FORECAST ASSESSMENT OF THE DEVELOPMENT OF THE DOCTORAL EDUCATION SYSTEM

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Abstract. *The article presents an analysis of the main indicators of training of doctoral students, research institutions that train doctoral students, the dynamics of the total cost of scientific and scientific-technical work on the sources of funding. The subject of the research is doctoral higher education as an element of the system of highly qualified personnel in Ukraine. The author developed his own method of the dollar equivalent. The method involves the transfer of costs for scientific and scientific and technical work in a particular period in their dollar equivalent for the average annual exchange rate of hryvnia to the dollar according to the NBU. The purpose of the article is to develop theoretical and methodological foundations for the formation and development of the system of training highly qualified personnel, to determine the features of improving the quality of doctoral education. The dynamics of the total number of doctoral students (including their number by branches of science), as well as persons who completed doctoral studies in 2000-2019 are presented. The preparation structure of doctorates degrees by organizations in per cent ratio is constructed. The dynamics of total costs for scientific and technical work by sources of funding is presented comparison of financial indicators was carried out according to the method of calculating the index of scientific products and the method of dollar equivalent (it is own development). The proposed method of comparing the funding of science (finding the dollar equivalent) shows a reduction in funding for both scientific and scientific and technical work. Taking into account the deflator index of scientific products shows that the real costs of science in Ukraine have decreased. The dynamics of the state order for the training of doctors of sciences in 2014-2020 and the forecast estimate for the 2021-2022 academic year of the number of people are analyzed. In order to improve the training quality of qualified personnel, it is necessary to upgrade the legal framework, reduce bureaucracy, improve the requirements for the defense of dissertations and doctoral theses, increase funding for education and science and not the survival of scientists. To solve the problem of reducing the number of highly qualified personnel in Ukraine, it is necessary to take measures at the state level, raise the prestige of scientific activity, improve social protection.*

Keywords: *higher education, postgraduate studies, doctoral studies, law, scientific organization, system, scientific titles, scientific and scientific-technical activity, highly qualified personnel.*

JEL Classification: A23

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Introduction. Ukraine is traditionally considered a country with significant scientific potential, world-renowned scientific schools, a developed system of training highly qualified personnel. The development of science and the formation of the information society have come to the fore as components of an intensive factor in the development of the innovative economy, scientific, scientific and pedagogical workers, and highly qualified researchers. They generate innovations and create favorable conditions for the innovation process and increase the competitiveness of the economy.

Nowadays, the obvious fact is that the main condition for achieving long-term positive rates of socio-economic development, both the country's economy as a whole

and its individual industries, is an active innovation sphere. However, the problem is that the transition to market economic relations in Ukraine has not yet contributed to a significant impetus to the development of innovation processes in the technological renewal of traditional sectors of the economy and the creation of new modern industries and social development. This is especially true in the field of educational activities. Today, all developed countries are involved in a powerful movement for the democratization of educational opportunities and educational expansion to increase their competitiveness. Therefore, the active development of training systems for higher qualifications (at the 6th - the highest educational level according to the International Standard Classification of Education or at the 3rd highest cycle of higher education in the terminology of the Bologna process), which in the world educational and scientific space are called "doctoral education" , was seen as a guarantee of sustainable development of the national innovative economy and the competitiveness of the state in the new globalizing economic conditions.

Literature review. One of the most priority strategic ways to develop the domestic economy is the full-scale and uncompromising implementation of modern science, technology and innovation policy, the main factor in the implementation of which should be the system of doctoral education. The first to introduce the category of "innovation" was the Austrian economist J. Schumpeter. Subsequently, this category was developed to a special economic concept, the followers of J. Schumpeter developed his theoretical developments, namely S. Kuznets, P. Drucker, D. Bellemt and others. NM Kraus speaks about the systemic interdependence of the categories "innovative economy" and "intellectual potential", noting that the innovative economy is a set of interconnected and interacting structures that are engaged in the production and commercialization of scientific knowledge and technology. NM Kraus, emphasizes that the construction of an innovative economy is based on the realization of intellectual potential, namely doctoral education.

Aims. The subject of the research is doctoral higher education as an element of the system of highly qualified personnel in Ukraine. The purpose of the article is to develop theoretical and methodological foundations for the formation and development of the system of training highly qualified personnel, to determine the features of improving the quality of doctoral education.

Methods. The author developed his own method of the dollar equivalent. The method involves the transfer of costs for scientific and scientific and technical work in a particular period in their dollar equivalent for the average annual exchange rate of hryvnia to the dollar according to the NBU.

Results. In order to make a forecast assessment of the development of the doctoral education system in Ukraine, we analyze the data posted in the statistical yearbook of Ukraine for 2019 (unfortunately, the 2020 yearbook of has not yet been published) (Table 1).

Analysis of the main indicators of doctoral students' training in 2000-2019 allows us to identify two main periods, characterized by different dynamics. Thus, in the period from 2000 to 2015, the number of research institutions and institutions of higher education that had a doctorate increased from 209 to 283, and in the next 4

years decreased to 253. Thus, if we compare 2019 with 2000, we have an increase by 44 institutions (+ 21.1%), and if from 2015 - a decrease by 30 institutions (10.6%).

Table 1. Dynamics of the main indicators of doctoral students' training in 2000-2019

Indicator	Years							Deviation of 2019 from			
								2000		2015	
	2000	2010	2015	2016	2017	2018	2019	A	%	A	%
Number of graduate students at the end of the year	23295	34653	28487	25963	24786	22829	25245	1950	8,4	-3242	-11,4
Number of research institutions and higher education institutions with doctoral studies at the end of the year	209	263	283	282	277	270	253	44	21,1	-30	-10,6
Number of doctoral students at the end of the year	1131	1561	1821	1792	1646	1145	1113	-18	-1,6	-708	-38,9
Number of students enrolled in doctoral studies	376	603	650	584	493	544	511	135	35,9	-139	-21,4
Number of persons who completed doctoral studies	401	459	563	551	543	963	511	110	27,4	-52	-9,2

Source: built by the author on the basis of the Statistical Yearbook for 2019.

To clarify the identified trends, the dynamics of the total number of doctoral students, as well as persons who completed their doctoral studies in 2000-2019 were presented in the form of graphs (Fig. 2).

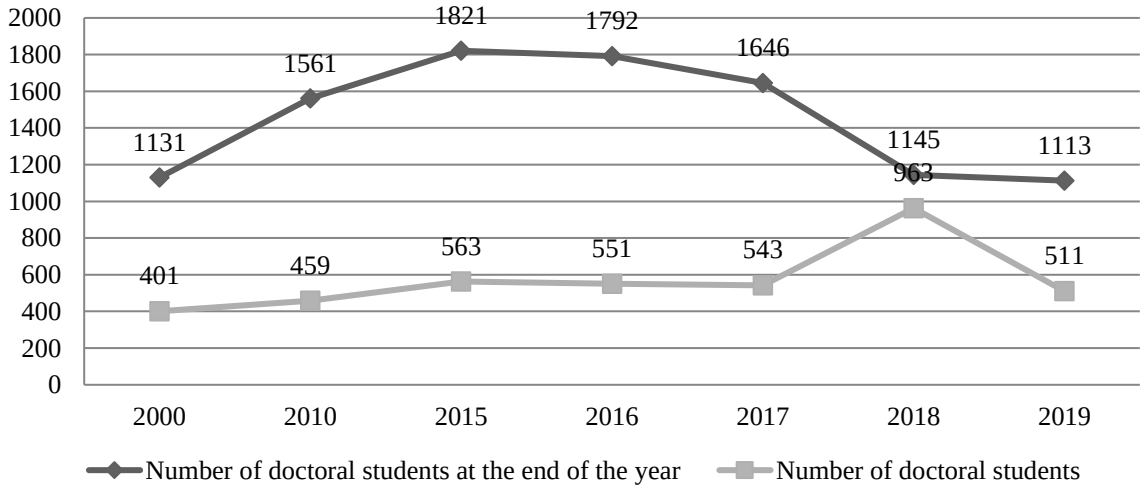

Figure 2. Number of doctoral students as well as persons who completed doctoral studies in 2000-2019, pers.

Source: made by the author on the basis of the Statistical Yearbook for 2019

A similar situation is observed with other quantitative indicators of the system of training of doctors of sciences, such as:

- the total number of doctoral students (peak value of 1821 people in 2015 and a gradual decrease to 1113 people in 2019). Compared to 2015, the number of doctoral students in the reporting period decreased by 708 people, or 38.9%;

- the total number of persons enrolled in doctoral studies (the peak value was 650 people was recorded in 2015. And according to the results of 2019, only 511 people have already been admitted to doctoral studies, which is 21.4% less than 4 years ago;

- the number of people who completed their doctoral studies in 2015 was 9.2% higher than in 2019.

Most experts tend to attribute such trends to the fact that, on the one hand, in 2016-2019 there was a sharp decrease in the number of government orders in this area (due to the reduction of the budget for science in the context of the complicated political and economic situation in the country and an increase in defense spending), and on the other hand, the training of doctors of science in Ukraine has no close connection with social production, which should ensure the demand for highly qualified scientific personnel.

With the strengthening of requirements for the defense of doctoral dissertations and more attention of the Ministry of Education and Science and the Financial Inspectorate to the responsibility of applicants and employers for the successful completion of doctoral studies, the number of doctoral students, in our opinion, will continue to decline.

Meanwhile, the statistical collection of the State Statistics Committee "Scientific and Innovative Activity in Ukraine" for 2019 (hereinafter - the statistical collection 2019) states that the vast majority of institutions training doctoral students are subordinated to six ministries and academies of science: Ministry of Education and Science - 40%, the National Academy of Sciences of Ukraine - 25%, the Ministry of Health and the Ministry of Agrarian Policy and Food - 5% each, the National Academy of Agrarian Sciences and the Academy of Pedagogical Sciences - 4% each (Fig. 3).

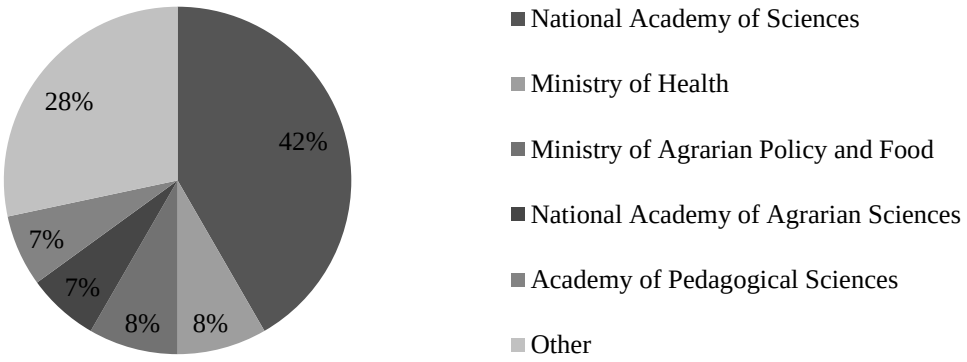

Figure 3. The structure of training of doctors of sciences by organizations, %

Source: made by the author on the basis of the Statistical Collection 2019

The data of fig. 3 show that the major part in the structure of subordination of doctoral students belongs to the Ministry of Education and Science and the National Academy of Sciences of Ukraine. Thus, their total share in the training of doctors of science is 65%.

We observe that 61% of doctoral students work at higher educational institutions, and 39% at scientific institutions. The largest number of graduate students study in the field of technical, economic, pedagogical and legal sciences.

The vast majority of doctoral students (93%) study at the expense of the state budget. In our opinion, this indicates a weak relationship between business and the training of highly qualified scientific personnel in Ukraine. In other words, large enterprises of Ukraine currently do not show interest in domestic doctors of sciences, as well as the low demand for such personnel in the Ukrainian labor market by private entities.

The expected outcome of doctoral studies is the defense of the thesis. In 2019, the share of people who defended their doctoral thesis was 27%, which is quite a high rate.

Ukraine should be noted as a country that adheres to gender democracy in the training of scientific personnel. Women, along with men, use the right to continue their education in doctoral studies. Thus, in 2019, women accounted for 52% (579) of doctoral students.

At the same time, the age structure of doctoral students in Ukraine is quite traditional. Thus, the majority of doctoral students (47%) have already reached 40 years of age.

Two thirds of the total number of new specialists of higher qualification are teachers of higher and other educational institutions, associate professors, professors of departments, assistants; 14.3% - researchers, scientific secretaries; 13.7% - heads of enterprises, institutions, organizations and heads of production (main, functional) units [statistical collection 2020].

On the other hand, if we analyze the dynamics of the number of doctoral students in the fields of science, we can see that in the last 5 years there is a steady trend to reduce the number of doctoral students in almost all fields, but the most rapid decline (about 50%) is observed in economics, physics and mathematics, historical, philosophical and biological spheres (table 4). All calculations were performed using an electronic spreadsheet Microsoft Excel 2019. The source of calculations were data from the State Statistics Committee of Ukraine.

The data in Table 4 show that in 2019, 511 people received doctor's diplomas, including the largest number of doctoral dissertations was defended in the field of technical sciences (20.15%, or 224 people), in economics (17.19%, or 191 people) and in pedagogy (10.42%, or 116 people).

In other words, the lion's share of doctors of science in Ukraine is trained in several fields, namely in technical and economic sciences. For example, every third doctoral student in 2019 studied in either technical or economic fields.

At the same time, it should be noted that the share of these sciences in the study period decreased slightly due to a decrease in the share of doctoral students in

economics, whose share in the overall structure of doctoral students compared to 2015 decreased by almost 4%.

Table 4. Dynamics of training of doctors of sciences in Ukraine for 2015-2019

Branch of knowledge	Years						Deviation	
	2015		2017		2019		-	
	persons	%	persons	%	persons	%	persons	%
DOCTORAL STUDENTS	**1821**	**100**	**1646**	**100**	**1113**	**100**	**-708**	**-38,88**
- economic	354	19,42	278	16,88	191	17,19	-162	**-45,90**
- technical	270	14,85	292	17,74	224	20,15	-46	**-17,07**
- pedagogical	213	11,72	204	12,29	149	13,37	-65	**-30,27**
- physical and mathematical	137	7,5	95	5,62	116	10,42	-21	**-15,08**
- philological	117	6,43	145	8,55	95	8,55	-22	**-18,73**
- juridical	95	5,23	76	4,63	69	6,2	-26	**-27,54**
- historical	77	4,23	64	3,9	39	3,52	-38	**-49,14**
- philosophical	68	3,72	74	4,52	35	3,18	-32	**-47,75**
- psychological	49	2,69	43	2,59	35	3,18	-14	**-27,75**
- medical	41	2,24	40	2,45	25	2,27	-16	**-38,06**
- biological	37	2,05	32	1,97	18	1,65	-19	**-50,81**
- others	363	19,92	302	18,36	115	10,3	-248	**-68,40**

Source: compiled by the author on the basis of data from State Statistic Service of Ukraine [7]

In order to better understand current trends in the development of the doctoral education system in Ukraine, we will analyze the dynamics and structure of funding in this area.

Table 5, in particular, analyzes the dynamics of total costs for scientific and scientific-technical work by sources of funding.

Table 5. Dynamics of total costs for the implementation of scientific and scientific and technical work by sources of funding in Ukraine in 2010-2019, million UAH

	2010	2017	2018	2019	Deviation 2019 from 2010	
					A	%
Total	8107,1	13379,3	16773,7	17254,6	9147,6	112,8
budget funds	3647,4	4896,4	6222,7	6724,7	3077,4	84,4
of them the state budget	3603,3	4740,1	6020,9	6603,9	3000,6	83,3
own funds	795,6	1340,8	1610,0	1725,1	929,5	116,8
funds of public sector organizations	264,9	718,7	1141,6	798,6	533,7	201,5
funds of business sector organizations	1237,7	3007,8	3947,4	4035,7	2798,0	226,1
funds of organizations in the higher education sector	4,8	8,9	6,8	3,7	-1,0	-22,0
funds of private non-profit organizations	9,7	2,8	21,3	14,7	4,9	50,7
funds from foreign sources	2092,3	3262,8	3642,6	3856,2	1763,9	84,3
funds from other sources	54,7	141,1	181,4	96,0	41,3	75,4

Source: compiled by the author on the basis of data [2]

We draw your attention to the fact that the comparison of financial indicators was carried out according to two methods:

- according to the method of calculating the index of scientific products, approved by the order of State Statistic Service of Ukraine. dated 22.12.2010 № 516. This method provides for the GDP index of scientific products, which is calculated on the basis of the index of real wages and capital investment index in Ukraine as a whole [7].

- by the method of dollar equivalent (author's development). This technique involves the transfer of costs for scientific and scientific and technical work in a particular period in their dollar equivalent at the average annual exchange rate of hryvnia to the dollar according to the NBU.

At the same time, we believe that converting the cost of funding research into the dollar equivalent is easier to use and gives a more accurate result than the method approved by the order of State Statistic Service of Ukraine from 22.12.2010 № 516, as it allows you to compare similar indicators with developed countries.

Thus, the data in Table 5 show that in nominal terms, funding for the costs of scientific and technical work in 2010-2019 has more than doubled, namely from 8107 million in 2010 to 17254.6 million in 2019, which, at first glance, may seem a pretty good rate.

Taking into account the GDP index of scientific products according to the methodology approved by the order of State Statistic Service of Ukrainedated 22.12.2010 № 516 shows that the real costs of science in Ukraine over the past 10 years have not increased, but even decreased (from 8,107 million in 2010 to 8050 million UAH in 2019), which is definitely a negative trend.

Our proposed method of comparing the financing of science (finding the dollar equivalent) shows an even more dramatic reduction in real costs of scientific and technical work, which was primarily due to the sharp devaluation of the national currency. It is not difficult to calculate that in 2010 at the NBU exchange rate of 7.99 UAH to USD. Almost 1.015 million dollars were spent on investigation, and in 2019, when the average annual exchange rate was 26 UAH to USD, the dollar equivalent of science funding was only $ 351.8 million, which is almost three times less than in 2010.

Simultaneously, with regard to direct financing of doctoral education, we observe a gradual decrease in the number of government orders for admission/graduation of doctoral studies (Table 6).

Places for training of applicants at the expense of the state budget are regulated by annual resolutions of the Cabinet of Ministers of Ukraine "About the state order for preparation of experts, scientific, scientific and pedagogical and working shots, on advanced training and retraining" (further - the Resolution). The main customer for the execution of the state order is the Ministry of Education and Science, which accounts for almost 70% of the volume.

Forecast estimate of the amount of the state order of doctoral students, specified by the Resolution for 2020. It is expected to accept 500 new doctoral students in 2021 and the same number in 2022.

Table 6. Dynamics of the state order for the training of doctors of sciences in 2014-2020 and the forecast estimate for 2021-2022, persons

Year	Graduation	Admission	Graduation of MES	Admission of MES
2014	526	554	356	342
2015	529	516	383	368
2016	524	493	373	353
2017	501	468	353	317
2018	824	478	568	320
2019	449	459	309	295
2020	442	431	309	295
2021	500	500	350	350
2022	490	500	343	350

Source: compiled by the author on the basis of data [3]

A comparative analysis of the number of graduates in 2019 in terms of regions showed that of the 511 people who completed their doctoral studies, the largest number came from Kyiv (37%), Kharkiv (13.2%), Lviv (8.9%) regions (Fig. 4).

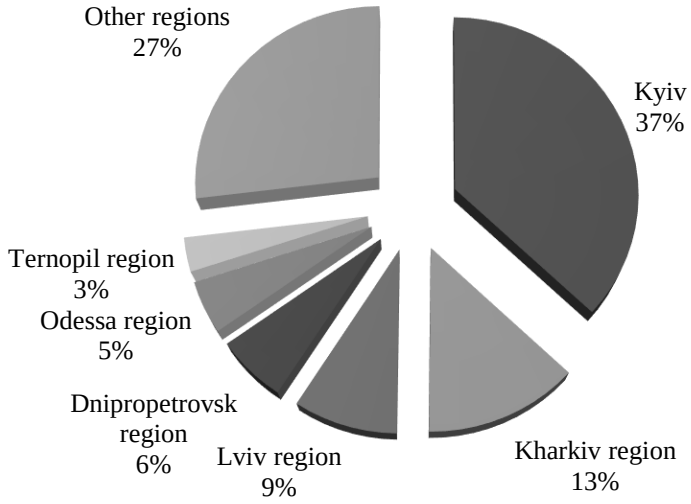

Figure 4. Geographical structure of doctoral students for 2019, %

Source: made by the author on the basis of [4]

However, Ternopil (58.8%), Kirovohrad (57.1%), Vinnytsia (38.5%), Khmelnytsky (38.5%), Kharkiv (34, 6%), Sumy (33.3%), Zhytomyr (33.3%), Lviv (30.2%) regions. The lowest rates are in Luhansk (6.3%) and Chernivtsi (7.2%) oblasts. In three oblasts, after finishing the doctoral program, no work was defended, namely in Zakarpattia Kherson Rivne.

Conclusion. It can be concluded that the formation and development of the system of training highly qualified scientific personnel in Ukraine during the years of independence has come a long way, the result of which is quite ambiguous. On the one hand, we managed to get rid of some attributes of the Soviet education system, in particular in the organizational and legal plane, where many positive steps were taken to bring the domestic education system and training system closer to the requirements

of the Bologna process. On the other hand, to some extent excessive bureaucratization, lack of close relationship between science and the private sector, as well as chronic lack of funding for education and science hinder the full realization of domestic intellectual potential and train really high-quality scientific personnel who could provide innovative way of development of the Ukrainian economy.

The formation and development of the system of training highly qualified scientific personnel in Ukraine during the years of independence has come a long way, the result of which is quite ambiguous. On the one hand, we managed to get rid of some attributes of the Soviet education system, in particular in the organizational and legal plane, where many positive steps were taken towards the approximation of the domestic education system, in particular in the organizational and legal plane. But excessive bureaucratization, the lack of a close link between science and the private sector, and the lack of funding for education and science hinder the full realization of domestic intellectual potential.

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