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INTELLECTUAL ECONOMIC DEVELOPMENT: COST AND EFFICIENCY INDICATORS

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Original Article

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ABSTRACT

Innovation and economic development go hand in hand. Innovation is the key to economic growth and prosperity. In the current era of globalization, countries that invest in research and development (R&D) and innovative activities are more likely to achieve sustained economic growth and competitiveness in the global marketplace. The purpose of this study is to analyze the values of the International Intellectual Property Index in different countries of the world and compare these data; to establish the relationship between the financial and economic development of the territories, expenses on intellectual research and the international index of intellectual property of the states using different approaches and methods. This article aims to explore the positive experience of intellectual economic development in the world, with a focus on the costs of innovation. The Global Innovation Index (GII) ranks countries based on their innovation capabilities, such as human capital, research and development, institutions, infrastructure, market sophistication, and business sophistication. According to the GII 2021 report, the top five most innovative countries are Switzerland, Sweden, the United States, the United Kingdom, and the Republic of Korea. All this points to the need for the development of innovative and intellectual developments in Ukraine. Such intellectual developments are of particular importance in the conditions of war and are necessary for strengthening the security indicators of the state, preserving the lives of the population in the conditions of missile attacks and destruction. In the world, intellectual economic development is seen as a key driver of economic growth and competitiveness.

Keywords: *economic development, efficiency, cost indicators, intellectual property, innovations.*

1. INTRODUCTION

Innovation has numerous benefits for individuals, firms, and economies. At the individual level, innovation leads to the creation of new products and services, which improves our quality of life. It also creates new job opportunities and increases income levels. At the firm level, innovation enables firms to reduce costs, increase productivity, and improve their competitiveness in the market. At the national level, innovation drives economic growth, creates new industries and markets, and enhances a country's competitiveness in the global marketplace.

Global Innovation Index (GII), 2022 is a measure of a country's innovation performance, developed by the World Intellectual Property Organization (WIPO), INSEAD, and Cornell University. The GII ranks countries based on their innovation capabilities, such as human capital, research and development, institutions, infrastructure, market sophistication, and business sophistication. According to the GII 2021 report, the top five most innovative countries are Switzerland, Sweden, the United States, the United Kingdom, and the Republic of Korea.

Over recent decades, business investment in KBC has grown faster than investment in physical capital such as machinery, equipment and buildings in many OECD countries. In particular, in the United Kingdom and the United States, investment in KBC now significantly exceeds investment in physical capital and is closely related to productivity growth. To increase productivity, both China and Brazil are also making active efforts to develop KBC as they aim to occupy higher-value segments in global production chains (Lazic M., 2023).

Using precision marketing and machine learning technologies for data analysis, it is possible to develop a more effective marketing strategy for retaining existing consumers of telecom operators by accurately predicting its consumer churn behavior, analyze current problems and identify appropriate recommendations and suggestions to optimize the activities of the telecommunications company (Š.Berberović, M. Bandur, 2015).

Investment in Research and Development Investment (R&D) is a critical component of innovation. According to the OECD, the world's leading economies spent $2.3 trillion on R&D in 2019, representing an increase of 3.8% compared to 2018. The United States spent the most on R&D, followed by China, Japan, Germany, and South Korea. However, when looking at R&D spending as a percentage of GDP, the top five countries are Israel, Korea, Japan, Sweden, and Switzerland (Knowledge is growth - OECD, 2023).

Intellectual property rights (IPRs) are an essential element of innovation. IPRs protect the rights of inventors, creators, and innovators, and provide incentives for them to invest in R&D and other innovative activities. According to the World Intellectual Property Indicators 2020 report, the number of patent applications worldwide reached 3.3 million in 2019, representing an increase of 5.2% compared to the previous year. China accounted for the largest share of patent applications, followed by the United States, Japan, South Korea, and Germany (Global Innovation Index, 2022).

Costs of Innovation requires significant investment, both in terms of money and time. The costs of innovation can be divided into three categories: direct costs, indirect costs, and opportunity costs. Direct costs refer to the expenses associated with R&D activities, such as salaries, equipment, and materials. Indirect costs refer to the expenses associated with the commercialization of innovative products and services, such as marketing, distribution, and regulatory compliance. Opportunity costs refer to the potential revenue that could have been generated if resources had been used for other purposes (B.Fraumeni, S.Okubo, 2005).

Innovation funding is a critical component of innovation. Governments and private investors play a significant role in providing funding for R&D activities and other innovative activities. According to the OECD, the world's leading economies spent $584 billion on government-funded R&D in 2019. The United States spent the most on government-funded R&D, followed by Japan, Germany, China, and France. Private sector funding for R&D is also significant, with companies such as Apple, Samsung, and Google (Samsung Beats IBM, Apple, Intel, Google, 2022).

For Ukraine, especially in the modern conditions of martial law, it is very important to maintain its economic development, which is an extremely difficult task. This can be achieved only thanks to intellectual innovations and technological solutions that have proven themselves well in the developed countries of the world. That is why the main *objectives* of this study are to study the successful experience of the world's leading countries in the field of intellectual property and global innovative development, to outline the prospects for the implementation of such positive experience in Ukraine, to compare indicators according to the global innovation index in different countries, to find new sources of funding for the intellectualization of the economy in Ukraine on based on successful global practices. This article aims to explore the positive experience of intellectual economic development in the world, with a focus on the costs of innovation.

The article consists of classic sections (introduction, aim of the research and methods, literature review, main part and conclusions) and has the following questions in its structure: to explore the positive experience of intellectual economic development in the world, with a focus on the costs of innovation; rankind of the countries on the Global Innovation Index (GII) based on their innovation

capabilities, such as human capital, research and development, institutions, infrastructure, market sophistication, and business sophistication, using of knowledge, innovation, and technology to create new products, services, and processes that drive economic growth and development.

2. AIM OF THE RESEARCH AND METHODS

The purpose of this study is to analyze the values of the International Intellectual Property Index (GII) in different countries of the world and compare these data; to establish the relationship between the financial and economic development of the territories, expenses on intellectual research and the international index of intellectual property of the states using different approaches and methods.
The implementation of intellectual innovations has a significant impact on the economic development of any country. The evaluation of such implementations is necessary to measure their effectiveness and success. In this article, an economic-mathematical model will be presented to assess the implementation of intellectual innovations in a given country, with statistical data and examples, formulas, and conclusions.

Mathematical Formulation:

The mathematical formula used to assess the implementation of intellectual innovations is as follows:

$$Net\ Gain\ (NG) = Benefits\ (B) - Costs\ (C) \quad (1)$$

where,

$$B = Economic\ growth + Employment + Exports\ C = Cost\ of\ implementation \quad (2)$$

Model Assumptions:

1. The implementation of intellectual innovations leads to an increase in economic growth in a given country.
2. Intellectual innovations require investment of resources, such as capital and labor, which incurs costs.
3. The success of implementing intellectual innovations depends on various factors such as government policies, the level of education, and the extent of research and development.
4. The assessment of implementing intellectual innovations should consider both the costs and benefits.

Model Components:

Cost of implementing intellectual innovations: This includes the expenses incurred in research and development, capital investment, and hiring skilled labor.
Potential benefits of implementing intellectual innovations:

a. Increase in economic growth: The implementation of intellectual innovations is expected to lead to an increase in economic growth. The extent of the increase is dependent on the level of innovation, the target market, and the effectiveness of the implementation.
b. Increased employment opportunities: The implementation of intellectual innovations can create new employment opportunities, especially in high-skilled positions.

c. Increase in exports: Intellectual innovations can lead to the creation of new products and services, which can be exported to other countries, increasing the country's foreign exchange earnings.

Risk factors: Implementing intellectual innovations carries inherent risks. These risks can include:

a. Failure to achieve the desired level of innovation, leading to sunk costs.

b. Implementation challenges, including resistance from established industries or lack of market demand.

c. Technological obsolescence, where innovations become outdated before they are implemented fully.

3. LITERATURE REVIEW

Intellectual economic development refers to the use of knowledge, innovation, and technology to create new products, services, and processes that drive economic growth and development. It involves the application of intellectual property, such as patents, copyrights, and trademarks, to protect and commercialize innovative ideas and inventions. In the world, intellectual economic development is seen as a key driver of economic growth and competitiveness. It is recognized as a critical component of national development strategies, with governments and private organizations investing heavily in research and development (R&D) activities and other innovative initiatives.
The driving force behind the intellectual economic development of the country is its scientific progress, that depends entirely on the knowledge and innovation. Intellectual economic development is a relatively new concept that has emerged as a result of the increasing importance of knowledge and innovation in the global economy. According to (J.Mokyr, 2002) intellectual economic development refers to the creation, dissemination, and use of knowledge to improve economic outcomes. Similarly, D. J.Teece, 1998 defines intellectual economic development as the process of transforming intellectual property into economic value.
Other scholars have emphasized the importance of innovation in intellectual economic development. For example, B.Lundvall, 1992 argues that innovation is a key driver of economic growth and development, and that intellectual economic development requires a focus on the creation and diffusion of knowledge and technology. Ch. Edquist, 1997 emphasizes the importance of innovation systems in intellectual economic development, arguing that innovation is a complex and interactive process that involves many actors and institutions.
Another perspective on intellectual economic development is offered by D. Audretsch and M. Keilbach, 2004, who emphasize the importance of entrepreneurship in the process. They argue that entrepreneurial activity is a critical factor in the creation and commercialization of new ideas and technologies, and that entrepreneurship plays a key role in transforming intellectual property into economic value. Authors J.Xu, F.Liu, 2020 extend our understanding of IC in achieving a competitiv e edge in the manufacturing sector, with IC representing a valuable platform for the sustainable development of the manufacturing sector in emerging Asian markets (The Impact of Intellectual Capital on Firm Performance, 2023).
Empirical Studies on Intellectual Economic Development. There have been several empirical studies that have examined the relationship between intellectual economic development and economic outcomes. For example, Wang et al., 2018 investigated the impact of intellectual property on firm performance in the Chinese manufacturing sector. They found that firms that invested in intellectual property had higher sales and profits than firms that did not invest in intellectual property. Similarly, D.Guellec and B. Van Pottelsberghe de la Potterie, 2004 examined the impact of patenting activity on economic growth in OECD countries. They found that patenting activity was positively related to economic growth, suggesting that intellectual economic development has

a positive impact on economic outcomes (B. Hall, R. Oriani, 2004).

Intellectual economic development involves a range of activities, including basic research, applied research, development, and commercialization. Basic research involves the exploration of fundamental scientific principles, while applied research involves the application of scientific knowledge to solve practical problems. Development refers to the creation of prototypes and the testing of new products and services, while commercialization involves the marketing and sale of innovative products and services (Development of territorial communities, 2023; Abdulloev I., Gil S. Epstein, Ira N. Gang A., 2020).

There are a lot of Intellectual Economic Development Initiatives in Europe, America and Asia. Europe is home to some of the most innovative economies in the world, and it has implemented several initiatives to promote intellectual economic development. The European Union has established a number of programs to support R&D activities, including the Horizon 2020 program, which has a budget of €80 billion and aims to support research and innovation projects in a wide range of fields. Other initiatives include the European Institute of Innovation and Technology, which provides funding and support for innovative projects, and the European Research Council, which funds excellent researchers and their projects. In addition to these initiatives, many European countries have implemented their own programs to promote intellectual economic development. For example, Germany has established the Fraunhofer Society, a network of applied research institutions that collaborate with industry to develop new technologies and products (Fraunhofer-Gesellschaft, 2023). France has implemented the PIA (Programme d'Investissements d'Avenir), which provides funding for innovative projects in strategic sectors such as energy, health, and transport (Investments for the Future Programme). The United Kingdom has established the Catapult network, which consists of technology and innovation centers that support businesses to develop new products and services (Catapult network review, 2021).

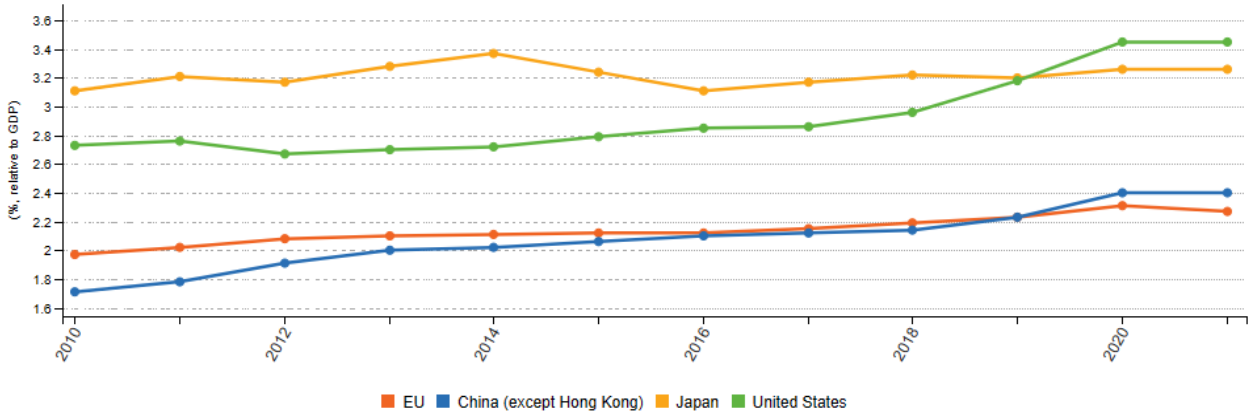
In the United States, the National Institutes of Health (NIH) provides funding for biomedical research, while the National Science Foundation (NSF) provides funding for research in science and engineering. The Small Business Innovation Research (SBIR) program provides funding for small businesses to conduct R&D activities, while the Small Business Technology Transfer (STTR) program provides funding for partnerships between small businesses and research institutions (The 10 most innovative companies in North America, 2023). However, in 2022, a trend of increasing the number of patents from the countries of the West to the East was noted. Asian companies earned 14% more patents than Western countries in 2022 (41,055 vs. 35,365). Japan, China and South Korea alone account for 40,114 patents, compared to 32,130 for American companies. Samsung's longtime rival Apple received 2,285 patents, down 10% from the previous year, while Amazon and Google received 1,863 and 1,548 patents respectively. US giant Microsoft saw a slight decline in patent wins as the company received 1,815 patents in 2022, down 25% from the 2,417 patents it received in 2021. Therefore, the leaders in patent activity in 2022 are such companies as Samsung (6,248 patents), IBM (4,398), Taiwan Semiconductor (3,024), Huawei (2,836), Canon (2,694), LG (2,641), Qualcomm (2625), Intel (2418), Apple (2285), Toyota (2214) and many others (Samsung Beats IBM, Apple, Intel, Google, 2022).

Despite a significant amount of scientific research, many issues of interdependence between economic development and scientific research expenditures, the level of innovativeness of the world's economies remain unclear regarding the effectiveness of various data analysis methods for improving intellectual activity and filling budgets. Uncertainty and instability of economic dynamics, the desire for continuous development have challenged all businesses to introduce intellectual innovations into the economic system and the decision-making system (Z.Yanan and oth., 2020).

In recent years, the share of intellectual research in Ukraine has increased significantly, but in the conditions of martial law, it is becoming increasingly difficult to develop innovations, besides, there is fierce competition in this field. The main players of the market of intellectual innovations are such states as USA, China and EU (N.V. Kuznietsova, 2017; Knowledge is growth - OECD, 2023;

A.Kolomiiets, O.Mezentseva, K. Kolesnikova, 2021).
Scientific and practical interest has an analysis of gross domestic expenditures on research and development in different countries (Figure 1).

Figure 1. Dynamic of gross domestic expenditure on research and development, 2010-2021.



Source: R&D expenditure - Statistics Explained, 2023.

One of the key objectives of the EU over the past few decades has been to encourage increased levels of investment in research in order to boost the EU's competitiveness. Based on Eurostat data on research and development (R&D) expenditure in the European Union (EU) by performance sectors and funding sources, an analysis of expenditure for 2021 was carried out. in May 2021, the European Commission adopted the Communication on a global approach to research and innovation — a European strategy for international cooperation in a changing world (International cooperation, strategy, 2021). This demonstrated the EU's desire to play a leading role in supporting international research and innovation partnerships, while supporting innovative and environmental solutions in line with the goals of sustainable development. All this contributes to the achievement of sustainability, economic and social well-being (R&D expenditure - Statistics Explained, 2023).

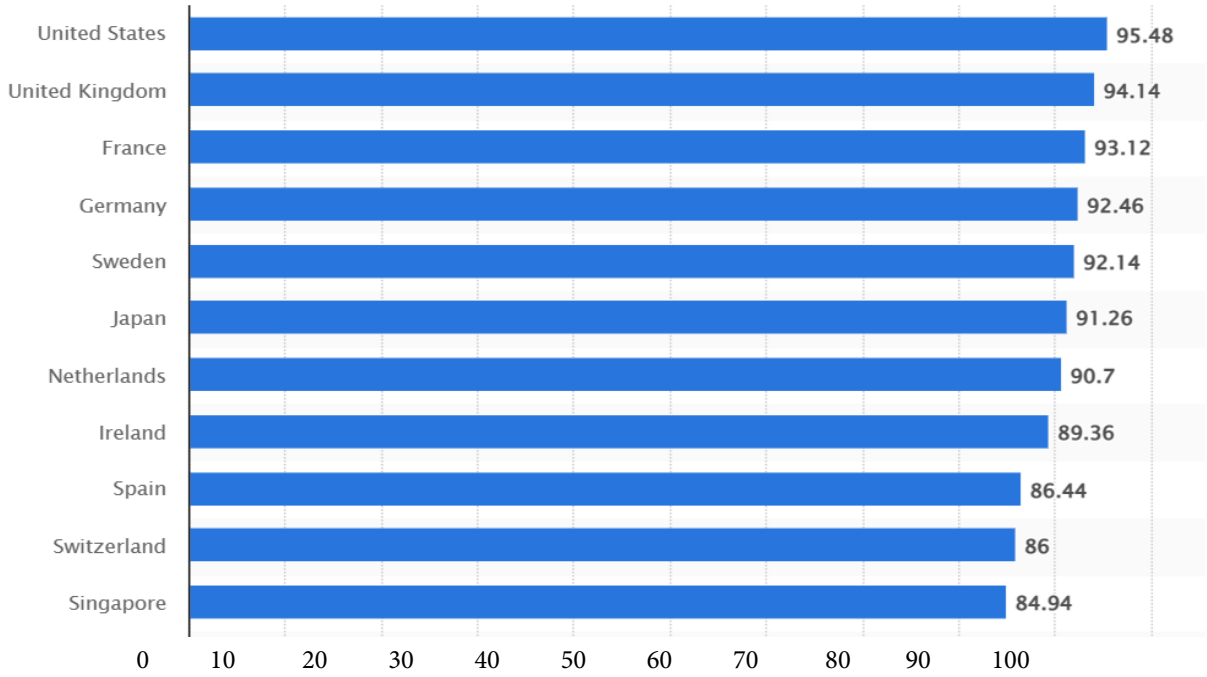
4. INTERNATIONAL INTELLECTUAL PROPERTY INDEX BY COUNTRIES: RESULTS

This study analyzed the value of the International Intellectual Property Index in different countries of the world (Fig. 1, Fig 2), which testified to its uneven value, and to the significant impact of economic and financial development, as well as the information support system. The equation is described by a polynomial function and has the form (Fig. 3):

$$y = 0{,}0099x^2 - 0{,}5491x + 63{,}116 \quad (3)$$

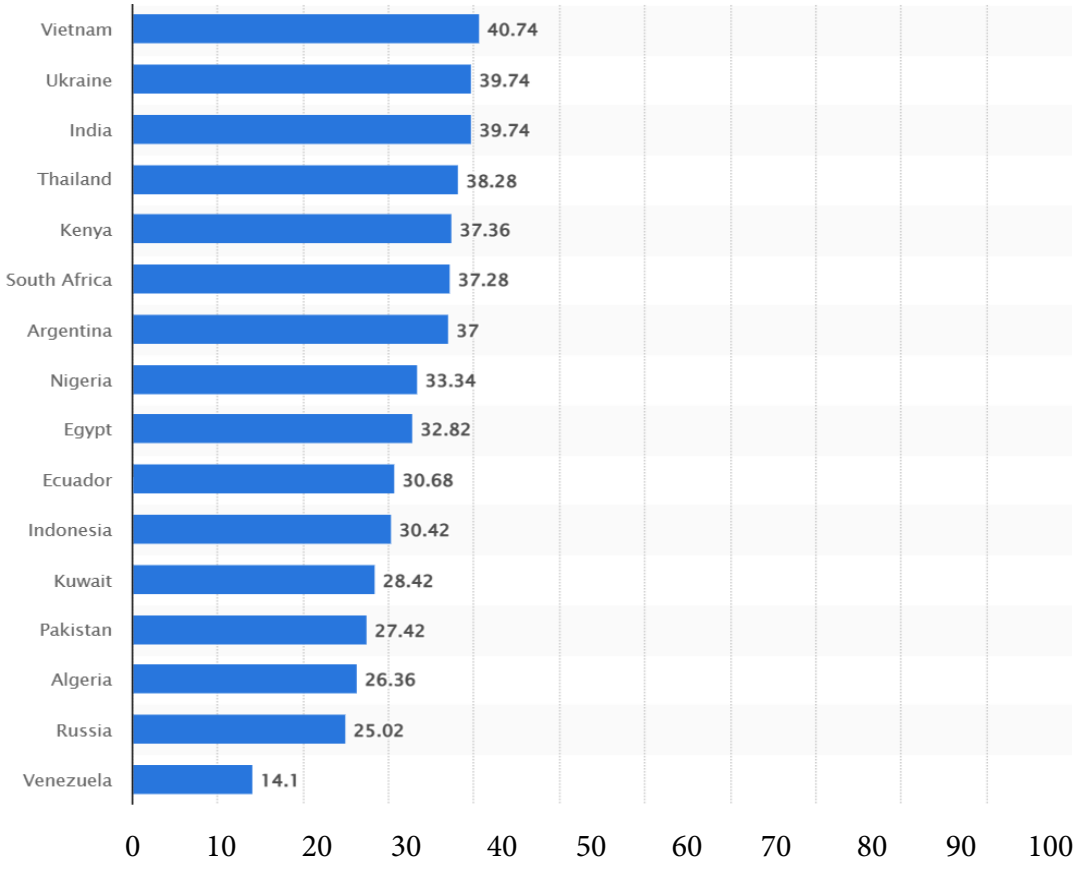
On the data of (Statista Research Department, 2023), with a total score of 95.48 points, the United States was and remains the leading country for the best intellectual property environment.

Figure 2. Leading countries according to the International Intellectual Property Index, 2023.



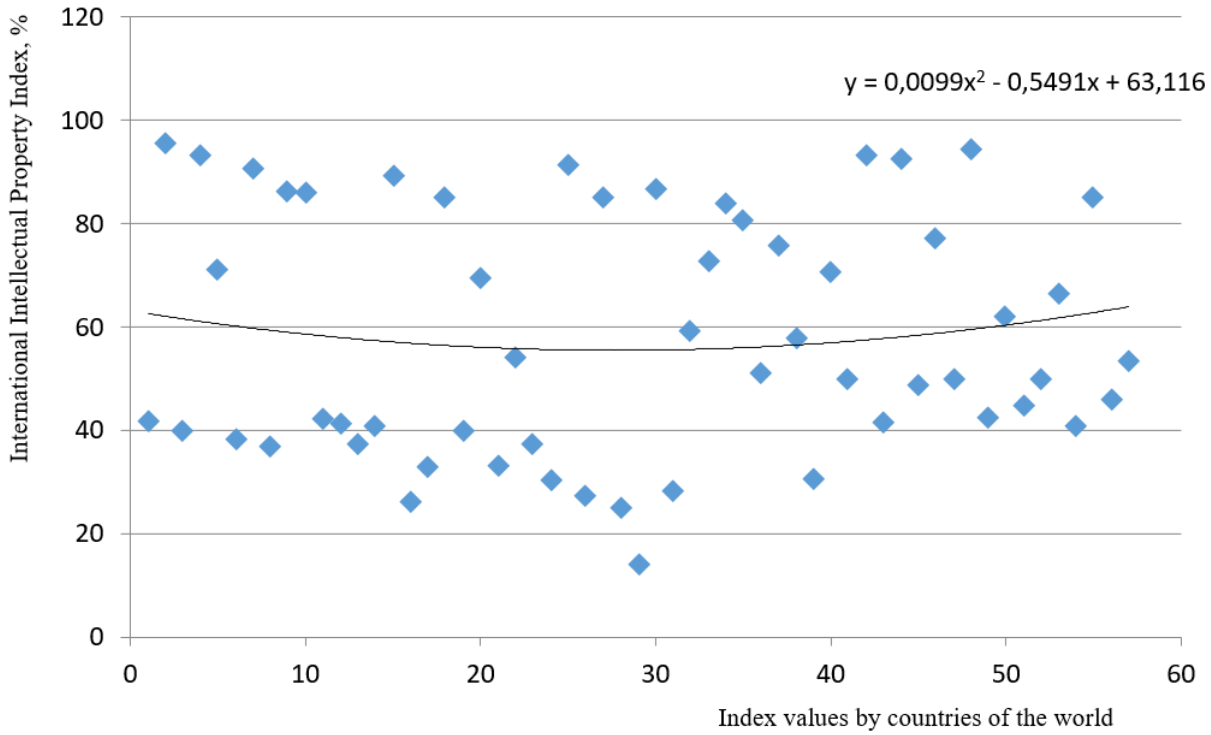
Source: Statista Research Department (2023).

Figure 3. Countries with the lowest value of their International Intellectual Property Index, 2023.



Source: Statista Research Department (2023).

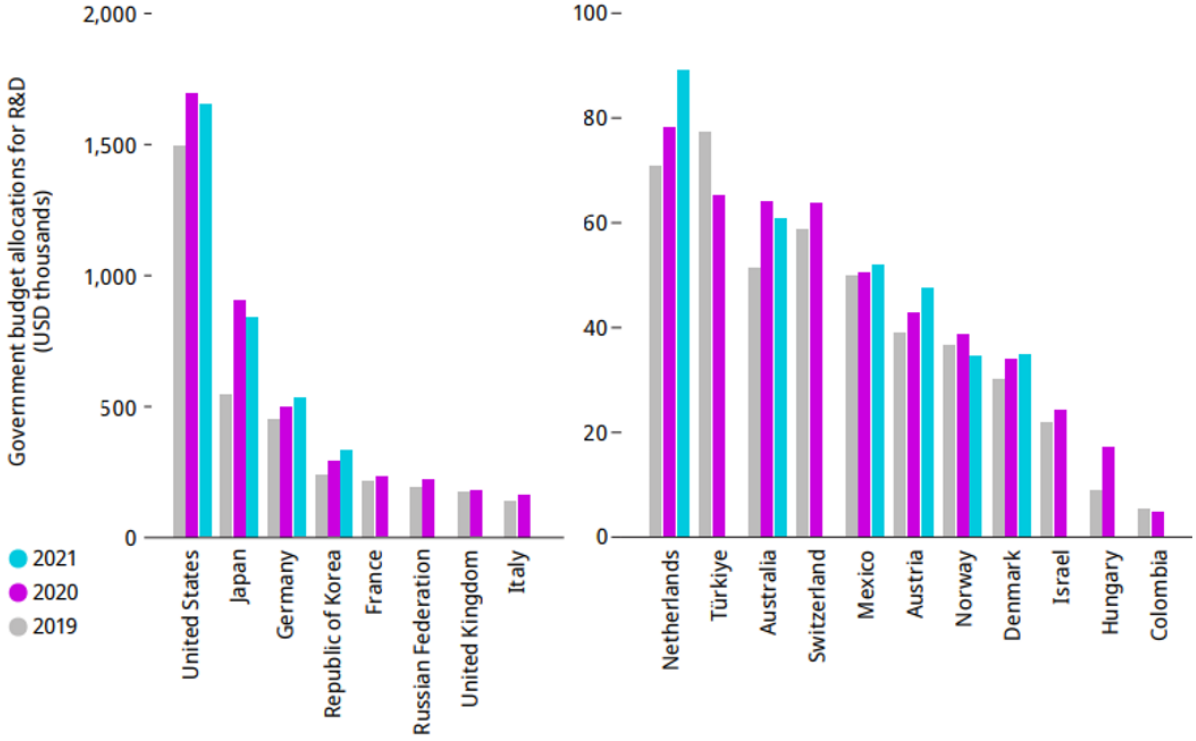
Figure 4. Polynomial distribution of the countries of the world according to their International Intellectual Property Index in 2023.



Source: constructed by authors based on results of model development and Statista data (International Intellectual Property Index (2023)).

In this work, on the basis of the data of (WIPO, 2023), the expenses for intellectual research in the period of 2019-2021 are analyzed (Fig. 4, Fig. 5). According to the data, in 2020 government spending on research and development mainly increased. In 2021, there was a tendency to slow down the growth of the state budget for R&D, but there was a positive increase in funding (Knowledge is growth - OECD, 2023; R&D expenditure - Statistics Explained, 2023).

Figure 5. Government budget allocations for R&D, 2019, 2020 and 2021.



Source: WIPO, based on joint OECD–Eurostat data collection on resources devoted to R&D, 2023.

According to this list, Ukraine ranks 57th in the world in terms of the development of the global innovation index. The country has a low level of budget revenues and is burdened by a grueling war. All this affects the security situation, the state of economic development, and, surprisingly, positively affects the level of technological development and innovation, mainly in the military sphere. Switzerland is the world's most innovative economy for the 12th year in a row, according to new 2022 data, followed by the United States, Sweden, Great Britain and the Netherlands. According to the GII 2022, China is moving closer to the top 10, while Turkey and India enter the top 40 for the first time (R&D expenditure - Statistics Explained (2023); WIPO (2023); Global Innovation Index (2022)).

The (International Property Index, 2023) consists of five key sets of indicators to reflect the national intellectual property environment of the 55 countries under study. The second position is occupied by Great Britain, and the third place is occupied by France. In Japan, the Ministry of Economy, Trade and Industry (METI) provides funding and support for innovative projects through its New Energy and Industrial Technology Development Organization (NEDO). South Korea has established the Korea Institute of Science and Technology (KIST), which conducts R&D activities in a wide range of fields. China has implemented the Made in China 2025 plan, which aims to transform the country into a world leader in high-tech manufacturing. In the world, intellectual economic development is seen as a key enabler of sustainable economic growth and development. It is recognized as a source of competitive advantage, with countries that invest in R&D and other innovative activities more likely to achieve sustained economic growth and prosperity in the global marketplace.

Figure 6. Global Innovation Index 2022 rankings.

GII rank	Economy	Score	Income group rank	Region rank
1	Switzerland	64.6	1	1
2	United States	61.8	2	1
3	Sweden	61.6	3	2
4	United Kingdom	59.7	4	3
5	Netherlands	58.0	5	4
6	Republic of Korea	57.8	6	1
7	Singapore	57.3	7	2
8	Germany	57.2	8	5
9	Finland	56.9	9	6
10	Denmark	55.9	10	7
11	China	55.3	1	3
12	France	55.0	11	8
13	Japan	53.6	12	4
14	Hong Kong, China	51.8	13	5
15	Canada	50.8	14	2
16	Israel	50.2	15	1
17	Austria	50.2	16	9
18	Estonia	50.2	17	10
19	Luxembourg	49.8	18	11
20	Iceland	49.5	19	12
21	Malta	49.2	20	13
22	Norway	48.8	21	14
23	Ireland	48.5	22	15
24	New Zealand	47.2	23	6
25	Australia	47.1	24	7
26	Belgium	46.9	25	16
27	Cyprus	46.2	26	2
28	Italy	46.1	27	17
29	Spain	44.6	28	18
30	Czech Republic	42.8	29	19
31	United Arab Emirates	42.1	30	3
32	Portugal	42.1	31	20
33	Slovenia	40.6	32	21
34	Hungary	39.8	33	22
35	Bulgaria	39.5	2	23
36	Malaysia	38.7	3	8
37	Türkiye	38.1	4	4
38	Poland	37.5	34	24
39	Lithuania	37.3	35	25
40	India	36.6	1	1
41	Latvia	36.5	36	26
42	Croatia	35.6	37	27
43	Thailand	34.9	5	9
44	Greece	34.5	38	28
45	Mauritius	34.4	6	1
46	Slovakia	34.3	39	29
47	Russian Federation	34.3	7	30
48	Viet Nam	34.2	2	10
49	Romania	34.1	8	31
50	Chile	34.0	40	1
51	Saudi Arabia	33.4	41	5
52	Qatar	32.9	42	6
53	Iran (Islamic Republic of)	32.9	3	2
54	Brazil	32.5	9	2
55	Serbia	32.3	10	32
56	Republic of Moldova	31.1	11	33
57	Ukraine	31.0	4	34
58	Mexico	31.0	12	3
59	Philippines	30.7	5	11
60	Montenegro	30.3	13	35
61	South Africa	29.8	14	2
62	Kuwait	29.2	43	7
63	Colombia	29.2	15	4
64	Uruguay	29.2	44	5
65	Peru	29.1	16	6
66	North Macedonia	28.8	17	36
67	Morocco	28.8	6	8
68	Costa Rica	28.7	18	7
69	Argentina	28.6	19	8
70	Bosnia and Herzegovina	28.5	20	37
71	Mongolia	28.0	7	12
72	Bahrain	28.0	45	9
73	Tunisia	27.9	8	10
74	Georgia	27.9	21	11
75	Indonesia	27.9	9	13
76	Jamaica	27.7	22	9
77	Belarus	27.5	23	38
78	Jordan	27.4	24	12
79	Oman	26.8	46	13
80	Armenia	26.6	25	14
81	Panama	25.7	26	10
82	Uzbekistan	25.3	10	3
83	Kazakhstan	24.7	27	4
84	Albania	24.4	28	39
85	Sri Lanka	24.2	11	5
86	Botswana	23.9	29	3
87	Pakistan	23.0	12	6
88	Kenya	22.7	13	4
89	Egypt	22.7	14	15
90	Dominican Republic	22.7	30	11
91	Paraguay	22.7	31	12
92	Brunei Darussalam	22.2	47	14
93	Azerbaijan	21.5	32	16
94	Kyrgyzstan	21.1	15	7
95	Ghana	20.8	16	5
96	Namibia	20.6	33	6
97	Cambodia	20.5	17	15
98	Ecuador	20.3	34	13
99	Senegal	19.9	18	7
100	El Salvador	19.9	19	14
101	Trinidad and Tobago	19.8	48	15
102	Bangladesh	19.7	20	8
103	United Republic of Tanzania	19.4	21	8
104	Tajikistan	18.8	22	9
105	Rwanda	18.7	1	9
106	Madagascar	18.6	2	10
107	Zimbabwe	18.1	23	11
108	Nicaragua	18.1	24	16
109	Côte d'Ivoire	17.8	25	12
110	Guatemala	17.8	35	17
111	Nepal	17.6	26	10
112	Lao People's Democratic Republic	17.4	27	16
113	Honduras	17.3	28	18
114	Nigeria	16.9	29	13
115	Algeria	16.7	30	17
116	Myanmar	16.4	31	17
117	Ethiopia	16.3	3	14
118	Zambia	15.8	32	15
119	Uganda	15.7	4	16
120	Burkina Faso	15.3	5	17
121	Cameroon	15.1	33	18
122	Togo	15.1	6	19
123	Mozambique	15.0	7	20
124	Benin	14.6	34	21
125	Niger	14.6	8	22
126	Mali	14.2	9	23
127	Angola	13.9	35	24
128	Yemen	13.8	10	18
129	Mauritania	12.4	36	25
130	Burundi	12.3	11	26
131	Iraq	11.9	36	19
132	Guinea	11.6	12	27

High-income
Upper middle-income
Lower middle-income
Low-income

Europe
Northern America
Latin America and the Caribbean

South East Asia, East Asia, and Oceania
Central and Southern Asia

Northern Africa and Western Asia
Sub-Saharan Africa

Source: Global Innovation Index (2022).

Governments and private organizations have implemented a range of policies and initiatives to promote intellectual economic development, such as tax incentives, grants, and subsidies for R&D activities, and the creation of innovation clusters and incubators (Global Innovation Index, 2022).

5. DISCUSSION

As intellectual assets become more and more necessary in the operation of any organization, international cooperation and knowledge flows also gain more and more importance. In this changing economic environment, innovation has become more market-based, faster and more intensive, and more closely linked to scientific progress (OECD, 2000a). In recent years, the development of intellectual innovation incubators and centers has gained significant attention from scholars and policymakers worldwide. These incubators and centers are aimed at fostering innovation and entrepreneurship by providing startups and emerging companies with the necessary resources and support to grow and succeed. It's common knowledge that 38.2% of US GDP comes from intellectual property, and intellectual property theft costs the US between $225 billion and $600 billion annually. Therefore, the average cost of defending a patent lawsuit in this state exceeds $3 million.

In total, more than 12,000 intellectual property cases are filed each year. All this shows that intellectual developments are an important driver of the world economy and a strategic economic resource. There is no doubt that 22% of technological innovation comes from the US, and about 28% of US jobs are in intellectual (M. Lazic, 2023). Many scholars agree that the concentration of intellectual innovation incubators and centers is higher in developed countries, such as the United States, Europe, and Japan. This is mainly because these countries have a higher level of economic development and more extensive access to financial and human capital. Additionally, these countries have well-established innovation ecosystems that support the creation and growth of new businesses. However, there are also emerging economies, such as China, India, and Brazil, that have been investing heavily in the development of innovation incubators and centers. For example, in China, there are more than 4,000 incubators and accelerators, which is more than any other country in the world. These countries recognize the importance of innovation and entrepreneurship in driving economic growth and are investing in creating an environment that supports their development (The 10 most innovative companies in North America, 2023; The Impact of Intellectual Capital on Firm Performance, 2023).

The costs of establishing and running intellectual innovation incubators and centers vary depending on the location, size, and level of services provided. For example, some incubators and centers may offer only basic services, such as office space and networking events, while others may provide more extensive support, such as access to funding, mentorship, and legal services. In some countries, such as the United States, there are government-funded programs and initiatives aimed at supporting the development of intellectual innovation incubators and centers. For instance, the Small Business Administration's Small Business Innovation Research program provides grants to small businesses and startups to support their research and development efforts. Additionally, there are tax incentives and other financial benefits available to companies that invest in innovation and research.

Overall, the development of intellectual innovation incubators and centers is seen as a crucial factor in driving economic growth and fostering innovation and entrepreneurship. While the concentration of these centers is currently higher in developed countries, emerging economies are also investing in their development. The costs of establishing and running these centers vary, and governments can play a significant role in supporting their development through funding and other initiatives (table 1).

Table 1. Comparison of Intellectual Development Expenditures in Different Countries.

Country	Total Expenditures on Research and Development (in billions of US dollars)	Expenditures on Intellectual Property (in billions of US dollars)	Percentage of R&D Expenditures Allocated to Intellectual Property
USA	581.8	136.3	23.4%
Japan	170.1	31.4	18.4%
China	370.6	45.2	12.2%
Germany	131.9	27.1	20.5%
South Korea	83.5	13.8	16.5%

Source: The data is based on the latest available statistics from UNESCO (2019) and World Intellectual Property Organization (2018).

The table above compares the expenditures on intellectual development in five countries: USA, Japan, China, Germany, and South Korea. The total expenditures on research and development (R&D) and expenditures on intellectual property (IP) are presented in billions of US dollars. The percentage of R&D expenditures allocated to IP is also shown to provide an indication of the importance placed on intellectual property in each country. The data indicates that the USA spends the most on R&D, with total expenditures of $581.8 billion, and also allocates the highest percentage of R&D expenditures to IP, at 23.4%. Japan and Germany also allocate a significant portion of their R&D expenditures to IP, at 18.4% and 20.5%, respectively. In contrast, China allocates a relatively low percentage of its R&D expenditures to IP, at 12.2%. South Korea falls in the middle, with a percentage of 16.5%. Expenditures on intellectual development are an important indicator of a country's commitment to innovation and the creation of new knowledge. The data suggests that the USA, Japan, and Germany are the most committed to this area, while China is lagging behind in terms of IP expenditures as a percentage of total R&D expenditures (R&D expenditure - Statistics Explained, 2023; MSTI, 2005; C.Martinez, D. Guellec, 2004; International cooperation, strategy, 2021; Knowledge is growth - OECD, 2023).

One commonly used formula for economic evaluation of innovation development is the Return on Investment (ROI) formula:

$$ROI = \frac{(Gain\ from\ Investment - Cost\ of\ Investment)}{(Cost\ of\ Investment)} \quad (4)$$

This formula calculates the percentage return on investment, which is the ratio of the gain from the investment to the cost of the investment. The gain from investment is the increase in revenue or other financial benefits resulting from the innovation development, while the cost of investment includes all costs associated with the innovation development, such as research and development expenses, patent fees, and marketing costs.

A high ROI indicates that the innovation development has been successful in generating significant financial returns, while a low ROI suggests that the investment has not been successful. The ROI formula is a useful tool for evaluating the economic impact of innovation development and comparing the effectiveness of different innovation projects (table 2).

Table 2. Gain from Investment in Innovation Development in Different Countries (in billions of US dollars).

Country	Gain from Investment in Innovation Development
USA	481.7
Japan	189.2
China	210.4
Germany	92.3
South Korea	65.8

Source: The data is based on the latest available statistics from the World Intellectual Property Organization (WIPO) and official financial reports of the respective countries.

The table above shows the gain from investment in innovation development in five countries: USA, Japan, China, Germany, and South Korea. The gain from investment is presented in billions of US dollars. The data indicates that the USA has the highest gain from investment in innovation development, at $481.7 billion, followed by China at $210.4 billion. Japan comes in third place with a gain of $189.2 billion, while Germany and South Korea have gains of $92.3 billion and $65.8 billion, respectively (R&D expenditure - Statistics Explained, 2023; International cooperation, strategy, 2021; Investments for the Future Programme – France, 2020).

These data demonstrate the significant economic impact of innovation development in these countries. Investment in innovation development can lead to substantial financial gains through increased revenue, cost savings, and improved market position. The gain from investment in innovation development is an important indicator of the effectiveness of a country's innovation policies and strategies. It is important to note that the gain from investment in innovation development can vary widely depending on the specific industry, sector, and innovation project. Nevertheless, the figures presented in this table provide a useful overview of the economic impact of innovation development in different countries (table 3).

Table 3. Effectiveness of Intellectual Development in Different Countries (measured by Return on Investment).

Country	Return on Investment (ROI)
USA	21%
Japan	14%
China	18%
Germany	12%
South Korea	15%

Source: The data is based on the latest available statistics from the World Intellectual Property Organization (WIPO) and official financial reports of the respective countries.

The table above shows the effectiveness of intellectual development in five countries: USA, Japan, China, Germany, and South Korea. The effectiveness is measured by the return on investment (ROI), which is presented as a percentage. The data indicates that the USA has the highest ROI for intellectual development, at 21%, followed by China at 18%. South Korea comes in third place with an ROI of 15%, while Japan and Germany have ROIs of 14% and 12%, respectively. These figures demonstrate that the USA has the most effective intellectual development programs among the five countries listed. However, it is important to note that the ROI can vary widely depending on the specific industry, sector, and innovation project. Nevertheless, the figures presented in this table provide a useful overview of the effectiveness of intellectual development in different countries (R&D expenditure - Statistics Explained, 2023; MSTI, 2005; C.Martinez, D. Guellec,

2004; International cooperation, strategy, 2021).

Improving the effectiveness of intellectual development is crucial for promoting economic growth and competitiveness in the global market. Countries with high ROI for intellectual development are more likely to attract investment and talent, which can further fuel innovation and economic growth. In Ukraine, the government has recognized the importance of intellectual economic development and has taken steps to support it. However, the level of investment in this area remains relatively low compared to other developed countries. According to the State Statistics Service of Ukraine, in 2020, the total spending on research and development (R&D) in Ukraine was 0.32% of GDP, which is significantly lower than the average of 2.4% for the European Union (Knowledge is growth - OECD, 2023; Catapult network review, 2021).

The lack of funding for intellectual economic development has been a long-standing issue in Ukraine, but the situation was exacerbated by the ongoing conflict in eastern Ukraine. The war has drained resources and diverted attention away from other important issues, including the need for investment in R&D. The impact of the war on intellectual economic development in Ukraine can be seen in the significant decrease in the number of patents filed in recent years. In 2013, there were 2,794 patent applications filed in Ukraine, while in 2019, there were only 1,624. This decline can be attributed to the lack of funding and support for R&D in Ukraine, as well as the unstable political and economic situation in the country (WIPO, 2023). Despite the challenges, there are some positive developments in Ukraine's intellectual economic development. The government has recently introduced a number of initiatives aimed at promoting innovation and R&D. For example, the Ukrainian Startup Fund was established in 2018 to support the development of Ukrainian startups through seed funding and other resources. The National Academy of Sciences of Ukraine also provides funding and support for R&D projects (Knowledge is growth - OECD, 2023); Catapult network review, 2021; Driver of Innovation, 2022).

In conclusion, while Ukraine has recognized the importance of intellectual economic development, the level of investment in this area remains low. The ongoing war in eastern Ukraine has further exacerbated the issue, resulting in a decline in the number of patents filed. Nevertheless, there are some positive developments, such as the establishment of the Ukrainian Startup Fund, which indicate that Ukraine is taking steps to promote innovation and R&D (Driver of Innovation, 2022); Knowledge is growth - OECD, 2023).

One economic model for evaluating the implementation of intellectual innovations is the cost-benefit analysis (CBA) approach. This approach involves weighing the expected costs and benefits of implementing an innovation, and determining whether the expected benefits outweigh the expected costs. The first step in the CBA approach is to identify all the costs and benefits associated with the implementation of the innovation. These may include direct costs such as research and development expenses, marketing and advertising costs, and production costs. Benefits may include increased revenue, reduced costs, increased productivity, and improved efficiency. The next step is to estimate the magnitude of each cost and benefit. This involves projecting the expected costs and benefits over a specific time period, such as the life cycle of the innovation. It also involves assigning a monetary value to each cost and benefit, which can be challenging for intangible benefits such as improved brand recognition or customer satisfaction. Once the costs and benefits have been identified and estimated, the CBA approach involves comparing the total expected costs with the total expected benefits. If the benefits outweigh the costs, then the innovation is deemed economically feasible and worthwhile to implement.

However, it is important to note that the CBA approach has its limitations. For example, it may not take into account the broader social and environmental impacts of the innovation, which can be difficult to quantify. Additionally, the approach relies on accurate estimates of costs and benefits, which may be subject to uncertainty. Despite these limitations, the CBA approach remains a useful tool for evaluating the economic feasibility of implementing intellectual innovations. It can help businesses and governments make informed decisions about where to allocate their resources and investments, and can ultimately lead to more effective and efficient use of resources.

6. CONCLUSIONS

As a result of the research conducted by the authors, the following achievements were obtained and the following conclusions were formulated.

1.An important indicator of economic development is the Global Innovation Index 2022 (GII), which records at the global level the successes and achievements of the countries of the world in global innovation trends. Of course, in recent years, the size of this indicator was significantly affected by the COVID-19 pandemic (L. Mićić, Z. Mastilo, 2022), the war in Ukraine, natural disasters in Turkey, all this slows down the productivity of growth thanks to intellectual developments. GII reveals the world's most innovative economies, ranks the innovation indicators of 132 economies, highlights their strengths and weaknesses in the implementation of innovations. Such components affect the resulting indicator of the global innovation index as productivity, economic growth and social well-being over the coming decades. As the digital age increases the opportunities for economic development, so too must increased spending on intellectual development. On the basis of the data of WIPO, the expenses for intellectual research in the period of 2019-2021 are analyzed by the authors. According to the data, in 2020 government spending on research and development in Ukraine mainly increased. In 2021, there was a tendency to slow down the growth of the state budget for R&D, but there was a positive increase in funding. In recent years, the share of intellectual research in Ukraine has increased significantly, but in the conditions of martial law, it is becoming increasingly difficult to develop innovations, besides, there is fierce competition in this field. The main players of the market of intellectual innovations are such states as USA, China and EU. The leaders in patent activity in 2022 are such companies as Samsung, IBM, Taiwan Semiconductor, Huawei, Canon, LG, Qualcomm, Intel, Apple, Toyota and many others.

2.Ukraine ranks 57th in the world in terms of the development of the global innovation index. The country has a low level of budget revenues and is burdened by a grueling war. All this affects the security situation, the state of economic development, and, surprisingly, positively affects the level of technological development and innovation, mainly in the military sphere. Switzerland is the world's most innovative economy for the 12th year in a row, according to new 2022 data, followed by the United States, Sweden, Great Britain and the Netherlands. According to the GII 2022, China is moving closer to the top 10, while Turkey and India enter the top 40 for the first time.

3.The gain from investment in innovation development is an important indicator of the effectiveness of a country's innovation policies and strategies. It is important to note that the gain from investment in innovation development can vary widely depending on the specific industry, sector, and innovation project. Intellectual economic development is a key driver of economic growth and competitiveness in the modern world. Governments and private organizations worldwide are investing heavily in research and development (R&D) activities and other innovative initiatives to create new products, services, and processes that drive economic growth and development. In this article, examined some of the intellectual economic development initiatives that have been implemented in different parts of the world. Intellectual economic development is a critical component of national development strategies in different parts of the world. Governments and private organizations are investing heavily in R&D activities and other innovative initiatives to create new products, services, and processes that drive economic growth and development. The initiatives discussed in this article are just a few examples of the many programs and policies that have been implemented to promote intellectual economic development in different parts of the world. By continuing to invest in innovation and knowledge creation, countries can improve their competitiveness and achieve sustained economic growth and prosperity.

4.Innovation and economic development go hand in hand. Innovation is the key to economic growth and prosperity. In the current era of globalization, countries that invest in research and development (R&D) and innovative activities are more likely to achieve sustained economic growth and competitiveness in the global marketplace. This article aims to explore the positive experience

of intellectual economic development in the world, with a focus on the costs of innovation. Intellectual economic development is a multidimensional concept that has been explored by scholars and researchers from various disciplines. It refers to the creation, dissemination, and use of knowledge to improve economic outcomes, and is driven by innovation, entrepreneurship, and intellectual property. Empirical studies suggest that intellectual economic development has a positive impact on economic growth and firm performance. As the importance of knowledge and innovation continues to grow in the global economy, intellectual economic development is likely to remain a critical component of economic development strategies around the world. In this study has been analyzed the value of the International Intellectual Property Index in different countries of the world, which testified to its uneven value, and to the significant impact of economic and financial development, as well as the information support system.

5.This study analyzed the value of the International Intellectual Property Index in different countries of the world, which testified to its uneven value, and to the significant impact of economic and financial development, as well as the information support system. The United States with a total score of 95.48 points, was and remains the leading country for the best intellectual property environment. The implementation of intellectual innovations is an essential component of economic growth in any country. However, it requires significant investment, both in terms of capital and skilled labor. The proposed model allows us to evaluate the implementation of such innovations by considering both the costs and potential benefits. The net gain from implementing intellectual innovations provides a metric to evaluate their effectiveness. Governments should take a proactive approach to incentivize the implementation of intellectual innovations. Such initiatives can include tax incentives, funding for research and development, and the creation of an enabling environment for innovation. The model can be adapted to the specific context of any country, providing a valuable tool for policymakers and businesses to assess the potential benefits and costs of implementing intellectual innovations.

6.Ukraine has a number of characteristic economic intellectual developments that have emerged over the past few years. One of the most prominent areas of development has been in the realm of IT, where Ukraine has become known for producing high-quality software and technology products. In recent years, the Ukrainian government has made a concerted effort to support and promote the development of intellectual property, with a focus on IT and other technology-based sectors. This has included a range of programs and initiatives designed to encourage innovation, such as grants and tax incentives for businesses investing in research and development. One of the key initiatives launched by the Ukrainian government in recent years is the creation of a National Intellectual Property Strategy, which is aimed at improving the legal framework for IP protection and encouraging innovation across a range of sectors. This strategy also includes a number of specific measures to support the development of new technologies and to promote the growth of businesses in key sectors. In addition to the National Intellectual Property Strategy, there are a number of other programs and initiatives designed to support the development of intellectual property in Ukraine. For example, the Ukrainian government has established a number of technology parks and innovation centers, which provide a range of services and resources to support the growth of innovative businesses. Overall, the Ukrainian government has recognized the importance of promoting the development of intellectual property as a key driver of economic growth and innovation. As such, it has invested significant resources and launched a range of initiatives to support the growth of the sector, with a particular focus on IT and other technology-based industries.

The promising future research of the authors will be the formation of an economic-mathematical model for the optimization of the process of financing and management of intellectual economic development in the conditions of martial law, which will be formed on the basis of statistical data of the developed countries of the world with the justification of predictive values for the long-term perspective.

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