

## FINTECH AS A DIGITAL DIMENSION OF STABLE DEVELOPMENT

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*The subject of the article is a study of the formation, development and implementation of Fintech technologies in the context of ideologies of sustainable development and innovation DeFi (Decentralized Finance) [6], caused by the intensification of large-scale digital economy and global digitalization of all spheres of industry and services. blockchain and prospects for the spread of the Internet of Things (IoT) in combination with artificial intelligence (AI).*

*Results of work.* Features of chronology and joint course of epochs of industrial evolution together with stages of development of the financial technologies based on a combination and integration of so-called, drivers of "Fintech for sustainable development" (FT4SD) are designated and characterized. The toolbox of FT4SD is shown to be a triad of blockchain, AI and IoT, which together provide a synergistic effect of "decentralized finance", creating a virtually unlimited investment resource for technological innovation in the digital economy within the processes of sustainable development.

*Conclusions.* Despite the difficult economic and epidemiological situation in the world in general and in Ukraine in particular, it has been shown that the ideology of "decentralized finance" has had and will have a positive result.

*Keywords:* Fintech, sustainable development, investment resources, decentralized finance, blockchain, AI, IoT.

## «ФІНТЕХ» ЯК ЦИФРОВИЙ ВИМІР СТАЛОГО РОЗВИТКУ

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*Предметом статті є дослідження проблематики становлення, розвитку та впровадження технологій Фінтеху в контексті ідеологій сталого розвитку та інновацій DeFi (Decentralized Finance) [6], які спричинені інтенсифікацією процесів масштабного охоплення цифровою економікою і глобальною діджиталізацією усіх сфер виробництва та послуг, особливо, під впливом концепцій блокчейн та перспектив поширення «Інтернету речей» (IoT) в комплексі з методами штучного інтелекту (AI).*

*Результати роботи.* Окреслені і охарактеризовані особливості хронології та спільного протікання епох промислової еволюції разом зі стадіями розвитку фінансових технологій, які базуються на сполученні та інтеграції, так званих, драйверів «Фінтех для сталого розвитку» (FT4SD). Показано, як інструментальну основу FT4SD складає триада блокчейн, AI та IoT, які разом забезпечують синергійний ефект «децентралізованих фінансів», створюючи, фактично, необмежений інвестиційний ресурс для технологічних інновацій цифрової економіки в межах процесів сталого розвитку.

*Висновки.* Незважаючи на складну економіко-епідеміологічну ситуацію в світі взагалі і в Україні, зокрема, продемонстровано, який позитивний результат має і матиме ідеологія «децентралізованих фінансів», яка через трансформацію та спільне використання інструментів Фінтех здатна забезпечити сталий розвиток і стабільний підйом цифрової економіки.

*Ключові слова:* фінтех, сталий розвиток, інвестиційні ресурси, децентралізовані фінанси, блокчейн, AI, IoT.

## «ФИНТЕХ» КАК ЦИФРОВОЕ ИЗМЕРЕНИЕ СТАБИЛЬНОГО РАЗВИТИЯ

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**Предметом статьи** является исследование проблематики становления, развития и внедрения технологий Финтех в контексте идеологии стабильного развития и инноваций DeFi (Decentralized Finance) [6], вызванных интенсификацией процессов масштабного охвата цифровой экономикой и глобальной диджитализацией всех сфер производства и услуг, особенно под влиянием концепций блокчейн и перспектив распространения «Интернета вещей» (IoT) в комплексе с методами искусственного интеллекта (AI).

**Результаты работы.** Обозначенные и охарактеризованы особенности хронологии и совместного протекания эпох промышленной эволюции вместе со стадиями развития финансовых технологий, основанных на сочетании и интеграции, так называемых, драйверов «Финтех для устойчивого развития» (FT4SD). Показано, как инструментальную основу FT4SD составляет триада блокчейн, AI и IoT, которые вместе обеспечивают синергический эффект «децентрализованных финансов», создавая фактически неограниченный инвестиционный ресурс для технологических инноваций цифровой экономики в пределах процессов устойчивого развития.

**Выводы.** Несмотря на сложную экономико-эпидемиологическую ситуацию в мире вообще и в Украине, в частности, показано, положительный результат имеет и будет иметь идеология «децентрализованных финансов», которая через трансформацию и совместное использование инструментов Финтех способна обеспечить устойчивое развитие и стабильный подъем цифровой экономики.

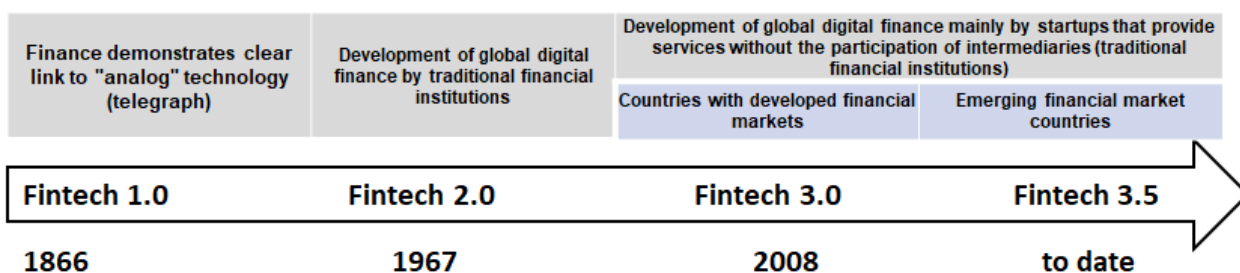
**Ключевые слова:** Финтех, устойчивое развитие, инвестиционные ресурсы, децентрализованные финансы, блокчейн, AI, IoT.

*Relevance of the research topic.* Trends in the modern economy increasingly confirm that "in the face of growing climatic, environmental and social challenges and risks, the requirements of reliability and stability of global, regional and national financial systems in the long run can be met only by harmonizing these requirements with sustainable development" [1]. The financial system consists of institutional units and markets that interact to mobilize funds for investment and provide them, including payment systems, not so much to finance business as to refocus on the fintech and technological innovation sectors. The role of financial institutions within such a system is mainly an intermediate link between those who provide funds and those who need them, which usually entails the need to transform and manage the risks of the entire socio-economic system and, above all, its human capital, innovative resources and investment potential.

*Formulation of the problem.* Without diminishing the role of banking institutions, which play an important role in assessing risks, obtaining loans and confirming the issuance of shares and debts, it should be noted the emergence of new financial innovations, increasingly related to the digital economy and virtual assets. In this context, short- and medium-term bank deposits are no longer very good and do not always fit to keep long-term assets on the balance sheet of their investors. Therefore, capital markets serve as platforms to enhance the ability of long-term debt or asset-backed securities to be sold to institutional investors, such as pension funds, insurers and sovereign wealth funds, that have long-term liabilities and must meet these long-term assets in the context of fintech transformations dealing modern finance.

*Analysis of recent research and publications.* On the one hand, Fintech

instruments work for the financial system to mobilize sources of long-term investment and as a means of transferring monetary policy to the real economy, which also depends on the efficient operation of the traditional financial system, i.e., banks, capital markets and institutional investment as a system. distribution of capital. On the other hand, fintech today represents the sector of technology startups, whose products replace traditional financial market participants, in most cases – banking and insurance institutions, by offering a wide range of consumers alternative solutions without the participation of such intermediaries and, consequently, for a lower fee. In this context, we can identify 4 epochs of development of Fintech industry from 1.0 to 3.5, which cover a long period of financial development of more than 150 years and according to [1, p.15] represent Fintech from the primary telegraph to modern digital and virtual technologies (Fig. 1).



**Figure.1. General chronology of Fintech development.**

Figure 1 highlights the epochs of Fintech 3.0 and 3.5 for countries with financial markets at different stages of development. Moreover, sometimes emerging financial markets are significantly ahead of traditional markets of developed countries in the implementation of innovations Fintech and Central Banks of developed countries have to catch up and adapt to changing conditions and new financial products. This situation today is typical, for example, for cryptocurrencies and blockchain.

*Selection of unexplored parts of the general problem.* At the same time, insurance continues to play an important role as a risk manager, risk bearer and investor at the same time. Insurers help prevent and reduce risks using a variety of disaster risk and loss prevention models. Insurance pricing also signals risk and reduces it, and insurers are large investors because they manage assets worth \$ 29 trillion [3, p.32]. Financial systems are crucial both for large-scale projects and corporate enterprises in terms of being able to mobilize capital and transfer risks, and for small, medium, micro-enterprises and households to plan and invest in the long run.

*Problem statement, research goals.* Regarding the support of sustainable development, the main tasks of financial systems are the implementation of two goals of investment and management nature:

- ensure the mobilization of funding for specific priorities for sustainable development;
- monitoring and taking into account the factors of sustainable development in the financial decision-making process.

The task of financial mobilization has a wide range: from the inclusion of certain groups in the investment process (e.g., low-income citizens), raising capital for sustainable and resilient infrastructure (e.g., energy) to finance critical areas of innovation (e.g., offshore energy solutions, small agriculture, sustainable land use and fisheries, important in modern conditions measures to fund medical research and control pandemics).

*Method or methodology of the study.* Expert estimates confirm that 5-7 trillion. dollars The United States is needed annually to achieve the goals of sustainable

development on a global scale. Developed countries receive an annual investment of about \$ 2.5 trillion in areas such as infrastructure, clean energy, water supply and agriculture, ecology and ecosystems [9, 10]. Monitoring and accounting for sustainability is becoming increasingly important, stability factors are relevant and essential for decision-making by financial institutions in terms of sustainable development. Support and implementation of global sustainable development projects begins with ensuring market integrity (for example, fighting corruption, forming and securing new public resource markets, improving the efficiency of existing markets and shrinking traditional markets due to the loss of their prospects) and extends to the integration of environmental and social factors. risk management (for example, climate-related risk ratings of biological assets, risk transfer in agriculture and joint assets focused on global risk diversification).

*Presentation of the main material.* In today's environment, sustainability is already included in disclosure and reporting responsibilities (e.g., property registers and movable assets, IFRS, knowledge bases and taxonomies of financial information based on universal language tools such as XBRL) for market participants to manage decisions based on global security and information protection factors.

According to leading financial scientists [11], the world community today is at the stage of the fourth or even the beginning of the fifth industrial revolution, which began in the XXI century due to the widespread use in production of digital and information technologies, which originated during the previous revolution, namely – the Internet, 3D printing, bio- and nanotechnology, advances in artificial intelligence, genetic engineering, space breakthrough technologies, etc. At the same time, the period of industrial development provided an opportunity to witness the introduction into production of such previously unknown technologies as blockchain (Table 1) in the field of IT and electronic payment systems.

**Table 1. Generalized characteristics of world industrial revolutions**

<b>Industrial Revolution, period (years, approx.)</b>	<b>Key technological achievements</b>	<b>The main sources of energy</b>	<b>Description</b>
The first (1760-1900)	Steam engine	Coal	Steam and hydropower are used for mechanization of production
The second (1900-1970) "Technological revolution"	Internal combustion engine	Oil, electricity	Mass production is made possible by the use of electricity
The Third (1970-2000) "Digital Revolution"	Internet, IoT, computers and robots, 3D printing, genetic engineering, artificial intelligence, data analysis, virtual and mixed reality	Atomic energy, natural gas	Production automation is carried out with the help of electronics and information technology
Fourth (2000-...) Industry 4.0	Fintech, IoT globalization, blockchain, industrial nano-, biotechnology, genetic engineering and 3D printing	Green energy	Almost all production is automated, it uses artificial intelligence and data analysis, human intervention is completely or almost absent; information is stored on the

			blockchain
Fifth (...? ...)	Industrial IoT, collaborative work ("cobots") – machines that require physical human intervention during their work to obtain a better end product		Personalized products are manufactured in accordance with the requirements and needs of consumers; collaborative work is used, and therefore the human factor again becomes key in production

In the 4th period of the industrial revolution, the connection between financial technology and sustainable development in a new area, which is commonly called "Fintech for Sustainable Development" (FT4SD), was actually formed.

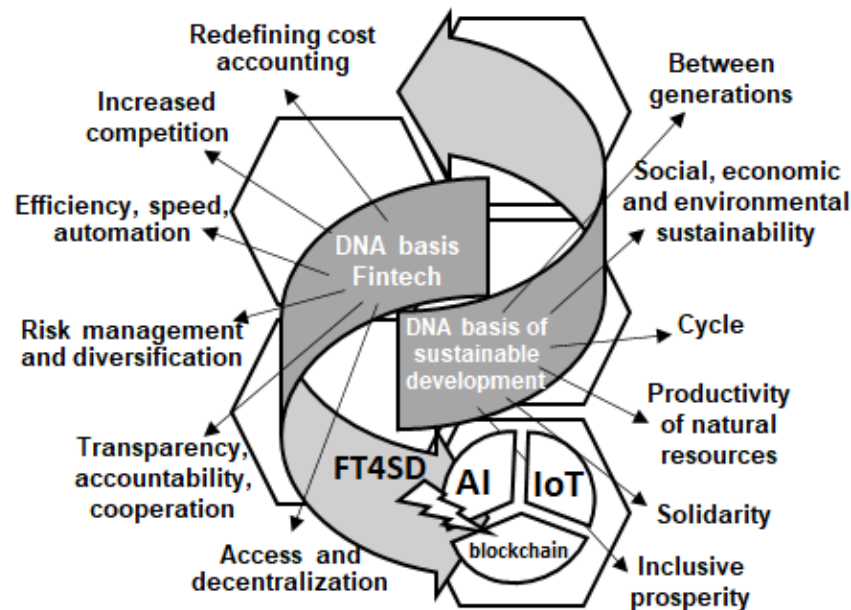
We can assume that even in the publications of the 3rd period of the industrial revolution [3, p.34] laid the scientific foundations of Fintech concepts through the definition of three types of costs in the economy: the cost of search, coordination and contracting, which assumes that the firm expands to as long as the cost of the transaction within the firm does not exceed the cost of the transaction outside it. Basically, this thesis concerns information-related costs and the prediction that Fintech can destroy many functions of the financial system and the real economy, significantly reducing the cost of search, coordination and through the reduction of transaction costs. In subsequent publications in Nature, in January 2013, scientists demonstrated the ability of DNA to encode information to store digital data [10]. The use of the double-stranded DNA analogy to describe the main attributes of the FT4SD process is becoming a trend in many scientific publications, as the idea of coding, processing and storing information on the basis of genetic engineering in Fintech is spread and fixed theoretically, mathematically and instrumentally [3, p.32].

Hidalgo's research [7] examines the relationship between information and knowledge, their development, dissemination, use and implementation, and how this determines the complexity of the economy around the world and, consequently, their ability to develop over time. The author notes that most DNA molecules consist of two helix strands that form a double helix, and consist of simpler units, the so-called bases, which are combined, in turn, in predetermined ways of gene generation and encode all life forms on land. To understand the fundamental attributes (or basics of DNA) of Fintech and sustainable development as factors of destruction and influence, the use of the language "double helix FT4SD" is proposed (Fig. 2). These two concepts can also be "connected" in predetermined ways to create new sustainable business models. It helps to explore and influence change and provide a common language to discuss both the positive and negative effects of FT4SD – effectively ensuring the use of metalanguage for communication between the financial, industrial and technological spheres, taking into account the priority and importance of social and humanitarian components.

The concept of fintech today as a phenomenon, along with the positive attitude of the world community, is also of concern, in particular from representatives of regulatory bodies. The reason for this is not the financial technologies themselves, but the speed of their development and the integrity of the intentions of those who use them. Thus, the era of modern society is marked by a new digital economy, which, according to professor of fintech and blockchain D. Kuo Chuen Lee (Singapore), provides for the presence of four "D" [1, p.23]:

- *Digitalization* (digitization);
- *Disintermediation* (reduction of the use of intermediaries);
- Democratization and

- *Decentralization.*



**Figure.2. Double DNA helix FT4SD.**

The combination of these four factors has given society, in addition to innovative forms of doing business (digital nomadism, Digital Nomadism) and everyday digital life (social networks, Social Networks) also a synergistic effect – the fifth industrial revolution is expected to bring back the human factor (Human Touch) in production in a broad sense [13, p.24]. According to some forecasts, in the future the industry will again feel the urgent need for human intervention due to the influence of behavioral factors (e.g., the desire to stand out from the crowd with exclusive things), because the driver of any change is not new technology, but the person behind them. her personality. While some professions will disappear due to primitive robotization, new ones will appear – those that require a suitably skilled workforce [9, p.12] with an emphasis on intelligence and decision-making.

The influence of the digital economy and these 4D factors have a significant impact on the "Fundamentals of DNA Fintech", which can be characterized by various processes and which conditionally constitute the left side of the double helix of DNA (Fig. 2):

- maximum availability and decentralization of the financial system: elimination of unnecessary intermediaries, implementation of reasonable contracts in the financial sector, reduction of production, ancillary and financial cycles, tokenization of the economy;

- Improved transparency, simplified accountability and global cooperation: elimination of cross-sectoral boundaries and restrictions, copyright and protection, free exchange of information between regulators, citizens and businesses, open information in global projects in the public interest;

- "smart" risk management and diversification: preventive analysis and risk management using big data, development of infrastructure for early warning, identification and diversification of financial risks, improving information and financial security;

- cost savings, efficiency, speed and quality of informatization: the use of AI platforms (artificial intelligence) to support neural networks, genetic algorithms, pattern recognition methods, data mining and knowledge management to perform external and internal functions of the financial system;

- improved competition: expanding the competitive space through the introduction of Fintech startups, improving the investment climate, expanding the availability of investment resources, alternative products and financial services, flexible business models create a more affordable, cheaper choice for all participants;

- inventory and rethinking of traditional accounting models and financial reporting for valuation (constant) value: search for innovative models of IFRS and knowledge bases for fintech, associated with the gradual abandonment of double-entry bookkeeping authored by L. Pacioli 700 years ago, combining modern fintech methods with concepts of machine learning, neural networks, genetic methodologies, cryptoeconomics and blockchain, multi-scenario high-performance computing for algorithmic representation of the constant cost of fintech.

Reflected on the right in the double helix "Fundamentals of DNA of sustainable development" (Fig. 2) can also be characterized through FT4SD drivers integrated in the concepts of AI, IoT and blockchain:

-distribution and expansion of the common good for all: this approach will require the reduction of inequality and the provision of basic needs for humanity (basic resources, social, educational services, health, etc.);

- support for intergenerational solidarity: solidarity approaches and decisions are needed primarily within national borders (e.g., national funded pension and health insurance systems at various levels) and internationally (global insurance systems and funds), especially during periods and emergencies situations.

*Field of application of results.* Improving the consumption of natural resources: the use of water, energy, food, land and material resources of mankind can be improved by sharply reducing the impact of negative external factors on the environment and providing affordable access to all major natural resources to ensure a stable and balanced life and economics. Ensuring social, economic and environmental sustainability: this dimension of the sustainability of modern society has a global scale and to avoid catastrophic and irreversible changes requires maintaining the stability and sustainability of the financial system and natural infrastructure and its ecosystem functions in a global sense.

Situation with increased circularity: this concerns the destruction of entire industries and supply chains, where efficient flows of materials, energy, labor and information interact and contribute to the creation of a restitutionary, restorative and more productive economic system through the use of appropriate financial instruments.

Finally, the importance of intergenerational decision-making: it is a system of individual, business, governmental and collective decision-making to ensure and maintain a safe and habitable planet for future generations.

*Conclusions.* In a comprehensive presentation, the basics of DNA of financial technology and sustainable development (Fig. 2) are connected using so-called "DNA connectors", which are integrated into the "reducer FT4SD" and, if necessary, can be combined using different methods [ 4]. This combination of "FT4SD reducer" contains IoT (Internet of Things), blockchain (blockchain as a fixed register distributed on the Internet [12]) and AI (Artificial Intelligence – artificial intelligence), which are able to provide a large-scale sustainable development program for modern world community. This is due to two factors, which are essentially a model of operation of the "FT4SD reducer":

1) The combination of IoT and AI allows you to implement a wide range of tasks that make up the set of both DNA helices for sustainable development and were considered within the "reducer FT4SD" in terms of involving blockchain drivers as a second factor. In turn, the use of "IoT and AI reducers" provides the implementation of many projects, programs and startups, where individual methods, algorithms and AI models are tools, and IoT space is a set of products, services and services that are the



result of the entire Fintech system. sustainable development ecosystem;

2) The use of blockchain as a second factor is designed to solve two tasks: a) the creation of an electronic peer-to-peer cryptocurrency system as an environment for the subsequent use of decentralized finance in the implementation of startups "IoT + AI" described in the previous paragraph; b) use of "smart contracts" technology based on "multi-signature" methods at all stages of startups (from justification, search and mobilization of investment resources, to the implementation and implementation of startups mentioned in the first paragraph ).

Creating and maintaining this two-factor interoperability between the real economy and the financial system will have, in our view, positively revolutionary consequences. "FT4SD reducer" easily connects drivers of financial technologies with drivers of sustainable development. The FT4SD portfolio is an inexhaustible but representative set of case studies for all five key financial system functions, each of which can be connected to, enhanced, and enhanced by the drivers in question. In fact, the FT4SD innovation portfolio is characterized by applied geographical contexts, sustainable development goals, sustainable financial drivers, level of maturity and scalability, etc.

Finally, it can be assumed that Fintech will have many unpredictable consequences in many areas. Its rapid development already raises political issues regarding proper regulation and supervision. But, as a rule, regulators of financial systems focus their efforts on financial stability, rather than on the unintended consequences of the use of financial technologies, covering various areas that often fall within the competence of other sectoral regulators in telecommunications / IT, natural resource consumption, social security, ecology, education, etc. We hope that the issues of Fintech discussed in the article will help orient researchers and scientists in the context of financial innovations.

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