

УДК 340:330:334.021.1

Aleksandr Kud

CEO of SIMCORD LLC,

Postgraduate student of the Department of Economic Theory and Economic Policy,

Simon Kuznets Kharkiv National University of Economics,

Kharkiv, ave. Nauki, 9a, 61166, Ukraine

Email: Alexander.Kud@simcord.com

ORCID: 0000-0001-5753-7421

Corresponding author and information about:

the same one.

GLOBAL PROBLEM OF GROWING ECONOMIC INEQUALITY AND TOKENIZATION OF ASSETS AS A PROSPECT OF ITS SOLUTION

Abstract

The paper is dedicated to the discussion of tokenization of backed assets as a promising and potentially new solution to the long-standing and unresolved problem of growing economic inequality in modern society. Asset tokenization is considered as a simple and technologically realistic way to facilitate the financial accessibility of valuable investment assets (real estate, securities, gold, etc.), which is a modern and unexpected manifestation of blockchain technology, provided that tokens of real assets are recorded in decentralized information platforms.

The paper successively solves three working tasks: 1) the problem of global wealth inequality has been described, and its solution through increasing digital financial accessibility has been presented; 2) the essence of asset tokenization as a new phenomenon and trend in the modern digital economy has been presented, 3) the idea of asset

tokenization due to its ability to radically increase the level of accessibility of investment assets for any strata of the population owing to a unique property of divisibility of the distributed ledger token has been explained.

The author uses considerable aggregated data and a review of modern foreign literature. The author concludes that asset tokenization can indeed be a new means of significantly reducing the barrier to investment for billions of people worldwide by lowering the threshold of minimum investment costs and increasing the liquidity of existing tangible assets. To make this possible, the issues of regulation and compliance with the regulatory requirements must be addressed. Many countries and organizations have taken steps to better understand the tokenization of assets and their value. It also causes the reconfiguration of institutions and rules of the market infrastructure operation.

***Keywords:** tokenized asset; tokenization; financial inclusion; economic inequality; distributed ledger token; digital financial accessibility; global wealth.*

JEL classification: K10, K24, M15, O38

Introduction

Problem statement. During 2022–2023, the world faced not only massive geopolitical shifts, especially felt in Ukraine due to the Russian aggression, but also significant transformations in the global financial system and economic relations. The emergence of a new global order is imminent, the contours of which can already be seen: among other things, new types of assets and means for their confirmation are emerging, the role and manifestations of money and their equivalents as well as the content of capital as an object of ownership are changing [1], etc.

It would seem that these changes and processes mostly relate to those individuals and legal entities that have financial and monetary capital intended or available to carry out operations in financial markets: Forex, stock market, precious metals and stones market, cryptocurrency market. As a result, this essence of financial transformations seems to concern a relatively small number (in absolute and relative terms) of people and organizations with assets, and this cannot be what most people would worry about. However, in fact, this is just a very small and visible part of the giant “iceberg” of global financial inequality that almost all people in the world face. Accordingly, the invisible part of this “iceberg” hides what the modern world can and should really do to solve this global problem, differently perceiving the objects of property rights and organizing access to them with the latest digital technologies.

Analysis of the latest research. Despite the fact that the global problem of growing economic inequality is very old, and its successful solution is still not clearly visible, there are already many well-known organizations, such as geopolitical organizations (G20 [2]), analytical centers (WEF [3–5]), banks [6–8], consulting companies [9], non-state scientific and expert centers, which offer unexpected ways to mitigate this problem as a purely side effect of using digital technologies or another way of organizing global governance in the world. While understanding the irreversibility, depth and scale of digitalization processes in the world, bold visionary scenarios and unexpected cause-and-effect chains are now being built regarding how rapidly the world around us is changing and how large corporations and innovators should not miss their chance: to become fabulously rich or survive again in the “new normality”. These forecasts and scenarios may seem like fantasy

to someone, but large corporations and world leaders are increasingly accepting them as a baseline scenario.

A clear evidence of this is the recent unexpected experience of using generative artificial intelligence (Chat GPT, Midjourney, Dalle-2, etc.), which made a splash among scientists and entrepreneurs, students and teachers at the beginning of 2023: at least new digital solutions and breakthrough technologies can no longer be ignored even for simple operations and actions. Nevertheless, the author sees the benefit in trying to connect the old and unresolved problem of wealth inequality with those new solutions that are already offered based on distributed ledger technologies (blockchain) through an understudied and relatively new mechanism for the tokenization of underlying (backed) assets.

Aim and Tasks of the Research

The aim of the research is to theoretically substantiate the possibility of solving the global problem of growing economic inequality by means of asset tokenization in the digital environment using distributed ledger technologies (blockchain). The achievement of the stated aim provides for solving the following three search **tasks**:

- to describe the problem of global wealth inequality and provide a traditional way to solve it through increasing digital financial accessibility;
- to present the essence of asset tokenization as a new phenomenon and trend in the modern digital economy;
- to explain the idea of asset tokenization due to its ability to radically increase the level of accessibility of investment assets for any strata of the population owing to a unique property of divisibility (fractionalization) of the distributed ledger token, legally and fully represent the share of legal rights to the corresponding share of property, which is accounted for in a blockchain-based decentralized information platform.

Presentation of Basic Material of the Research

Over the past two decades, the problem of financial exclusion (i.e. complicated access to finance) in the world has gained significant impetus for its solution, and the main drivers of this have been the informatization of financial services (e.g. mobile banking) and the

expansion of service infrastructure (e.g. POS terminals, better Internet connection, digital personal verification, etc.) among both poor and rich countries. Nevertheless, we have to admit that the problems of access to bank loans (given low financial literacy and financial discipline among the majority of the population) and access to traditional investment goods (securities, land, real estate, gold) have different solution trajectories. Relatively speaking, the opening of a new ATM in a provincial village will probably not affect the investment activity of the residents of this village regarding the purchase of investment assets, which investors usually buy in anticipation of an increase in their value over time. This means that the oldest and global problem of wealth inequality, which in industrial and post-industrial economies has significantly intensified due to low financial accessibility with regard to the purchase of investment assets and exchange speculation with them, is one of the key problems for humanity today and requires innovative digital solutions according to technology capabilities, readiness of political and financial elites as well as condition of the global financial system. Together, this fits into four main and traditional directions of its solution:

1) development of financial literacy. In this case, digital technologies are used and will continue to be used to develop and distribute educational programs, including mobile programs, online courses and websites;

2) improvement of accessibility of financial services. In this case, digital technologies, such as mobile programs, online banking and electronic payment systems, can really improve the accessibility of financial services for people who live in remote or poor regions;

3) support for micro and small businesses to create jobs. Particular emphasis is placed on e-commerce information platforms (e.g. Amazon, AliExpress, Rakuten, OLX), which help private entrepreneurs to significantly expand their business even with minimal investment;

4) promoting the idea of corporate social responsibility, in particular through a more equitable distribution of incomes and opportunities, and digital technologies will be useful for improving the transparency and accountability of companies.

Despite significant (as publicly announced) efforts by politicians and bankers from

supranational organizations, the problem of global financial inequality is far from being solved, and income inequality continues to grow against the backdrop of rapid development of digital technologies. Income inequality has increased in virtually all major advanced economies since the 1980s, a period of increasing digital technology boom (Figure 1): it has increased particularly sharply at the top of the income distribution [10].

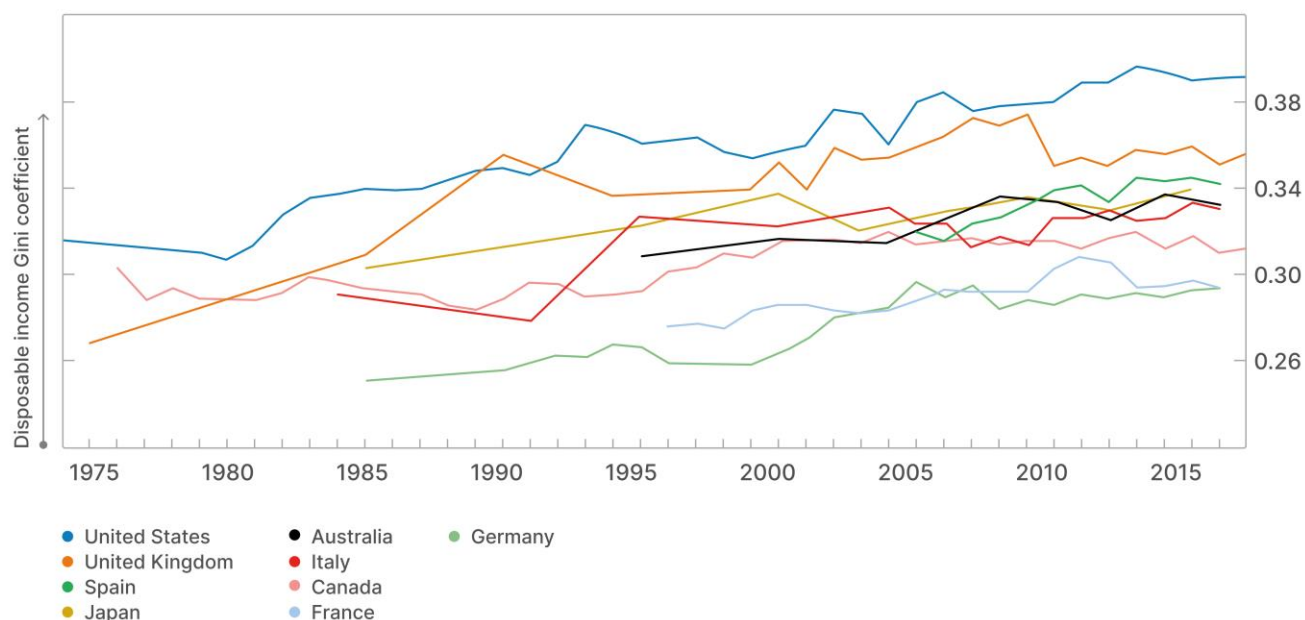


Fig. 1. Dynamics of growth in income inequality in the main advanced economies of the world in 1975–2015 [10]

* Source: based on data from the OECD Income and Wealth Distribution Databases (<https://www.oecd.org/social/income-distribution-database.htm>), 2022.

The related problem of wealth inequality is no less acute than income inequality. The growing inequality is particularly noticeable in the United States. Between 1995 and 2015, disposable income inequality in the United States (as measured by the Gini coefficient) increased by more than 10%. The income share of 1% of the wealthiest people has more than doubled to 22% since the early 1980s to 2016, and the share of 1% of the wealthiest people has increased to about 40%. Those who had income as the working middle class were disadvantaged, and the average worker often saw stagnation in real wages over long periods. Higher inequality is associated with a decrease in intergenerational economic mobility [11].

Below we consider how the problem of financial exclusion is perceived at the global

level and what the consequences of attempts to solve it are: through international commitments regarding digital financial inclusion and logical connection of inequality with this.

First, at the highest global level of the UN, this problem was directly related to the problem of poverty. In 2015, the UN Report on Achieving the Millennium Development Goals by 2030 focused on global poverty: globally, the number of people living in poverty has more than halved, falling from 1.9 billion people in 1990 to 836 million people in 2015. The greatest progress has been observed since 2000. The number of people who belong to the working middle class and live on more than \$4 a day has practically tripled between 1991 and 2015. Today, this population group makes up over 50% of the labor force in the developing world regions, while in 1991 it was only 18%. Since 1990, the proportion of undernourished people in developing regions has almost halved from 23.3% in 1990–1992 to 12.9% in 2014–2016. The UN Sustainable Development Goal 1 declares the following: “to end poverty in all its forms everywhere by 2030”. This goal contains 5 tasks, and to fulfill all of them, wide financial inclusion of ordinary people is and will be expedient:

1) “by 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions;

2) by 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance;

3) by 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters;

4) ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programs and policies to end poverty in all its dimensions;

5) create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support

accelerated investment in poverty eradication actions” [12].

Secondly, at the level of the most economically powerful countries, the countries of the Group of Twenty (G20) back in 2016 in the relevant High-Level Principles for Digital Financial Inclusion recognized “the key role of financial accessibility in helping to move towards an innovative, vibrant, interconnected and inclusive world economy” [13, p. 3], and that “seizing the opportunities offering digital technologies to reduce costs, scale up and deepen financial services will be critical to achieve universal financial accessibility” [13, p. 3]. Already now in 2023, it is clear that the G20 countries in recent years have focused their political and economic attention on the diffusion of financial technologies to promote digital financial accessibility through support for private fintech start-ups. Indeed, since the financial crisis of 2008, ordinary commercial banks have been losing people’s trust: people are increasingly using the convenient services of numerous fintech companies offering new digital solutions for greater trust, transparency and technological effectiveness [14], but, admittedly, they do not always guarantee a high-quality and safe service, and sometimes they even turn out to be fraudulent at the initial stages of their projects. Nevertheless, this technology market is growing rapidly now. Furthermore, digital technologies create a unique opportunity for various financial institutions to offer services at an adequate and affordable price for individuals and small businesses. For example, having peer-to-peer lending in a mobile app encourages people to borrow directly from lenders rather than indirectly borrowing from banks or other institutions that would incur more transaction costs to do so [15].

Within the G20, digital financial inclusion is understood as the use of digital tools to provide formal financial services to customers at an affordable price, while providers can also use the services in a sustainable way [16, p. 3]. Through digitalization, the G20 is trying to remove barriers in financial services such as high cost (essentially the transaction cost of servicing) and long distance (physical inconvenience) to financial institutions. The principles [13] indicate how digital technologies can be used to provide high-quality and customized financial products for financially excluded and financially vulnerable groups (poor people, adolescents, women or people living in rural areas), that is, to destroy the threshold of access to at least borrowed credit money and at most capital and investment

markets. In addition, the principles (as shown in Figure 2) also became the basis for promoting the World Bank’s financial inclusion initiative [17], which is still being implemented.

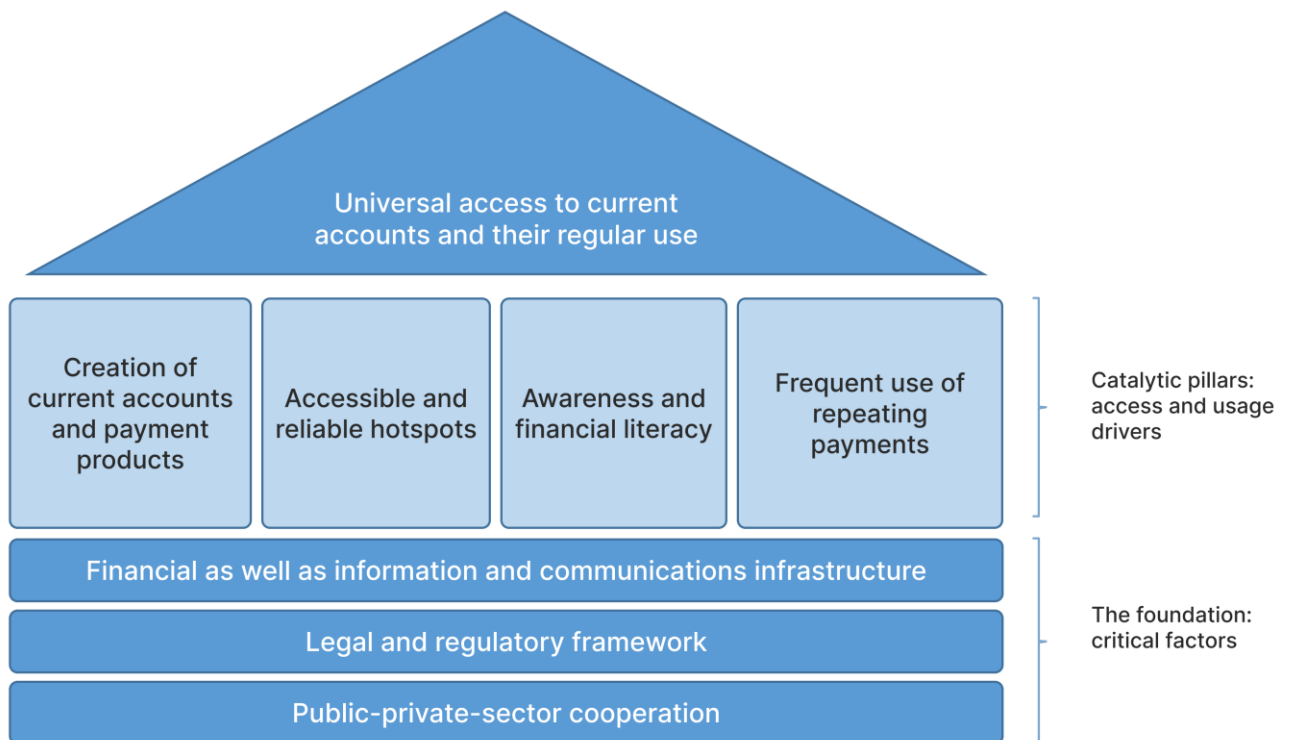


Fig. 2. Eight G20 High-Level Principles for Digital Financial Inclusion [17]

The concept of inequality is very closely related to the essence of digital financial accessibility. Inequality has long been a concept causing confusion for many people because they can subjectively perceive it in different ways and it can have different emotional connotations. Therefore, it is important to note how well-known experts have defined the concept of inequality. First, let us think in terms of “unequal opportunities”. Nobel laureate A. Sen noted [18] that the concept of equality means that more attention should be paid not only to human well-being but also to how a person is able to function (equal ability to function). “To be equal” can also be understood as “to have the same opportunity to live and freely make your life choices”. Hence, the focus should be on equal opportunities rather than means of living such as income. However, this perception of equality is at odds with the “inequality of outcomes” perspective. “Equality in outcomes” exists when people have the same income or the same economic position [19]. It is also argued that income inequality is a sign that there is an imbalance in the distribution of goods

and services [20]. Thus, income inequality has a role to play in determining fluctuations in wealth. Therefore, it is necessary to soften the starting points of equal income, since this promotes more equal opportunities. Since income inequality is mentioned as a very important key to determining access to well-being such as health, nutrition and education, this paper will use the concept of “inequality of outcomes” as the basis for defining inequality.

Research has also found that digital financial accessibility reduces discrimination in lending, which provides more people with access to loans. This thesis is proved by at least four independent studies from different continents:

1) for example, a group of American scientists proved [21] that, compared with general lenders, lenders from fintech companies are a third less likely to covertly discriminate against their borrowers and less likely to refuse loans to borrowers on formal grounds than regular US banks do. However, it should be noted that Latin American and African American borrowers still pay higher mortgage rates, but that is a matter for another study. Therefore, eliminating discrimination in loan pricing is not enough;

2) the use of big data in the loan market in the US and Canada will increase the participation of less affluent households in the use of loans and reduce non-statistical discrimination [22]. Nevertheless, this still does not eliminate the inequality between groups;

3) the use of integrated mobile banking in Kenya increased daily private consumption, and digital financial accessibility significantly affected half of households compared to the richest and poorest households [23];

4) a study by the World Economic Forum, which was published in December 2022 and was conducted in the Southeast Asia region (ACEAH) [24, p. 4], a large macro-region with the highest population density in the world and the highest GDP dynamics of these countries over the past 5 years, indicates that access to digital financial services has become a common practice among the majority of rural residents of Southeast Asia during 2017–2022. It was confirmed that small and especially micro businesses, as well as self-employed persons, received significantly more loans from small private fintech companies, supplementing traditional offline bank loans. Women use more

digital finance applications (65%) than men (59%). One in five women in need of a loan over the past five years has borrowed from fintech lenders, making them the second most important source of loans after commercial banks. This means that digitalization offers the potential to improve access to finance and, accordingly, promote greater inclusion for groups that were previously little or hardly served (for example, rural residents, micro businesses and women), even for the purpose of replenishing their working capital, rather than purchasing investment assets.

These facts indicate that increasing financial accessibility reduces inequality among people. This means that further, by expanding traditional financial services and accessibility to them, theoretically, there is hope for inequality reduction. However, this is an illusion, since there is a more fundamental factor that prevents this. This factor is the maturity of the country's financial development, an integral part of which is the popularity of private investment in investment assets.

Let us get into detail below.

First, it is an explanation from a macroeconomic point of view. One of the basic assumptions is that the relationship between (a) deeper penetration of financial services and (b) income distribution is non-linear, since it resembles Simon Kuznets' inverted U-shaped relationship between economic growth and income distribution [25]. The non-linear hypothesis is based on the observation that, in the early stages of financial development, it was quite expensive for low-income households as well as small and medium-sized enterprises to access financial intermediaries for funding. This was often due to the fact that they could not provide collateral, a reliable credit report, or because of their compromising political connections, that is, they could not pass bank compliance. Many of these potential borrowers who have been denied access to bank funding are unable to make indivisible investments other than their initial capital, thus missing out on potentially profitable investment opportunities that could enhance their wealth. Limited access tends to exacerbate income inequality, especially if the financial industries are characterized by an oligopolistic market structure captured by the wealthy. As the financial sector develops and receives a more efficient infrastructure, financial institutions can reduce transaction costs as well as improve credit and market risk management [26]. This allows them to ease credit

restrictions for small low-income borrowers. Financial growth allows banks to increase their ability to meet the credit needs of these newcomers to the financial sector. This change in the structure of bank lending, which favors new entrants more than existing ones, reduces and then gradually stabilizes income inequality.

In the same vein, it was proved [27, p. 1] that in low-income countries, income inequality first increased and then decreased with increasing financial accessibility. The reason for this is that the loan cost (all direct and indirect expenses in total) has decreased from a very high value, which encourages only a small number of business groups to conduct business or other economic activities. However, as the participation cost decreases, a business group has the opportunity to invest more in their business, which will create new opportunities for other people who previously could get a bank loan.

Secondly, an explanation from a macroeconomic point of view should be provided. There is ample evidence that access to financial products can enhance long-term economic growth [28]:

- it was found [29] that access to funding has a strong direct correlation with the level of GDP per capita;
- several findings also suggest that financial inclusion helps reduce income inequality [30; 31]. In low-income countries, a reduction in inequality due to financial accessibility is likely to occur if access to financial services is improved [31];
- digital finance promotes financial inclusion in the sense that providing financial services through mobile phones can improve access to funding [32]. It has been established that digital finance contributes to overcoming barriers in accessing financial services, mainly in the appropriate environment;
- according to the World Bank [33], M-Pesa, Africa's largest mobile payment platform in Kenya, is a clear evidence that digital services help a large number of people with their financial needs daily. In fact, in the four years surveyed by the World Bank, the M-Pesa platform reached 80% of Kenyan households [23]. Similar results were in Tanzania, Ghana, Rwanda and Uganda.

Therefore, while there is a lot of evidence that greater use of digital technologies somehow reduces income inequality and increases the chances of earning more from self-

employment, it is important to note that the global problem of inequality has not yet been solved in this way, and the pace of its solution does not add optimism:

1) during the period of emergence of the first global platform businesses and the first fintech services (2003–2008), the level of inequality according to the Gini coefficient was very high, that is, almost 70% [34, p. 24], although most studies observe this relationship at the country level;

2) the same situation was during the period of rapid scaling of the platform business in e-commerce, mobile banking and microcredit, subject to the rapid and global coverage of the population by the Internet (2017–2022) [24].

In this regard, it is very important to caution about a related problem with similar roots — the problem of uneven distribution of benefits (in particular, the concentration of market power) and uneven labor productivity in case of using digital technologies in favor of digital “giants”. It is important now because, if it continues to be ignored, it will be almost impossible to find an opportunity to solve the global problem of financial inequality. In this paper, this formulation of the question is important in the context of the author’s viewpoint.

Despite long-term political attempts and geopolitical efforts to reduce financial inequality, it should be recognized that a new “wave” of polarization of corporate and personal incomes as well as the widening gap between firms in financial rewards and market power are related to the use of digital technologies (collection and analysis of big data, centralized information platforms, artificial intelligence) and copyright concentration. Digital technologies are changing more than just business models and the way firms compete and grow. Digital technologies are even changing market structures, and these changes affect all markets: from production and trade to loans and personal finance [10, p. 3–4]. What is clear is the uneven diffusion of new technologies and the widening gap between firms: how technological innovations spread throughout the economy and interact with market conditions is of great importance both for labor productivity growth and for income distribution. This means that the benefits of new technologies do not spread widely among firms, but have mostly been captured by a relatively small number of digital corporations:

1) firstly, due to labor productivity dependence on that how close a company to

the “technological network” (*technological edge*) is. Even in the OECD countries as highly developed countries, during 2001–2013, the difference in labor productivity between “technologically border” and “technologically remote” enterprises increased by 35% and 5%, respectively [35];

2) secondly, with the growth of market power, the distribution of returns on invested capital has become even more unequal, and this has allowed a relatively small number of digital corporations to make daily super profits. Markets have shifted towards more monopolistic corporate structures, which has led to a multiple increase in their profits, and in fact, rents from the concentration of market power [36–38]. Since monopoly profits have increased the market value of corporate stocks and provided significant capital gains, the share of the total value of the US stock market that characterizes monopoly power (“monopolistic wealth”) has grown from a negligible level to about 80% in just a few years [39].

The development of a non-material economy, where software and intellectual property are very important for economic success, is associated with a strong trend towards the emergence of dominant firms [40]. Digitization also allows digital companies that collect and process big data through information platforms [41] to reap disproportionately more benefits: this is due to the asymmetry of information in the case of increasingly complex pricing algorithms and customized offers. The old “winner takes more” rule has found new manifestations and evidence in the Internet technology sectors (Amazon, Apple, Facebook and Google).

However, they are also increasingly affecting the economy on a larger scale, since digitalization penetrates deeply into business processes across industries.

Digital technologies have played an important part in the economy financialization, increasing the momentum to deregulate the financial sector. In the OECD countries, credit and other financial intermediation has grown three times faster than economic activity in 20 years. Admittedly, there have been many innovations in financial services based on new technologies. Yet, a large part of them concerned the areas of trade and asset management, which primarily benefit wealthy and very wealthy people (i.e. the problem of personal financial inequality) as well as do not have a decisive impact on labor productivity and

probably do not concern poverty reduction at all. Remuneration in the financial sector of the OECD countries grew multiply, but unjustifiably, in contrast to the real economy sector, even in comparison with such investment-attractive and high-status areas as precision engineering and power industry. In European countries, employees in the financial sector, on average, accounted for at least 20% of 1% of the top paid employees, although they accounted for only 1/25 of the total labor force [42]. That is, financial wealth grew rapidly, but for the most part those who were at the top benefited from this. For example:

1) if in 2013 in the USA, 1% of people who accounted for the largest distribution of wealth owned 50% of shares and assets of mutual funds, 10% of these wealthy people owned over 90% of such assets [43];

2) in 2019, the global market for common stocks and fixed income securities (bonds, etc.) was estimated at approximately \$178 trillion, while 0.9% of the world's population owned 43.9% of the world's wealth. Conversely, over 50% of the world's population at the bottom of the pyramid (Figure 3) together own 1.8% of wealth. Access to a wider range of investment assets at an affordable price will benefit this group, which faces limited access to banking services, hindering its ability to save and accumulate wealth;

3) at the beginning of 2020, the world's population was 7.8 billion, of which 3.46 billion people were in the labor force, but 1.7 billion adults remained unbanked.

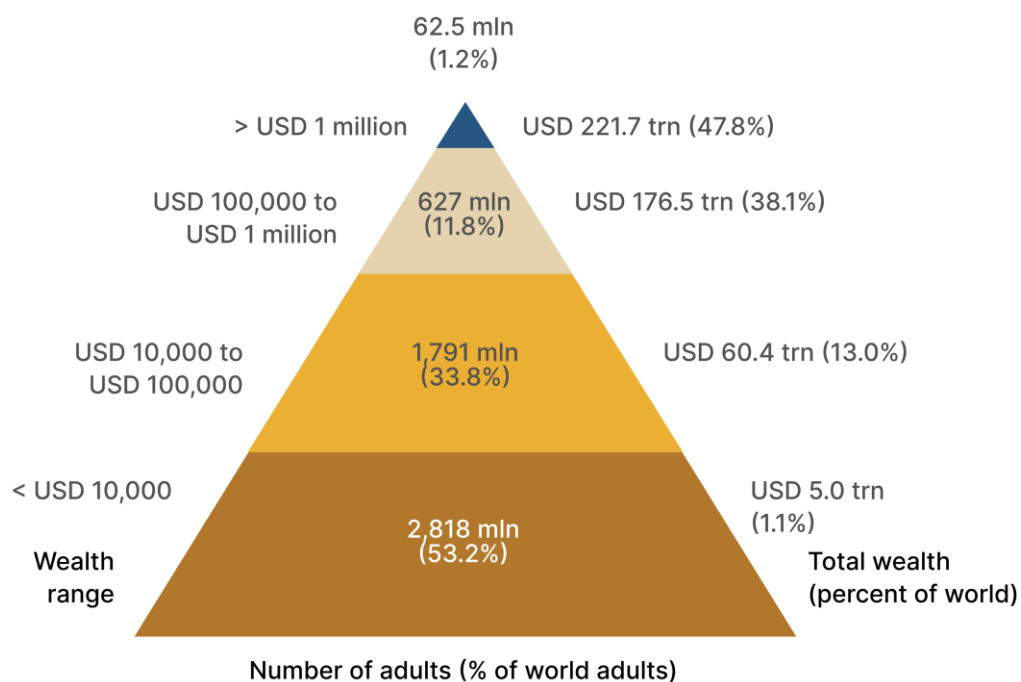


Fig. 3. Distribution of world wealth among people with different incomes [44, p. 3]

As Figure 3 shows, only 1.2% (62.5 million people) of the population own 47.8% of the world's wealth, 11.8% of the population own 38.1% of the world's wealth, 33.8% of the population own 13% of the world's wealth, and the largest part of 53.2% of the population owns only 1.1% of the world's wealth. These striking statistics on the wealth distribution perhaps leave no hope for known or existing tools to rectify this tricky situation. All this together is another concentrated manifestation and explanation of the global financial inequality problem, which this research is devoted to. There is great difficulty in solving it by traditional or established methods, which is associated with a significant property redistribution among the elites and large conflicts. New solutions are needed that will make it possible to make asset markets, in particular investment markets, much more widespread. That means contributing to a significant increase in the number of the middle class in the world, and especially people who can and want to invest, and not just spend money.

Perhaps one of the latest and most inspiring solutions to the global financial inequality problem is asset tokenization.

Technologically, asset tokenization is based on the blockchain technology, and “this is primarily a technology for storing and recording accounting objects (property), and blockchain tokens are accounting tools. That is, if we draw an analogy with accounting, the token in this case is an inventory number and is assigned to a specific type of property, which is accounted for using the blockchain technology. Cryptocurrencies or cryptoassets are in no way connected with real property, although by their nature they are also tokens” [45]. Realizing this, or at least feeling it, the largest banks and funds (for example, HSBS, Credit Suisse, Bank of New York Mellon, IFC, etc.) are paying attention to tokenization based on the distributed ledger technology (in particular, blockchain technology), since the latest digital solutions based on this technology have the potential to preserve and capitalize assets. Consequently, they have the potential to reduce global inequality in the wealth distribution and even radically lower the threshold for entry into investment asset markets.

To date, there are very encouraging expectations in the Western world regarding this phenomenon. According to analysts from Bain, American consulting company, the

potential of digital assets in private markets is much greater than in public securities and raw materials markets and amounts to \$258 trillion for the global debt market and \$317 trillion for the global real estate market [46]. According to a survey of global institutional clients in 2022, 97% of institutional investors (pension funds, sovereign wealth funds, institutional asset management firms, hedge funds, etc.) agree that “tokenization will revolutionize asset management” and will be “beneficial to the industry”, and 91% of institutional investors showed their interest in investing in tokenized products [47].

Tokenization allows providing investment options to underbanked populations and supporting the UN Sustainable Development Goal 10 aimed at reduced inequalities. However, in order for tokenization to provide access to these populations, several factors should be taken into account: necessary infrastructure, secure access to the Internet, customer credit profile, financial and digital literacy of the population. Despite these problems, the increase in smartphone use and digital banking, for example, in Southeast Asia suggests that this part of the population may be on the path to greater financial accessibility [44, p. 3]. Some Asian countries (Thailand, Philippines and India) are already implementing digital identities and centralized Know Your Customer (KYC) repositories in order to provide reliable sources for customer credit profile.

The blockchain technology potential to significantly change the financial services sector is becoming increasingly evident. This global industry now spends approximately \$1.7 billion on new blockchain solutions annually. Back in 2015, the World Economic Forum (Geneva — Davos) predicted [48] that all blockchain solutions for the financial sphere will cover up to 10% of global GDP by 2027. By 2027, tokenized asset markets could potentially reach \$24 trillion, and for this potential to be fully realized, financial market participants and private infrastructure providers should cooperate. It is clear that investment has traditionally been limited to mass wealth due to high transaction costs (high entry threshold) and low financial literacy of a large part of the world’s population. In fact, over 84% of the world’s population would have to save money for more than two years to afford a stake in each of the five largest market capitalization companies. Meanwhile, the fractionalization (or divisibility or breaking down into any small fractional parts) of an asset, which the blockchain technology ensures, can make investment much more accessible to

the majority of the world’s population. If the legislation provides such an opportunity, anyone will potentially be able to acquire any small proportion of the shares in such large companies as Tesla, Apple or Alphabet, access to which is now very complicated despite the publicity of these companies (Figure 4).

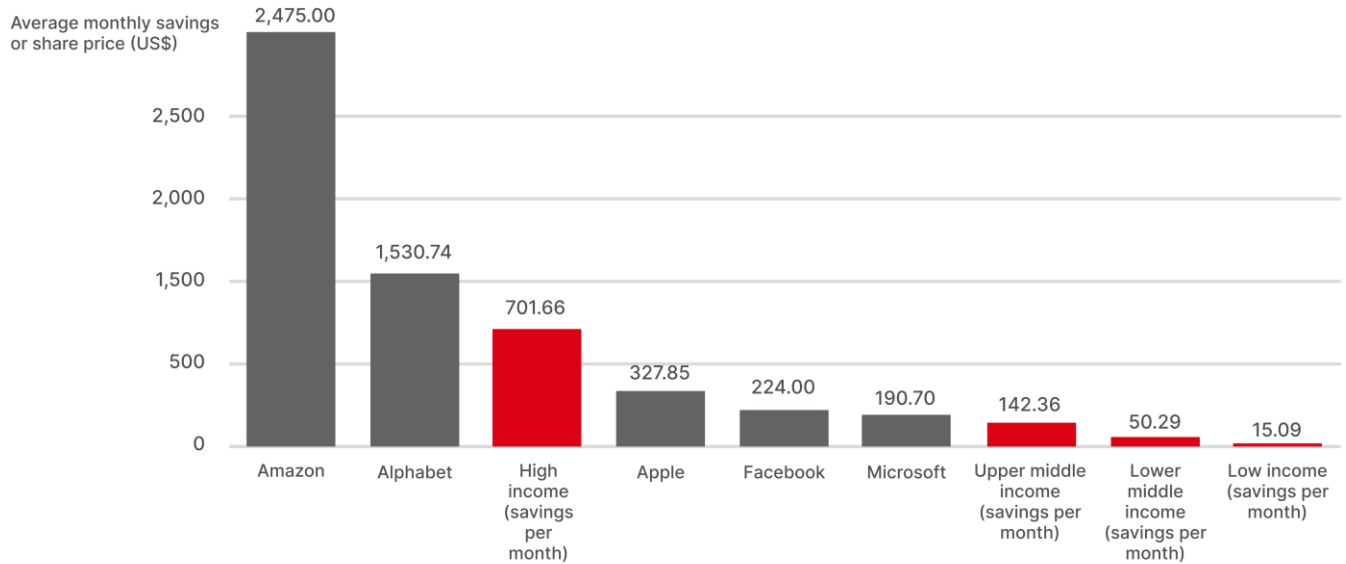


Fig. 4. Average monthly savings of each income class compared to the price of each five shares of the company with the largest market capitalization [44, p. 3]

Using distributed ledger technologies, any real assets (intellectual rights, real estate, securities, gold, etc.) can be provided and circulated as programmable distributed ledger tokens [49] by means of smart contracts [50] in a distributed ledger environment. It is worth emphasizing two important features of a distributed ledger token in an organizational sense:

1) since a distributed ledger token has accounting units in a distributed ledger token accounting system, a user of this accounting system, taking into account their goals, at the time of creating the distributed ledger token, can independently specify the number of accounting units of this distributed ledger token that are issued. For its part, the distributed ledger token as an accounting object can be an independent object of property relations, which has its own accounting units in the distributed ledger token accounting system [50];

2) each token can be easily programmed to represent legal ownership of the underlying asset, and can be subdivided into any small (fractional) number of units, allowing fractional ownership.

No other known tool or mechanism allows you to do this. Thus, it provides significantly greater access to the securities market by rapidly reducing the minimum investment amount (low entry threshold) and providing investment opportunities to a wider range of investors.

What could this practically mean for solving the global problem of financial inequality? This will mean, for example, that in low-income countries, an ordinary person, making monthly savings of \$10–20 or \$100–200, can actually become an investor in investment assets. Since such a person will be able to independently overcome the threshold of entry into these markets, making their investments without a hired broker who usually takes a significant fee for their services. This, together with the growing popularity of investment programs and expanding middle class, indicates that microinvestment is indeed a viable option for those with lower incomes. For example, by the end of 2018, 588 million users of the China's Alipay had already invested their small amounts of money in the Tianhong Yu'e Bao corporate mutual fund, and in mid-2019, its assets under management had already reached \$150 billion.

Tokenization also makes it possible to partially own low-liquid assets (real estate, precious metals and stones) or alternative assets (antiques and art objects), which usually require large investments at once and are therefore of interest to a limited circle of knowledgeable investors. This not only expands the range of asset choices for investors but also increases accessibility, allowing for investment portfolio diversification and mass financial literacy stimulation even in poor countries. Conversely, tokenization will create more market liquidity for sellers of said assets. This already means that the existing property will become more valuable for its owner and can even stimulate their frugality, and consequently — the global preservation of natural resources. Overall, tokenization has the potential to: a) reimagine both investor geography and investor demographics; b) increase accessibility and expand the universe of available investment opportunities.

However, some principles traditional for the modern financial market are of exceptional importance for tokenization introduction:

1. *Financial and legal compliance* (or integrity compliance). It will be critical for most transactions using tokenized assets and especially in investment asset markets. Along

with traditional transactions, they must comply with the same Know Your Customer (KYC) and Anti-Money Laundering (AML) standards. Nevertheless, the speed, efficiency and irreversibility of transactions in a distributed ledger imply that the current manual means of control and verification should be replaced by automated compliance checks, which is technically possible only in the environment of decentralized information platforms [51]. Some companies have already developed specialized utilities for managing compliance checks and accounting for tokenized assets, for example, American Avimetal (www.avimetal.com), Harbor (<https://harbor.com>) and Ukrainian Simcord (<https://bitbon.space>). Their information platforms allow (to varying degrees yet) to ensure that transactions concluded in relation to assets comply with the KYC and AML principles and applicable legislation, in particular on securities. Another example is the Rate3 network (www.net3.network), which is a protocol for asset description and tokenization as well as identification in the Ethereum and Stellar blockchains.

2. In order for tokenization to spread, *international and state regulation* is very important. Throughout 2020–2022, the international understanding of the essence of tokenized assets seems to have got off the ground: big regulators (for example, the IMF in 2022–2023) are increasingly distinguishing between tokenized assets and, for example, cryptoassets. Many central banks (e.g. in China, Singapore, Switzerland, Ukraine, Hong Kong) have already made significant progress in introducing tokenized currencies, in particular central bank digital currency (CBDC), for payments, settlements and cross-border trade. For example, the Central Bank of China introduced a pilot version of its digital currency in four Chinese cities back in 2021, but even at the beginning of 2023 this experience did not spread throughout the country, since there are not enough willing users. The similar situation is in Ukraine: despite rather successful experiments with the digital hryvnia, since 2017 [52], the e-hryvnia has not been introduced due to the lack of market demand from its potential corporate users, who see its introduction as extra financial costs for preparation.

3. Services of a custodian of tokenized securities (custodial services), which are critical to providing issuers and investors with confidence that their assets are stored and managed securely. However, the role of a custodian of tokenized assets is different from

the role of a custodian of traditional assets, such as securities. Ownership of tokenized assets is confirmed using a cryptographic private key that prevents theft and unauthorized use of it. The role of the custodian is to securely store and manage these keys. The general world approach is as follows: if not one, then literally 2–3 qualified custodians can be licensed to store tokens on behalf of institutional investors, but so far in different jurisdictions of the world there are not enough standardized licensing requirements for storing digital assets.

Nevertheless, back in 2020–2021, some companies (for example, Coinbase, Gemini, BitGo) managed to get approval from regulatory authorities as qualified custodians in the US. In addition, major institutional players in asset management and services have begun to offer their own solutions for storing backed tokenized assets. In particular, HSBC, the large Asian financial corporation, launched Digital Vault, a blockchain platform for storing digitized private transaction records. Back in 2021, the platform could cover \$20 billion in private placement assets, including equity capital, debt obligations and real estate, allowing its international users to securely access their records in real time. Similarly, Fidelity, American company, launched the Fidelity Digital Asset Services platform (<https://www.fidelitydigitalassets.com/>) in Europe in 2020 to store and trade backed virtual assets. The continued growth and development of digital asset storage solutions as well as the standardization of licensing requirements are critical to stimulating the tokenized asset ecosystem growth and, consequently, approaching the right solution to the global financial inequality problem for millions of private investors and micro businesses, even in the poorest countries of the world.

Conclusions and Prospects for Further Research

Based on the conducted research, the following aggregated conclusions can be drawn:

1. The oldest and global problem of inequality in the level of well-being, which in the industrial and post-industrial economies has significantly intensified due to low financial accessibility with regard to the purchase of investment assets and exchange speculation with them, is one of the key problems for humanity today. Due to the great complexity of its solution using traditional or well-known methods associated with a

significant redistribution of property among the elites and large conflicts, it is not actively declared in the world, and globally it was replaced by “green” and energy problems.

2. Asset tokenization is considered as a new way and mechanism that can significantly reduce the barrier to investment for billions of people around the world by lowering the minimum investment cost threshold and increasing the existing tangible asset liquidity. The blockchain technology can also provide investors with access to assets that traditionally require significant capital investments (real estate, precious metals, private securities, works of art), expanding the range of investment options available for buying and selling.

3. To make this possible, the issue of regulation and compliance with the regulatory requirements must be addressed. Fortunately, many countries and organizations have already taken steps to better understand the tokenization of assets and their value as well as the potential of tokenization for asset ownership relationships, allowing people of all income levels to increase their wealth and financial literacy. This also leads to a reconfiguration of the institutions and rules for the market infrastructure operation, where the states and private providers of such services will be ready to jointly establish the accounting of tokenized assets, thereby fixing a very low threshold for entering the investment asset markets in the world right at the level of institutions.

The prospects for further research are associated with a deeper understanding of the essence of tokenized assets (approaches to their definition, generic features and technological conditions of use), with an explanation of a tokenized asset divisibility property through the technological aspects of a blockchain token and accounting units and, consequently, substantiation and testing of procedures for correlating property with a virtual object through the procedure for digitization and creation of a tokenized asset, which is already successfully implemented in Ukraine.

References

1. Kud, A. A. (2022). Transformation of economic relations and methods of their implementation in the conditions of the development of digital technologies. *Bulletin of Lviv University. The series is economical*. No. 62. p. 42–59. URL: <http://publications.lnu.edu.ua/bulletins/index.php/economics/issue/view/522>. DOI: <http://dx.doi.org/10.30970/ves.2022.62.0.6204> [original in Ukrainian].
2. G20 verdict: Oxfam criticizes G20 for lack of action to tackle extreme inequality / OCHA, 22nd November 2022. URL: <https://reliefweb.int/report/world/g20-verdict-oxfam-criticizes-g20-lack-action-tackle-extreme-inequality>.
3. Global inequality is a failure of imagination. Here's why / World Economic Forum. Davos, 2023. URL: <https://www.weforum.org/agenda/2023/01/global-inequality-is-a-failure-of-imagination/>.
4. Middleton, C. Davos 2023: does tokenization solve any real-world problems? Davos : WEF, 2023. URL: <https://diginomica.com/davos-2023-does-tokenization-solve-any-real-world-problems>.
5. Going mainstream: four Web3 developments to watch in 2023 / WEF. Davos : WEF, 2023. URL: <https://www.weforum.org/agenda/2023/01/four-web3-developments-davos2023/>.
6. Shumba, C. Goldman Sachs Says It Is Exploring the Tokenization of Real Assets. URL: <https://www.coindesk.com/business/2022/04/27/goldman-sachssays-it-is-exploring-the-tokenization-of-real-assets/>.
7. McCurdy, W. BlackRock CEO Says ‘Next Generation for Markets’ Is Tokenization. URL: <https://decrypt.co/116145/blackrock-ceo-says-next-generation-markets-is-tokenization>.
8. Elliott, S. Singapore Tests Institutional DeFi on Ethereum, Welcomes USDC Issuer. URL: <https://decrypt.co/113413/singapore-tests-institutional-defi-on-ethereum-welcomes-usdc-issuer>.
9. Skinner, C. 2023 according to 11FS, IBM, McKinsey, Accenture, PwC, EY, KPMG, Deloitte and me. January 23, 2023. URL:

<https://thefinanser.com/2023/01/summarising-the-outlook-for-2023-from-11fsibm-mckinsey-pwc-ey-kpmg-and-deloitte>.

10. Work in the age of data / BBVA, 2020. 14 p. URL: <https://bbva.info/2SOUC49>.

11. Chetty, R., Grusky, D., Hell, M., Hendren, N. (2017). The Fading American Dream: Trends in Absolute Income Mobility Since 1940. *Science*. 2017. No. 356(6336). p. 398–406.

12. Poverty / Council of Europe. Strasbourg : Council of Europe, 2019. URL: <https://www.coe.int/uk/web/compass/poverty> [original in Ukrainian].

13. G20 High-Level Principles for Digital Financial Inclusion / G20. Beijing, 2016. 32 p. URL: <https://www.gpfi.org/sites/gpfi/files/G20%20High%20Level%20Principles%20for%20Digital%20Financial%20Inclusion.pdf>.

14. Menat, R. (2016). Why we're so excited about FinTech / The FinTech Book, 2016. URL: <https://doi.org/10.1002/9781119218906.ch2>.

15. Kern, A. (2019). Financial technology, digital currencies and inclusion / Principles of Banking Regulation. Cambridge : Cambridge University. p. 329–346. URL: <https://doi.org/10.1017/9781108551557>.

16. GPMI Issues Paper Digital Financial Inclusion and the Implications for Customers / GPMI. October 2014. URL: https://slidelegend.com/issues-paperdigital-financial-inclusion-and-the-implicationsgpfi_59c55b1f1723dd5242be2c7d.html.

17. UFA2020 Overview: Universal Financial Access by 2020 / WorldBank. New York : WorldBank, 2018. URL: <https://www.worldbank.org/en/topic/financial-inclusion/brief/achieving-universalfinancial-access-by-2020>.

18. Sen, A. (2014). Inequality reexamined. *Essays and Reviews*. p. 1959–2002. DOI: 10.2307/40184045.

19. UN-DESA (2015). Concepts of inequality. Development Issues No. 2 United Nations. URL: www.un.org/en/development/desa/policy/wess/wess_dev_issues/dsp_policy_01.pdf.

20. Demirguc-kunt, A., Klapper, L., Singer, D. (2017). Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence. *Policy Research Working*

Paper. p. 1–27.

21. Bartlett, R., Morse, A., Stanton, R., Wallace, N. (2019). Consumer-lending discrimination in the FinTech era. Cambridge : National Bureau Of Economic Research. 44 p. URL: <https://www.nber.org/papers/w25943.pdf>.

22. Philippon, T. (2019). On FinTech and financial inclusion. *National Bureau of Economic Research*. p. 162–172. DOI: 10.4337/9781788114226.00024.

23. Gathoni, A. (2018). Impact of Mobile Financial Services on Household's Welfare and Inequality: Evidence from Kenya: Ph.D in Public Policy. Seoul : KDI School. 136 p.

24. ASEAN digital generation report: digital financial inclusion (Insight report). Geneva : WEF, 2022. 24 p. URL: www3.weforum.org/docs/WEF_ASEAN_Digital_Generation_Report_2022.pdf.

25. Greenwood, J., Jovanovic, B. (1990). Financial development, growth, and the distribution of income. *Journal of Political Economy*. No. 98(5). p. 1076– 1107.

26. Dunayev, I., Kud, A., Latynin, M., Kosenko, A., Kosenko, V., Kobzev, I. (2021). Improving methods for evaluating the results of digitizing public corporations. *Eastern-European Journal of Enterprise Technologies*. No. 6(13–114). p. 17–28. DOI: 10.15587/1729-4061.2021.248122.

27. Dabla-Norris, E., Ji, Y., Townsend, R., Unsal, D. (2015). Identifying constraints to financial inclusion and their impact on GDP and inequality: A structural framework for policy. *IMF Working Papers*. No. 15(22). p. 1. DOI: 10.5089/9781498381598.001.

28. Sahay, R., Cihak, M., N'Diaye, P. (2015). Financial Inclusion: Can it Meet Multiple Macroeconomic Goals? *Staff Discussion Notes*. No. 15(17). p. 1. DOI: 10.5089/9781513585154.006.

29. Honohan, P. (2008). Cross-country variation in household access to financial services. *Journal of Banking and Finance*. DOI: 10.1016/j.jbankfin.2008.05.004.

30. Beck, T., Demirgüç-Kunt, A., Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*. No. 12(1). p. 27–49. DOI: 10.1007/s10887007-9010-6.

31. Kim, J. (2016). A study on the effect of financial inclusion on the relationship between income inequality and economic growth. *Emerging Markets Finance and Trade*. No. 52(2), p. 498–512. DOI: 10.1080/1540496X.2016.1110467.
32. World Bank (2018). Overview of financial inclusion 2018. URL: www.worldbank.org/en/topic/financialinclusion.
33. World Bank (2021). UFA2020 Overview: Universal Financial. URL: www.worldbank.org/en/topic/financialinclusion/brief/achieving-universalfinancialaccess-by-2020.
34. Lakner, C., Milanovic, B. (2015). Global income distribution from the fall of the Berlin wall to the great recession. *Revista de Economia Institucional*. No. 17(32), p. 71–128. DOI: 10.1596/1813-9450-6719.
35. Andrews, D., Criscuolo, C., Gal, P. (2016). The best versus the rest: the global productivity slowdown, divergence across firms, and the role of public policy. OECD Productivity Working Paper, No. 5. Paris : OECD. 98 p.
36. Krugman, P. (2016). Robber Baron Recessions. *The New York Times*. April 18, 2016. URL: <https://www.nytimes.com/2016/04/18/opinion/robber-baronrecessions.html>.
37. Stiglitz, J. (2016). Monopoly's New Era. *Project Syndicate*. May 13, 2016. URL: <https://www.project-syndicate.org/commentary/high-monopolyprofits-persist-in-markets-by-joseph-e--stiglitz-2016-05>.
38. Summers, L. (2016). Corporate Profits are Near Record Highs. Here's Why That Is a Problem. *The Washington Post Wonkblog*. March 30, 2016. URL: <https://www.washingtonpost.com/news/wonk/wp/2016/03/30/larry-summerscorporate-profits-are-near-record-highs-heres-why-thats-a-problem/>.
39. Kurz, M. (2018). On the Formation of Capital and Wealth: IT, Monopoly Power and Rising Inequality. *Working Paper 17–016*. Stanford, CA : Institute of Economic Policy Research, 2018. URL: <https://siepr.stanford.edu/publications/working-paper/formation-capital-andwealth-it-monopoly-power-and-rising-inequality>.
40. Haskel, J., Westlake, S. (2019). Capitalism without Capital: The Rise of the Intangible Economy. *Princeton university press*. 296 p.

41. Dunayev, I., Byelova, L., Kud, A., Rodchenko, V. (2023). Implementation of the “government as a platform” concept: assessment method and optimal human-centered structure to address technological challenges. *Eastern-European Journal of Enterprise Technologies*. No. 2(13(122)). DOI: 10.15587/1729-4061.2023.275613.
42. Denk, O. (2015). Financial sector pay and labor income inequality: evidence from Europe. *Economics Department Working Paper*. No. 1225. Paris : OECD. 35 p. DOI: 10.1787/5js04v5wjw9p-en.
43. Wolff, E. (2014). Household wealth trends in the U.S., 1962–2013: what happened over the Great Recession? *NBER Working Paper Series*. No. 20733. Cambridge, MA : National Bureau of Economic Research.
44. Tummala, R., Roch, R., Yi Tan, X. The 10x Potential of Tokenisation / HSBC. Hong Kong, 2021. 11 p.
45. **Bitbon** is the key for Ukraine to the world of innovative platform economy / TSN. 2023. URL: <https://pr.tsn.ua/groshi/bitbon-klyuchdlya-ukrayini-u-svit-innovaciyanoi-platformnoi-ekonomiki-2300176.html> [*original in Ukrainian*].
46. Digital Assets, Private Markets Offer the Greatest Opportunities / Bain & Company; T. Olsen, J. Fildes, K. Gridl. URL: <https://www.bain.com/insights/fordigital-assets-private-markets-offer-the-greatest-opportunities/>.
47. Institutional Investing 2.0. Migration to digital assets accelerates : 2022 Survey of Global Institutional Clients / BNY Mellon. Celent. URL: <https://www.bnymellon.com/content/dam/bnymellon/documents/pdf/insights/migration-digital-assets-survey.pdf>.
48. Deep Shift: technology tipping points and societal impact / WEF. Geneva : WEF, 2015. 44 p. URL: https://www3.weforum.org/docs/WEF_GAC15_Technological_Tipping_Points_report_2015.pdf.
49. Draft Law on tokenized assets and crypto-assets 4328 dated November 5, 2020. URL: <https://itd.rada.gov.ua/billInfo/Bills/Card/4570> [*original in Ukrainian*].
50. Kud, A. A. (2021). Comprehensive Classification of Virtual Assets. *International Journal of Education and Science*. Vol. 4. No. 3–4. p. 64–91. DOI: 10.26697/ijes.2021.3.6 [*original in Ukrainian*].

51. Kud, A. A. (2021). Decentralized Information Platforms as a Tool for Modernization of Public Administration. *Bulletin of Postgraduate Education: Management and Administration Series*. No. 1. Vol. 15(44). p. 233–274. DOI: 10.32405/2522-9931-2021-15(44)-233-274 [*original in Ukrainian*].

52. Survey results regarding the possibility of introducing the e-hryvnia / NBU. 2021. URL: https://bank.gov.ua/admin_uploads/article/Ehryvnya_2021.pdf?v=4 [*original in Ukrainian*].