Greenberg, a prominent figure in cryptocurrency research, who in 2011 published the first academic paper on the bitcoin system in *Hastings Science and Technology Law Journal*. The title of the article was “Bitcoin: an Innovative Alternative Digital Currency, which focuses on bitcoin theory” [26]. In “SoK: Exploring the Prospects and Challenges of Bitcoin and Cryptocurrencies” [6], Joseph Bonneau, Andrew Miller, Jeremy Clark, Arvind Narayanan, Joshua Krol, and Edward Felten collect, rework, and synthesize vast amounts of previous work, sources spanning three decades, to IRC logs and posts from online forums and developer mailing lists. Also, they debate on why academics for a quarter of a century could not discover what Satoshi Nakamoto (apparently) intuitively understood. Stages of development of the cryptocurrency market from the standpoint of competing investment projects, in particular the main components of cryptocurrency as an investment project, were studied by V. Soslovsky and I. Kosovsky [35]. Articles by N. Arkhireyska [17], N. Zozulya [23], Don Tepscott [4] are devoted to the study of the legal basis for the legalization of

digital currency in terms of the national settlement system, systematization of approaches to the state regulation of cryptocurrencies in the world. N. Marchenko [27] studied the geographical features of the cryptocurrency market in the world and determined the influence of various factors on this process. I. Makarchuk O. Perchuk, V. Malyshko [28], E. Molchanova [29] studied the problematic aspects and prospects of cryptocurrency institutionalization, substantiated the possibilities of solving the problem of integration of new cryptographic objects into the world financial system. G. Karcheva, G. Nikitchuk [24], N. Sabo [34], described the role of virtual currencies as an alternative to the classic currency and a kind of electronic money in the information economy. V. Kozyuk [25], N. Panteleeva [32] in their articles pay attention to the prospects and risks of the spread of alternative forms of money in circulation and the consequences of the impact of the spread of cryptocurrency on the budget security. Among those who outlined the issue of analysis of cryptocurrency transactions there were Peter D. De Vries and Erik Johan Helland [15]. They conducted a SWOT analysis of the cryptocurrency bitcoin (Professor P. Vriez, University of Houston, USA) and a comparative analysis of the cryptocurrency market and its future based on the marketing methodology of PESTEL (Master of Stavanger E. Helland, Norway). The authors of this study contributed to the theoretical understanding of the pragmatic role of the cryptoindustry in the paradigm of digitalization and transformational development of the economy, substantiation of innovative opportunities of cryptocurrencies in the financial market and identification of risks of their use in modern digitization and virtualization of cryptocurrency and cryptocurrency.

**The aim of the study.** The purpose of the study is to identify the main problems and outline the directions of cryptocurrency development in the digital economy.

The adaptation mechanism of the crypto industry in the conditions of the virtualization of financial flows is investigated in the interconnection and interdependence, with the help of system analysis. The study of this

problem was carried out using a multi-level concept, which includes a range of various scientific methods, in particular, dialectical and general scientific principles of complex research, which include: empirical (to identify approaches available in the global and domestic practice to the assessment of trends in cryptocurrency circulation and the cryptocurrency market – observation, comparison, description); theoretical-cognitive (to consider the essence and substantiate the cryptocurrency features – formalization, proposal and testing of hypotheses); general logic (to identify methodological problems of cryptocurrency integration into the financial system and differentiation of approaches to the concept of cryptocurrency – analysis, synthesis, scientific abstraction, generalization, induction, deduction, analogy).

#### **Presentation of research results.**

Modern information technologies enhance the development of new forms of money and the emergence of new payment instruments, the issuance and circulation of which is associated with the use of the benefits and opportunities of the digital age. Accordingly, new terms have appeared in the scientific literature to describe a wide range of new payment instruments, such as electronic money, digital money, virtual money, cryptocurrencies and others. However, the lack of the well-established legal regulation and theoretical substantiation of the essence of these categories leads to their incorrect use. As such, we consider it appropriate to systematize their categorical and conceptual apparatus.

The concepts of “electronic money”, “virtual money” and “digital money” are not identical and have different meaning. The basic documents for explaining the essence of the concepts being studied are official publications of international regulatory and supervisory bodies in this field, including the EU directives, documents of the FATF (International Anti-Money Laundering Group), the European Banking Organization (EBA), etc.

According to the FATF’s interpretation, virtual (non-fiduciary) and electronic (fiduciary) money are two types of digital money, but quite often “digital money” is identified with the term “virtual money” [14]. This is

incorrect, because according to the FATF approach, digital money is classified as fiduciary (or fiance), i.e., money issued by the central bank or other institution and recognized by the state as a legal tender, having no intrinsic value [10], while virtual money belongs to non-fiduciary money. According to the EU Directive 2009/110/EC, electronic money is the preservation of monetary value in electronic form, including magnetic value, which expresses the issuer's obligations, is issued upon receipt of funds, used for payment transactions and is accepted by individuals and legal entities other than issuer of electronic money [5].

Researchers of electronic money in Ukraine, V. Kravchuk, D. Naumenko and A. Hlybovets [7] argue that classifying an electronic payment instrument into the category of "electronic money" is possible under the following conditions: the payment instrument should perform the functions of money, i.e., it should function as a means of payment and store of value and exist existence in electronic (non-paper) form. The outlined characteristics are inherent in electronic money, but do not allow to clearly distinguish it from virtual money, which also can perform one or more functions of money and exist in electronic form.

In our opinion, an indispensable feature of electronic money is its belonging to fiduciary money which is recognized as a legal tender by the state and can be used in the settlements similar to traditional coins and banknotes. Electronic money must be backed by traditional money or other highly liquid assets and exchanged for ordinary money at the request of its owner.

Electronic money systems are based on the use of smart cards or special software: electronic money card systems VISA Cash, Mondex and network systems PayPal, GlobalMoney, etc.

In many countries around the world, the issuance of electronic money is tightly controlled by the state, that determines the range of entities that are allowed to issue electronic money and the terms of issue. For example, in Ukraine only banks can issue electronic money. The value of electronic money can

be expressed in hryvnias, and the amount of their issue should not exceed the amount of cash and non-cash funds received from users and agents.

According to the definition of the European Banking Organization (EBA), virtual currencies are also a digital expression of value, but they are not issued by the central bank or other public authority, nor do they necessarily belong to fiduciary money, but they are accepted by individuals and legal entities and can be transmitted and stored. In this context, we note that the key features that distinguish virtual currency from electronic money are their decentralized and unregulated nature [12].

There are no intermediaries in the mechanism of issuing and circulation of virtual money in the form of the central bank and traditional financial and credit institutions: the central bank, credit institution or issuer of electronic money cannot issue virtual money. The issue of virtual money is not limited to a single issuer – its issue and circulation is controlled by developers and members of a specific virtual society, where such money is accepted for settlements. Accordingly, the monetary regulation established by state and international legal documents for traditional means of payment is not extended to virtual money.

Note that, unlike electronic money, virtual money is not secured by traditional cash or non-cash money (other highly liquid assets), and its issuer has no obligation to repay it or convert the value into traditional means of payment. Virtual money can perform the functions of money: function as a means of circulation, a measure of value and a store of value, but does not have the status of a legal tender as electronic money [11].

When researching virtual money, it is necessary to say about the variety of existing forms, mechanisms of issuance and circulation of virtual currencies. We consider it appropriate to classify them into convertible and non-convertible virtual currencies and centralized and decentralized models of virtual money issuance.

Convertible (open) virtual currencies are exchanged for fiduciary money at a cer-

tain rate, and non-convertible (closed) virtual currencies are a means of circulation within a certain community and are not exchanged for fiduciary money according to the rules of their use. The issuer of virtual money with a centralized emission model is an individual or a group of people. In case of decentralized models, it is almost impossible to limit the range of their issuers, as well as to control the issue and circulation of such money.

Due to the fact that the most common form of virtual money is a cryptocurrency, these concepts are used as synonyms. But in economic terms, cryptocurrency is associated with a specific technology of encryption of information, and virtual money is a characteristic of the economic essence of such means of payment. According to the report of the FATF (Financial Action Task Force on Money Laundering, Ukrainian International Anti-Money Laundering Group), Report on Virtual Currencies Key Definitions and Potential AML / CFT Risks June 2014, cryptocurrency is just one type of virtual currencies, namely decentralized virtual currency [14].

Cryptocurrency in the system of international monetary, financial and credit relations is a convenient form of electronic payments and promising form for investment. Note that cryptocurrency is a digital coin that is protected against counterfeiting and can be stored in e-wallets or transferred between them. 2009 officially marked the creation of the most famous and most common cryptocurrency – bitcoin (Bitcoin from the English Bit is a unit of information “bit” and Coin is a “coin”). It should be noted that the release of bitcoin is carried out by the computers of network users, this process (mining) is carried out on the basis of a special program. The source code of this program is published in the public domain, and anyone can release bitcoin. The speed of release depends on the power of the computer (mainly on the performance of the video card). The creation of bitcoins is programmatically limited to 21 million coins, after which the issue will automatically stop, which will eliminate the possibility of inflation and help strengthen bitcoin in the future. The process of the extracting cryptocurrency is separated from the

process of its issue, as the issue is carried out by a virtual network, and bitcoin is extracted by network users. The threat that the issue of various types of crypto currency may get under control of the secret services of the aggressor countries or terrorist extremist organizations is quite real.

The idea of creating cryptocurrency markets and cryptocurrency was covered in the works of Neil Stevenson in 1999. Later, in 2009, Satoshi Nakamoto proposed a practical model for the implementation of global cryptocurrency circulation in the financial system [9]. Cryptocurrency is unsecured, it is trusted by users, the main advantage that attracts them to Bitcoin is its anonymity.

The crypto industry is digital money without material expression that circulates in the Internet environment. [24]. The crypto industry as a phenomenon of recent years is going through stages of formation, as it has passed the markets of classical investment: securities, currency, intangible assets, real estate. Indicators of the development of the crypto industry are the incredible dynamics and speed of transformations.

In the crypto industry, we can outline the main segments for investing [19]:

- cryptocurrency (mono- or multi-portfolios of tokens and coins) is similar to the capital market and securities in mixed form;
- ICO market (initial coin offering) is close to the IPO market (initial public offering);
- mining is supported by the service or operation of the blockchain infrastructure;
- mining pool is essentially similar to mutual funds;
- cryptocurrencies are a close analogue to investing in venture or other high-risk assets.

The crypto market is accelerating to go through the mandatory development stages that lasted for decades in case of the stock and capital markets and for millennia in case of the real estate markets: the emergence; chaotic/speculative expansion; excess risks and excess profits; monopolization; regulation, demonopolization, socialization; integration and forecasting.

Despite constant criticism, global players are involved in the emergence of a young

and promising crypto industry, although, on the other hand, they fear involvement in unregulated anonymous financial transactions. The emergence of cryptocurrency exchanges, the disclosure of the potential and opportunities for the use of cryptocurrencies has led to the activation of the crypto industry and the development of the cryptocurrency market. Note that currently there is no internationally agreed definition of cryptocurrencies (see Table 1), so there is no standardized approach to the systematization of different types of cryptocurrencies.

Definitions of the concept of “cryptocurrency” by various scientists and institutions are given in Table 2. Based on the views of the above scholars, we define cryptocurrency as a type of digital currency that has encrypted information and cryptographic methods of protection, is issued directly in the electronic network and is not associated with ordinary currencies or the state system. In this context, the term “cryptocurrency” is more related to the term “electronic money” than to the term “money” as a basic category.

Cryptocurrency provides a fast and reliable system of payments and money transfers, which is based on the latest technologies and is not controlled by regulatory authorities. The issue and accounting of cryptocurrency is based

on asymmetric encryption and the use of various cryptographic methods of protection, including Proof-of-work and / or Proof-of-stake. In general, the system operates decentrally in a distributed computer network [18]. Cryptographic protection methods regulate the issuance, transactions and accounting of cryptocurrencies.

All currently available cryptocurrencies are “pseudonymous”, i.e., transactions are conducted in public, and there is no connection with a particular person. Receiving each new unit of cryptocurrency is accompanied by certain costs of electricity and computer time.

An important feature of cryptocurrencies is their independence from the central bank, their issuance is based on the latest blockchain technologies and asymmetric encryption (public private keys), which ensure the reliability of transactions and network operation. Asymmetric cryptosystems are effective cryptographic data protection systems or public key cryptosystems. In such systems, the data is encrypted with one key and decrypted with another secret key. Accordingly, the decryption key is not determined from the data encryption key.

Cryptocurrency can be both an investment and an object of investment activity. In the process of making a decision about investing in cryptocurrency, one should

Table 1

#### Definition of cryptocurrency in the international format

ECB	Any asset recorded in digital form that does not contain financial claims on any financial liabilities of any natural or legal person, and which does not provide for ownership against the entity
IMF	Digital assets that use cryptography for security and are coins or tokens of distributed registers and / or blockchains, including tokens secured by assets
IOSCO, BIS, FSB, ESMA	A type of private asset that is primarily dependent on cryptography and blockchain technology or similar technology as part of its perceived or intrinsic value, and may represent an asset such as currency, commodity or security, or be a derivative financial instrument on commodity or security
FATF	A digital value expression that can be traded in digital format or transferred, and that can be used for payment and investment purposes
OECD, UNECE	Digital equivalents of value, which are exchanged through a peer-to-peer architecture based on cryptographic technologies – a method of storing and transmitting data in encrypted form, which allows you to read them only to those for whom they are intended, using a secret key

Source: <https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2019-04-ccaf-global-cryptoasset-regulatory-landscape-study.pdf>

Table 2

## Definitions of “cryptocurrency” by various scientists and institutions

Author	Definition
M. Abramovich [1]	a type of digital currency, whose issue and accounting are based on asymmetric encryption and the use of various cryptographic methods of protection
T. Zhelyuk, O. Brechko [21]	a stable universal instrument of global financial payments and at the same time a financial instrument with high capitalization which is a competitive form of international capital inflows
E. Molchanova [29]	a fiduciary digital currency, whose exchange rate is set on the basis of a free-floating regime as a result of supply and demand in the foreign exchange market with a complete lack of control by central banks
O. Primostka [33]	a special kind of electronic money, whose operation is based on a decentralized mechanism of the issue and circulation and represents a complex system of information technology procedures based on cryptographic methods of protection that regulate the identification of owners and recording the fact of their change
V. Soslovsky [35]	a means of payment, which has no material form, but exists in the form of program code, using cryptographic methods of protection, the issue and accounting of which is often decentralized and known to the participants of the calculations
T. Jacyk [37]	a special electronic means of payment, whose rate is supported only by supply and demand
D. Yakovlev [36]	a digital currency that is protected against counterfeiting because it is encrypted information that cannot be copied
Official site of Bitcoin [31]	a digital currency that uses cryptography to secure and verify transactions on its network. Unlike traditional currency currencies, cryptocurrency does not require the central bank or any other centralized authority to provide security or maintain control over the money supply

analyze its characteristics and features in the world. An indicator of cryptocurrency is the creation of a new centralized system based on a distributed computer network that is independent of the state.

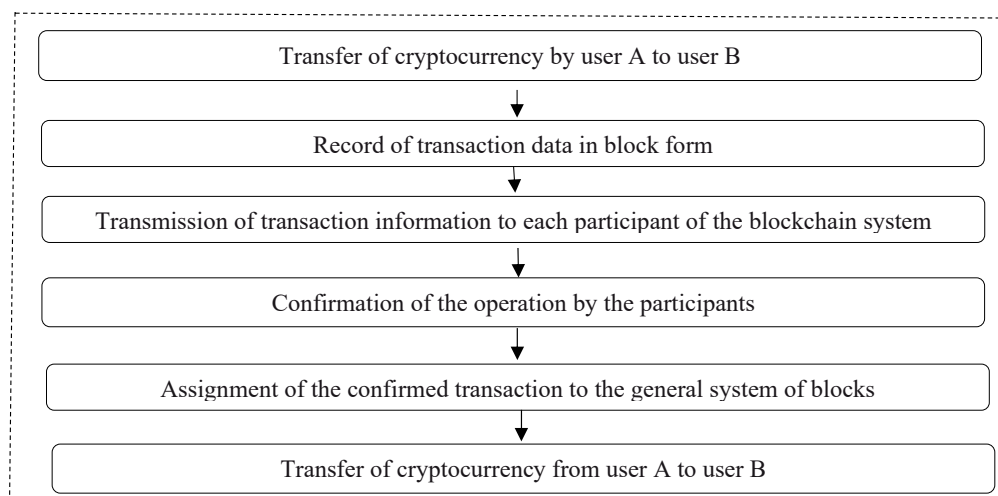
Among the variety of decentralized payment systems (hereinafter – DPS) and cryptocurrency, the most widespread technology is “blockchain bitcoin” (blockchain) and bitcoin coin (bitcoin, English BTC).

Bitcoin is a technology and currency, a digital unit of virtual value, virtual money issued by individuals [20]. For this purpose, special programs are used, which are designed so that the maximum number of bitcoins does not exceed 21 million. Each new member of the State Tax Service has corporate rights both to the use of cryptocurrency and to its issuance. Each subsequent created block BTC continues to form a chain of blocks (blockchain). Bitcoin transactions take place between users without an intermediary. Node networks check them using cryptography and write to the public distributed register – blockchain (Fig. 1).

Blockchain is a multifunctional and multilevel information technology designed to securely distribute and store records of all issues and transactions ever made. Transactions are carried out according to the cryptographic protocol, and settlements in the BTC system are carried out using digital bitcoin coins. Every single bitcoin coin is a fragment of cryptographically protected code that can be transferred via the Internet and stored in a wallet file [4; 8].

Bitcoin coins are intangible and represent a number associated with a set of requirements. In addition to transfers from one address to another, they can be exchanged for goods and services, as well as can be used for purchase and sale of money in exchange offices or online exchanges. The exchange rate of bitcoins for different currencies is determined by their supply and demand. Today, many countries around the world have developed advanced networks of participants in BTC systems, including so-called miners who create virtual money in the form of their blocks, users who accumulate





**Fig. 1. Cryptocurrency calculations using blockchain**

BTC in their “e-wallets” and spend them on specialized exchanges or POS-terminals (in certain countries) to calculate the PTS in stores. The BTC corporate community has millions of users, and the BTC system can be represented as a corporate decentralized computer network, whose total performance is eight times the total capacity of the Grid network of all the world’s supercomputers.

Given the importance of the blockchain technology for humanity, the depth of structural adjustments in financial and other areas, and the opportunities offered by this technology, its further development should be carried out on the principles of public-private partnership. Canadian blockchain theorist Don Tepscoff [4] justifies this point as follows: we have a lot of data that is very difficult to structure independently, it is very difficult to operate, but there are companies that know how to work and monopolize information, and there are governments that collect and consolidate information about entities, undermining all the foundations of confidentiality and showing a monopoly.

Existing and potential blockchain technologies are divided into three categories: blockchain 1.0, 2.0, 3.0. Blockchain 1.0 is a cryptocurrency used in various applications for specific purposes. Blockchain 2.0 is a contract that operates in various economic applications based on the blockchain. Such










applications work with certain types of financial instruments, including stocks, bonds, futures, mortgages and legal titles, “smart” assets and contracts. Blockchain 3.0 is an application whose scope goes beyond monetary settlements, it extends to public administration, health care, science, education, culture and the arts.

A key feature of the blockchain is the use of mathematical calculation algorithms, as well as the exclusion of “man” and the human factor in decision-making system. Cryptocurrencies are similar to precious metals, as their creation is under control, and most of them are limited by the number of units, similar to precious metals, which are not unlimited in terms of production.

As of June 2022, there were more than 10,000 cryptocurrencies in the world, and their number is growing as new cryptocurrencies are being constantly created. The top 10 cryptocurrencies by market capitalization as of June 2022 include Bitcoin (BTC) (\$ 373.220 billion), Ethereum (ETH) (\$ 242.725 billion), Tether (USDT) (\$ 74.318 billion), USD Coin (USDC) (\$ 52.635 billion), Binance Coin (BNB) (\$ 51.353 billion), XRP (XRP) (\$ 20.261 billion), Binance USD (BUSD) (\$ 18.606 billion), Cardano (ADA) (\$ 18.062 billion), Solana (SOL) (\$ 17.848 billion), Dogecoin (DOGE) (\$ 11.493 million) (Table 3).

Table 3

## Capitalization and prices of major cryptocurrencies as of 25.06.2022

№	Cryptocurrency	Cryptocurrency designation	Price (\$)	Capitalization (\$)	Exchange rate / 24
1	BTC <i>Bitcoin</i>		20 123,63	373 220 020 737	29 549 452 191
2	ETH <i>Ethereum</i>		2 009,05	242 725 919 241	18 359 494 592
3	USDT <i>Tether</i>		0,998990	74 318 340 001	52 668 641 272
4	USDC <i>USD Coin</i>		1,000291	52 635 255 289	7 274 989 719
5	BNB <i>Binance Coin</i>		305,17	51 353 830 265	1 735 223 695
6	XRP <i>XRP</i>		0,417845	20 261 757 673	2 234 194 529
7	BUSD <i>Binance USD</i>		1,001858	18 606 828 195	6 810 002 132
8	ADA <i>Cardano</i>		0,534029	18 062 029 148	912 758 753
9	SOL <i>Solana</i>		52,76	17 848 378 204	1 744 386 187
10	DOGE <i>Dogecoin</i>		0,086487	11 493 951 917	502 201 616

Source: <https://www.crypto-rating.com/price-prediction/xlm/>

As one can see, the first place is occupied by Bitcoin, the most popular virtual currency on the market with a price of \$20 123.63, the second place – Ethereum with a price of \$ 2 009.05, and the third place – Tether with a price of \$ 0.998990.

Each cryptocurrency has its own capitalization ratio. The capitalization of cryptocurrencies depends on its total quantity and value per unit. The level of capitalization of a cryptocurrency is influenced by the volume of supply and demand of this currency. It should be borne in mind that the demand for cryptocurrency can be of two types: transactional, which is due to the need to buy a product for a particular currency, and investment demand.

An important factor that an investor takes into account when deciding whether to buy a cryptocurrency is the size of its capitalization. The source of such information can be a popular analytical service Crypto-Rating.com, which presents more than 800

digital assets, ranked by capitalization. The top ten Crypto-Rating.com rankings are reflected in the TOP-10 most popular cryptocurrencies (see Table 3 and Fig. 2).

These currencies are in the highest demand among traders and crypto-investors thanks to the constant growth of the exchange rate, as well as their high liquidity and development prospects. In this paper we consider three main types of cryptocurrencies, which are among the Top-10 assets by the size of market capitalization.

Bitcoin (BTC), the first decentralized and most widespread cryptocurrency that occupies most of the cryptocurrency market, began operating in 2009. BTC dominates the cryptocurrency market due to the inflow of money from institutional investors and the introduction of innovative technological solutions.

BTC was created by a group of people under the pseudonym Satoshi Nakamoto

Satoshi Nakamoto, who had provided its source code before it was created, which allowed other programmers to create and develop other cryptocurrencies on this basis. The mechanism of operation of the cryptocurrency Bitcoin can be simplified as follows (see Fig. 3).

Due to such advantages of bitcoin as versatility, anonymity, efficiency and security, a large number of fraudulent schemes are widespread in this area. The intervention of hackers and the inability to return transfers distracts people from this market. The NBU, in turn, also warns against fraud. The president of the European Central Bank, the French financier Christine Lagarde, considers the price of bitcoin too high to invest in it [32].

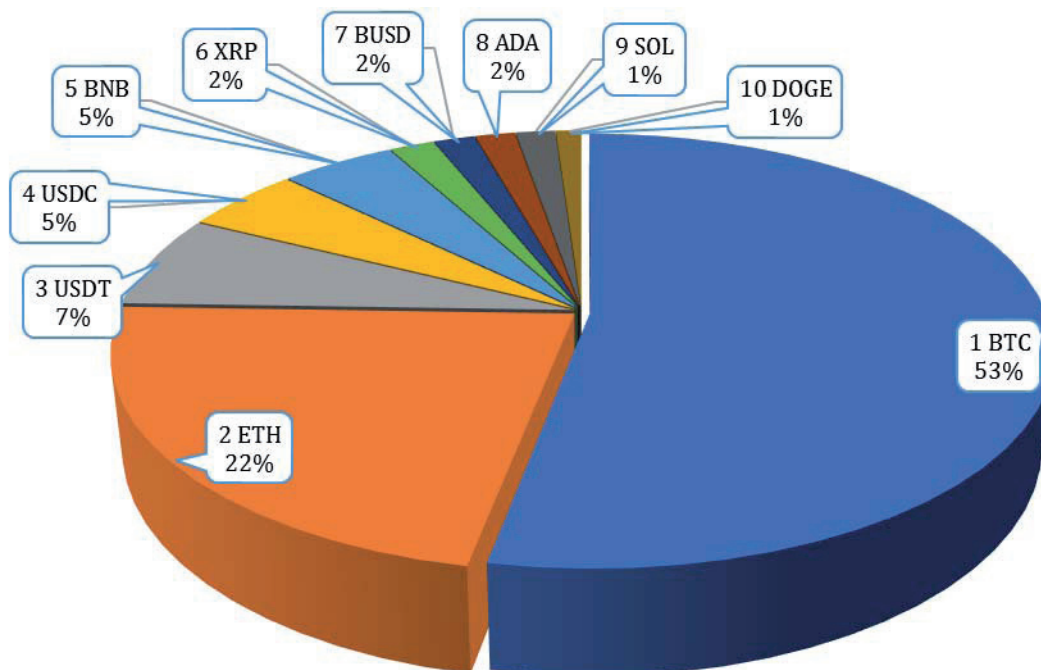
Ethereum (ETH) is a mint that has been officially in operation since 2015, based on the blockchain and smart contract technology, which is based on the algorithm that allows to automatically fulfill the terms of the contract.

The blockchain contains information about each participant in the system – “node” – and the connection is made through cryptocurrency “ether”.

On the example of Ethereum, one can analyze the cost of its extraction. Note that in order to calculate the cost of extracting cryptocurrency and its profitability, it is necessary to take into account several aspects, namely:

- the price of electricity;
- the cost of computer components required for extraction;
- the lifespan of computer components before they become obsolete;
- the amount for which they can be sold;
- the hash rate that can be obtained with these components. That is, their computing power required for extraction;
- monetary value of this cryptocurrency.

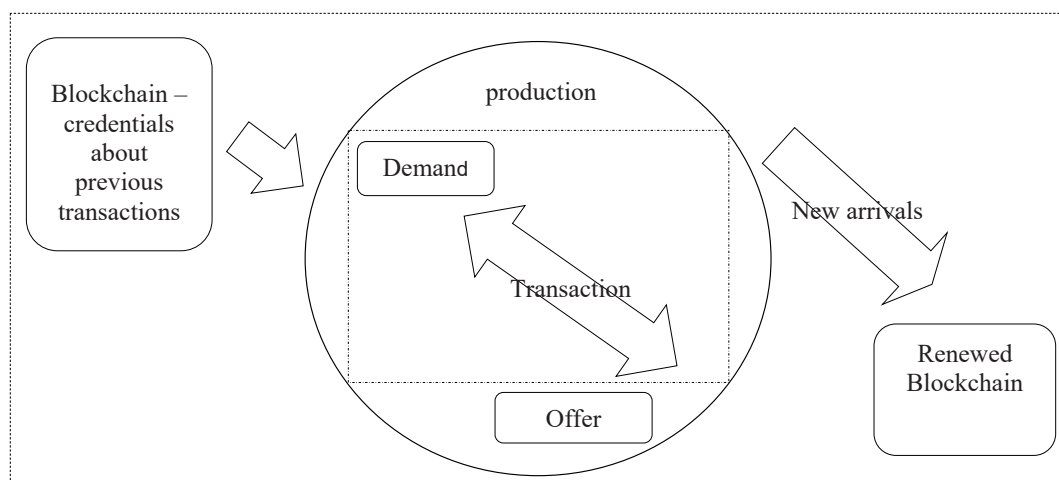
But for the initial investment and analysis of the cost of mining, it is enough to determine the cost of equipment and the cost of electricity.



**Fig. 2. Capitalization of major cryptocurrencies as of June 25, 2022**

Source: <https://bank.gov.ua/doccatalog/document?id=30432161>

<http://coinmarketcap.com>



**Fig. 3. The mechanism of operation of cryptocurrency Bitcoin**

Source: <http://jibfnet.com/vol-3-no-1-june-2015-abstract-1-jibf>

<http://m.nv.ua/ukr/opinion/danylyshyn/u-chomu-fenomenbitkoini-2235296.html>

We will calculate revenues and costs for mining a computer system based on the ASUS ROG-STRIX-RX5600XT-O6G-GAMING video card – a model in the middle-class segment of the last generation, announced in January 2020, included in the Top-10 video cards at the time of study – which demonstrated a good level of productivity with a production capacity of Hashrate – 42.2 MH/s. The price of the video card is \$1018. Our coin of choice is Ethereum (ETH). Daily income is \$3.25. Payback period is 314 days. Profit/price ratio is 0.003190. The power consumption of the ASUS ROG-STRIX-RX5600XT-O6G-GAMING video card is 0.15 kW/h. For a month it is  $(0.15 \times 24 \text{ hours} \times 30 \text{ days}) = 108 \text{ kW/h}$ .

In Ukraine, the cost of electricity consumed over 100 kW / year per month per 1 kW is equal to 1.68 UAH.  $108 \text{ kW} / \text{year} \times 1.68 \text{ UAH} = 181.44 \text{ UAH}$  per month, and for the year 2,177.28 UAH. The cost of electricity consumed during the year together combined with the cost of the video card will be 30,177.28 UAH (1097 USD).

Thus, in Ukraine, Ethereum mining is currently profitable and cost-effective, as the cost of paying for electricity consumed is less than the cost of earned cryptocurrency. Note that due to the complexity of calculations,

the most popular cryptocurrency is mined in specially equipped premises with ASIC devices that contain dozens or even hundreds of graphics chips rather than with the help of video cards.

The third cryptocurrency in the top 10 cryptocurrencies by market capitalization is the Tether project, which was initiated in 2015 by the Bitfinex exchange. After the main goal in the exchange of real dollars for digital currency – avoiding barriers and bans on the conversion of fiat currencies into cryptocurrency – had been achieved, the “digital dollar” was included in the list of the largest cryptocurrency exchange Poloniex. Traders have been advised to use this option as a simplified way to switch from e-fiat to digital money.

The Tether platform is based on the Bitcoin blockchain using the Mastercoin / Omni algorithm and includes all cryptocurrency characteristics. This project allows to convert any national fiat currency into a digital analogue in a ratio of 1:1. Tether combines bitcoin technology with fiat currencies, which allows to take advantage of the blockchain.

Blockchain has many advantages over traditional financial technologies, it offers cheap, fast and unlimited transactions

without intermediaries, but the volatility of exchange rates based on blockchain does not allow them to become widespread. The Tether platform allows to convert US dollars, euros or Japanese yen into the appropriate Tether tokens.

Virtual currencies can act as a medium of exchange in a real trade in goods, which affects real GDP. This should be taken into account when assessing the effects of their impact on the real money supply. The impact of virtual currencies on the real money supply depends on the effect of the replacement of virtual economy with the real sector and on the effect of displacement of real money with virtual currencies [24].

Despite the limited issuance of cryptocurrency, its market value is a priori programmed for sustainable economic development. An investor planning to invest in this area needs to keep track of its total value. Most often, a potential investor uses digital currency (such as bitcoin) as an investment, buying digital tokens (tokens) of the company. Such tokens can be either a cryptocurrency or an asset. In essence, the difference between a cryptocurrency token and a value token comes down only to technical aspects: an asset, unlike cryptocurrency, does not have its own blockchain (distributed database). That is, the token value is issued using special platforms with their own blockchain (for example, Nxt). There are two types of cryptocurrency tokens: fork and altcoins. Fork is a copy of an existing digital currency with minor changes in the code, altcoin is a new cryptocurrency with a unique code and blockchain [16]. Tokens can confirm both the participation of their holder in the project (system) and his right to receive a share of the company's future profits. They are sold through cryptocurrency fundraising (fundraising in cryptocurrency): through ICO (Initial Coin Offering) or crowdsale. ICO is essentially analogous to Initial Public Offering (IPO) and crowdsale is crowdfunding, but in the cryptocurrency world [30].

The main advantage of cryptocurrency fundraising is that one can invest quickly, easily and anonymously. The disadvantage

of cryptocurrency fundraising consists in the imperfection of the legal regulation of these relations. Accordingly, there is a regulatory risk for a company conducting an ICO or a crowdsale, and crypto-investors have no guarantees. In addition, speed, ease and anonymity are not always good.

Modern cardinal changes in the monetary system of the world create new challenges and threats. The number of cryptocurrencies is constantly increasing, their supply is growing, as they are in great demand, respectively, their capitalization is increasing. The return on investment in cryptocurrencies is steadily increasing. The interest of investors in cryptocurrency transactions, obviously, determines the impact on the national economies. In particular, the unregulated development of new financial technologies, cryptocurrencies, creates significant obstacles to Ukraine's economic stability and security, where the situation requires decisive action at the state level to determine the legal status and create a legal framework for cryptocurrency market development.

The main methodological approaches to solving the problems of investing in the crypto industry can be divided into three groups [27]:

- a) a group of problems of legislation and responsibility of market participants;
- b) a group of problems of professional responsibility of market players, expertise;
- c) a group of problems of a speculative trend.

It is known that only a few countries have been engaged in developing legal framework for crypto industry, taxation issues and the qualifications of market participants. The main goal is to determine the financial responsibility, ethics and discipline of such institutions as cryptocurrencies, cryptocurrencies, cryptofunds, as it depends on the trust in the industry.

In order to adapt the mechanism of the crypto industry to the virtualization of financial flows, it is important to take into account the predicted changes in the supply in order to correctly calculate the future market capitalization and price of

a particular cryptocurrency. The current trends in the average trading volume show a growing demand for BTC coins against the backdrop of a decrease in the supply of the corresponding cryptocurrency. Most traders in the cryptocurrency market are looking for digital assets that promise high returns due to the volatility inherent in this space. Although the ability of most cryptocurrencies to make huge profits has been somewhat hampered by the crisis, they are still attractive to those who see the market as an alternative to stocks, Forex and other traditional markets. Therefore, volatility is an important aspect of cryptocurrency. Cryptorating always takes into account a number of factors in the process of analysis of bitcoin price and offers short-, medium- and long-term price forecasting using a patented algorithm.

According to a survey conducted by the Bank for International Settlements (BIS), global central banks have now stepped up their work on exploring digital currencies (CBDC). CBDC has grown significantly in developing countries in recent years, and the BIS believes that the first CBDCs are likely to be released in such countries. CBDC is a digital version of the central bank money, which differs from the existing two types: cash and current accounts (money for banks).

BIS divides money into different types depending on four groups of characteristics:

- who issues them (central bank or not);
- forms (electronic or physical);
- accessibility (wide or narrow);
- technologies (tokens transferred from user to user, or between accounts) [2].

Based on these characteristics, CBDC can be defined as digital money issued by the central bank. Depending on the level of availability, it is divided into two types – a wholesale CBDC, which can be used for interbank payments (money for banks); and a general purpose CBDC, which is available to the general public and used in retail transactions.

According to the technology, “wholesale” CBDCs are tokens, and “broad” ones can be implemented both in the form of tokens and in the form of invoices (the difference between tokens and invoices

is in the system of their verification: the authenticity of the token is verified by the account. It is checked, as a rule, by the intermediary – the account holder).

Approximately 80% of central banks are interested in CBDC (70% a year earlier), half of them are studying both digital money options (“wholesale” and general purpose), the “money for banks” option is of interest to twice as many monetary regulators as the general public option (15% almost a third) [2; 13]. Central banks are working on general-purpose CBDC to improve the efficiency of internal payments, their security and the level of affordability.

Cryptocurrencies are viewed by central banks as a niche financial product. The BIS survey states that none of the central banks has certified cryptocurrency as an important or widely used means of payment in domestic or international settlements.

Based on the results of a comprehensive justification, generalization and analysis of theoretical aspects and pragmatic approaches in the context of Ukrainian realities and global trends in the mechanism of adaptation of the crypto industry in the process of virtualization of financial flows, it can be stated that the main provisions are as follows:

1. It is substantiated that in modern conditions of unrestrained growth of money markets, active rise of the newest technologies and innovations, dynamic transformations of global economic processes, along with real economy, the virtual economy based on the circulation of digital currency has been actively developing. Digital currency exists in two forms: electronic money, which is a digital reflection of real money and circulates in the real economy for the purpose of conducting banking transactions, and cryptocurrency, which is a virtual currency circulating freely in the digital world.

2. It is proved that the development of the digital economy leads to an increase in the popularity of electronic currencies, which quickly respond to changes in the virtual payment market. So far, two categories of digital money have been formed – electronic money, the main features of which are their recognition by the state as a means of

payment, controllability and centralized issuance; and virtual money, which is based on cryptocurrencies, characterized by a lack of regulatory influence, mainly decentralized issuance and a lack of collateral in the form of traditional money.

3. It is accepted that the emergence of cryptocurrencies has radically changed the perception of the world of finance and business. The first cryptocurrency was created in 2008 and was called bitcoin. The emergence of cryptocurrency is part of the crypto-economy (digital economy), which is based on a fundamental technology – blockchain, which can be viewed as a distributed database of transactions that are transparently protected and autonomously stored and converted into values and data, with no central authority to control these transactions.

4. Cryptocurrency is defined as a decentralized convertible digital currency based on mathematical principles, which are generated and managed automatically by software that has encrypted information and cryptographic protection methods. Cryptocurrencies are issued directly in the electronic network and are not associated with conventional currencies or the state system. Such currencies can be obtained as a result of mining (mining). However, the extraction of some currencies is technologically difficult in the face of their steady increase. The costs of cryptocurrency mining have been analyzed and their economic feasibility has been considered. The findings show that, currently, classic mining is profitable for Ukraine, but cloud mining of cryptocurrencies that can diversify risks and efficiently distribute the investment portfolio in the future can be a more effective solution.

5. It is established that the main advantages of cryptocurrency are: the possibility of its use as an investment instrument, protection against inflation, lack of control and restrictions on financial

transactions, anonymity, high transaction speed and low commission. However, there are certain disadvantages, namely: the possibility of a hacker attack, the high cost of cryptocurrency, the instability of its exchange rate, the complexity of legal regulation, the possibility of tax evasion and financing of criminal groups, speculation in the virtual currency market.

6. It is noted that the success of investments in cryptocurrency depends on the correct choice of digital currency, which should have the following properties: be popular (show great interest from users, be available on exchanges, grow in value); be mobile (move without losses); be safe (protected from fraud). It is theoretically proven that despite different opinions about cryptocurrencies, their appearance on the world financial market is a phenomenon that in theory can radically change the existing financial system in the world. That is why governments are in no hurry to allow the mass introduction of cryptocurrency on their territories, as such an alternative to the existing financial system may change the strength of the influence of central authorities on the management of financial processes.

7. It is argued that cryptocurrency can have a positive impact on business, as the lack of commission during transactions allows companies to obtain free funds and use them to develop production and reduce the cost of business entities. High speed of operations with cryptocurrencies will save time and labor, increase the dynamism of business, which will contribute to a positive impact on the economy.

The use of cryptocurrency as a financial asset for investment is also possible and attractive for banks as a way to diversify their activities. Analysis of the cryptocurrency market has revealed that the price of financial assets depends on the development and implementation of additional technologies for the selected cryptocurrency.

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## ADAPTATION MECHANISM OF THE CRYPTO INDUSTRY IN THE PROCESS OF VIRTUALIZATION OF FINANCIAL FLOWS

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DOI: 10.32342/2074-5354-2022-2-57-6

**Key words:** *crypto industry, cryptocurrency, blockchain, bitcoin.*

It has been investigated that the development dynamics of digital media environment causes the emergence of the crypto industry on the basis of blockchain technologies and asymmetric encryption of reliable transactions. The authors state that the crypto industry has been growing through the stages of

adaptation, whose features are incredible dynamics and speed of transformations. It has been established that cryptocurrencies, introduced on the markets, function as a means of exchange, store of value and unit of account, are based on mathematical calculations, are a result of these calculations and have cryptographic protection. It has been noted that the basis of cryptocurrency is blockchain technology, considered as a distributed database created by electronic computing and representing a code, whose process of creation is called mining. The advantages and disadvantages hindering the development and use of cryptocurrency in the world have been outlined.

**Introduction.** Current trends in the development of information technology and digitalization of economic processes create an innovative basis for the functioning of the financial market. The dynamic development of the digital media environment is due to the emergence of a new digital economy – Industry 4.0, which is accompanied by virtualization of financial flows through cryptocurrency circulation in the Internet environment based on new blockchain and asymmetric encryption technologies.

**Problem Statement.** Modern computer information technology has significantly affected the global economy and the stock markets, creating opportunities for their virtualization. Today, despite the value of scientific results, many issues of organizational, legal, financial, information support, economic stimulation of the cryptocurrency market, as well as the adaptation mechanism of the crypto industry in the process of virtualization of financial flows remain unresolved. Although studies have been conducted by many authors, methodological approaches to solving the problems of the functioning of the financial mechanism and the integral assessment of the effectiveness of the development of cryptotechnologies are still insufficiently explored. In this context, there is a need for theoretical justification and the formation of a holistic view of the role of the crypto industry in the process of virtualization of financial flows as a basis for building effective financial policy, which determines the relevance of this study.

**Purpose.** The aim of the study is to identify the main problems and outline the directions of development of cryptocurrency in the digital economy.

**Materials and Methods.** The study of this problem was carried out using a multi-level concept, which includes a range of various scientific methods, in particular, dialectical and general scientific principles of complex research, which include: empirical (to identify approaches available in the global and domestic practice to the assessment of trends in cryptocurrency circulation and the cryptocurrency market – observation, comparison, description); theoretical-cognitive (to consider the essence and substantiate the cryptocurrency features – formalization, proposal and testing of hypotheses); general logic (to identify methodological problems of cryptocurrency integration into the financial system and differentiation of approaches to the concept of cryptocurrency – analysis, synthesis, scientific abstraction, generalization, induction, deduction, analogy).

**Results.** It has been found that the emergence of cryptocurrencies has dramatically changed the perception of the world of finance and business. The costs of cryptocurrency extraction have been analyzed and their economic feasibility has been considered. It has been established that the main advantages of cryptocurrency are: the possibility of its use as an investment instrument, protection against inflation, lack of control and restrictions on financial transactions, anonymity, high speed transactions and low commission. However, there are some disadvantages, such as the possibility of a hacker attack, the high cost of cryptocurrency, the instability of its exchange rate, the complexity of legislation, the possibility of tax evasion and financing of criminal groups, speculation in the virtual currency market.

*Одержано 9.09.2022.*