
FINANCING OF SCIENTIFIC WORK IN AGRICULTURAL UNIVERSITIES OF UKRAINE

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Abstract

The purpose of this article is to analyze the commercialization of the results of scientific work of agricultural universities of Ukraine and the formation of their ratings according to these indicators. Data from the Ministry of Education and Science of Ukraine for the years 2018–2020 were used to achieve the goal. The research was carried out in three stages: analysis of absolute indicators of commercialization (amounts of earned funds based on the results of scientific work) using the ABC method; analysis of relative indicators of commercialization (amount of earned funds based on the results of scientific work per one scientific-pedagogical worker); formation of ratings of agricultural higher education institutions of Ukraine according to absolute and relative indicators of commercialization of scientific work. The following results were obtained: during the analyzed period, agricultural higher education institutions of Ukraine improved the overall effectiveness of scientific activity. In 2019, 7 higher education institutions, and in 2020, 11 higher education institutions increased the absolute financial indicators of their scientific work, compared to the previous year. In 2019, 8 higher educational institutions, and in 2020, 11 higher educational institutions increased the relative financial indicators of their scientific work, compared to the previous year. According to the rating of agricultural higher education institutions of Ukraine, four leaders were identified according to these indicators. It is expedient to study and implement their experience in attracting funds for financing scientific work in other 12 agricultural higher education institutions of Ukraine.

Key words: funding, research activities, special fund, agricultural universities, Ukraine

INTRODUCTION

Scientific research in the agricultural sector of any country contributes to the breeding of new varieties of plants and breeds of animals, the development of new equipment and technologies, the emergence of new methods and theories. However, for the successful conduct of scientific works and the provision of scientific services, appropriate funding is necessary. In particular, agricultural universities of Ukraine finance their scientific activities both from budget funds (general fund) and from their own funds (special fund). It is worth noting that the financial effectiveness of scientific activities in higher education institutions (hereinafter – HEIs) is different: not only the sums of funds earned by universities differ, but also the amount of funds allocated to one scientific-pedagogical worker (hereinafter – SPW). In 2019, the Cabinet of Ministers of Ukraine by its resolution approved the formula for the distribution of state budget expenditures for

higher education among HEIs based on indicators of their educational, scientific and international activity. Among other things, it should stimulate HEIs to develop science, partnership with business and diversify funding sources. However, in connection with military operations on the territory of Ukraine, the effect of this resolution is suspended until December 31, 2023 [1].

Over the past five years, a large number of publications have been devoted to the financing of science in the academic field. Scientists from different countries have studied the following aspects: Chandran V. G. R. *et al.* (2021) – selective research funding policy in Malaysian universities [2]; Fu Y. (2022) – the influence of state funding on scientific innovation in Chinese universities [3]; Haake U. and Silander C. (2021) – ways of applying performance-based research funding systems in new universities and university colleges in Sweden [4]; Hoenig B. (2018) – the impact of European funding on universities [5]; Ito S.

and Watanabe T. (2020) – a multilevel analysis of research management and external funding specialists in Japanese universities [6]; Kundu O. and Matthews N. E. (2019) – the role of philanthropic funding in university research [7]; Lee Y. H. (2021) – the role of research funding in scientific productivity in Korean universities [8]; Muizniece L. (2021) – university autonomy and commercialization of state-funded research on the example of Latvia [10]; Pereira-Puga M. and Sanz-Menendez L. (2020) – development of tools for financing university research in Galicia (Spain) [12]; Pourdeyhimi B. (2021) – funding of university research by industry in the USA [13]; Stenbacka R. and Tombak M. (2020) – competition between universities and firms in basic research and university funding policy [14]; Totska O. L. (2022a) – financial aspects of scientific activity of HEIs in the regions of Ukraine and strategizing of commercialization of its results [15]; Wohlrabe K. *et al.* (2019) – an analysis of the effectiveness of German universities whose strategies for the future were awarded within the framework of the Excellence Initiative [19].

However, in the mentioned publications, the authors did not focus their attention on the financing of science in agricultural HEIs. Therefore, the purpose of this article is the analysis of the commercialization of the results of the scientific work of agricultural HEIs of Ukraine and the formation of their ratings according to these indicators.

MATERIALS AND METHODS

Data from the Ministry of Education and Science (hereinafter – MES) of Ukraine for the years 2018–2020 were used to achieve the goal [9].

The analysis of absolute indicators of commercialization of scientific activity was carried out using the ABC method. It is related to a statistical regularity called the Pareto Rule “20 by 80” (for many phenomena, 20% of the causes cause 80% of the effects). In our case, agricultural HEIs of Ukraine are divided into three groups:

A – HEIs with a large amount of financial income from scientific work (about 80% of the total amount);

B – HEIs with average level of commercialization of scientific activity (about 15%);

C – HEIs with little or no amount of financial income from scientific work (about 5%).

In addition, with the help of rating assessment, agricultural universities of Ukraine are divided into six zones based on absolute and relative indicators of incomes to the special fund based on the results of scientific activity. Note that in agricultural studies, Totska O. (2022d, 2022c, 2022b) used the ABC-analysis method to classify EU countries by the volume of purchases of Ukrainian grain crops/fats and oils of animal or vegetable origin [18]; agricultural products by the value of export / import in Ukraine-Romania trade [17]; the method of rating research – to determine the position of each region of Ukraine according to selected financial and quantitative indicators of labor in agriculture [16].

RESULTS AND DISCUSSIONS

Analysis of absolute indicators of financial effectiveness of scientific activity of agricultural HEIs of Ukraine

Indicators of commercialization of the results of scientific work of agricultural HEIs for 2018–2020 include:

- 1) funds received as a result of scientific and scientific-technical works under international cooperation projects;
- 2) funds received as a result of scientific and scientific-technical works under business contracts;
- 3) funds received as a result of the provision of scientific services.

They are shown in Table 1. In it, indicators in hryvnias were converted into euros at the official rate of the National bank of Ukraine (average for the period):

2018: 1 euro = 32.14 UAH;

2019: 1 euro = 28.95 UAH;

2020: 1 euro = 30.79 UAH [11].

Table 1. The amount of incomes to the special fund based on the results of the scientific work in the agricultural HEIs of Ukraine (euro)

No	Name of the higher education institution	2018	2019	2020	Total revenue for three years	The share of revenues in the total amount, %	The accumulated share of revenues in the total amount, %	ABC group
1	Nat. Un-ty of Life and Environmental Sciences of Ukraine (NULESU)	318,508	446,071	316,536	1,081,115	38.88	38.88	A
2	Mykolaiv Nat. Agrarian Un-ty	213,613	120,921	175,340	509,875	18.34	57.22	A
3	Dnipro State Agrarian and Economic Un-ty	95,101	85,530	105,201	285,832	10.28	67.50	A
4	Sumy Nat. Agrarian Un-ty	105,051	79,687	91,966	276,704	9.95	77.45	A
5	Vinnitsia Nat. Agrarian Un-ty	24,331	22,406	142,911	189,649	6.82	84.27	B
6	Bila Tserkva Nat. Agrarian Un-ty	11,274	30,034	61,108	102,415	3.68	87.95	B
7	Poltava State Agrarian Un-ty	7,307	15,006	47,150	69,463	2.50	90.45	B
8	Dmytro Motornyi Tavria State Agrotechnological Un-ty	16,537	13,256	30,099	59,892	2.15	92.61	B
9	Lviv Nat. Agrarian Un-ty	25,415	9,243	20,669	55,327	1.99	94.60	B
10	Odesa State Environmental Un-ty	18,915	20,535	11,435	50,886	1.83	96.43	C
11	Kherson State Agrarian and Economic Un-ty	11,560	16,494	14,537	42,591	1.53	97.96	C
12	Uman Nat. Un-ty of Horticulture	11,209	11,597	13,482	36,288	1.31	99.26	C
13	Separ. subdiv. NULESU "Berezhany Agotechnical Institute"	1,438	6,820	-	8,258	0.30	99.56	C
14	Separ. subdiv. NULESU "Nizhyn Agrotechnical Institute"	-	-	7,795	7,795	0.28	99.84	C
15	Odesa State Agrarian Un-ty	-	-	4,412	4,412	0.16	100.00	C
16	Luhansk National Agrarian Un-ty	-	-	-	-	0.00	100.00	C
Together		860,259	877,602	1,042,640	2,780,502	100.00		

Source: Author's calculation based on data from the MES of Ukraine and the National bank of Ukraine [9; 11].

The analysis of the dynamics of absolute indicators shows that during 2018–2020, agricultural universities of Ukraine improved the overall effectiveness of scientific activity from 860.3 to 1,042.6 thousand euros. In particular, in 2019, 7 HEIs, and in 2020, 11 HEIs improved the financial indicators of their scientific work, compared to the previous year.

According to Table 1, group A included four universities (NULESU, Mykolaiv Nat. Agrarian Un-ty, Dnipro State Agrarian and Economic Un-ty, Sumy Nat. Agrarian Un-ty), which in 2018–2020 received from 276.7 to 1,081.1 thousand euros. Their accumulated share in the total amount of incomes was 77.45%.

Group B united five universities (Vinnitsia Nat. Agrarian Un-ty, Bila Tserkva Nat. Agrarian Un-ty, Poltava State Agrarian Un-ty, Dmytro Motornyi Tavria State Agrotechnological Un-ty, Lviv Nat. Agrarian Un-ty) with revenues in the amount of 55.3 to 189.6 thousand euros. In the total amount of

incomes, their contribution was 17.15%. The difference between the bottom income position in the previous group (276.7 thousand euros) and the top one in this one (189.6 thousand euros) amounted to 87.1 thousand euros.

Group C included the remaining 7 HEIs (Odesa State Environmental Un-ty, Kherson State Agrarian and Economic Un-ty, Uman Nat. Un-ty of Horticulture, Separ. subdiv. NULESU "Berezhany Agotechnical Institute", Separ. subdiv. NULESU "Nizhyn Agrotechnical Institute", Odesa State Agrarian Un-ty, Luhansk Nat. Agrarian Un-ty). Their income to the special fund was either less than 51 thousand euros or absent. Their accumulated share in the total amount of incomes was 5.40%. The difference between the lower income position in the previous group (55.3 thousand euros) and the upper one in this group (50.9 thousand euros) was small and amounted to 4.4 thousand euros.

In the analyzed period, agricultural HEIs received funds from 4.4 to 1,081.1 thousand euros based on the results of scientific activity. One HEI (Luhansk Nat. Agrarian Un-ty) did not receive such funds.

The results of the ABC-analysis of agricultural HEIs of Ukraine according to the absolute indicators of commercialization of the results of scientific work for 2018–2020 are shown in Fig. 1.

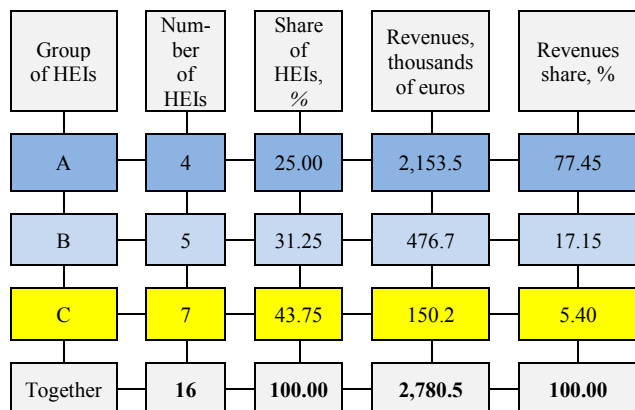


Fig. 1. The results of the ABC-analysis of agricultural HEIs of Ukraine according to the absolute indicators of commercialization of the results of scientific work for 2018–2020

Source: Formed by the author based on Table 1.

Therefore, according to the results of scientific activity in 2018–2020, 94.6% of the earned funds were accumulated in the special fund accounts of 56.25% of agricultural HEIs of Ukraine.

Analysis of relative indicators of the financial effectiveness of the scientific activity of agricultural HEIs of Ukraine

Universities of Ukraine, including agricultural universities, have different absolute indicators of commercialization of the results of scientific work and the number of SPW. In view of this, it is advisable to also investigate the relative indicators of the financial performance of the scientific works and services performed by them.

To do this, we will build Table 2, in which we will display the amount of incomes to the special fund in 2018–2020 based on the results of scientific activity for one SPW by main place of work. On the basis of these indicators, we will calculate the average volume of incomes for each HEI for three years.

Table 2. The amount of incomes to the special fund based on the results of scientific work per SPW by main place of work in agricultural HEIs of Ukraine (euro)

No	Name of the higher education institution	2018	2019	2020	Average revenue for three years
1	Mykolaiv Nat. Agrarian Un-ty	606.85	343.53	498.13	482.84
2	Dnipro State Agrarian and Economic Un-ty	275.66	249.36	321.72	282.24
3	NULESU	234.71	351.24	261.60	282.52
4	Sumy Nat. Agrarian Un-ty	243.74	184.89	238.87	222.50
5	Vinnitsia Nat. Agrarian Un-ty	69.12	70.91	437.04	192.36
6	Odesa State Environmental Un-ty	95.05	114.72	68.07	92.61
7	Bila Tserkva Nat. Agrarian Un-ty	29.98	79.88	162.52	90.79
8	Poltava State Agrarian Un-ty	22.48	46.17	145.08	71.24
9	Dmytro Motorny Tavria State Agrotechnological Un-ty	58.85	45.55	103.08	69.16
10	Kherson State Agrarian and Economic Un-ty	53.52	76.36	67.30	65.73
11	Lviv Nat. Agrarian Un-ty	74.97	28.88	71.27	58.38
12	Separ. subdiv. NULESU “Nizhyn Agrotechnical Institute”	-	-	136.75	45.58
13	Uman Nat. Un-ty of Horticulture	35.03	36.24	45.70	38.99
14	Separ. subdiv. NULESU “Berezhany Agotechnical Institute”	17.76	87.44	-	35.07
15	Odesa State Agrarian Un-ty	-	-	31.29	10.43
16	Luhansk Nat. Agrarian Un-ty	-	-	-	-

Source: Author’s calculation based on data from the MES of Ukraine [9].

Analysis of the dynamics of relative indicators shows that during 2018–2020, agricultural universities of Ukraine also improved the performance of individual

employees, as in 2019, 8 HEIs, and in 2020, 11 HEIs improved their activities, compared to the previous year. In general, during the analyzed period, the average volume of

incomes per SPW of the agricultural HEIs ranged from 10.43 to 482.84 euros (with the exception of Luhansk Nat. Agrarian Un-ty).

Ranking of agricultural HEIs of Ukraine by absolute and relative indicators of funding of scientific research

We will build Table 3 on the basis of the indicators of the total amount of incomes from the results of scientific activity for three years and the average amount of incomes from the results of scientific activity for three years per SPW in agrarian HEIs.

Table 3. Ranking of HEIs of Ukraine by the total and average amount of incomes per SPW by main place of work to a special fund based on the results of scientific and scientific-technical works and the provision of scientific services for 2018–2020

Name of the higher education institution	Rating of HEIs 1	Rating of HEIs 2
NULESU	1	2
Mykolaiv Nat. Agrarian Un-ty	2	1
Dnipro State Agrarian and Economic Un-ty	3	3
Sumy Nat. Agrarian Un-ty	4	4
Vinnytsia Nat. Agrarian Un-ty	5	5
Bila Tserkva Nat. Agrarian Un-ty	6	7
Poltava State Agrarian Un-ty	7	8
Dmytro Motornyi Tavria State Agrotechnological Un-ty	8	9
Lviv Nat. Agrarian Un-ty	9	11
Odesa State Environmental Un-ty	10	6
Kherson State Agrarian and Economic Un-ty	11	10
Uman Nat. Un-ty of Horticulture	12	13
Separ. subdiv. NULESU “Berezhany Agotechnical Institute”	13	14
Separ. subdiv. NULESU “Nizhyn Agrotechnical Institute”	14	12
Odesa State Agrarian Un-ty	15	15
Luhansk Nat. Agrarian Un-ty	16	16

Source: Author’s calculation based on the data of Tables 1 and 2.

As you can see, the ratings of HEIs in terms of absolute and relative indicators are approximately the same. The largest discrepancy is observed for Odesa State Environmental Un-ty (10 and 6 ranking positions, respectively).

The rating matrix of zoning of agricultural HEIs of Ukraine is shown in Fig. 2. On it, agricultural HEIs of Ukraine are divided into six zones:

zone 1 – high level (both rating positions from 1 to 4) – NULESU, Mykolaiv Nat. Agrarian Un-ty, Dnipro State Agrarian and Economic Un-ty, Sumy Nat. Agrarian Un-ty (25.00% of HEIs);

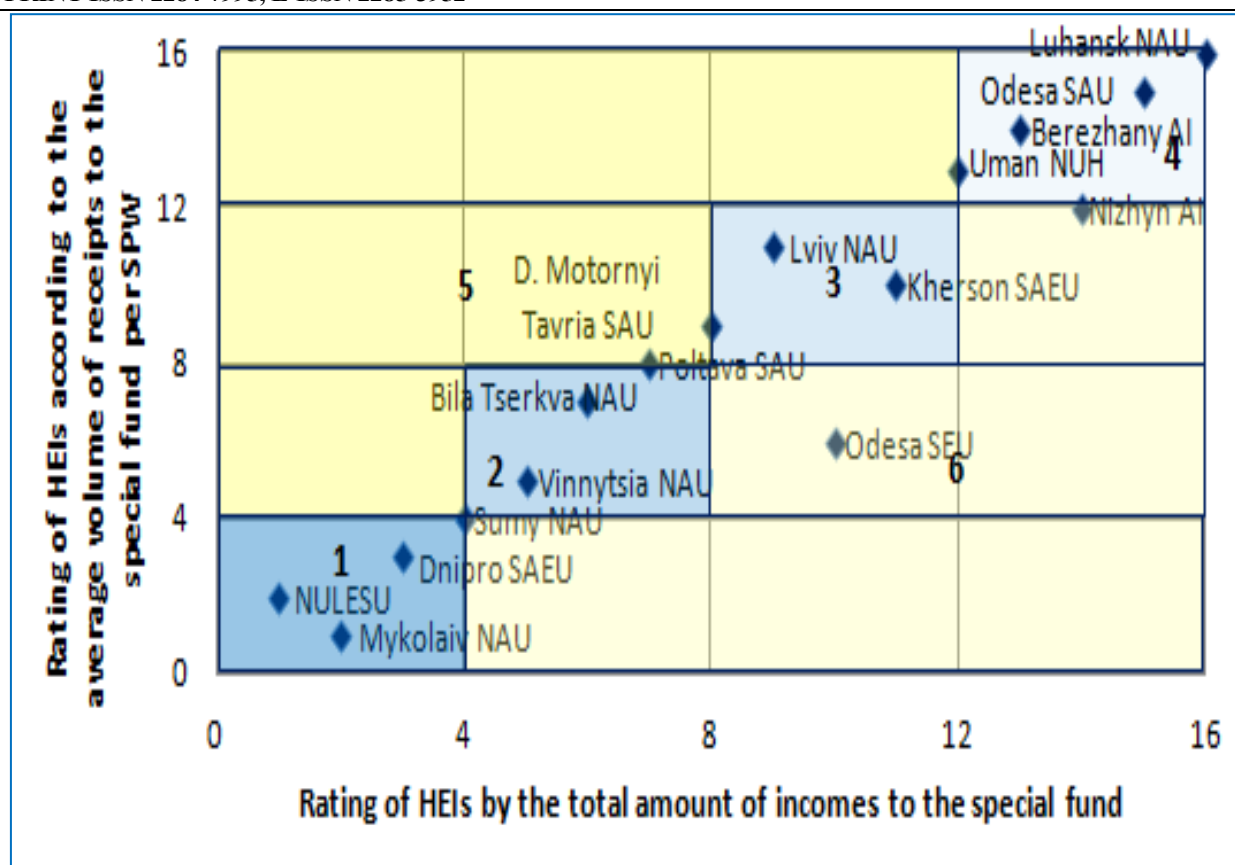
zone 2 – level above the average (both rating positions from 4 to 8) – Vinnytsia Nat. Agrarian Un-ty, Bila Tserkva Nat. Agrarian Un-ty, Poltava State Agrarian Un-ty (18.75%);

zone 3 – level below the average (both rating positions from 8 to 12) – Dmytro Motornyi Tavria State Agrotechnological Un-ty, Lviv Nat. Agrarian Un-ty, Kherson State Agrarian and Economic Un-ty (18.75%);

zone 4 – low level (both rating positions from 12 to 16) – Uman Nat. Un-ty of Horticulture, Separ. subdiv. NULESU “Berezhany Agotechnical Institute”, Separ. subdiv. NULESU “Nizhyn Agrotechnical Institute”, Odesa State Agrarian Un-ty, Luhansk Nat. Agrarian Un-ty (31.25%);

zone 5 – zone of imbalance with a higher level of the total volume of receipts to the special fund of HEIs – does not include HEIs (0%);

zone 6 – zone of imbalance with the highest level of the average volume of receipts to the special fund of HEIs per SPW at the main place of work – Odesa State Environmental Un-ty (6.25%).



- Zone 1 – high level;
- zone 2 – above average level;
- zone 3 – below average level;
- zone 4 – low level;
- zone 5 – an imbalance zone with a higher level of revenues to the special fund of HEI;
- zone 6 – an imbalance zone with a higher level of incomes to the special fund of HEI for one SPW by main place of work.

Fig. 2. Rating matrix of zoning of agricultural HEIs of Ukraine.
 Source: Author’s development based on Table 3.

CONCLUSIONS

The analysis of the dynamics of indicators of the financial effectiveness of the scientific activity of the agricultural HEIs of Ukraine for 2018–2020 shows that the agrarian universities of Ukraine improved the overall effectiveness of the scientific activity from 860.3 to 1,042.6 thousand euros. In addition, in 2019, 7 HEIs, and in 2020, 11 HEIs improved the absolute financial indicators of their scientific work, compared to the previous year; in 2019, 8 HEI and in 2020, 11 HEIs improved the relative financial indicators of their scientific work, compared

to the previous year. One of the factors of such revitalization can be approved by a resolution of the Cabinet of Ministers of Ukraine, the formula for the distribution of state budget expenditures for higher education among HEIs based on the indicators of their educational, scientific and international activity. According to the conducted ABC-analysis, in 2018–2020, the largest amount of funds (from 276.7 to 1,081.1 thousand euros) based on the results of scientific activities went to the special fund of four universities – NULESU, Mykolaiv Nat. Agrarian Un-ty, Dnipro State Agrarian and Economic Un-ty, Sumy Nat.

Agrarian Un-ty. Their accumulated share in the total amount of incomes was 77.45%.

According to the ranking of agricultural HEIs of Ukraine by the total and average volume of incomes per SPW by main place of work to a special fund based on the results of scientific and scientific-technical works and the provision of scientific services for the years 2018–2020, these same universities fell into zone 1 with a high level as an absolute, as well as the relative indicator. For HEIs of Ukraine that did not enter this zone, it is recommended to study the best practices of four leading agricultural universities in the field of commercialization of the results of scientific work.

For a more in-depth study of the field of funding of scientific work in HEIs, it is advisable to conduct a comparative analysis of incomes from the scientific activity of agricultural universities of Ukraine and the world.

We hope that the end of the war in Ukraine will restore the effect of the Decree of the Cabinet of Ministers of Ukraine on the distribution of state budget expenditures for higher education among HEIs based on the indicators of their educational, scientific and international activity. And this will be an additional incentive for agricultural universities to diversify the sources of funds for financing their scientific activities.

REFERENCES

- [1] Cabinet of Ministers of Ukraine (Кабінет Міністрів України), 2019, Про розподіл видатків державного бюджету між закладами вищої освіти на основі показників їх освітньої, наукової та міжнародної діяльності: Постанова Кабінету Міністрів України від 24.12.2019 р. № 1146 (зі змінами) [On the distribution of state budget expenditures between higher education institutions on the basis of indicators of their educational, scientific and international activities: Resolution of the Cabinet of Ministers of Ukraine of 24.12.2019 No. 1146 (as amended), <https://zakon.rada.gov.ua/laws/show/1146-2019-%D0%BF#n18>. Accessed on 03.01.2023. (In Ukrainian).
- [2] Chandran, V. G. R., Nourani, M., Selvarajan, S. K., Baskaran, A., 2021, Selective research funding policy and catching up the ladder in university research performance in Malaysia. *Managerial and Decision Economics*, 42(3):539–550.
- [3] Fu, Y., 2022, The impact of government funding on research innovation: An empirical analysis of Chinese universities. *Managerial and Decision Economics*, doi: 10.1002/mde.3680.
- [4] Haake, U., Silander, C., 2021, Excellence seekers, pragmatists, or sceptics: Ways of applying performance-based research funding systems at new universities and university colleges in Sweden. *European Journal of Education*, 56(2):307–324.
- [5] Hoenig, B., 2018, Structures, mechanisms and consequences of Europeanization in research: how European funding affects universities. *Innovation-The European Journal of Social Science Research*, 31(4):504–522.
- [6] Ito, S., Watanabe, T., 2020, Multilevel analysis of research management professionals and external funding at universities: Empirical evidence from Japan. *Science and Public Policy*, 47(6):747–757.
- [7] Kundu, O., Matthews, N. E., 2019, The role of charitable funding in university research. *Science and Public Policy*, 46(4):611–619.
- [8] Lee, Y. H., 2021, Determinants of research productivity in Korean universities: the role of research funding. *Journal of Technology Transfer*, 46(5):1462–1486.
- [9] Ministry of Education and Science of Ukraine (Міністерство освіти і науки України), 2023, Розподіл коштів з державного бюджету між закладами вищої освіти [Distribution of funds from the state budget between higher education institutions], <https://mon.gov.ua/ua/osvita/visha-osvita/rozpodil-koshtiv-z-derzhavnogo-byudzhetu-mizh-zakladami-vishoyi-osviti-u-2020>. Accessed on 03.01.2023. (In Ukrainian).
- [10] Muizniece, L., 2021, University autonomy and commercialization of publicly funded research: the case of Latvia. *Journal of the Knowledge Economy*, 12(3):1494–1516.
- [11] National bank of Ukraine (Національний банк України), 2023, Офіційний курс гривні до іноземних валют (середній за період) [Official exchange rate of the hryvnia to foreign currencies (average for the period)], <https://bank.gov.ua/ua/markets/exchangerate-chart>. Accessed on 03.01.2023. (In Ukrainian).
- [12] Pereira-Puga, M., Sanz-Menendez, L., 2020, Change and continuity in science policy: The design of funding instruments for university research in Galicia (2005-2018). *Revista Espanola de Ciencia Politica-RECP*, 54:151–171.
- [13] Pourdeyhimi, B., 2021, University research funding: Why does industry funding continue to be a small portion of university research, and how can we change the paradigm? *Industry and Higher Education*, 35(3):150–158.
- [14] Stenbacka, R., Tombak, M., 2020, University-firm competition in basic research and university funding policy. *Journal of Public Economic Theory*, 22(4):1017–1040.
- [15] Totska, O. L., 2022a, Financial aspects of scientific activity of higher education institutions in the regions

of Ukraine and strategy of commercialization of its results. *Journal of Management & Technology [Revista Gestão & Tecnologia]*, Special Edition, 22:34–57.

[16]Totska, O., 2022b, Labor resources in the agriculture of Ukraine and their financial security: regional aspect. *National Interest*, 2(9):25–33.

[17]Totska O., 2022c, Ukraine and Romania: financial aspects of trade in agricultural products. *Scientific Papers. Series “Management, Economic Engineering in Agriculture and Rural Development”*, 22(3):771–776.

[18]Totska O., 2022d, The value dimension of Ukrainian exports of grain crops, fats and oils to European Union countries. *Scientific Papers. Series “Management, Economic Engineering in Agriculture and Rural Development”*, 22(3):767–770.

[19]Wohlrabe, K., Bornmann, L., Gralka, S., de Moya Anegón, F., 2019, How efficient are research universities in Germany, which were funded for their “future concepts” in the Excellence Initiative? An empirical comparison of input- and output-data. *Zeitschrift für Evaluation*, 18(1):9–27.