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EFFICIENCY ANALYSIS OF USING THE SCIENTIFIC POTENTIAL IN THE UKRAINIAN HIGHER EDUCATION SYSTEM

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Introduction and purpose of the study. Solving the problem of ensuring the compliance of Ukrainian higher education with the current and future needs of the development of the national economy and society involves solving a number of interrelated tasks: assessing the state of Ukrainian higher education and science at the current stage; management problems of education institutions, marketing activities and increasing the competitiveness of Ukrainian institutions of higher education, which would allow to enter the world market of educational services; analysis of state management and regulation of the education system and innovative development of the field of higher education; outline of theoretical issues of modeling the processes of using the potential of the knowledge economy of society as a whole. The center of the development of innovations and the implementation of scientific research is the system of higher education of the state. According to the systemic approach, scientific activity in higher education is a system consisting of the following subsystems: carrying out scientific research, training academic staff, creative activity of participants in educational activity, publicizing the results of scientific research and implementing the obtained results in the educational process. It is the use of a systemic approach that will help improve the quality of higher education and increase the competitiveness of domestic institutions of higher education at the international and national levels. The aforementioned outlines the relevance of this study and reflects the purpose of this article as determining the effectiveness of the scientific potential of the higher education system of Ukraine and determining the impact of factors on this effectiveness.

Research methods used: the method of induction in the implementation of formal-logical generalizations; deduction method for obtaining intermediate (partial) conclusions based on the analysis of the nature of the general process; method of abstraction to locate and identify significant trends in economic processes; correlation analysis to determine the most significant factors affecting the level of GDP formation from professional, scientific and technical activities; regression analysis to construct a linear multiple regression. Special software and technical tools were used for modeling: MS Excel, Statistika10.

Results. It has been proven that the effectiveness of using the scientific potential of the higher education system depends on the effectiveness of training academic staff, the level of financing scientific and technical activities of the higher education system, the publication activity of scientists and the number of patented inventions. In the process of analysis, it was proven that the level of GDP from professional, scientific and technical activities depends on changes in such factors as: the number of graduate students who completed graduate studies with the defense of theses; the number of doctoral students at IHE at the end of the year; the number of scientific and technical works performed by institutions of higher education; publishing activity of higher education: printed monographs and articles in scientific journals published in the Scopus scientometric database; the number of received patents for inventions. The obtained multiple regression equation makes it possible to predict the size of GDP from professional, scientific and technical activities at the specified sizes of the specified factor characteristics.

Conclusions. The development of the scientific potential of the higher education system largely depends on balanced state, regional and domestic policies. Currently, in the conditions of a full-scale war, institutions of higher education receive smaller amounts of real funding for scientific activities, therefore it is important to develop a strategy for the development of the higher education system of Ukraine, which would be aimed at ensuring the development and competitiveness of domestic institutions of higher education in the conditions of globalization.

Keywords: system of higher education; scientific activity; scientific potential; postgraduate studies; doctoral studies; publishing activity.

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АНАЛІЗ ЕФЕКТИВНОСТІ ВИКОРИСТАННЯ НАУКОВОГО ПОТЕНЦІАЛУ СИСТЕМИ ВИЩОЇ ОСВІТИ УКРАЇНИ

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Вступ і мета дослідження. Вирішення проблеми забезпечення відповідності української вищої освіти сучасним і майбутнім потребам розвитку національної економіки і суспільства передбачає вирішення цілого ряду взаємопов'язаних завдань: оцінювання стану української вищої освіти і науки на сучасному етапі; проблеми управління навчальними закладами, маркетингова діяльність та підвищення конкурентоспроможності українських закладів вищої освіти, які б дозволили вийти на світовий ринок освітніх послуг; аналіз державного управління і регулювання системи освіти та інноваційний розвиток сфери вищої освіти; окреслення теоретичних питань моделювання процесів використання потенціалу економіки знань суспільства в цілому. Осередком розвитку інновацій та здійснення наукових досліджень є система вищої освіти держави. Відповідно до системного підходу наукова діяльність у вищій освіті є системою, що складається з таких підсистем: здійснення наукових досліджень, підготовка наукових кадрів, творча активність учасників освітньої діяльності, оприлюднення результатів наукових досліджень та впровадження отриманих результатів в освітній процес. Саме використання системного підходу сприятиме підвищенню якості вищої освіти та зростанню конкурентоспроможності вітчизняних закладів вищої освіти на міжнародному і національному рівні. Вищезазначене окреслює актуальність даного дослідження та відображає **мету** даної статті як визначення ефективності наукового потенціалу системи вищої освіти України та визначення впливу чинників на цю ефективність.

Методи дослідження, що використовувались: метод індукції при здійсненні формально-логічних узагальнень; метод дедукції для одержання проміжних (часткових) висновків на основі аналізу характеру загального процесу; метод абстрагування для виявлення та ідентифікації значимих тенденцій економічних процесів; кореляційний аналіз для визначення найбільш суттєвих чинників, що впливають на рівень формування ВВП від професійної, наукової та технічної діяльності; регресійний аналіз для побудови лінійної множинної регресії. Для моделювання використовувались спеціальні програмно-технічні засоби: MS Excel, Statistika10.

Результати. Доведено, що ефективність використання наукового потенціалу системи вищої освіти залежить від результативності підготовки наукових кадрів, рівня фінансування наукової та науково-технічної діяльності системи вищої освіти, публікаційної активності науковців та кількості запатентованих винаходів. В процесі аналізу доведено, що рівень ВВП від професійної, наукової та технічної діяльності залежить від зміни таких чинників як: кількість аспірантів, які закінчили аспірантуру із захистом дисертацій; кількість докторантів у ЗВО на кінець року; кількість науково-технічних робіт, що виконували ЗВО; публікаційна активність вищої освіти: надруковані монографії та статті надруковані у наукових виданнях, що опубліковані у наукометричій базі даних Scopus; кількість отриманих патентів на винаходи. Отримане рівняння множинної регресії надає можливість спрогнозувати розмір ВВП від професійної, наукової та технічної діяльності при заданих розмірах зазначених факторних ознак.

Висновки. Розвиток наукового потенціалу системи вищої освіти багато в чому залежить від виваженої державної, регіональної та внутрішньої політики. Наразі в умовах повномасштабної війни ЗВО отримують менші розміри реального фінансування наукової діяльності, тому важливо розробити стратегію розвитку системи вищої освіти України, яка була б направлена на забезпечення розвитку та конкурентоспроможності вітчизняних закладів вищої освіти в умовах глобалізації.

Ключові слова: система вищої освіти; наукова діяльність; науковий потенціал; аспірантура; докторантура; публікаційна активність.

Introduction. Progressive global trends nowadays include not only the global nature of the functioning of economic systems and the strengthening of their social focus, but also the transition to a knowledge economy. Formation of the knowledge economy is one of the most important areas of economic policy in all developed countries of the world. In this regard, the task arises as for transition to a qualitatively new stage of economic development based on knowledge, scientific achievements and innovations (Varnalii, 2017, p. 8).

Studying the interpretation of the concept of "innovation" by foreign scientists, we believe that their approach to the definition of this concept is conceptually related to the concept of "knowledge economy": innovation is considered to be a process of obtaining benefit from skills and knowledge for the production of new or improvement of new or improved products and services. It is knowledge that generates innovation, that is, the growth of knowledge, which is the source of economic growth, is the basis for economic development.

Currently, the state policy is aimed at integrating education, science and business. In this link, universities play the role of a scientific and innovative center, in which highly qualified academic staff, scientific and informational infrastructure, methods, means and technologies, certain resources and long-term connections with domestic and foreign scientists and business structures are concentrated. That is, the development of science in universities is one of the urgent problems in modern higher education in Ukraine. Scientific research activity and innovative products created in the process of its implementation are one of the most important and valuable assets for attracting additional funding not only to ensure scientific and research work, but also to support the economic stability of the entire university as a whole (Drantusova).

Education and science ensure the formation of a methodological base for the development and implementation of innovative projects, optimizing the use of the competitive advantages of the territory and a separate institution of higher education (hereinafter – IHE). Considering the multifaceted nature of the problems of scientific activity at institutions of higher education, the mentioned issue is considered by scientists from different sides, which is confirmed by the defended theses studies for the period 2001–2020 (Table 1).

Thus, Serhii Savchenko's research is aimed at improving the management system of institutions of higher education based on the implementation of innovative management tools directed to increase consumer satisfaction with the quality of educational and scientific services and products (Savchenko, 2010, p. 2). Andriy Shevchuk investigates the innovative development of regional educational systems, sets practical tasks and develops a system of measures aimed at stimulating the innovative development of regional educational systems (Shevchuk, 2014, p. 8). Oleksandr Romanovsky's research is aimed at

developing the theoretical and methodological foundations of the innovative development of the higher education system based on university entrepreneurship and substantiating practical recommendations for improving the state policy of actualizing the role of higher education in the innovative development of the national economy of systems (Romanovskyi, 2014, p. 8).

Table 1

Study of the problems using scientific potential and the issue of innovative development of institutions of higher education in scientific works

№	Scientist	Research topic	Defense year
theses for obtaining the scientific degree of Doctor of Economics			
1	Serhii Savchenko	Models of innovative management of an institution of higher education	2010
2	Oleksandr Romanovsky	Theoretical and methodological principles of innovative development in the field of higher education	2014
3	Andriy Shevchuk	Innovative development of regional educational systems	2014
theses for obtaining the scientific degree of Candidate of Economic Sciences			
4	Inna Khodykina	University education in the context of innovative development of Ukraine	2006
5	Yuliya Aranovych	Organizational and economic mechanism of using intellectual property objects of institutions of higher education of the aviation profile	2008
6	Tetyana Koroleva	Effectiveness of scientific research and use of innovative potential of an institution of higher educational	2008
7	Pavlo Dudkin	Organizational and economic mechanism of development of innovative and logistic systems in the educational, scientific and industrial complex	2009
8	Larisa Ivashko	Innovative information and communication technologies for ensuring the quality of higher economic education	2011
9	Artur Oleksyn	Effectiveness of financing educational innovations in the system of higher education of Ukraine	2012
10	Denis Deacon	Organizational and economic foundations of innovative development of the national system of higher education	2014
11	Oksana Demchenko	Activation of the influence of higher education on the innovative development of the national economy	2014
12	Tetyana Kmytyuk	Modeling of staff motivation in relation to innovative activities (on the example of universities)	2015
13	Olga Avdeeva	Socio-economic levers of state regulation of innovative development of education in Ukraine	2017
14	Volodymyr Prus	Formation of the management mechanism of innovative development of an institution of higher education	2018
15	Olha Maguta	Innovation of higher education in Ukraine based on attracting target capital (endowment)	2018
16	Nataliya Fedorova	Science as a factor of social and economic development of society	2018

Also, certain aspects of the effectiveness of the use of scientific potential were considered in the works of Ukrainian scientists: M.I. Bublyk, I.M. Gryshchenko, M.P. Denisenko, V.Ye. Yermachenko, S.A. Yerokhina, A.V. Zhuravka, I.S. Kaleniuk, A.O. Kasych, O.E. Kuzmina, B.A. Malytsky, I.O. Tarasenko.

The analysis and generalization of literary sources and special scientific studies showed that most scientists in their works paid attention to the innovative development and management of institutions of higher education. At the same time, issues related to the effective use of the scientific potential of the higher education system of Ukraine remain insufficiently covered in the economic literature. The need to study this problem at the proper level considering the specifics and peculiarities of the economic situation in Ukraine has led to the choice of the article topic and determined its purpose and tasks.

Matherials and Methods. ***Data Description.*** As Dmytro Lukyanenko noted in his report, "higher education systems are the most competitive, and universities of countries with a long successful history of consistent development with constant support of best practices in this area are the most rating. A vivid example of the tradition of strong consistent state support for the educational and research sector is the USA. Thus, today the share of public spending on funding research in US universities ranges from 37.1% to 93.3% and has remained relatively stable over recent years. This fully applies to the leading European countries, primarily Great Britain, Germany, France. The share of public expenditures on average in OECD countries is 90% for primary, secondary, as well as professional education outside of higher education, and about 68% for higher education" (Lukianenko, 2020, p. 2).

It has been proven that the higher the level of education of employed persons is, the higher the potential opportunities for increasing labour productivity in the national economy are and the greater the total income of society is. Thus, there is a close connection between education and economic growth, which is manifested in the growth rates of general economic indicators: gross national product (hereinafter – GNP), gross domestic product (hereinafter – GDP), etc. (Table 2).

Science as a source of new information and knowledge is one of the most powerful factors of development, since it contributes to the qualitative improvement of both the economy and the entire social system, causing a synergistic effect within it, therefore the assessment of the pace and vector of development of professional, scientific and technical activity, as well as education is also a priority because these types of economic activity are the basis for the progressive socio-economic development of any society. According to the analysis results, it was found out that the share of education as a part of the gross domestic product over the years takes an insignificant part – in the range

of 4–5%, the share of professional, scientific and technical activities is even smaller – in the range of 2–4%.

Table 2

Gross domestic product and the share of scientific activity in 2010–2021[1]

Indexes	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Gross Domestic Product, UAH million, including:	1079346	1299991	1404669	1465198	1586915	1988544	2385367	2983882	3560596	3978400	4194102	5459574
professional, scientific and technical activities, UAH million	27625	30471	41966	47712	47139	55789	68460	86537	113354	141523	136832	159284
- share in GDP, %	2.56	2.34	2.99	3.26	2.97	2.81	2.87	2.90	3.18	3.56	3.26	2.9

[1] without considering the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the area of the anti-terrorist operation.
Source: derived from State Statistics Service of Ukraine (http://www.ukrstat.gov.ua/).

The value of GDP depends on the influence of certain factors. We believe that the level of GDP is primarily influenced by the scientific potential of the higher education system, which is formed due to:

- funding of scientific and technical activities;
- the number of employees involved in scientific research and development;
- effectiveness of post-graduate studies and doctoral studies in the higher education system;
- completeness and timeliness of publicizing the results of scientific activity;
- patent activity.

An indicator measured by many international organizations – the World Bank, the World Economic Forum, the European Institute of Business Management INSEAD, etc. is spendings on scientific research and development as a percentage of GDP covering fundamental, applied research and experimental development. The level of expenditures for carrying out scientific research and development in Ukraine is shown in the Table 3.

The level of expenditures for scientific research and development in Ukraine in 1999 was 0.97% of GDP, in 2010 – 0.75%, in 2015 – 0.55%, and in 2021 – 0.17%. At the same time, the corresponding indicator in the world in 2010 was 2.02%, in 2015 – 2.09%, in 2018 – 2.20% and is constantly growing in accordance with the implementation of the strategic task of increasing its level up to 3% in 2020. The largest share of research and development expenditures in GDP in 2018 was in Israel – 4.94%, Switzerland – 3.37%, Sweden – 3.31%, Japan – 3.28%, Austria – 3.21%, Germany – 3.13%, Denmark – 3.03%, the United States – 2.83% (The World Bank; Maidanik, 2020).

Table 3

The level of expenditures for scientific research and development in 2010–2021[1]

Indexes	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Expenditures for carrying out scientific research and development, UAH million	8107.0	8513.4	9419.9	10248.5	9478.5	11003.6	11530.7	13379.3	16773.7	17254.6	17022.4	12171.01
- share in GDP, %	0.75	0.65	0.67	0.70	0.60	0.55	0.48	0.45	0.47	0.43	0.41	0.17

[1] without considering the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the area of the anti-terrorist operation

Source: derived from State Statistics Service of Ukraine (http://www.ukrstat.gov.ua/).

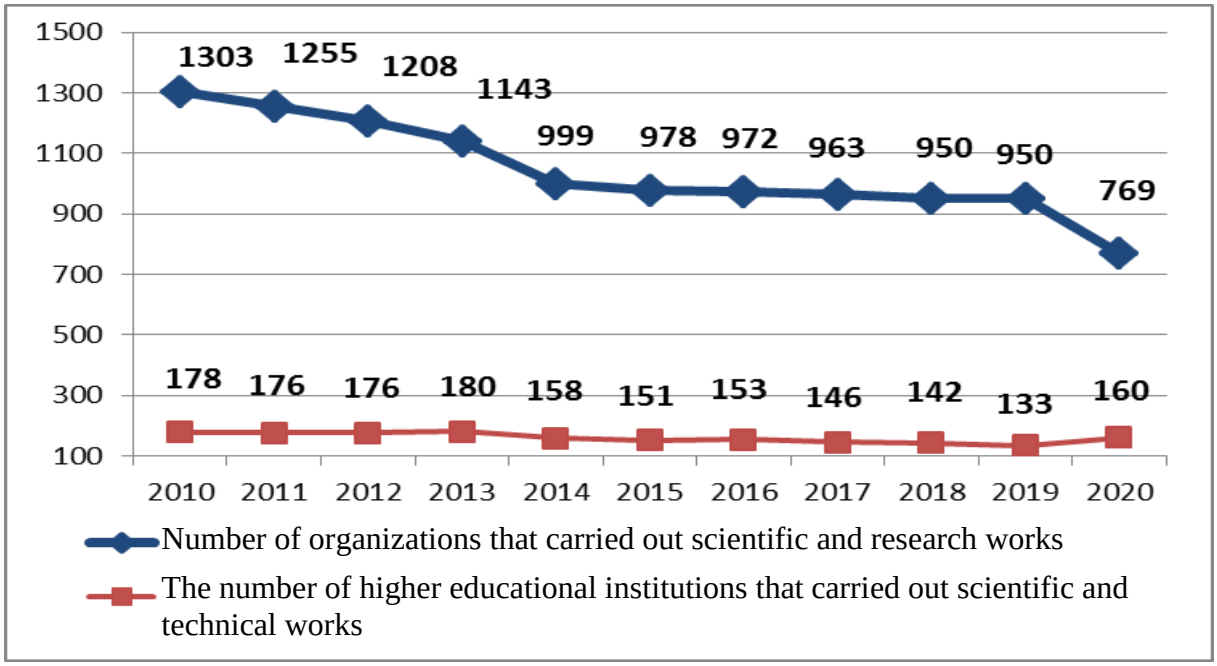
In Ukraine, over the years, there has been a trend that the largest specific weight in the expenditures for the implementation of scientific research and development is taken by expenditures for scientific and technical (experimental) developments. Thus, in 2020, scientific and technical (experimental) developments accounted for 51.7% of all expenses, for fundamental scientific research – 25.0%, for applied scientific research – 23.3%.

According to the data of the State Statistics Service of Ukraine, during 2010–2021, the number of domestic organizations and employees performing scientific research and development had a constant tendency to decrease (Fig. 1, 2).

The number of organizations carrying out scientific research work decreased from 1,303 to 769 (excluding temporarily occupied territories); the number of scientists during the corresponding period decreased from 182.5 to 78.9 thousand people, that is, more than twice, and in comparison with 1991 – almost five times (https://mon.gov.ua).

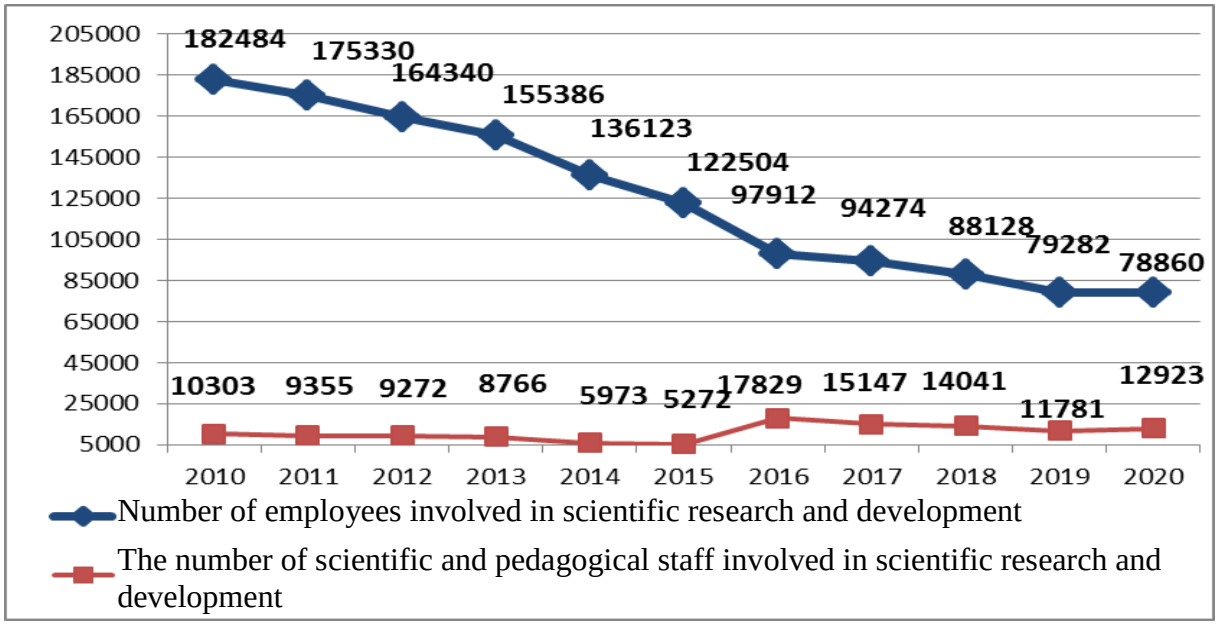
The number of researchers per 1,000 employed people (aged 15–70) in Ukraine was 3.2 in 2020 (3.1 in 2019). According to Eurostat, the highest values of this indicator in 2018–2019 were in Norway (23.0), Finland (23.4), Iceland (20.1), Portugal (21.7); within 11–16 people – in Slovenia, Lithuania, Hungary, Spain, Poland, the Czech Republic, Estonia, Slovakia, and the lowest – in Latvia (8.5), Bulgaria (7.4), North Macedonia (4.6), Romania (3,3) (https://ec.europa.eu/).

It should be noted that despite the negative dynamics of the indicators discussed above, in 2020 the number of organizations that carried out scientific research in the field of higher activity increased. Thus, if in 2010 the number of institutions of higher education carrying out research was 178, in 2018 – 142, in 2019 – 133, then in 2020 there were 155 of them (30.1% of the total number of institutions of higher education). That is why it is important to focus attention specifically on researching the effectiveness of using the scientific potential of the higher education system.



Source: derived from State Statistics Service of Ukraine (http://www.ukrstat.gov.ua/).

Fig. 1. **Number of organizations, including institutions of higher education carrying out research work**



Source: derived from State Statistics Service of Ukraine (http://www.ukrstat.gov.ua/).

Fig. 2. **The number of employees involved in scientific research and development**

In recent years, the quality of human scientific capital has been constantly improving in Ukraine – the number of doctors and candidates of sciences increased by one and a half times between 1995 and 2020 (Vlasiuk, 2019). In addition, during 2014–2019, among highly qualified specialists, there is a

tendency to decrease the specific weight of age groups from 50 to 64 years and a corresponding increase in the specific weight of age groups 30–49 years old, which is a positive trend.

At the same time, in recent years, Ukraine has lost more than 20,000 young researchers, and the strongest emigration sentiments are noted among students and post-graduate students. The influence of the educational factor on migration motivation is quite predictable: people with different levels of higher education, in comparison with graduates of secondary education institutions, more often associate foreign employment with the search for a better fate in another country, and not with avoiding failure at home (20.3% and 13.3%, respectively) (Savchenko, 2010).

An important part of the effectiveness of scientific activity is the publication of the results of scientific activity, namely the publication activity of scientists and the number of patents obtained. It is also currently important to publish the results of scientific research in scientific publications that are included in scientific metric databases. Thus, the largest number of Ukrainian publications in the Scopus database in 2020 refers to such areas of scientific research as "Mechanical Engineering" (about 6,000 publications), "Computer Science" (4,300), "Physics and Astronomy" (4.3 thousand), "Materials Science" (3.3 thousand) and "Mathematics" (2.6 thousand publications) (https://mon.gov.ua, 2020).

In addition to personnel qualifications, publication activity, and the quality of the system, the effectiveness of using the scientific potential of the higher education system depends on other conditions and factors – the established value system of society, the institutional organization of scientific activity, methods of stimulating labour activity, and the degree of receptivity of the economy to scientific results are really important (Kuranda and Kochetkova, 2020).

We believe that the effectiveness of using the scientific potential of the education system is influenced by the following factors: the number of institutions of higher education with postgraduate programs at the end of the year, number (x1); number of post-graduate students at the end of the year, people (x2); number of post-graduate students who completed graduate studies with thesis defense, people (x3); the number of institutions of higher education with doctoral programs at the end of the year, number (x4); number of doctoral students at the end of the year, people (x5); number of doctoral students who completed doctoral studies with thesis defense, people (x6); the dynamics of the number of institutions of higher education that carried out scientific and technical activities, number (x7); the number of personnel employed in the field of research and development, people (x8); financing scientific and technical activities of higher education, million hryvnias (x9); the number of scientific and technical works performed at the institution of higher education, number (x10);

publishing activity of higher education: printed monographs (x11), articles in scientific specialized publications (x12), articles in scientific specialized publications included in the Scopus scientometric database (x13); the number of patents for inventions received by the IHE (x14) (Table 4).

Table 4

Initial data for analysing the influence of factors on the effective use of the scientific potential of the education system

Year / №	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
x1	242	238	240	238	225	234	231	231	221	226	231
x2	28630	28305	27999	26270	23493	24625	22838	22134	20 749	23 034	23 469
x3	1789	1905	1971	1997	1736	1818	1583	1328	1373	695	975
x4	160	162	163	166	162	177	176	176	174	168	168
x5	1236	1292	1445	1454	1418	1483	1484	1374	969	937	937
x6	114	114	126	176	128	151	141	138	209	132	132
x7	178	176	176	180	158	151	153	146	142	133	155
x8	10303	9355	9272	8766	5973	5272	17829	15147	14041	11781	12800
x9	573.23	607.97	729.94	688.06	594.3	635.52	1052.65	975.8	1120.16	1056.75	1342.13
x10	6794	8283	9784	10154	7966	7577	3655	4922	5286	4020	2443
x11	5602	5752	5929	6320	4787	4479	5616	5828	5231	2852	3298
x12	136967	153997	158109	160297	137765	119486	175649	176924	173824	170519	148628
x13	1923	3114	2771	4341	4937	6135	8501	9071	10180	11309	12717
x14	3002	2336	3620	2307	2250	4553	1634	1525	1498	1511	1086

In this case, the generalizing feature (g) is the gross domestic product from professional, scientific and technical activities.

Method Description. STEP 1. At the first stage, correlation analysis was used. Correlation analysis was performed using the STATISTICA program. Using this method, the closeness of the linear relationship between factor characteristics and the resulting one is identifies, correlation coefficients are determined. It can take values from (-1) to (+1). The "-" sign shows that the connection is inverse, and the "+" sign shows that the connection is direct. With a correlation of less than 0.3, the closeness of the relationship is assessed as weak, from 0.31 to 0.5 – moderate, from 0.51 to 0.7 – significant, from 0.71 to 0.9 – close, from 0.91 and above is very tight. All coefficient values are taken modulo. For analysis, it is recommended to use significant, close and very close connections. The most significant indicators affecting the level of GDP formation from professional, scientific, and technical activities were selected with the help of the table (Table 5).

It can be seen from the matrix that the level of GDP formation from professional, scientific and technical activities has the greatest influence on the number of scientific articles published in the scientific metric database Scopus (0.958), financing scientific and technical activities of higher education (0.899),

the number of graduate students who graduated postgraduate studies with thesis defense (-0.942). At the same time, it was determined that some factors have a moderate relationship and it is advisable to exclude them when conducting the next study, namely: the number of institutions of higher education with doctoral degrees at the end of the year (0.432); the number of doctoral students who completed postgraduate studies with a thesis defense (0.312); the number of articles published in specialized publications of Ukraine (0.431).

Table 5

Results of the correlation analysis of the closeness of the connection between GDP and professional, scientific and technical activities and factor characteristics

Variable	Correlations (Table) The indicated correlations are significant at the p <.05000 level N = 11 (Stepwise removal of PD)															
x1	1,000000	0,908157	0,618839	-0,449002	0,466284	-0,486486	0,840738	-0,278008	-0,555444	0,580223	0,491356	-0,337575	-0,725332	0,707609	-0,684276	1,000000	0,908157
x2	0,908157	1,000000	0,643691	-0,724042	0,347508	-0,547225	0,881255	-0,486048	-0,697968	0,686609	0,398037	-0,435998	-0,839052	0,804318	-0,734101	0,908157	1,000000
x3	0,618839	0,643691	1,000000	-0,307641	0,790214	-0,042123	0,797722	-0,484534	-0,806855	0,735136	0,804631	-0,390757	-0,891139	0,771584	-0,941515	0,618839	0,643691
x4	-0,449002	-0,724042	-0,307641	1,000000	0,044864	0,516373	-0,675802	0,464005	0,497993	-0,570744	-0,102955	0,301808	0,602985	-0,526777	0,432256	-0,449002	-0,724042
x5	0,466284	0,347508	0,790214	0,044864	1,000000	-0,165978	0,473016	-0,299970	-0,653553	0,433531	0,674659	-0,241280	-0,645368	0,560982	-0,786384	0,466284	0,347508
x6	-0,486486	-0,547225	-0,042123	0,516373	-0,165978	1,000000	-0,306984	0,176648	0,307627	-0,071759	0,128732	0,313773	0,335921	-0,321528	0,312130	-0,486486	-0,547225
x7	0,840738	0,881255	0,797722	-0,675802	0,473016	-0,306984	1,000000	-0,388282	-0,642920	0,793181	0,643796	-0,331594	-0,838942	0,712245	-0,799519	0,840738	0,881255
x8	-0,278008	-0,486048	-0,484534	0,464005	-0,299970	0,176648	-0,388282	1,000000	0,735486	-0,741203	0,034597	0,811620	0,566594	-0,591804	0,479322	-0,278008	-0,486048

End of the Table 5

x9	-0,555444	-0,697968	-0,806855	0,497993	-0,653553	0,307627	-0,642920	0,735486	1,000000	-0,644002	-0,507591	0,570358	0,926417	-0,802215	0,898542	-0,555444	-0,697968
x10	0,580223	0,686609	0,735136	-0,570744	0,433531	-0,071759	0,793181	-0,741203	-0,644002	1,000000	0,422311	-0,486392	-0,706041	0,694724	-0,626944	0,580223	0,686609
x11	0,491356	0,398037	0,804631	-0,102955	0,674659	0,128732	0,643796	0,034597	-0,507591	0,422311	1,000000	0,157749	-0,675075	0,499001	-0,749100	0,491356	0,398037
x12	-0,337575	-0,435998	-0,390757	0,301808	-0,241280	0,313773	-0,331594	0,811620	0,570358	-0,486392	0,157749	1,000000	0,437372	-0,466809	0,431173	-0,337575	-0,435998
x13	-0,725332	-0,839052	-0,891139	0,602985	-0,645368	0,335921	-0,838942	0,566594	0,926417	-0,706041	-0,675075	0,437372	1,000000	-0,897565	0,958195	-0,725332	-0,839052
x14	0,707609	0,804318	0,771584	-0,526777	0,560982	-0,321528	0,712245	-0,591804	-0,802215	0,694724	0,499001	-0,466809	-0,897565	1,000000	-0,800061	0,707609	0,804318
Y	-0,684276	-0,734101	-0,941515	0,432256	-0,786384	0,312130	-0,799519	0,479322	0,898542	-0,626944	-0,749100	0,431173	0,958195	-0,800061	1,000000	-0,684276	-0,734101

STEP 2. In order to assess the impact of each factor on the value of GDP from professional, scientific and technical activities, we will use regression analysis. Regression analysis was performed using the STATISTICA program. In general, linear multiple regression is written as follows (Eq. 1):

$$Y = \beta 0 + \beta 1x1 + \beta 2x2 + ... + \beta mxm, \quad (1)$$

where β_0 – free term;

β_n – values of the coefficients of influence of each specific factor on the final result;

x_n – quantitative value of the factor.

Results and Discussion. The results of the regression analysis are shown in Fig. 3.

Multiple results. Regressions (Step 6)

Dependent: Y Multiple R = ,99651859 F = 95,24685
R2 = ,99304929 df = 6,4
No. to cases: 11 adjusted R2= ,98262323 p = ,000287
Standard error of estimate: 5440,6453685
Intercept: 38622,134638 Std.Error: 30269,10 t(4) = 1,2760 p = ,2710

X13 beta =,891 X5 beta =-,17 X14 beta =,240
X3 beta =-,39 X10 beta =,154 X11 beta =,093

Fig. 3. **Results of regression analysis of GDP dependence on professional, scientific and technical activity and factor characteristics**

The result is a regression equation:

$$Y = 38622{,}135 - 0{,}39X_3 - 0{,}17X_5 + 0{,}154\ X_{10} + \\ + 0{,}93\ X_{11} + + 0{,}891x_{13} + 0{,}240\ X_{14}$$

Let us have a schedule of residuals in case of normal movable distribution (Fig. 4).

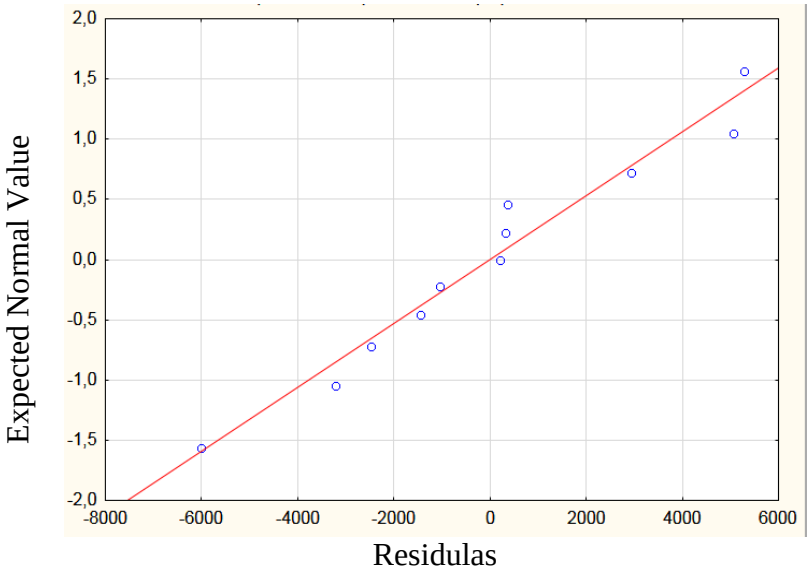


Fig. 4. **Normal Probability Pilot of Residuals**

Since the residuals are distributed according to the normal distribution law, they lie well on a straight line, which indicates the adequacy of the constructed model.

In the process of analysis, it was found out that the amount of GDP from professional, scientific and technical activities is influenced by: the number of graduate students who completed graduate studies with the defense of theses; the number of doctoral students at IHE at the end of the year; the number of

scientific and technical works performed at institutions of higher education; publishing activity of higher education: printed monographs and articles published in scientific publications included in scientometric databases; the number of received patents for inventions.

Myroslava Bublyk believes that the main directions for overcoming the problems of the development of the scientific activity of the higher education system at the national level are: the implementation of the policy of decentralization of higher education from the point of view of their economic activity with the improvement of the education quality control system and ensuring the growth of funding in full for the most promising and significant scientific research; at the regional level, the policy of promoting the development of higher education should consist of financing scientific research of regional significance; in IHE: ensuring the innovativeness of the educational process and the development of partnership relations with business structures for the implementation of joint scientific and practical projects (Bublyk et al., 2018).

Conclusion. The development of science contributes to the formation of both new knowledge and the development of new information, which can serve as a source of new knowledge in the future, which shows the incessant self-development of science. The constructed regression equation will make it possible to predict the size of GDP from professional, scientific and technical activities with the known values of the specified factors: the number of post-graduate students who completed postgraduate studies with the defense of theses; the number of doctoral students at IHE at the end of the year; the number of scientific and technical works performed at institutions of higher education; publishing activity of higher education: printed monographs and articles published in scientific publications, which are included in scientific-metric databases and the number of received patents for inventions.

We believe that since the economic development of higher education is impossible without an increase in the share of allocations earned by individual institutions of higher education and the higher education system as a whole, including scientific activity, the perspective for the development of institutions is to strengthen their autonomy, the introduction and development of contractual relations in the field of higher education and thereby contributing to the provision of independent conditions for spreading its self-sufficiency and self-financing, that is, self-development, which in turn will contribute to the increase of GDP from professional, scientific and technical activities.

Conflict of Interest. Tetiana Vlasiuk substantiated the research methodology, validation, conceptualization and control; collected the initial information for the analysis. Julia Bondarchuk conducted research and literature analysis. Natalia Fastovets gave a graphic presentation of the material.

ABBREVIATIONS

IHE is an Institution of Higher Education.

GDP is Gross Domestic Product.

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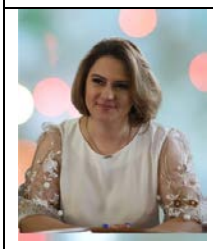

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