

<https://doi.org/10.7250/scee.2022.007>

ECONOMIC ISSUES OF BLOCKCHAIN USE IN BUSINESS: CHALLENGES OF INDUSTRY 4.0

**Oleksandr MATSENKO, Maryna TANASHCHUK,
Vladyslav PIVEN, Maryna MATIUSHCHENKO, Leonid MELNYK**

Sumy State University, Sumy, Ukraine

Corresponding author e-mail: matsenko@biem.sumdu.edu.ua

Abstract. Today's world is developing at a fast pace, and new technologies appear every day, the use of which is aimed at improving people's lives. Industry 4.0 involves automation of all processes and stages of production and helps to increase interconnectivity. In this context, blockchain is one of the most promising technologies, which in recent years has confirmed its effectiveness due to the increase in the profits of companies that use it. This technology makes it possible to significantly reduce the costs of companies, especially those that are participants in the stock market. Blockchain ensures high stability and consolidation of positions in the market. At the same time, blockchain is capable of changing the payment ecosystem by improving the efficiency of financial transactions around the world. With its help, it is possible for companies to reduce data processing costs and increase the volume of information flows. The article analyzes the advantages and disadvantages of this technology, its prospects, and steps to implement blockchain in business. The purpose of the research is to investigate the level of use of blockchain technology by Ukrainian companies and to consider existing global examples. The advantage of using blockchain technology is that it allows a company to record both sides of a transaction simultaneously in a shared ledger in real-time, rather than simply keeping verified records of financial transactions in separate privately created databases or ledgers. The main drawback of blockchain technology is the lack of a single regulatory framework regulating the use of this technology.

Keywords: *blockchain, business development, digitalization, Industry 4.0.*

JEL Classification: O36, M21

INTRODUCTION

Industry 4.0 is significantly changing the way businesses produce, improve and distribute their goods. A variety of new technologies appeared due to the Fourth Industrial Revolution. For example, blockchain technologies are already used in various fields of economic activity. It can be emphasized that the blockchain has gone beyond the sphere of cryptocurrencies and is being actively implemented in various spheres of business activity. The volume of expenses for the development of blockchain technologies, according to experts, amounted to 4.1 billion US dollars at the end of 2020. Therefore, the growth of the blockchain technology market is 50 % higher than in 2019. This fact looks impressive against the background of the coronavirus pandemic and the resulting decrease in economic activity in most traditional industries. There is a possibility that the pandemic has become catalyst for blockchain technologies, but this issue needs to be studied further. If analysts'

estimates turn out to be correct, and the industry continues to grow at a rate of 45 % per year, then by 2024 the number of expenses for the development of blockchain will amount to \$17.9 billion (Ellis et al., 2020).

At the moment, the volume of blockchain spending reaches only 0.1 % of the IT market, which cannot be considered a significant indicator (Kimani et al., 2020). But the absolute number is significant, and if we consider that the IT market has existed for more than 50 years and the blockchain technology market is just forming, and if we compare the above estimates of the growth of the blockchain market, we can emphasize that the implementation of blockchain in various fields of activity is an interesting and relevant subject of scientific research (Gartner, 2021).

The peculiarity of blockchain technologies lies in their transparency, security, integrity and, most importantly, in the fact that it is practically impossible to falsify. This, in turn, opens an endless stream of new opportunities for humanity in the field of economy and security. Big data storage, medical technology, instant money transfers abroad, electronic voting at the state level, means of exchange and accounting are different opportunities of blockchain. Today, society is just beginning to realize the scale and value of this technology, and scientists predict a big boom in the development of blockchain technologies in a few years. There is a high probability that thanks to the implemented technologies, traditional banking schemes will be completely pushed out of use. However, at the nascent stage of technology, it is still quite difficult to unambiguously predict its impact on the development of the world economy in the future. Therefore, the novelties in the IT market, namely blockchain technologies, their implementation in business and the optimization of all possible processes with their help, require further research.

The purpose of the study is to investigate the level of use of blockchain technology by Ukrainian companies and to consider existing global examples. Following the purpose of the research, following objectives can be outlined:

- to define the concept of blockchain and its key principles;
- to figure out the main advantages and drawbacks of the blockchain technology.
- to analyze the impact of blockchain on companies in Ukraine and all over the world.

1. LITERATURE REVIEW

Though the role of blockchain for Industry 4.0 is growing, there are still not enough scientific publications concerning this issue. Ellis S., Jewell J., Speer J.K. predict that if the industry continues to grow at a rate of 45 % per year, then by 2024 the volume of costs for the development of blockchain technologies will amount to \$17.9 billion (Ellis et al., 2020).

The Boston Consulting Group (BCG) predicts that the volume of the digital economy may reach \$16 trillion by 2035 (GeSI, 2012), and according to estimates by the World Economic Forum (World Economic Forum, 2018), digitalization has enormous potential for business and society and may bring to the world economy by 2025 year in addition to more than \$ 30 trillion income. Other authors wrote that the blockchain is a distributed database technology based on an ever-growing chain of records (Iansiti & Lakhani, 2017; Frizzo-Barker, 2020).

Some authors highlighted the main principles of blockchain (decentralization, security, transparency, immutability), as well as the main tasks in business that can be solved by blockchain technology (Pisarenko, 2012; Demirkan et al., 2020). Usenko A. singled out the

main shortcomings of blockchain technologies: irreversibility of transactions, lack of legal regulation of blockchain operation, "Attack 51" (Usenko, 2018; Beck et al., 2017).

Therefore, the relevance of the topic increases the demand for new researches in the field. Our study will make the contribution to the existing knowledge by considering practical issues of blockchain use in business in the context of Industry 4.0.

2. METHODOLOGY

In our study, a variety of research methods was used. We analyzed a lot of sets of textual or visual data collected from scientific literature and other trustworthy sources. The comparative analysis was utilized to figure out the differences in blockchain implementation in the five world-known companies. Analysis and synthesis were also applied to determine the key advantages and drawbacks of blockchain use in business. The authors also employed the analogy method to demonstrate the similarities and peculiarities of blockchain compared to other disruptive technologies. In the research, we also provide statistical data and develop its basic analysis.

3. RESULTS

Blockchain is a distributed database technology based on an ever-growing chain of records. At the beginning of its existence, it was used in cryptocurrencies, namely in Bitcoin technology, because it made it possible to conduct chain transactions with a high level of protection against falsification and forgery or theft of data, as well as enough high speed of transaction processing (Iansiti & Lakhani, 2017). The main innovation of the blockchain is the ability to create not only something related to cryptocurrencies but any service based on this technology. Blockchain-based business models may vary, but nevertheless, they all share important attributes such as transparency, security, integrity, and efficiency that set them apart from all other technologies. The following principles of blockchain technology are distinguished: decentralization, security, transparency, and immutability.

According to these principles, blockchain technology allows solving many tasks in business (Pisarenko, 2012):

- compromise when concluding an agreement with unreliable parties.
- there are few risks in blockchain technology. The algorithms are built in such a way that each block is linked to the previous one and when a new one is added (which is confirmed by each participant), the register is automatically updated;
- reduction of commission costs.
- blockchain technology significantly reduces business costs due to the absence of intermediaries;
- ensuring complete confidentiality.

To break the blockchain, you need access to the millions of computers involved in the network. It is technically almost impossible to do this. If we consider the application of the blockchain in the organizational and management activities of the enterprise, then the blockchain is a rather convenient tool for storing and distributing information (not only financial).

One of its advantages is that the decentralization of data storage provides greater reliability (security) than in the case of a centralized system (Usenko, 2018). Due to the

decentralization of storage, the reliability of the data transmission system is increased, the receipt of information by all interested parties at the enterprise does not require a centralized server, allowing to preserve information exchange even in the event of a temporary failure of the server equipment.

Also, an important advantage of blockchain technology in the field of data storage is its protection against possible modification due to the protection due to the very nature of the blockchain: the next added block cannot be changed afterwards. Thus, the main direction of non-financial use of blockchain technology at the enterprise is information support of the enterprise's activities, in particular, information support of organization and management processes.

The main advantages provided by the implementation of blockchain technologies are shown in Fig. 1.

Security of transactions	<ul style="list-style-type: none"> • There is little risk in blockchain. Each block of the system is linked to the previous one and cannot be removed or replaced. This means that you cannot be afraid that your counterparty will not fulfill its obligations.
Incorruptibility	<ul style="list-style-type: none"> • Blockchain is a technology. It cannot be bribed or deceived, and there is no such thing as the "human factor".
Minimum commissions	<ul style="list-style-type: none"> • Fees from many small transactions can add up to a significant amount at the end of the month. Blockchain, due to the absence of intermediaries, makes these costs minimal.
Speed of transactions	<ul style="list-style-type: none"> • Thanks to blockchain technology, it does not matter when the bank's business day ends and in which country the counterparty is located. Money transfer is made in 2-3 minutes at any time of the day.
Complete privacy	<ul style="list-style-type: none"> • Hacking the blockchain is almost impossible. For this, you need to have simultaneous access to hundreds and thousands of computers that are involved in the network. Therefore, by using the blockchain, companies guarantee themselves complete security.
Increasing trust on the part of customers	<ul style="list-style-type: none"> • Thanks to the blockchain, consumers can receive reliable data about the origin of the product, the date of packaging and the expiration date of the product, which significantly increases their loyalty to the seller.
Independence	<ul style="list-style-type: none"> • Blockchain does not depend on the political situation in different countries, due to which it opens up great opportunities for scaling.

Fig. 1. The advantages of the blockchain use (created by the authors).

The main obstacle to the use of blockchain is the extremely high degree of volatility of cryptocurrencies. Although there are examples of their use that have gained wide popularity, first of all, the \$1.5 billion purchase and the announcement of Tesla's intention to use bitcoins as a means of payment (Forbes, 2022). From this successful move and the jump in the cryptocurrency exchange rate caused by it, Tesla received a multibillion-dollar profit, which is not related to its core business and is recorded in the financial statements as non-operation income. These revenues are determined solely by the ratio of supply and demand for the cryptocurrency token.

The disadvantage of blockchain technology is the lack of a single regulatory framework regulating the use of this technology. This causes the level of trust of the users of the technology to be significantly lower. A more detailed list of shortcomings is presented in Fig. 2.

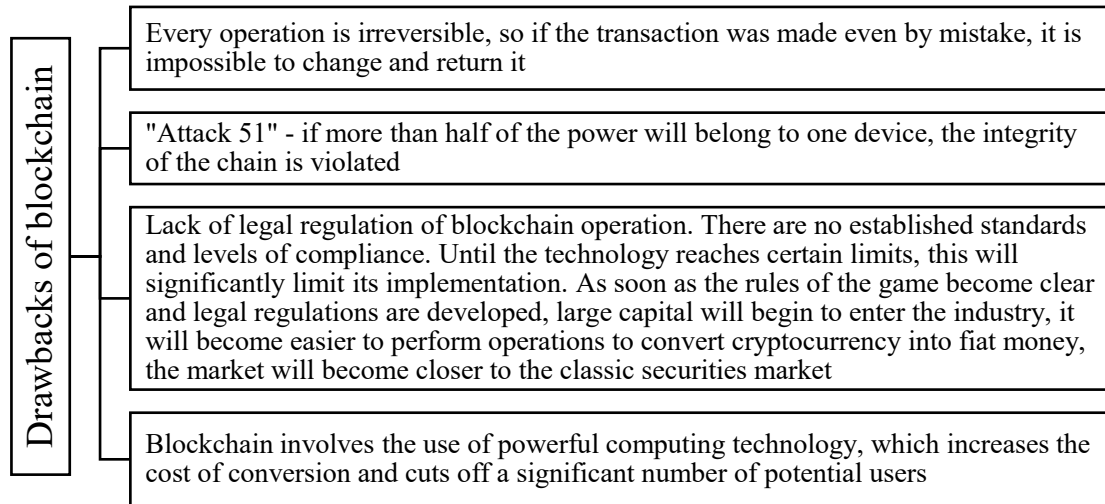


Fig. 2. The drawbacks of the blockchain use (created by the authors).

At the beginning of July 2020, the consulting company Deloitte summarized the results of a global survey and concluded that blockchain from an experimental technology is turning into a strategic priority for organizations. About 1500 senior executives in 14 countries took part in the survey, with 39 % of companies have already moved their blockchain pilot projects into production, compared to just 23 % in 2019. Moreover, 83 % of respondents in a Deloitte survey believe that they will lose a competitive advantage if they do not use blockchain. In 2019, only 77 % of respondents thought so.

The study revealed that blockchain projects are becoming an investment and strategic priority for many companies. Almost 90 % of respondents said that digital assets will become "very important" or "somewhat important" to the development of their industry in the next three years. At the same time, 82 % of respondents said that they hire or plan to hire employees who have already worked with blockchain projects (Enterprise, 2020).

Before involving blockchain technology in your business, it is important to analyze the characteristics and in general the possibility of implementing these technologies.

Any blockchain business idea should always consider three key factors:

- the value of blockchain technology;
- short-term return on investment in terms of growth;
- an individual plan for long-term action.

Many entrepreneurs are currently wondering how to correctly and expediently introduce innovative technologies into their businesses. The main steps of introducing blockchain technologies into business are shown in Fig. 3. It is important to mention that all these steps are flexible, and the team can return to any of previous stages if needed.

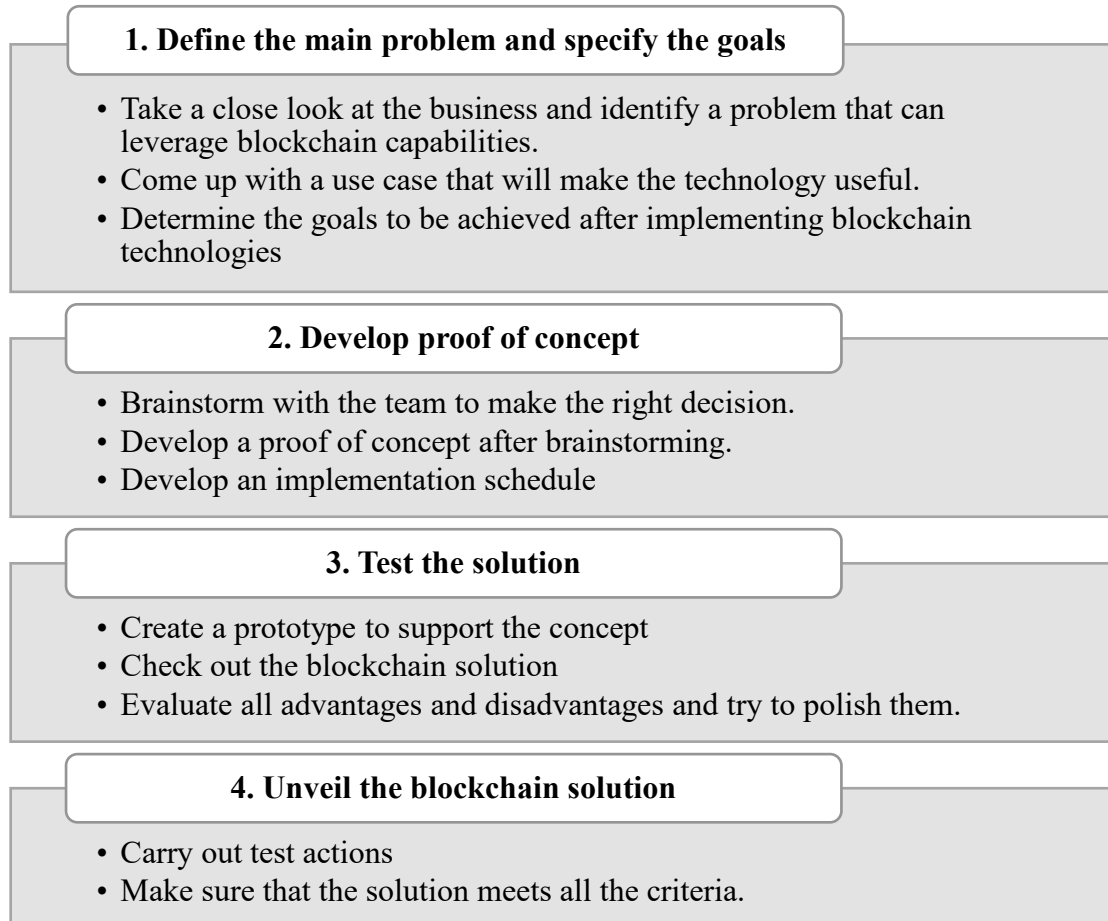


Fig. 3. The main steps of introducing blockchain technologies into business (created by the authors using (Imena, 2020)).

For example, a supply chain business may initially structure its blockchain business strategy to focus on reducing operational costs. In turn, this technology can help eliminate inaccuracies in the delivery process, as well as product loss, and, accordingly, reduce the time of its delivery.

Cost reduction is one of the most important and successful short-term goals as a way to achieve a return on investment through the use of blockchain technology (Nowiński & Kozma, 2017). For greater success after involving blockchain technologies in business, it is important to use the technology for one specific issue. Instead of trying to use the technology for all activities, businesses should configure the blockchain business strategy to focus on one problem. As an example of such an application, we can describe the experience of the five largest companies on the American stock market.

Table 1. Five world-famous companies that use blockchain technology in their activities (created by the authors using (Koybichuk & Rozhkova, 2020))

Company	About the company	How it uses blockchain
Amazon	A retail company that is known throughout the world for selling mass-produced goods on the Internet	This company started implementing blockchain as one of the first in the world market. It does not only use it in its activities but also supplies its developments for the use of blockchain in other enterprises

Meta	The company has two largest social networks (Facebook and Instagram), which are popular all over the world	This company uses blockchain to protect its users, as well as for effective advertising activities
Nestle	A Swiss company engaged in the production of food products	The company uses blockchain to research the wishes of customers, analyze their individual needs and adjust production to each region, which can significantly increase profits
Oracle	The largest software developer in the world	When developing its databases, this company uses blockchain algorithms, which increases the competitive advantage of their products
Visa	The world's largest payment system.	Blockchain technology is used to reduce cybercrime and protect customers, as well as enable payments around the world, which brings additional revenue

Ukraine is also on the list of leaders in the implementation of blockchain technology in the public sector, together with such developed countries as the USA, Canada, Brazil, Australia, Israel, UAE, Georgia, Estonia, the United Kingdom, France, Germany, and Sweden. Implementation of distributed ledger technology began in 2016 and is gradually gaining momentum. It is expected that soon, new blockchain-based projects will appear in both the public and private sectors because the introduction of information technologies into the activities of economic entities will significantly modify the business processes of their information provision and management. According to official statistics, 95.5% of enterprises in Ukraine use computer technologies in their activities; 32.8% of the average number of employees use computers and 82.6% of them have access to the Internet; 98.1% of enterprises have access to the Internet (Rada, 2018). Therefore, Ukrainian companies have significant opportunities in blockchain adoption and overall business digitalization.

CONCLUSION

Industry 4.0 changes the way companies and national economies function. New disruptive technologies, including blockchain, are quite promising because of a variety of opportunities they offer. Managers will not have to hire a large staff of employees to collect all the necessary information. Also, companies will not have to spend a lot of money on the purchase of consulting services. All this will lead to the fact that organizations will have more free money at their disposal, which they can direct to the development and expansion of business, and this will have a very positive effect on the Ukrainian economy in general. In addition, there will be an opportunity to eliminate potential violations in the tax field.

Today, in Ukraine, blockchain has found its application mainly in the financial sphere. Thus, on its basis, the register of bank guarantees works. This register accumulates and provides information on issued bank guarantees and serves the provision of new guarantees. In addition, on the basis of blockchain technology, a register of transactions with securities has been created. With the help of this register, reports on concluded agreements are compiled.

Therefore, blockchain is an important modern achievement, the scope of which is constantly expanding. Caution in the use of blockchain technologies is due to the need to further study the risks of their operation and the peculiarities of adaptation in the conditions of the national economy. Despite a large number of advantages, not all possible features of

the blockchain have been fully explored. But it is possible to confirm the effectiveness of the blockchain and predict a great future for it.

ACKNOWLEDGMENT

This work has been supported by a grant from the state budget of the Ukraine “Fundamentals of the phase transition to the additive economy: from disruptive technologies to institutional sociologization of decisions” No. 0121U109557.

REFERENCES

- Ellis, S., Jewell, J., Speer, J.K. (2020). *Worldwide Supply Chain Management Applications Market Shares*. IDC. Retrieved from <https://www.idc.com/getdoc.jsp?containerId=US46435921>
- Kimani, D., Adams, K., Attah-Boakye, R., Ullah, S., Frecknall-Hughes, J., & Kim, J. (2020). Blockchain, business and the fourth industrial revolution: Whence, whither, wherefore and how? *Technological Forecasting and Social Change*, 161, 120254.
- Gartner Forecasts Worldwide IT Spending to Grow 6.2% in 2021. (2021). Retrieved from <https://www.gartner.com/en/newsroom/press-releases/2020-01-25-gartner-forecasts-worldwide-it-spending-to-grow-6-point-2-percent-in-2021>
- GeSi (2012). *GeSISMARTer 2020: The Role of ICT in Driving a Sustainable Future*. Boston: Boston Consulting Group. Retrieved from https://www.telenor.com/wp-content/uploads/2014/04/SMARTer-2020-The-Role-of-ICT-in-Driving-a-Sustainable-Future-December-2012_2.pdf
- The Future of Jobs Report 2018. World Economic Forum. Retrieved from https://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf
- Iansiti M. Lakhani K.R. (2017). The truth about blockchain. Harvard Business Review. Retrieved from https://enterpriseproject.com/sites/default/files/the_truth_about_blockchain.pdf
- Frizzo-Barker, J., Chow-White, P. A., Adams, P. R., Mentanko, J., Ha, D., & Green, S. (2020). Blockchain as a disruptive technology for business: A systematic review. *International Journal of Information Management*, 51, 102029.
- Pisarenko, V. P. (2012) Implementation of electronic documentation in state and local self-government bodies. *Public administration: theory and practice*, 2, 43–54.
- Demirkan, S., Demirkan, I., & McKee, A. (2020). Blockchain technology in the future of business cyber security and accounting. *Journal of Management Analytics*, 7(2), 189–208.
- Usenko, A. (2018) Perspektyvy blockchain dlya biznesu i ukrayins'koyi ekonomiky. Finance. Retrieved from <https://news.finance.ua/ua/news/-/427333/andrij-usenko-perspektyvy-blockchain-dlya-biznesu-i-ukrayinskoyi-ekonomiky>
- Beck, R., Avital, M., Rossi, M., & Thatcher, J. B. (2017). Blockchain technology in business and information systems research. *Business & information systems engineering*, 59(6), 381–384.
- Elon Musk's Tesla bought almost a billion worth of bitcoins. Forbes. Retrieved from <https://forbes.ua/news/ilon-mask-prodav-bitkoiniv-tesla-mayzhe-na-milyard-tse-sprichinilo-korotkotrivale-padannya-kriptovalyuti-21072022-7289>
- Blockchain. (n.d.). Enterprise. Retrieved from <https://www.it.ua/knowledge-base/technology-innovation/blockchain>
- Blokcheyn — tse ne mahiya, abo yak vprovadzhuvaty tekhnolohiyu v biznes. Blog.Imena. Retrieved from <https://www.imena.ua/blog/how-to-deal-with-blockchain>
- Nowiński, W., & Kozma, M. (2017). How can blockchain technology disrupt the existing business models? *Entrepreneurial Business and Economics Review*, 5(3), 173–188.
- Koybichuk, V. V., Rozhkova M. S. (2020) Doslidzhennya zastosuvannya blokcheyn-tekhnolohiy u diyal'nosti svitovykh pidpryemstv: metodychnyy pidkhid. *Pryazovs'kyy ekonomichnyy visnyk*, 4(21), 118–123.
- Pro skhvalennya Kontseptsiyi rozvytku tsyfrovoyi ekonomiky ta suspil'stva Ukrayiny na 2018–2020 roky ta zatverdzhennya planu zakhodiv shchodo yiyi realizatsiyi: Rozporyadzhennya Kab. Ministriv Ukrayiny vid 17.01.2018. № 67-r. Retrieved from <https://zakon.rada.gov.ua/laws/show/67-2018-%D1%80#Text>

AUTHORS' SHORT BIOGRAPHY



Oleksandr M. Matsenko. He graduated from Sumy State University, Specialty “Business Economics”, 2005. Diploma with honours, 1971. He received the Ph.D. degree from 2009.

Associate Professor of the Department of Economics, Entrepreneurship and Business Administration of Sumy State University.

Scientific Interests: Competitive Strategy of the Enterprise, Digital Transformation, Industry 4.0.

E-mail: matsenko@biem.sumdu.edu.ua

ORCID iD: <https://orcid.org/0000-0002-1806-2811>.



Maryna S. Tanashchuk. Student of the Academic and Research Institute of Business, Economics and Management, Sumy State University.

Scientific Interests: Information economy; Industry 4.0; Blockchain; Business Development; Digitalization.

E-mail: tanashchuk@gmail.com

ORCID iD: <https://orcid.org/0000-0001-5596-2918>.

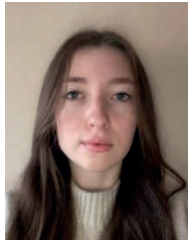


Vladyslav S. Piven. Student of the Academic and Research Institute of Business, Economics and Management, Sumy State University.

Scientific Interests: Information economy; Industry 4.0; Blockchain; Business Development; Digitalization.

E-mail: vladyslav.piven@student.sumdu.edu.ua

ORCID iD: <https://orcid.org/0000-0002-7296-3864>.



Maryna M. Matiushchenko. Student of the Academic and Research Institute of Business, Economics and Management, Sumy State University.

Scientific Interests: Information economy; Industry 4.0; Blockchain; Business Development; Digitalization.

E-mail: matusenkomarina2@gmail.com

ORCID iD: <https://orcid.org/0000-0002-3530-2784>.



Leonid Hr. Melnyk. He graduated from Sumy branch of Kharkiv Polytechnic Institute. Specialty – Machines and apparatus for chemical production, qualification – mechanical engineer. Diploma with honours, 1971. Doctor of Economics, specialty “Economics, organization of management and planning of the national economy”, 1978. Doctor of Economics, majors “Economics, planning and organization of national economy management” and “Economics of nature use and environmental protection”, 1990. Academic title: associate professor, 1983, at the Department of Economics; professor, 1991, at the Department of Economics.

Professor of the Department of Economics, Entrepreneurship and Business Administration of Sumy State University. Part-time director of the Institute of Development Economics of the Ministry of Education and Science and the National Academy of Sciences of Ukraine (at Sumy State University).

Scientific interests: Economics of Nature Use and Environmental Protection, Sustainable Development and Ecological Economics, Socio-economic Problems of the Information Society; Economy of Phase Transition and Industrial Revolutions.

E-mail: melnyk@econ.sumdu.edu.ua

ORCID iD: <https://orcid.org/0000-0001-7824-0678>.