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MONETARY INNOVATIONS AND DIGITAL ECONOMY

This article discusses the main changes in the field of digital and cryptocurrencies, as well as their interpretation from the standpoint of the common theory of money (e.g. the definition of monetary functions). The consequences of the central banks' monetary policies as well as their reaction by launching their own digital currency (central bank digital currency/CBDC) have also been dwelt upon. The possible changes in the global currency system have been outlined. Special attention has been paid to the development of higher economic education as a result of the new monetary and financial technologies and the digital economy. These topics have been set forth against the background of the experience of different countries (with a particular emphasis on Russia's practice), as well as by summarizing leading research and publications in the field.

JEL: A2; E40; E5; F02; O3

1. Introduction

In the years since Jean Bodin (XVI c.), the first theorist of state sovereignty, and over the time of the subsequent centuries in the recent history, the human race has managed to grow accustomed to the habitual functions of the state - power, administration, border protection, policing, tax collection, to mention but a few. State functions also embrace money issue - printing and control over the national currency circulation, control over the banking system flows, performed via the monetary policy (the interest rate and exchange rate policies).

Today, however, this money functions is drastically changing - money issue and money creation are passing from the state and the banking system to virtual structures, physical parties, and new forms of payment communities. The consequences of the said process are difficult to assess, but cannot be ignored any longer. According to the Bank of France

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estimates, by January 2018, the volume of cryptocurrencies had reached 330 billion euros (including: 35% in bitcoins, 20% in ethereums, and 10% in ripples). To put that in the context of the cryptomoney supply volume, the M1 aggregate of the Eurozone reaches 7,500 billion euros, while M1 in the US makes 3,500 billion dollars [Banque de France, 2018, 3]⁴. As to the statistics by the IMF and coinmarketcap.com, by late April 2018, the world had tallied 1500 cryptocurrencies (of which bitcoin, ethereum, and ripple are the most common) [Bouveret and Haksar, 2018, 3]. Despite statistical difficulties, when accepting cryptocurrencies as financial assets, as crypto assets (with all their markets), a strong increase in their capitalisation is clearly seen. Thus in 2019 of the thousands of cryptocurrencies, 35% were quoted on different trading platforms, of which 5% every day. Thus in September 2018 they were 2,456 and in 2019 700 new cryptocurrencies were added (Chimieni, and al., 2019). It is true that after the peak in 2018, there is a definite decrease in the volumes of crypto assets in 2019, but no doubt the tendency is towards an increase of their use.

Cryptocurrencies are not a monetary unit of a particular state. This is, in essence, the money of a group of private individuals or legal entities that have decided to use them in mutual settlements. The legal status of this phenomenon is not formalized, so cryptocurrencies are not yet taxed in any country of the world, just like the income received as a result of transactions of these payment systems. As a reaction to the numerous attempts at emitting global cryptocurrencies (on the part of Facebook as well) the central banks of the developed countries have recently spurred on their own projects of emitting central bank digital currency/CBDC (BIS, 2018).

In this article, mainly from Russian perspective, we will successively consider : (i) some basic theoretical problems regarding the definition of cryptocurrencies, discussions on this topic and the response of state authorities to the cryptocurrencies distribution, and especially the current discussion on central bank digital currency (ii) the place of these new monetary instruments in the evolution of the international monetary architecture, and finally, (iii) the response of the education and higher education sphere to the development of new monetary instruments in the digital economy.

We start with some basic theoretical problems related to the cryptocurrencies nature.

2. Theoretical Aspects of Cryptocurrencies Development

The focal point in the theoretical dispute over cryptocurrencies is the answers to two basic questions – whether these new instruments can be identified as money and whether they perform the money functions? In fact, the answers depend on what the purport of money is from our perspective and what theory of money we adhere to. In this regard, one must bear in mind that the very nature of money changes, evolves. We could suppose in fact that the very nature of money change.

⁴ Currently, there are thousands of cryptocurrencies in the world, but only about 240 crypto assets, whose capitalization exceeds 8 billion US dollars, can qualify for the status of real virtual payment systems.

Some economists flatly attribute the new forms of cryptocurrency to financial assets, while the discussion of monetary functions appears irrelevant or minimized for them. 2018 has seen a number of analytical documents by central banks of developed countries being published, in particular, the documents of the Bank of France and the Bank of England, which detail the problem of how cryptocurrencies perform and modify the basic and generally accepted functions of money. With some difference in detail, both documents emphasize that cryptocurrency performs the functions of money that are known to us (standard of value, unit of account, means of exchange, means of hoarding), but in a limited, incomplete, or inefficient manner. In 2019, the ECB published a document which was one of the first attempts at thoroughly studying crypto assets. It gives a definition and outlines the main problems facing the quantitative and statistical measurements of crypto assets. The ECB has chosen to define crypto assets as "a new type of asset recorded in digital form and enabled by the use of cryptography that is not and does not represent a financial claim on, or a liability of, any identifiable entity." (Chiemieni and Al., 2019, 3). According to the ECB, the main problem is the lack of a fundamental value of this money⁵. The risks of the crypto assets for the financial system and the real sector, the absence of a collateral, of applicable laws, and a clear institutional and regulatory environment have been analyzed in detail. At the same time, the ECB has attempted to set up a statistical surveillance system not only as regards the volumes but also of the prices of these assets at the different markets. The flows of these assets do not go through the official data collection system and one cannot get an idea of their volumes and of eventual consequences thereof. According to the ECB „Overall, available data on crypto-assets are neither complete nor fully reliable for the purposes of monitoring market trends to the degree of detail necessary to gauge their risks. Moreover, they only allow the monitoring of global trends with very limited country segregation“ (Chiemieni and al., 2019, 7).

However let's go back to the functions of money. It is critical to underscore that among economists there has always been and continues to be a discussion about how to technically determine the purport of money, which functions are essential for money and which are of secondary importance [Nenovsky, 2009]. In terms of determining functions, both documents by these central banks should be perceived as manifestations of only one particular monetary theory (in this case: the state and banking theory of money). In fact, the analytical reports by the two the central banks (those of England and France) express primarily the interests and points of view of their senior members and the state as a whole, for whom monetary and financial innovations have always been considered a danger. E.g., these documents assert that cryptocurrencies cannot function as a store of value (since their exchange rate is highly volatile in relation to traditional national currencies).

Cryptocurrencies are also held to perform the medium of exchange function in a limited and inefficient manner. There are high transaction costs and, above all, energy costs. E.g., in December 2017, one operation with the bitcoin "cost" 215 kW, as well as took a long time for coordination (in comparison with the Visa card). Although, on the other hand, it can be argued that to transfer small amounts of money, the transaction costs of

⁵ We consider that to be disputable from a methodological point of view but it is not possible to discuss this issue here.

cryptomoney are lower. [He, 2018, 14], which can contribute to the development of financial integration of the poor population segments and social economy.

Finally, cryptocurrency does not function as a means of accounting (unit of account) and means of payment (these two functions are still performed by the legal tender money) [Bouveret and Haksar, 2018, 27]. Additionally, central banks often note in regard to the cryptocurrency, including the bitcoin, that cryptocurrency is more like financial assets than genuine money. However, the volume of these financial assets is still insignificant. For example, the capitalization of these assets in 2018 was close to 1% of the world GDP, while the capitalization of credit derivatives and swaps alone was close to 100% of the world GDP [Carney, 2018, 21]. From this perspective, electronic monetary innovations are not yet a source of instability in the financial system. One of basic accusations against cryptocurrencies is the risks of fraud, piracy, and the use of this money to finance terrorism and other phenomena dangerous to society [Banque de France, 2018, 2, 13].

At the same time, a number of authors, analyzing the arguments as to the origin of money from the perspective of the so-called "chartal theory of money" defined by G. Knapp, claim that cryptocurrencies can be defined as money and can serve as a supplement to the legal money [Dubyansky, 2017]. Cryptocurrencies are manifestation of particular "monetary communities" (according to G. Simmel). The functions of money as a means of exchange and as a unit of account are split (accounting is done through conversion into recognized or legal tender money). This duality does not cancel the monetary nature of cryptomoney, rather it only brings it closer to the two-fold character of the money functioning - like in the Middle Ages. Then, accounting money and medium of exchange was physically separated, and the connection there between was regulated by so called state tariffs (exchange rates) [Nenovsky, 2009].

Turning again to history of money, one comparison is often down, considered sometimes in positive and sometime in critical terms. It is a matter of comparing cryptocurrencies with the gold standard. Some economists speak of a "digital, electronic gold standard", a return to commodity and physical money (and of a paradoxical result - overcoming problems of credit money and payment accounting) [He and all, 2017; He, 2018]. In this regard, it can be argued that monetarism and liberal monetary theory provide the most appropriate explanations, since cryptocurrencies are a creation of both decentralized and spontaneous economic actors. The fact of restricted cryptocurrencies supply is reminiscent of the gold standard, when money supply was fixed within certain limits.⁶ In this regard, one of the positive aspects of using the cryptocurrency is that its rate is not influenced by political or economic conditions. The rate of the cryptocurrency depends only on the supply and demand for it. The volume of demand depends on how many goods and services can be purchased for it, and the supply is strictly limited [Lskavian and Fedorov, 2014, 47]. On the other hand, critics of the classical or "modified gold standard" automatically transfer the disadvantages of the limited supply to the sphere of cryptocurrencies [Banque de France, 2018, Carney, 2018]. But again, our attitude to cryptomoney depends on the fundamental principles of money and monetary policy, which we adhere to.

⁶ Which in fact almost never took place in its pure form [8].

The similarity to the gold standard also leads to the conclusion that cryptocurrencies are inherently deflationary [He and all, 2017; He, 2018]. In fact, it is not subject to inflation, because, like gold, it is limited in quantity. It takes time and energy to produce it, as to the price thereof, it will only keep growing. As a result, economic agents will begin to spend less and hoard more, which will lead to a negative impact on the production of goods and services and people will be able to benefit only due to personal savings. As a consequence, there will be an ever smaller number of firms and people producing goods. That is why the cryptocurrency, at this stage, is not suitable for use as the major currency. However, counter-arguments are available as well. In fact there are different types of deflation, both negative and positive. And deflation, even if it exists, in the case of cryptomoney, will seem to be positive and stimulating in nature, as it will be connected with the growth of total factor productivity and the development of technologies.

The economics literature also reflects another discussion - on the causes and mechanisms of the cryptocurrency's genesis. French economists Odile Lakomski-Laguerre and Ludovic Desmedt believe that J. Schumpeter's institutional theory and the theory of entrepreneurship offer the best explanation for the cryptocurrency phenomenon (in the bitcoin case). Cryptocurrencies are considered as a complex form of technological, financial and, most importantly, social innovation. Social innovation is a manifestation of the search for alternatives to capitalism as a system, and in a sense, it is a political project (the authors sometimes talk about "crypto-anarchist" and "libertarian" approaches) [Lakomski-Laguerre and Desmedt, 2015, 2018]. A political project can be considered as a form of social and civic protest (contestation), primarily, against government central banking and bank money. These latter types of money, firstly, are associated with servicing the interests of the ruling elite, and secondly, they are considered the cause of the present-day global crisis. The new crypto money is a product of civil society, it is profoundly social in origin and in essence. In this "monetary institutionalist model", the problem of trust in money is solved differently, in this case trust takes a decentralized form, a form of consensus of those who produce and consume money. It is complemented by a source of trust, which used to be characteristic of metal money, namely, - the presence of a source limiting the money supply. This source is exogenous in relation to the monetary community. As a whole, Lakomski-Laguerre and Desmedt believe that cryptocurrencies by their nature are real, genuine money (with certain conventions, though).

Further on, we could wonder what will happen, should national cryptocurrencies be created? In this configuration, it can be assumed that individual citizens and business entities will have direct access to the Central Bank's settlement system and will be able to carry out their mutual settlements without the banking system intermediation. Under this scenario, it seems a reasonable guess to expect an opposition from the banks. We shall witness a situation with the banking system coming into conflict with civil society as to who has access to the Central Bank settlement system. It should be recalled that economists proved as far back as twenty years ago that in order to preserve the power and efficiency of the monetary policy pursued by the Central Bank and the state, all they need is to control the payment system. In this regard, they will strive to retain this control in various forms [Woodford, 2000; He, 2018; Ingves, 2018].

As a whole, cryptocurrencies are a manifestation of a new stage in the development of the economy, the so-called digital economy stage. Analyzing the conceptual approaches to the purport and functions of cryptocurrencies, we move on to accomplishing the next task of this article - to substantiate the response of the state, society, and higher education institutions to such profound changes.

3. Technological Aspects of Cryptocurrencies, State and Central Banks Reactions

Creating cryptocurrencies is primarily a technological innovation, introduction and promotion of IT-technologies that occur on computer farms by confirming transactions and supporting the network. The underlying technology is the one of the blockchain, which is represented by a decentralized system of records using cryptographic methods, monetary transaction registers [Genkin, 2018]. For it to be implemented, it is necessary to have resources such as video cards, a large amount of relatively economic power, process area with constant temperature, ventilation, etc.

As we have already noted, the main feature of cryptocurrencies is decentralization and no separate issuer, whose role by the legal tender money issue is usually played by the state national bank and the banking system as a whole. The absence of a familiar issuer makes semblance that state structures, represented by tax or judicial authorities, cannot interfere in the transactions and influence the participants of this payment system. The cryptocurrencies force of attraction is, among other things, in the inability to cancel its transfer – to block or, vice versa, force a transaction, without a special password key.

The virtual nature of cryptocurrencies is quite relative - the advent of various types of tokens, which can be credited to your online wallet, in fact, has brought about a material embodiment of the existing fiat money. The actions to participate in the circulation of cryptocurrencies begin, as a rule, with downloading a bitcoin purse, after which a person becomes a participant in the global financial network. When someone registers on a crypto exchange, he actually becomes an investor. In actual fact, the use of the cryptocurrency in widespread circulation is currently impossible. The main problem is the required process of converting, say, the bitcoin into the legal tenders, dollar, euros, rubles and settlements via a standard bank card (thus, the legal money continues to act as an accounting unit). At the same time, in many countries, bank exchange offices provide services for exchanging the cryptocurrency into the national one and those for the creation of virtual cards.

At the moment most countries do not pay serious attention to cryptocurrencies. However, a number of Asian countries, the United States, the EU, as well as Russia, have expressed their opinion on the emergence of the cryptocurrency in the world market. China and South Korea, in fact, have come to the idea of banning cryptocurrencies.

Russia opted for the idea of their heavy regulation. China, in its territory, has completely banned free circulation and exchange of the cryptocurrency, the Central Bank of Russia called the cryptocurrency a "surrogate" and "illegal money", and the citizens are advised to refrain from using it [Web Resource, Russia, 2016]. Meanwhile, Russia is discussing a draft law on cryptocurrencies. It defines the cryptocurrency, mining (cryptocurrency

mining), tokens (a digital asset that an investor receives in exchange for money) and the initial coin offering (ICO, the procedure for the initial placement of tokens). The cryptocurrency, according to the project, is a digital financial asset created and recorded in the distributed register of digital transactions by the participants of this register in accordance with the rules of keeping the register of digital transactions.⁷

In early 2017, the Russian Ministry of Finance introduced the draft law "On Digital Financial Assets". The document is based on the following provisions: 1) digital tokens, cryptocurrencies shall be regarded as "other property". This is not money in the proper sense of the word, but they can be exchanged for another product or service. Thus, the bitcoin is considered equivalent to securities, non-cash finance; 2) the ICO, according to the text of the draft law, is a kind of crowd investing. The participants of investment have to voluntarily disclose the purpose of investing funds, provide business information. 3) Everyone who passes the identification procedure shall be allowed to open accounts for the cryptocurrency exchange. 4) Mining is defined as a type of entrepreneurial activity for legal entities and independent entrepreneurs. 5) Income from trading shall be taxed. 6) The procedure for issuing tokens shall be controlled at all stages. The publication of a public offer listing all the information about the issuer and the acquirer of the asset shall be mandatory.

So far, the cryptocurrency will not be able to be granted the status of the national legal currency. In this issue, the Russian Central Bank and the Russian Ministry of Finance have not come to an agreement. In 2018 the law on the cryptocurrency in the Russian Federation will introduce the concept of the "crypto ruble" and assign it the status of a financial instrument. This asset will provide an opportunity to take control of part of the cryptocurrencies unregulated market and possibly ensure the stability of the country's economic growth. As of May 2018, the use of quasi-cash in the territory of the Russian Federation is virtually prohibited (as well as in China and many other countries). The draft law "On Digital Financial Assets", as noted above, is being discussed, however, there are already small for-profit businesses available that accept the cryptocurrency for the services and goods they provide. In April 2018, in Moscow the first apartment was sold for bitcoins. The Russian media advertise the farmer cooperative LavkaLavka selling food products, the Valenok restaurant, and some other enterprises. The most famous examples abroad are Amazon in the US and a supplier of ready-to-eat food in the European countries Takeaway.com, as well as firms in countries such as Japan and Switzerland.

As to England, in September 2014, the Bank of England designated the cryptocurrency as a significant innovation in the modern economy. This technology has the potential to substantially facilitate and simplify banking processes and reduce costs [Ishmuradova and Ishmuradova, 2015, 47]. The Governor of the Central Bank of England, Mark Carney, said that the cryptocurrency involved certain risks, primarily from a technological point of view, and was also expensive [Carney, 2018]. The Bank of France published a very critical document on the cryptocurrency, denying it the functions of money, emphasizing the danger of its spread and identifying it with financial assets [2]. In 2014, the Gartner consulting company published a report stating that the cryptocurrency was at the stage

⁷ The RIA Novosti newswire: <https://ria.ru/economy/20171228/1511928676.html>

between the peak of inflated expectations and the stage of disillusionment, in their opinion, the cryptocurrency would reach general recognition only in 10 years to come [Web Resource, Russia, 2016].

However, the reality has shown that already 2017 and 2018 have witnessed an intense debate at the global and national levels as to the possibilities of legalizing the cryptocurrency as a financial asset, its circulation as a parallel currency or a means of payment. So, the US, Canada, and Singapore have opted for recognizing cryptocurrencies as a financial asset. The initial coin offering (ICO) is considered equivalent to the IPO of common stock shares and is subject to strict licensing, registration of prospectuses and tax regulation. Japan and Germany have allowed the use of cryptocurrencies at the national level. Estonia seems to have made the boldest move to this regard by taking in 2017 the decision at the state level about the establishment of the state cryptocurrency (Estcoin), which would unite all Estonian e-residents (e-Residency) in the virtual space. [Korjus, 2017]

In this regard, of interest is the proposals of issuing the Petro national cryptocurrency in Venezuela [Petro, 2018]⁸. E.g., the official document states that: "Petro is a sovereign crypto asset, backed and issued by the Venezuelan State as a spearhead for the development of an independent, transparent and open digital economy. It will also serve as a platform for the growth of a fairer financial system that contributes to the development, autonomy and trade between emerging economies". [Petro, 2018, Web Resource, Russia, 2016]. According to the authorities, the new cryptocurrency will be secured by the country's natural resources, primarily oil, gas, gold and diamonds. It could be the realization of the old idea by Hugo Chavez about the money with commodity coverage, which, in theory, should free the country from the dependence on the dollar. According to the official government data, the subscription to the Petro is active, and by June 2018 the currency should be launched by the public sector. In fact, however, the functioning of the Venezuelan cryptocurrency is technically not very clear. The new money coverage is not regulated either (the transition from the Petro to the natural resource will be done through the national money), and the cryptocurrency creation decentralized nature practically does not exist, since the government will be at the center of this production and control of convertibility [Floyd, 2018].

The claims of state control bodies are, first of all, lodged against anonymous cryptocurrencies emission platforms (which are quite numerous). Especially if they have a pronounced ideological character or the name of the site contains advertisement of narcotic drugs, pornography, etc. The already identified shortcomings add to the fact that there is no single center in the blockchain and information is distributed throughout the network [Genkin, 2018]. I.e., it is impossible to identify a private individual who made a possible

⁸ Actually though they are often confused digital currency and assets are not always cryptocurrency and crypto assets. The latter presuppose the availability of crypto technology and they are decentralized. In the case of Venezuela it is a matter of digital currency of the central bank although cryptocurrency is also referred to. The CB stands behind the digital currency of the CB with definite assets while there are no assets or emittent behind the decentralized cryptocurrency – the emittent is the whole community.

error or created the problem encountered. Under the circumstances where the accidental or deliberate deletion of the Internet wallet leads to irreparable financial losses, you can easily imagine what far-reaching implications may be caused by the loss of documents or Internet records if they are practically impossible to restore. At the same time, the use of the blockchain is quite acceptable, and in fact becomes an integral element in public administration systems.

The attitude to cryptocurrencies as to an unsecured asset can be considered fair, since they are not backed by an asset in the form of a state gold reserve, or another real security like in all stocks and bonds. In fact, only the "mathematical apparatus" and the process of mining (computer calculations of ciphers for conducting transactions) secure cryptocurrencies. The question is why this security causes distrust? There is no absolute answer to this question. For now, as a possible explanation, we note the limited supply, as well as the emergence of a new form of trust, namely, the decentralized trust in money. It should be clearly stated that the charge with non-backing is also quite applicable to officially functioning money. In the case of the common European money (EURO) coverage, the ECB assets have debt securities of states, banks, and corporations, some of which will almost never be paid (see for ECB policy, Rodríguez and Carrasco, 2016). In this regard, state and bank money is also as unsecured as cryptocurrency.

The experience of attempting to launch the cryptocurrency at the national and state level, like in Venezuela and Estonia, clearly shows the strategic and international nature of the innovations observed. In 2018 and particularly in 2019 (as a reaction to different private projects on global digital currency) the central banks including those of the leading countries launched very fast large-scale plans about their own digital currency, CBDC (BIS, 2018, Barotini and Holden, 2019). That large-scale action has been prompted by numerous factors.

The leading explanation is related to the threat of a loss of control over the money supply (especially today given the low and even negative interest rates in the developed countries). CBDC and the elimination of cash have been considered a chance for new, almost limitless opportunities for pursuing a monetary policy, as well as for a rapid management of the transmission mechanism. However, all this depends on the CBDC design, whether they will be small scale or large scale, who will have access to them, whether they will be tokens or only accounting as well as other important, not yet studied but only presumed dependencies. It should be noted that the CBDC also have political implications. Their emission could result in a huge concentration of information in the Central banks and in all the known dangers for the free economic and civil society.

The second leading reason for launching the CBDC is related to the growing economic and monetary nationalism. In this environment each country and their CB respectively seek to shape up the national payment community and create barriers to the penetration of foreign public or private monetary instruments. The launching of the Chinese digital currency of the CB, as well as the discussions in the Russian Central Bank (Kiselev, 2019) can be regarded in that light. Both Russia and China develop today in the conditions of sanctions and commercial and currency warfare. CBDC are an important mechanism for promoting economic and monetary independence.

In view of this, it is extremely interesting to look at the development of cryptocurrencies and at the digital economy from the perspective of the global monetary system evolution.

4. Cryptocurrencies and Global Monetary System Architecture

As is known in the pyramid of the global monetary system, the dollar still holds the world positions [Cohen, 1998, 2015]. Suppose, however, that there comes a time when there is a mistrust of the US Federal Reserve System and the dollar as a world currency that is becoming increasingly vulnerable against the background of political and economic shocks in the US. At the same time, we do not reject just the opposite view that it was the FED, at the end of the twentieth century that initiated the project of creating cryptocurrencies as a possible means of distraction from the dollar problems.

The growing economy of China also contributes to the process of mistrust of the dollar as a world currency. The openly announced strategy towards the global economic leadership, declared by the PRC, cannot but alarm the financial and currency markets, traditionally working with the dollar. The Chinese economist H. Song in his popular book "The War of Money. China and the New World Order" openly states that China has claims to make the yuan a world money to replace the US dollar [Song, 2013, refer also to Guichard, 2014]. The emerging economic confrontation between China and the United States, the existence of problems in the economies of the European Union countries, the tendency to regain the position of the world power on the part of Russia, and many other factors create prerequisites for the search for entirely new forms of ensuring financial stability. The worldwide greater interest to cryptocurrencies can be explained, among other things, by the above reasons. However, we will raise arguments that are not at all related to the role of the dollar as the outgoing world currency. In general terms, there is a discussion about the new format of the global monetary system and about changes in the hierarchy and subordination of national currencies [Cohen, 1998, 2015, Song, 2013, Eichengreen, 1992].

The emergence of cryptocurrencies may well be associated with the advent of new rules and relations in the digital economy. The transition to electronic accounting of all economic transactions, digital assessment of the effectiveness of any enterprise or individual, allow us to assume a completely new system of accounting, mutual settlements, payments, etc. It is difficult to imagine that such likely innovations will occur without fundamental changes in the sphere of monetary circulation. We can assume with a high degree of probability that the introduction of a single world currency in a digital economy is a possible way and a fact of life in the future. For now, we can only guess how the process of merging or absorbing currencies will occur, quite possible, there will be a period of two or three currencies in circulation (the dollar, the euro, the yuan), between which a certain parity (rate) and area of influence will be established. Yet, there may be no such "transition" period.

It is conceivable that the rate of any currency currently in effect in the world can be adjusted to the appropriate volume of the cryptocurrency through a system of criteria. We can create national cryptocurrencies, which can become the main financial instrument for an indefinite period. Under this option, the countries with the greatest potential for electricity, and, most importantly, having the greatest free energy potential, can have a

competitive edge. At present, the major mining producers are the USA and China. It is by no means certain that only these countries have a real opportunity to find a large amount of free energy generating capacity without curtailing the existing energy-intensive industries. There is no clear evidence in the media on the existing completed development of new ways to produce energy, which could be used for cryptocurrencies mining.

But the fact that it is in the US and China that the most active discussions of options for the development of cryptocurrencies and their state regulation take place (from the total ban in China to the adoption of legislative acts at state levels in the USA) is a fact that attests to the particular attention to this problem. So far, the hope for state funding of mining centers with the allocation of energy capacity appears very faint. Large volatility of the cryptocurrency market and the rather powerful, already established centers in the US and China create greater risks for public investment. Rather, we should expect the proactive attitude of market structures under certain state guarantees and benefits. But even tax preferences may not provide a price edge to the Russian mining over the US and Chinese competitive companies operating in this market for years.

As noted above, the Russian Federation attitude to the development of cryptocurrencies is quite calm. Russia did not opt for a state ban, as it had been done in China. The relative restrictions imposed by the Central Bank and the Russian Ministry of Finance rather serve as guidelines. Many experts representing state structures, political parties, and business community are in favor of a thorough study of the possibilities for the development of the national cryptocurrency market. Cautious support is also given in the academic circles as to the idea of developing national mining platforms with mandatory state regulation.

The realities of the digital economy development dictate entirely new challenges not only in the system of finance and public administration, but also in the social sphere. The Russian Federation has already introduced e-government mechanisms based on digital technologies. The presentation of state and municipal services in the electronic form, the reality of e-healthcare, e-judicial system, e-electoral technologies serve to show the gradual transition to a digital system of government in the state. The decree of the Government of the Russian Federation dated July 28, 2017 № 1632-r "On the Approval of the Program "Digital Economy of the Russian Federation" indicated the major guidelines in the development of digital technologies in the national economy.

The digital or e-economy in the program adopted in the Russian Federation is formulated as a set of social relations that develop with the use of electronic technologies, electronic infrastructure and services, technologies for analysing big data and forecasting in order to streamline production, distribution, exchange, consumption, and improve the level of socio-economic development of the states. The program determines the main directions of the state policy and proposes working out specific actions until 2035, considering that the development of the national economy will take place in the context of a new economic paradigm. The preamble of the program runs that the stage of the digital economy formation will be difficult in the face of complicated foreign policy situation, but it does not contain direct administrative barriers and mechanisms for prohibitive state regulation.

There are different attitudes in assessing the digital economy potential development: it is viewed either as a continuation of liberalizing the economy and the maximum reduction in

state intervention in general, or, by the opposite viewpoint, it presupposes creating a legislative framework for tight control over the formation of digital flows, supercomputing capacities, Big Data, mining, etc. There are also polar opinions about the impact of the digital economy on the global economic crisis dynamics. Will the digitization of production and finance lead to relative stability or, on the contrary, create an even greater gap between countries, with some of them amassing the main software platforms and technological support, while others will act exclusively as a consumer test site? There are all grounds for assuming a real possibility of such stratification with the prospect of gradual intellectual degradation of entire countries, which will remain only an integral part of the digital chip space. The global economic crisis, which ends with the renewal of production technologies, the development of a new technological order based on a new type of social production, will inevitably lead to a revision of the relationship between the existing state blocs, the countries included in these interstate associations, the non-aligned countries and simply states with very different levels of economic development.

Even a brief overview of the problems we are considering clearly shows that cryptocurrencies and the digital economy as a whole pose serious problem to society and governmental authorities. One of the most important tasks in this regard is to prepare the citizens for these new realities. A key role in the implementation of the digital economy large-scale tasks is assigned to higher education, universities, a new model of which is widely discussed both globally and in Russia.

5. Digital Technologies, Digital Economy and Higher Education in Russia

The periods of entry into the new industrial relations of the digital economy may vary for different countries, both in time and in consequences. It means not only the economic consequences associated with the introduction of digital innovations, the change of technological processes in enterprises of many industries, as a consequence, accompanied by rising unemployment, a shortage of specialists of appropriate qualifications; it also implies the aggravation of social problems in the field of education, healthcare, science, and culture.

Statistics on the development of digital technologies in Russia are quite contradictory. At the end of 2016, the number of users of state and municipal services portals exceeded 40 million people. Of interest is the data for Moscow - in September 2017 alone the urban electronic services portal was visited by more than 20 million people. The most popular services (more than 15 million visits) were the student's electronic diary and joining various sports clubs and creative groups. This is a clear illustration of how quickly specific age groups respond to particular elements of the digital economy. In terms of the Internet users number, according to the report by McKinsey (an independent non-state source), Russia ranks first in Europe and sixth in the world, 60% of the population owns smartphones. However, the share of the digital economy in the RF GDP in 2015, by the same source, made only 3.9 percent, while in the European Union it totaled 8.2 percent, and in the US - 10.9 percent.

It stands to reason that the economy of any most developed country cannot be 100% digital, there will always be branches with a high proportion of unskilled labor: agriculture, services sector, small-scale mechanization in construction, and a number of others. But in such industries as engineering, energy, transport in a very short time there comes a due moment when the decision is made to switch to 3D technologies, additive processes in metallurgy, robotics in machine control, artificial intelligence, etc.

In terms of the forecast, the logistics schemes for the supply of components and raw materials may switch for a short while from the analogue economy to the digital one. In these chains, working personnel with "pre-digital" skills will still be used for some time, but all other technological redevelopments will have to already be serviced by specialists with the knowledge and competence in IT technologies.

In this regard, the "Education" section of the nationwide Russian digitalization program is a major one. The tasks of universities and colleges are defined quite extensively, they are not just about developing new educational materials and disciplines, their integration into existing programs, educational organizations are increasingly becoming centers of continuous learning of computer literacy, digital technologies. The development of new training programs in the use of information technologies in education, a widespread introduction of online training, the strategies for replacing existing educational standards with new ones, taking into account the needs of the digital economy, - all this is a challenge faced by the national universities.

The task assignment raises a number of questions, to which there is as yet no answer. How to most preferably accommodate the load across a wide range of subjects that need to be mastered to develop the required competencies? The current schemes - school, college, and university - can ideally solve this problem, but how much time will it take to develop methodological support for such a three-tier solution, how to optimally introduce interdisciplinary and transdisciplinary approaches in training?

There is another problem that needs to be addressed. Where should the profilisation center be located - at the bachelor's level, aimed to train rather a broad specialist within four years or at the master's level, taking into account the existing features in various sectors of the economy? There may be another solution – to create a system of a three-year profile training (lyceum) with the opportunity to further it at the level of a subject-oriented graduate school and in five years to obtain a sought-after specialist.

However, the indicated models will depend on the content of the educational subjects included in the curricula. Depending on who is planned to be qualified as a result of such training - an expert in website development, an analyst in the field of big data or a mining operator in a cryptocurrencies cycle, a student's learning pattern will be formed, with their own active participation. This is a very difficult choice, which has to be made by our education system in next to no time. Otherwise, we can create a standard that will be very far from the practical needs of the digital economy.

In the near future, digital academic record books, certification results, electronic diplomas, permanent portfolios, resumes and what is now called an occupational record will be

formed. This information will be recorded and stored for students during their professional activities.

The most famous Russian universities already have some experience in organizing bachelor's and Master's educational programs in the digital economy, financial innovations. They are MIPT (Moscow Institute of Physics and Technology), Moscow State University, Tomsk State University and NRU HSE (National Research University Higher School of Economics). In the field of supplementary vocational education, a number of programs on the cryptocurrencies functioning are taught at the Financial University under the Government of the Russian Federation, Plekhanov Russian University of Economics, and in Saint-Petersburg State University of Economics. There was also a launch of programs for bachelors "Digital State" (at RANEPa) and "Digital Economy" (at the Economics Department of PFUR).

It can be assumed that in the near future one should expect a surge in the activity of launching programs on digital economy, specialized for public administration, healthcare, financial technologies, Internet commerce, and training of teachers in computer science.

Of interest is the foreign experience of promoting information educational programs. In January 2016, the United States, for example, brandished the appeal of then-President Barack Obama, in which he called for a mass scale getting of a second degree in computer science, for which purpose \$ 4 billion was allocated and 50,000 teachers of schools and colleges were to be trained at the expense of the state budget. Thus, at the initial levels of education the model of accumulating basic knowledge in computer technologies is realized, while at the level of university education specific job preparation takes place.

In China, a course on the basics of technological mining is recommended for mandatory study, to a different extent of knowledge for schools, colleges, and universities. This approach allows to obtain basic competencies more of a technical nature, yet, the study of this subject, even to a small extent, will allow to extend purpose-oriented competencies at each next educational level.

In Russia, short-term courses in information technologies are aimed at training application programmers, application users, system and network administrators, web resource and databases administrators. They plan the development of competencies and a system for testing the said competencies by ad hoc groups that will comprise educators, public authorities' employees, and business environment representatives. The development of competencies is by far the most important result of the educational process, the most understandable to the potential employer. By the end of 2019, it is planned to obtain digital economy federal state standards for all levels of education. As a whole, we are going to operate with figures illustrating the scale of the tasks of the educational component in the Russian digitalization program for the next few years. The number of graduates of higher and secondary vocational education with the skills in the field of digital economy at the global average should reach 150 thousand people by 2020, and by 2025 – 500 thousand people; as to the number of professionals in the field of digital economy with higher education, it is expected to exceed 60 thousand people by 2020, and by 2025 - 100 thousand people.

6. Concluding Reflexions

In this article we stand on a number of main points in the theoretical discussion related to the interpretation of the purport and functions of the new monetary instruments - cryptocurrencies, vigorously earning a place in the financial markets of different countries, as well as on a number of possibilities for the future as to the development of the said financial innovations. We performed the analysis of the actions on the part of public authorities and central banks of different countries in response to the emergence and distribution of virtual electronic money and it has been clearly shown that the cryptocurrency as one of the digital economy manifestations leads to fundamental changes not only in the monetary, financial, and economic spheres, but also in social and political development. International relations, and international monetary and financial relations in particular, are also drastically changing.

In order to meet the challenges of the new digital technological revolution, states, all public institutions, and systems have to take a pro-active approach in relation to the demands of the digital economy, accepting its progressive innovations and counteracting the growing risks of a still greater gap in the tiered development of countries. At the same time, it is important for states and civil society structures to actively involve their citizens in these processes, helping them to adapt to new realities. In our opinion, education in general and higher education in particular are the main mechanism for creating new and imparting the already available knowledge, the most powerful tool for influencing the constructive adjustment of the differences that accompany the processes of digitalizing society.

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