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CURRENT STATE OF TECHNOLOGY TRANSFER IN UKRAINE AND THE WORLD IN THE FACE OF MODERN CHALLENGES

ABSTRACT

The article analyses the essence, significance, and current state of technology transfer in Ukraine and the world in the face of the latest challenges. The relevance of this topic results from the rapid pace of the development of innovative technologies and the expansion of the scope of innovation activity both at the level of individual enterprises and at the state level as a whole. The main stages of technology transfer and their features are identified. The problem of technology transfer development is studied in the face of the challenges of our time (globalization, pandemic, martial law in Ukraine).

KEYWORDS

technology transfer, innovation index, modern challenges.

Today, most countries around the world are investing significant material resources in the development of technologies and innovations (such as robotics, nanotechnology, genetic engineering, etc.) to improve their competitiveness on the global stage. At this stage of global economic development, the technological factor is the main condition for international competition, and the innovation process is, accordingly, a key indicator of economic growth for both companies and states.

Technology transfer is a tool that is used to implement the innovation process and determine its effectiveness. Currently, innovation processes are influenced by various factors: the ever-increasing globalization, the effects of the COVID-19 pandemic, which accelerated the process of technological transition in many industries, and the challenges and threats associated with the war in Ukraine.

1. Theoretical and methodological foundations of technology transfer.

The essence of technology transfer and the principles of its organization are described in numerous works by both foreign authors, such as G. Allard, J. Butler and D. Gibson, M. Porter, D. Somay, G. Markman, etc, as well as domestic researchers, such as O. Rozgon, I. Khomenko, O. Mnykh, L. Khomutenko and A. Hryhorovych, O. Kosenko, O. Plakhotnik, and I. Isupova, etc.

The term „technology transfer" in the general sense means the process of successful application or adaptation of technologies, acquisition of unique knowledge, as well as obtaining original results in any field of human activity, supplemented by their further material (or other) implementation and commercialization in other industries [3].

The World Intellectual Property Organisation (WIPO) defines technology transfer as „the process by which a technology developer makes its technology available to a commercial partner who will use it" [14].

The United Nations Conference on Trade and Development (UNCTD - a body of the UN General Assembly) considers the term „technology transfer" from a different angle: „Technology transfer is the process of dissemination of commercial technology in the form of technology transfer, which may or may not be protected by a legal contract, but includes a relationship (communication) between the person transferring the relevant knowledge and the person acquiring it" [11].

The history of technology transfer goes back more than 100 years and consists of 2 key stages. The first stage is 1911-1960 and the second stage is from the 70s of the twentieth century to the present [3].

The first stage of technology transfer development was dominated by a linear model of the innovation process, the main postulates of which are that, first, scientific thought develops independently of market practice, and second, there is no relationship between the development of science and technology and market needs. Each element of the innovation process is interested only in its own end results, and the distribution of labor and resources is based on its own needs and priorities. In other words, research and scientific discoveries are independent of the external environment and time, and the market plays a passive role - it only commercializes the results of scientific developments. This model has a number of disadvantages: it does not take into account the market's influence on possible events related to the invention of new technologies, cannot reflect the complexity of the relationship between production and research, and does not take into account the needs and desires of consumers [2, 3].

The second stage of technology transfer development was marked by the emergence of non-linear (interactive) models (Kline-Rosenberg model, Woolworth, and Clark model, Cooper model) [2, 3, 5]. The main features of these models are that innovations do not precede the market, but rather that market demands predict the emergence of new products, and that there are close links between the development of science and technology and the needs dictated by the market. Over time, the market needs for innovation begin to be met by a large number of competing companies, of which only the most ambitious and technologically advanced survive. Among the disadvantages of non-linear models is that they are successfully applied only to large technology firms, within which competition for resources takes place.

In our opinion, the most appropriate model of technology transfer is currently the Roswell model, which is focused mainly on innovative start-ups and large technology companies. This is the so-called linked or integrated model with an emphasis on linking technological capabilities to market needs. It involves the integration of innovation management into the company's development strategy. The main provisions of this model are based on close cooperation between the company's management and research management, which is used to form a portfolio of innovation projects that are identified in the process of strategic analysis of the company. The company's innovation processes are the path from the perception of a new market opportunity or new research to the analytical design of a new product or process, its development, production, and final sale. The advantage of this model is the need to generate feedback both internally and externally, which requires coordinated action by many participants involved in the innovation process. As practice shows, the combination of research and development with market requirements should go hand in hand [13].

Taking into account the experience of scientists who have considered this issue, we propose to divide the technology transfer process into the following logical stages:

1. Presentation of the invention, where the researcher (or a group of researchers) presents their invention. This stage includes a description of the innovation, the amount of money spent, and the names of the authors of the invention.
2. Evaluation of innovation - at this stage, a special body evaluates the invention in terms of its patentability, and potential commercial value and suggests the best way to protect and commercialize it.
3. Patent application - this stage involves a more detailed substantiation of the commercial value of the invention and filing a patent application.
4. Evaluation and marketing - at this stage, the technology is evaluated and the key characteristics of the invention are identified for its further promotion on the market.
5. Patent licensing - bringing the invention to the market, i.e. patented inventions are transferred to the industrial sector under licensing agreements.
6. Commercialisation is the last stage of technology transfer, where the licensee's business performance is assessed, and revenues are generated and distributed under the established agreements.

2. Organisation and conduct of the study, analysis of actual data.

The purpose of this article is to analyze the essence, significance, and current state of technology transfer, as well as to study the impact of new challenges on it.

The object of the research is the process of technology transfer.

The methods of scientific knowledge used in the study include observation, comparison, measurement, analysis and synthesis, induction, and deduction.

Since 2007, the World Intellectual Property Organisation has been annually assessing the scientific and innovation potential of countries around the world by publishing annual reports. The Global Innovation Index 2022 tracked the performance of innovation ecosystems in 132 economies and current global trends in innovation. Table 1 shows the individual countries in the Global Innovation Index ranking for 2022 [9].

Table 1 Global Innovation Index for selected countries in 2022

Country	Place in the ranking	Points (0-100)	Region
Switzerland	1	64,6	Central Europe
USA	2	61,8	North America
Sweden	3	61,6	Northern Europe
United Kingdom	4	59,7	Europe
Netherlands	5	58,0	Western Europe
Republic of Korea	6	57,8	East Asia
Singapore	7	57,3	Southeast Asia
Germany	8	57,2	Central Europe
Finland	9	56,9	Northern Europe
Denmark	10	55,9	Northern Europe
China	11	55,3	East Asia
France	12	55,0	Europe
Japan	13	53,6	East Asia
Hong Kong, China	14	51,8	East Asia
Canada	15	50,8	North America
Ukraine	57	31,0	Europe

Source: compiled by the authors based on [9].

Traditionally (for 12 years in a row), Switzerland has been ranked first in the Global Innovation Index, up 2.8 points from the second position held by the United States - 64.6 points to 61.8. Sweden ranks third, followed by the United Kingdom, the Netherlands, and the Republic of Korea. China moved up to 11th place, overtaking France; it is now the only middle-income country to remain firmly in the top 30. Canada has returned to the ranks of the leading innovative economies, ranking 15th. The gap between North America and Europe and other regions is narrowing only in the Southeast Asia, East Asia, and Oceania (SEAO) region. Two SEAO economies are among the ten most innovative in the world: the Republic of Korea (6th) and Singapore, which has climbed to 7th place. Ukraine ranks 57th, slightly ahead of Mexico, the Philippines, and Montenegro.

Undoubtedly, innovation in the global economy is one of the main factors in improving the competitiveness of countries, and it is of great importance for Ukraine in the context of transformation and globalization. However, it should be noted that Ukrainian policy on innovation is formed in a rather fragmented manner due to the lack of coherence of plans and inefficiency in the activities of the main stakeholders of innovation, which manifests itself in insufficient use of all opportunities and creates certain threats.

According to the World Bank, the indicator of research and development expenditures in Ukraine as a percentage of GDP tended to decrease from 1997 to 2018 (Fig. 2). As we can see, this indicator decreased from 1.19% in 1998 to 0.47% in 2018 [12].

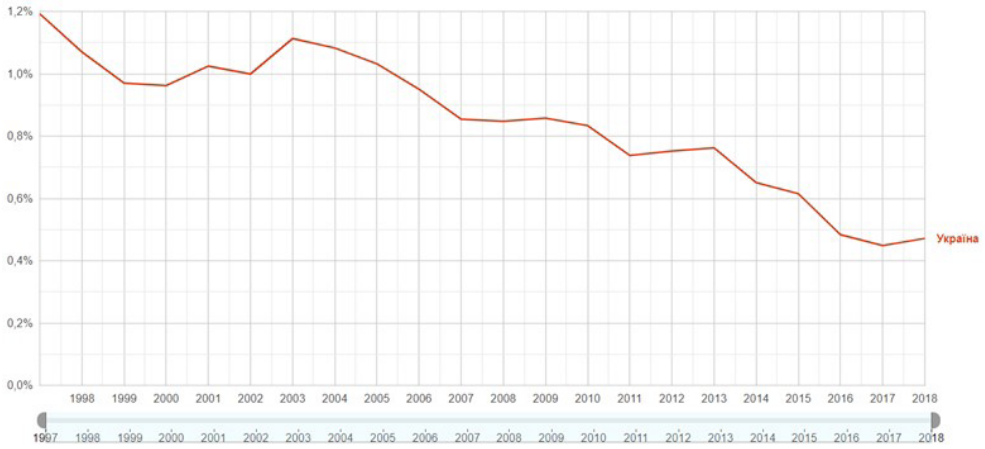

Fig. 2 R&D expenditures in Ukraine from 1997 to 2018 as a percentage of GDP
Source: compiled by the authors based on [12].

The total amount of investment in technology in 2019-2020 indicates the impact of the COVID-19 pandemic on innovation globally. Based on the analysis of relevant statistics, it can be concluded that funding for innovation globally decreased by $90 billion in 2020, and this was caused by the COVID-19 pandemic: in all regions, without exception, a decrease in research and development costs from 1% (in Asia) to 7% (in South America) was recorded, and on average, the global level of innovation spending decreased by 3.82%. The negative trend shows the extent to which the technology market can cope with global challenges, such as the pandemic. Of course, the decline in spending affected the global economy by 4.3% in 2020 [10].

Let us take a closer look at the investment activities of countries such as the United States, China, Japan, Germany, India, South Korea, France, the United Kingdom, and Brazil. The analysis showed that in 3 out of 10 countries (the USA, China, India), investments in technology increased slightly (compared to 2018), while in other countries, investments in technology decreased slightly (compared to 2018), with the total expenditures of the 10 countries on research and innovation activities amounting to $1,781.4 billion in 2018, $1,857.5 billion in 2019, and $1,795.1 billion in 2020 [10].

Thus, the decline in the investment in research and innovation is a consequence of the decline in GDP growth and its transition to a negative trend, the collapse of the global economy, and the complication of the process of economic globalization. In general, it can be concluded that despite a significant drop in both global GDP and individual countries, the COVID-19 pandemic has generally had a positive impact on technology transfer.

The Russian invasion of Ukraine has led to a humanitarian catastrophe. As of 10 January 2023, 4,867,106 IDPs were officially registered in Ukraine, and international estimates put the number of internally displaced persons at more than 7 million. Over 4 million more people have registered for temporary protection in Europe [8]. In addition, thousands of people have been injured or killed. Undoubtedly, the war will have serious economic consequences for Europe, as it began when the recovery from the pandemic was not yet complete. At the outbreak of the war, although European advanced and emerging market economies had already recovered a significant portion of their 2020 GDP losses, private consumption, and investment were still far below pre-crisis trends.

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The war has led to a significant increase in commodity prices and increased supply disruptions, which will further contribute to inflation and reduce household incomes and corporate profits.

New risks have emerged since the outbreak of the war. The prolonged war is increasing the number of refugees in Europe, exacerbating supply chain bottlenecks, increasing inflationary pressures, and deepening production losses. In economic terms, the war, which is damaging the production and supply of goods, exacerbates the economic policy challenges created by the pandemic. One of the tasks of policymakers is to facilitate a gradual adjustment to these war-related shocks, including higher commodity prices and new energy sources.

Overall, the war and its aftermath will exacerbate the structural problems that Europe has faced since the pandemic. In Ukraine, the social and economic infrastructure destroyed by the war needs to be rebuilt, which will require significant investments from donors. Improving energy security requires policy measures aimed at enhancing the stability of the energy supply and accelerating the transition to greener forms of energy production. Stimulating new driving forces and reallocating production factors requires active and passive labor market and education policies to improve working conditions, reduce transition costs, and upgrade the skills of the workforce. Only after overcoming all the challenges caused by Russia's military aggression in Ukraine will it be possible to restore technology transfer and investment activity to pre-war levels.

Conclusion

Modern challenges directly affect the process of technology transfer. Globalization, which has penetrated the life of the world community, has spared neither the global economy mpr science in general. It has led countries to unite and work together on technological inventions. The COVID-19 pandemic has somewhat changed the usual understanding of human interaction and slowed down the global economy. However, the economic crisis caused by the coronavirus pandemic has not had such a strong impact on technology transfer. The reduction of some staff has helped to free up additional cash resources to develop new technologies and support innovative start-ups. The global economic recovery, which directly depends on the effectiveness of the fight against COVID-19, will have a greater impact on further investments in technology. Along with global economic growth and the rapid transition to automation and robotization of production processes, investments are expected to grow steadily in the coming years. The threats associated with martial law in Ukraine have had a negative impact on technology transfer both domestically and globally. Only after the reconstruction of our country, balancing of the economy, and restoration of all its industries will it be possible to talk about positive trends in the process of technology transfer.

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AKTUALNY STAN TRANSFERU TECHNOLOGII W UKRAINIE I NA ŚWIECIE Z WPŁYWEM WSPÓŁCZESNYCH WYZWAŃ

STRESZCZENIE

Artykuł analizuje istotę, znaczenie i aktualny stan transferu technologii na ukrainie i na świecie wraz z najnowszymi wyzwaniami. Aktualność tego tematu wynika z szybkiego tempa rozwoju innowacyjnych technologii i poszerzania zakresu działalności innowacyjnej zarówno na poziomie poszczególnych przedsiębiorstw, jak i na poziomie całego państwa. Zidentyfikowano główne etapy transferu technologii i ich cechy. Badany jest problem rozwoju transferu technologii z wyzwaniami naszych czasów (globalizacja, pandemia, stan wojenny w Ukrainie).

SŁOWA KLUCZOWE

transfer technologii, wskaźnik innowacyjności, współczesne wyzwania.