





Szabolcs Nagy, Doctor of Economics, Professor, Deputy Dean of the Faculty of Economics, Miskolc University (Miskolc, Hungary)  

Anna Kobielieva, Post-graduate student of the Department of Business Economics and International Economic Relations, National Technical University "Kharkiv Polytechnic Institute" (Kharkiv, Ukraine)  

THEORETICAL AND METHODOLOGICAL ESSENCE OF INNOVATIVE TECHNOLOGY

Abstract. *The theoretical and methodological substantiation of the essence of innovative technology is the most important factor in the global development of the economy, the modern understanding of its content as an economical category, the basis of innovation. The analysis of the scientific definitions of "technology" made it possible to identify two main areas that form the content of this definition: the presentation of technology as a certain set of techniques and methods for preparing, organizing, and implementing production processes. This approach fully reflects the logic of the industrial economy; the presentation of technology as a system factor of production based on knowledge, skills, and abilities. This is a more modern concept of understanding technology, which leads to an innovative development area.*

Keywords: *innovations, technology, definition, methods of organization, factors of production*

Introduction. The first decades of the XXI century finally determined scientific and technological progress as the most important factor of economic development, the basis for the competitiveness of firms, industries, national economies. Today, there is a clear understanding in the world that future prosperity and even survival in the global economy is determined by the central role of innovations that increase labor productivity and capital invested. The world economy is actively shaping a new scientific and technological development concept. Its components are currently: the interdependence and relationship between the capital market and progressive technologies, the growing need for knowledge, the strengthening of the social content of innovative technologies, the demand of world corporations for the creation and use of new technologies, goods, services, etc. These processes explain the high interest in the innovative theory created by the Austrian scientist J. Schumpeter [18].

Innovative technologies are constantly being updated and enriched, reflecting the complex and multifaceted process of developing science and technology, all industrial and commercial activities. However, in the innovation theory, there are many controversial definitions and statements, a number of concepts of innovative content require their development and refinement. This, in particular, applies to such an important concept as "innovative technology".

Research results. Theoretical and methodological substantiation of the essence of innovative technology is the most important factor in the global development of the economy, the modern understanding of its content as an economic category, the basis of innovation. The solution to this problem will make it possible to formalize the theoretical foundations of the study of innovative technologies, to combine their essence with the goals of production and commercial activities of industrial enterprises.

Many scientists have considered the research questions of the essence of technology as an economic category. Table 1 shows the definitions of the term "technology" recommended by various researchers.

Table 1

Modern scientific definitions of the term "technology."

(developed by the authors)

Author	Definition
Abramov, S.M. [1]	This is a system based on the use of tools, apparatus, tools, skills, knowledge and skills developed by science, information technologies, and management systems for all types of resources.
Tiutlikova, V. [21]	A set of methods and techniques for obtaining, processing or processing raw materials, materials, semi-finished products or products carried out in various industries, in construction
Romanchik T.V. [17]	Technology is the management of the processes of creating production facilities, ensuring their passage in the right direction
Zheleny, M.S. [23]	A tool for converting raw materials and resources into products
Schumpeter J.A. [18]	The amount of knowledge, experience, skills and abilities for the production of goods and services using economic and production resources
Kosenko A.V. [9]	A set of methods for processing materials and manufacturing products used for production processes.
Svishchova N. [19]	The way enterprises implement a complex process by dividing it into sequential interrelated procedures and operations
Maksymenko Y. [11]	An operating system recorded in the form of knowledge and skills
Maslak, M. [12]	A system of actions aimed at the optimal implementation of industrial and commercial practices
Dictionary [3]	A set of knowledge, skills and methods of processing materials, manufacturing products, methods of implementing production processes
Todosiychuk A.V. [22]	Dynamic system of procedures, rules, standards, etalons and norms of technological activity, production process control
Encyclopedia [23]	A set of techniques and methods for obtaining, processing or processing raw materials, materials, semi-finished products or products carried out in various industries

The scientific definitions of the definition of "technology" presented in Table 1 are not contradictory, their diversity, in our opinion, can be explained by the evolutionary nature of this term – a change in the main factors of its content. An analysis of the existing definitions allows us to single out two main directions that form the content of this definition:

- a) presentation of technology as a specific set of techniques and methods of preparation, organization and implementation of production processes of production [1, 18, 21]. This approach fully reflects the logic of the industrial economy;
- b) presentation of technology as a systemic factor of production, which is based on knowledge, skills and abilities. It is a more modern concept of understanding technology that leads to an innovative development area.

It is proposed to select the most precise definitions from the large number of existing definitions of innovative technology. First of all, we note that the definition of the essence of innovative technology must meet some general requirements:

- a) on the one hand, it must be unambiguous in order to clearly represent the object of research, and on the other hand, it must be broad enough to reflect the meaning and essence of this category;
- b) the definition should correspond as much as possible to the content of international documents and generally accepted definitions;
- c) the definition must reflect the current level of achievements of scientific and technological progress, as well as the essential features of the scientific and technological revolution;
- d) in modern conditions, the methodology for determining the essence of innovative technology should take into account international standards.

The definition of innovative technology only as a tool for obtaining a product or process result, in our opinion, is to a certain extent a narrow approach. When using it, it is impossible to reveal the multilevel economic essence of this category fully. It is also necessary to consider that an innovative technology must have commercial potential in market conditions. This innovative technology should form effective demand for its use in a particular market, take a commodity form, and be sold to potential consumers. Only in the target market is the commercialization of the results of innovative activities carried out, which has become increasingly widespread in a post-industrial society (Fig. 1).

The factor of commercial potential allows us to define innovative technology as an economical category that meets the target market's needs. In our opinion, innovative technology simultaneously includes both technical and commercial components. Moreover,

any technology containing elements of technical novelty can acquire signs of innovative technology only if its content is important and interesting to business and, accordingly, to the market. Based on these provisions, it is proposed to define the category "innovative technology".

It is proposed to understand *innovative technology* as radically new or improved technologies that significantly affect the final result of industrial and commercial activities or, due to the presence of commercial potential in them, are themselves a commodity. From the proposed definition, it is clear that the primary goal of innovative technology is to innovatively change production processes and obtain a specific effect (economic, technical, social, or other).

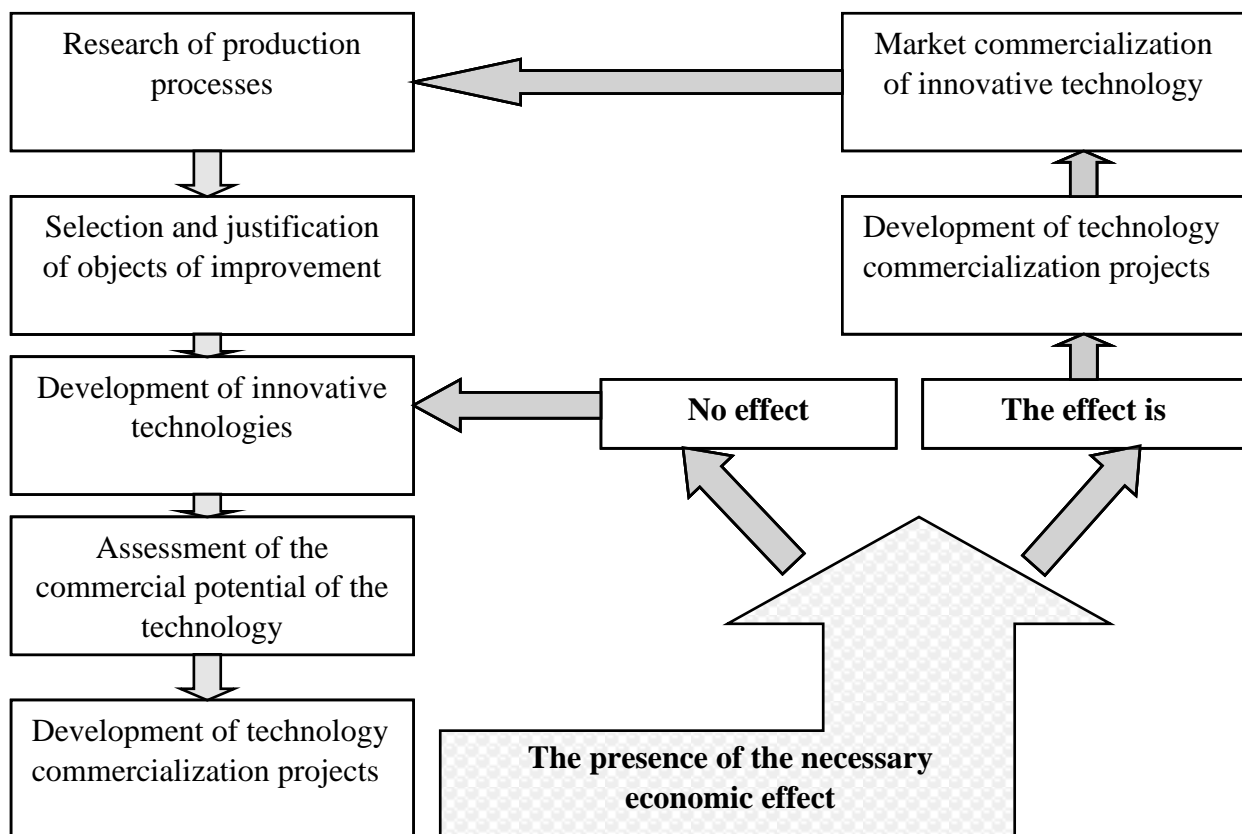


Figure 1. The commercial potential of innovative technology
(developed by the authors)

Based on the above provisions, it is necessary to distinguish between product and process innovation technologies. In these innovative technologies, materialization occurs, the embodiment of scientific achievements – ideas, inventions, discoveries and know-how, new research solutions, information, models, and other results of intellectual labor – into practice. In the economic literature, when considering innovative technologies, such concepts as "new

technologies," "high technologies," "high technologies," etc., are also used (Fig. 2).

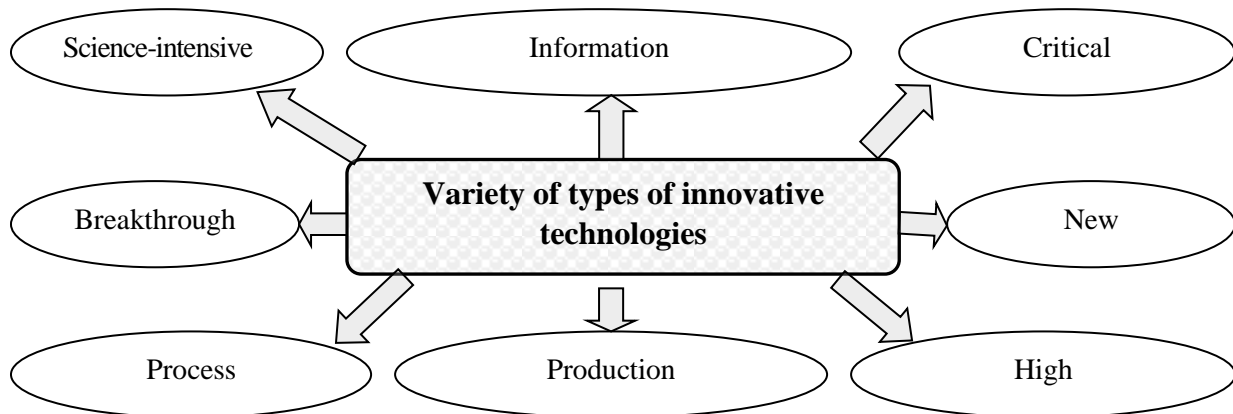


Figure 2. Diversity of forms of the existence of innovative technologies
(developed by the authors)

The use of these terms in practice makes it possible to assess the results of innovative activities from various positions.

Science-intensive technology is understood as the technology of production of products of enterprises (corporations, industries, regions), where the average annual cost of research to the average annual sales of products is relatively high, for example, more than 6-10%.

High technology is a technology for producing technically complex products, for the production of which complex (unique) technological processes are used. A sign of this kind of complexity is that in these industries, technological processes are based on the scientific results of applied and fundamental research and development.

High technology is, more often than not high technology. At the same time, high-tech products may not necessarily be science-intensive at the same time. This is because in the case of mass production of technically complex products, the scientific component of costs will most often be below the required level (less than 6%).

The concept of new technology represents new scientific and technical results in the field of R&D in high-tech industries. In terms of their content, these are scientific and technical products that can be sold as new technologies through the sale and purchase of licenses. This kind of technology can be both high-tech and science-intensive at the same time.

Thus, it is proposed to consider that science-intensive, high, and new technologies are varieties of innovative technologies.

For a more detailed description of an innovative technology as a result, it is extremely important to assess the level of its novelty. Such an assessment can be given using different indicators (criteria). In our opinion, these include the level of novelty (radicality) of technology the type or scale of novelty. The novelty of innovative technology can be considered at various levels:

- market level of novelty: global, national, regional, sectoral or local market for which innovative technology is new;
- management level of novelty: new technologies for an industry, corporation, enterprise or its structural unit.

In this regard, we note that individual enterprises are developing innovative technologies that may be new to them, but have no signs of novelty for the entire industry or for a specific market.

Technological advances happen every day, so business owners must either use innovative technologies or risk losing their competitive market advantage. Innovative technologies can take many forms in business, including the computerization and automation of essential systems and processes. While innovative technologies can be relevant and attractive, businesses need to be aware of both the advantages and disadvantages of innovative technologies. Assessment of the possible consequences of introducing innovative technologies is of great importance. It allows comparing the costs of their development and mastering technologies with the effects obtained when using them. Highlighting the most essential investments in innovative developments is very important compared to the costs of their creation and commissioning. The studies' results allow us to assert that innovative technologies have a number of significant advantages over conventional technologies (Fig. 3).

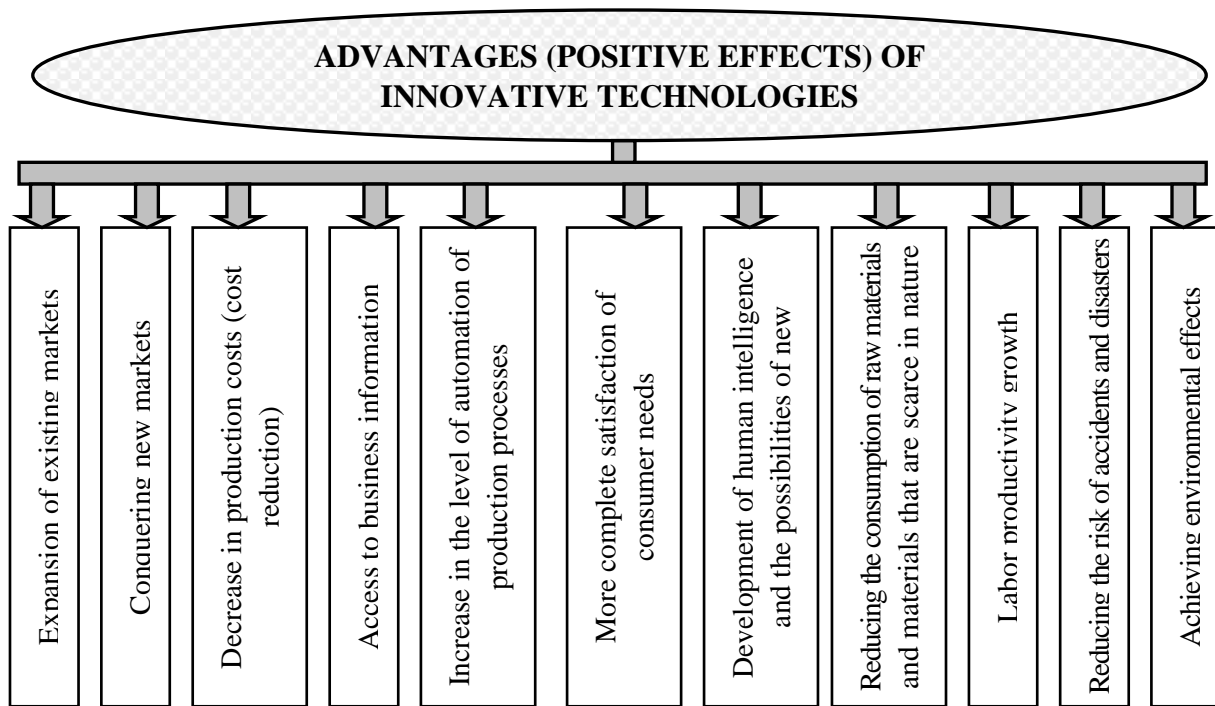


Figure 3. Benefits of innovative technologies

(developed by the authors)

Analysis of the data shown in Fig. 3 suggests that innovative technologies can significantly reduce production material and energy consumption. And also to optimize the production process, eliminating expensive waste. According to some estimates, the share of waste in traditional types of production accounts for 90–95% of the mass of natural resources extracted from the depths of nature. Innovative technologies can significantly reduce the amount of waste. Reducing the consumption of natural resources in many industrial areas supports the longevity of our planet as a whole.

One of the main benefits of innovative technologies is their ability to help even small businesses compete successfully on the global stage. It has become straightforward to access up-to-date information anytime, anywhere. For example, with the advent and ubiquity of broadband Internet, it has become possible even for individual entrepreneurs to offer their products or services to potential consumers worldwide through a website or social media. Innovative technologies help businesses expand their production. Many enterprises have introduced modern technologies into their production activities, increasing production and providing more stable quality. Technologies allow enterprises, on the one hand, to expand existing markets and on the other hand, to successfully create and develop new markets both within the country and abroad.

Innovative technologies are also successfully helping businesses to reduce production costs significantly. Automation of production reduces the dependence of business on the

human factor in the implementation of production processes. As a result, a business can substantially reduce personnel costs (salaries, benefits, and employee turnover). In addition, the partial abandonment of human labor makes it possible to fully or partially automate production processes to improve the accuracy of operations and the quality of the final product.

Active work on the creation and use of innovative technologies contributes to human intelligence development. The introduction of these technologies is the basis for the emergence of new scientific discoveries and achievements. The use of innovative technologies allows the creation of entirely new goods and services, which increases competition between manufacturers. And the growing competition helps to improve the quality of the final product.

The expected benefits (positive effects) of innovative technologies are potent incentives for their creation and use. They promise potential investors to see a tangible increase in income, and very often quite quickly. But for the achievement of scientific and technological progress, business in many cases has to pay a fairly high price in the form of undesirable negative consequences. Any of the innovative technologies in its practical use can turn out to be a source of many troubles for industrial enterprises. The entire history of socio-economic development evidences this. The fruits of civilization (for example, a car, electricity, conveyor belt, computer or the Internet) turn out to be so attractive (because of their economic benefits) that humanity is no longer able to refuse them, no matter what adverse consequences they cause (destruction of the natural environment, loss individual freedom, human unification, information dependence, creative degradation, etc.) [20].

The results of our studies allowed us to identify a number of certain disadvantages that are inherent in innovative technologies (Fig. 4).

The negative consequences of the use of innovative technologies are less obvious, their forecasting is more difficult. At the same time, many researchers rightly draw attention to the existing dangers when using them [1, 3, 21].

On the one hand, innovative technologies reduce the business's dependence on staff, and on the other hand, workers are losing their jobs. Downsizing of employees contributes to the growth of unemployment in the country. A businessman needs to make a difficult choice between increasing profits and laying off employees who have worked in this enterprise for many years. Even if the introduction of technology does not result in job loss, some workers will find it challenging to adapt to the changes ahead.

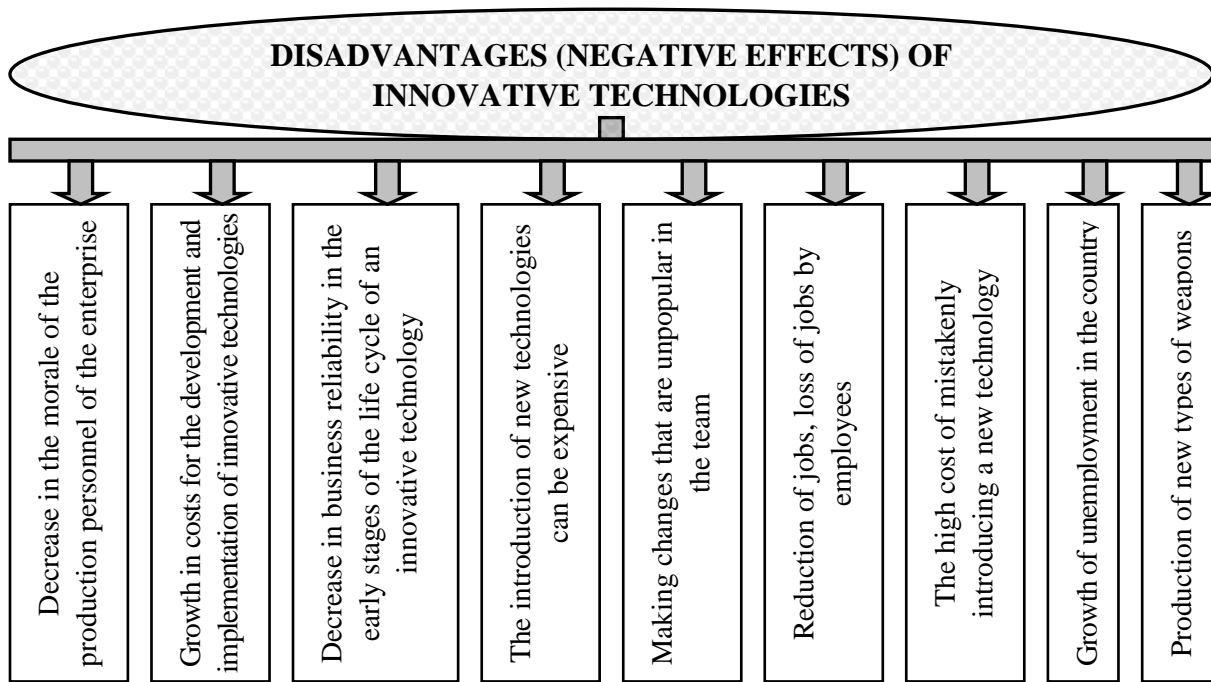


Figure 4. Disadvantages of innovative technologies

(developed by the authors)

With the introduction of innovative technologies, advanced training may be needed, which will inevitably lead to a short-term decrease in labor productivity. Mentioned factors lower team morale, even if only a few employees are affected by the innovative technology.

The main disadvantage of introducing innovative technologies is their high cost. The introduction of new technology usually requires additional costs, which are most often covered by loans. If the new technology does not expand production or reduce costs in the long term, it can negatively affect the stable operation of the plant.

As paradoxical as it may sound, innovative technologies can be the main reason for endless warfare. New technologies contribute to the production of modern weapons, which require large testing grounds. When this weapon falls into the hands of criminals, they can use it for their own selfish purposes.

Conclusions. The study of the economic essence of the category "innovative technology" allows us to characterize in more detail the individual components in the content of this category, characterize its varieties and directions of use, and give practical recommendations to industrial production.

Based on the study and generalization of the definition of the term "innovative technology", it is proposed to understand by this term radically new or improved technologies that significantly affect the final result of industrial and commercial activities or, due to the

presence of commercial potential, are themselves a commodity. Innovative technologies are not of commercial importance by themselves, their use is closely related to the goals of the enterprise (growth, development, ensuring the required level of competition, target market share, etc.). Through innovative technologies, enterprises can provide themselves with several additional advantages: production automation; creation of new and expansion of existing needs; reduction of the cost of manufactured products; setting market prices; increase in profits; conquering new and expanding existing markets. At the same time, innovative technologies can negatively affect individual enterprises. Among them, it should be noted the reduction of jobs and, as a result, the growth of unemployment; significant expenses for the acquisition and implementation of technologies; assistance in inciting military conflicts with the aim of practical approbation of the latest types of weapons, etc.

A deeper study and understanding of innovative technologies lead researchers to a deeper understanding of the main directions of technological progress in industrial production and the reasons that affect the development of technologies and their use.

References

1. Abramov, S.M. (2019) Research in the field of supercomputer technologies: retrospective and prospects // *History of Science and Technology*. No. 5. 41-65. URL: http://www.library.ugatu.ac.ru/pdf/magazins/pasu09_no7.pdf
2. Chernobrovkina, S., Usov, M., Larka, L., Pererva, P., Rudyka, V. (2021). Methods for Assessing the Investment Attractiveness of Innovative Projects // *Studies of Applied Economics*, 39 (6). <https://doi.org/10.25115/eea.v39i6.5167>
3. Dictionary of the Russian language (2019). Moscow : EKSMO. 875.
4. Great Soviet Encyclopedia (2011). Scientific publishing house "Great Russian Encyclopedia", Moscow. 1023.
5. Kobieliava, T., Kuchinskyi, V., Pererva, P., Garmash, S., Danko, T. (2021). Ensuring the Sustainable Development of an Industrial Enterprise on the Principle of Compliance-Safety // *Studies of Applied Economics*, 39 (5). <https://doi.org/10.25115/eea.v39i5.5111>
6. Kobieliava T.O., Pererva P.G. (2016) The formation of anti-crisis program of the industrial enterprise based on innovative monitoring // *Bulletin of the National Technical University "KhPI". Ser. : Economic sciences*. № 48 (1220). P. 41-44. URL: http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/29393/1/vestnik_KhPI_2016_48_Pererva_The_formation.pdf

7. Kosenko, A., Pererva, P. (2014) Technological market conjuncture: risk assessment commercialization of intellectual property // *Theory, Methodology, Practice*. Vol. 10, No. 1. 55-62. URL: http://tmp.gtk.uni-miskolc.hu/volumes/2014/01/TMP_2014_01_06.pdf
8. Kosenko, A.P.; Pererva, P.G.; Kobieliava, T.A.; Tkachev, M.M.; Tkacheva, N.P. (2017) Financial and technological leverage in the system of economic evaluation of innovative technologies // *Financial and credit activity: problems of theory and practice*. Kharkov. Vol. 2, No. 23, 405-413. <https://doi.org/10.18371/fcaptp.v2i23.121920>
9. Kosenko, A.V.; Tkachev, M.M.; Pererva, P.G.; Kobieliav, V.M. (2018) Innovative compliance of technology to combat corruption // *Innovative management: theoretical, methodical, and applied grounds : monograph / ed.: S.M.Illiashenko, W.Strielkowski*. Prague : PRIZK. Chap. 7.2, 285-294. URL: http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/39600/1/Pererva_Innovative_compliance_2018.pdf
10. Kosenko, O, Pererva, P., Tkachov, M. (2017) Compliance program of an industrial enterprise: the essence and content // *The Essence and Content. In Mérleg és Kihívások” X. Nemzetközi Tudományos Konferencia*, 87-93. URL: http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/32833/1/Pererva_Compliance_program_2017.pdf
11. Maksymenko, Ya., Sokol, K., Pererva, P.G. (2020) Marketing prerequisites for entering the enterprise in the international market of information technologies // *Marketing and digital technologies*. Vol. 4, No. 3. 13-22. <https://doi.org/10.15276/mdt.4.3.2020.2>
12. Maslak, M., Kobieliava, T., Pererva, P. (2021) Formation of the mechanism of commercialization of intellectual technologies on the basis of the functional approach // *Actual problems of modern science : monograph / ed.: S. Matiukh [et al.]*. Bydgoszcz : *Bydgoszcz University of Science and Technology*. 527-537. URL: http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/55056/3/Pererva_Formation_of_the_mechanism_2021.pdf
13. Nadezhda Tkachova, Petro Pererva, Tetiana Kobieliava, Maxim Tkachov, Tetiana Diachenko (2021). Management of relations with enterprise stakeholders based on value approach. *Problems and Perspectives in Management*, 19(1), 24-38. [https://doi.org/10.21511/ppm.19\(1\).2021.03](https://doi.org/10.21511/ppm.19(1).2021.03)
14. Valerii Kobieliav, Oleksandr Hutsan, Petro Pererva, Andrii Kosenko, Volodymyr Kuchynskyi (2018). Evaluating elasticity of costs for employee motivation at the industrial enterprises. *Problems and Perspectives in Management*, 16(1), 124-132. [https://doi.org/10.21511/ppm.16\(1\).2018.12](https://doi.org/10.21511/ppm.16(1).2018.12)
15. Pererva, P.G. (2017). Compliance program of an industrial enterprise: essence and tasks. *Bulletin of NTU "KhPI": Economic Sciences Series*, 24(1246), 153-158. URL:

http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/31263/1/vestnik_KhPI_2017_24_Pererva_Komplaens-programma.pdf

16. Poberezhnyi, R., Maslak, M., Pererva P. (2017) Current state and prospects of development of the tractors market in Ukraine // *Balance and Challenges : 10 nemzetközi tudományos konferencia, október 17-18, Miskolc-Lillafüred. Miskolci Egyetem Gazdaságtudományi Kar.* 94-99. URL: http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/32834/1/Pererva_Current_state_2017.pdf

17. Romanchik, T.V., Kobeleva, T.O., Pererva, P.G. (2018). Compliance as a factor of innovative development of the enterprise. *Bulletin of NTU "KhPI": Economic Sciences Series*, 1, 205-220. URL: http://repository.kpi.kharkov.ua/bitstream/KhPI-Press/39628/1/Pererva_Komplaiens_iak_faktor_2018.pdf

18. Schumpeter, Joseph A. (1934). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle.* University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship. URL: <https://ssrn.com/abstract=1496199>

19. Svishchova, N., Pererva, P. (2021) Development of approaches to the valuation of intellectual property objects influenced by Industry 4.0 [Electronic resource] // *International Marketing and Management of Innovations* : Global Sci. E-Journal. Electron. text data. Bielsko-Biala, No. 6. URL: http://immi.ath.bielsko.pl/wp-content/uploads/IMMI_2021_13.pdf.

20. Szakaly D., Kocziszky György, Pererva P.G., Somosi Veres M. (2012) Technology transfer. Kharkiv-Miskolc: NTU «KhPI», 2012. 668 p. URL: <http://repository.kpi.kharkov.ua/handle/KhPI-Press/39647>

21. Tiutlikova, V., Besprozvannykh, O., Pererva, P., Kovalova, V., Kudina, O., Dorokhov, O. (2019). Improvement of the Method for Selecting Innovation Projects on the Platform of Innovative Supermarket. *TEM Journal*, 8 (2), 454–461. <https://doi.org/10.18421/TEM82-19>

22. Todosiychuk, A.V. Scientific and technical sphere: the stage of modernization // *Problems*

23. Zheleny, M.S. (2012) Management of high technologies // *Information technologies in business.* SPb. : Encyclopedia. 55-62.