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National electronic scientific information system «URIS» as a tool for providing competitive selections of scientific (scientific and technical) projects

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Abstract. Conducting competitive selections is a prerequisite for funding individual scientific and scientific-technical programs, projects, and the allocation of state budget grants through targeted support. The effectiveness of such funding distribution largely depends on the quality of competition organization and execution. To ensure competitive selections in the conditions of digitalization, a clear, comfortable and orderly system of digital services for scientific purposes with a developed network of interconnections is necessary.
The purpose was to determine the role of the National Electronic Scientific Information System (System) in ensuring competitive selections of scientific (scientific and technical) projects. The analysis involved the study of regulatory and legal acts using general scientific (empirical) and general logical methods. To examine the operation of the «Competitions» module within the System, functional analysis, modeling (using BPMN), and information analysis were applied to assess qualitative and quantitative process characteristics. Statistical methods were used to analyze the results, complemented by data visualization (interactive diagrams).
To ensure competitive selections, the specifics of which are determined by the regulatory legal acts, an adaptation of the universal procedure scheme that formed the basis for the development of the Competitions Module was implemented, which led to changes, proposals for changes not only in the related regulatory and legal field, but also in ecosystem of module.
Providing competitions in the System made it possible to cover some of the challenges facing competitive procedures and project financing. Analysis of information processes in the Competitions Module contributed to the intensification of work on their improvement. Analysis of data of the results, provided they were constantly accumulated, allowed to form an overall picture of the scientific and partly innovative landscape of research support, provided the opportunity to conduct comprehensive forecasting activities with the aim of concentrating financial resources to ensure scientific, scientific and technical, and innovative development in the medium and long term.

Keywords: open science, grant, expertise, competitive selection, competitive financing, scientific and scientific-technical activity, project, National Electronic Scientific and Information System

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1 Introduction

In Ukraine, funding is implemented on a competitive basis, in particular when developing scientific principles of state policy in the field of scientific and scientific and technical activity, within the framework of implementing priority areas of development of science and technology, by state order, within the framework of state target programs, to ensure the development of the material and technical base, on a contractual basis and within the framework of international scientific and technical cooperation [1].

Funding for specific scientific and scientific-technical programs and projects, as well as the provision of grants from the state budget (budgetary funding), and funding through grants and targeted scientific and technical projects (competitive funding), is carried out based on the results of scientific and scientific-technical expertise within competitive selection processes. The effectiveness of funding distribution depends heavily on the quality of the organization and execution of these competitions. Budgetary funding is considered one of the main instruments for implementing state policy in the fields of science, technology, and innovation, enabling regulation of the coverage and development of the country's scientific and innovation landscape.

Monitoring the process and results of competitive selections makes it possible to assess the performance of scientific and scientific-technical actors—particularly researchers, research institutions (RIs), and higher education institutions (HEIs)—to justify further management decisions, forecast trends in scientific and scientific-technical development in the medium and long term to concentrate resources accordingly, and to develop recommendations for shaping the state budget in terms of determining overall volumes of funding for scientific and scientific-technical activities and its distribution within the framework of competitive funding for scientific research.

To ensure competitive selections in the conditions of digitalization, a clear, comfortable and orderly system of digital services for scientific purposes with a developed network of interconnections and a single access point is necessary. For this purpose, including within the framework of the implementation of the task of creating a single scientific platform of Ukraine, the operational goal of ensuring the professional implementation of Ukrainian scientists, their development and integration into the global scientific space of the action plan of the Human Development Strategy for 2021–2023 [2], the National Electronic Scientific and Information System was created and put into operation. In accordance with the approved Regulation on the System [3], its tasks include the automation of the processes of collecting, forming and storing data, information, procedures related to filling out questionnaires, applications, reports and other documents related to the professional scientific activities of subjects.

A measure has been defined for the System to create a single database (DB) on the results of scientific and scientific and technical activities within the framework of the task of creating conditions for effective work with scientific and technical information and research infrastructure objects available in the open access, of the National Plan for Open Science [4]. By 2026, it is planned to ensure open access to scientific results and scientific and technical information using the System through the implementation of the principles of open access of RIs and HEIs [4].

2 Analysis of recent research and publications

The growth of the role of funding in research is substantiated in the work of the authors W. Tian, R. Cai, Z. Fang, Q. Xie, Z. Hu, X. Wang [5]. According to the results of the study conducted on the basis of a large-scale dataset (over 13 million records of scientific literature from the Web of Science, 171 disciplines), there is a tendency to slow down the growth rate of funding while improving its universality and multiplicity. The indicators of funding provision for disciplines vary, in particular, the work published data according to which the largest percentage of universal funding was received by life sciences and earth sciences (78.31%), multiple funding was received by medicine (3.07%), rapid growth in funding was observed for engineering and computer science.

Traditionally, when considering research funding policies, papers distinguish between institutional (block, university, basic state) funding, i.e. funding of institutions, and competitive funding (project funding). In the work of G. Schweiger, A. Barnett, P. van den Besselaar et al. it is noted that significant differences in the balance between institutional block funding and competitive project funding in different countries affect the level and nature of competition for research funding [6]. At the same time, in the work of T. Zacharewicz, N. Pulido Pavón, L. A. Palma Martos, B. Lepori [7] it is noted that although institutional funding is traditionally considered non-competitive. As a result of its development in most countries of the European Union (EU) over the past decades, elements of competition have gradually been included in its mechanisms. Conversely, the competitive component is currently not a defining characteristic of project funding, since such resources can be provided on the basis of direct contracts without comparing project proposals.

The team of authors [6] in their studies within the framework of the analysis of the distribution of competitive research funding also raises the issue of the reliability of decision-making processes regarding funding and the size of the economic costs of providing the organization and conducting competitive funding.

Regarding decision-making processes, in the work [6] they distinguish two main models of peer review of grants, independent reviews and permanent groups with special members, separately mentioning the method of scientific evaluation, such as bibliometrics. At the same time, as the authors summarize [6], most of the identified shortcomings of peer review relate to three main aspects, namely reliability, which is usually checked by achieving agreement between reviewers, fairness, where the evaluation criteria are analyzed, and predictive validity, which demonstrates the connection of peer review with scientific results.

M. Dresler [8] emphasizes that the system of distributing funding through competitive applications, in particular for large-scale research that is subject to peer review, has repeatedly demonstrated its inability to fulfill its task of reliably ranking proposals, which is supported by empirical studies. At the same time, the author proposes alternative distribution strategies, including quality control through deferred, non-competitive peer review using open science practices.

Based on extensive survey data, L. Langfeldt, I. Reymert, and S. Svartefoss [9] conclude that, under increasing pressure from the rising share of competitive

funding, researchers tend to trust grant reviewers far less than journal reviewers or their colleagues' ability to assess research. As a result, transparency of competitive selection and quality reviewer expertise are deemed crucial.

A randomized experimental study by A. Barnett, T. Blakely, M. Liu, L. Garland, and P. Clarke [10] tested a modified lottery system, where funding was awarded randomly among shortlisted applicants after the initial expert review stage. The results showed no clear impact of funding on research outcomes. The ambiguous influence of competitive funding mechanisms on research effectiveness is also discussed in [7].

As for the economic costs of organizing and conducting competitive funding processes, the authors of [6] highlight that these costs include applicants' time spent writing proposals and seeking funding opportunities, decision-making processes, and administrative expenses. Funding schemes would yield zero net financial benefit if these costs equaled the amount of allocated funds. G. Schweiger [11] also examines the time costs and potential benefits of preparing proposals. Field-specific studies reveal that 90% of researchers spend excessive time preparing proposals, while only 10% perceive competitive third-party funding systems as positively impacting research quality. Moreover, researchers report limited trust in the objectivity of proposal review processes.

The **purpose**: to determine the role of the National Electronic Scientific and Information System in ensuring the competitive selections of scientific (scientific and technical) projects.

The list of **tasks** includes:

- to analyze the regulatory and legal acts governing the procedures of competitive selections and the mechanisms ensuring their implementation within the System;
- to analyze the operation of the Competitions and Project Reporting Module (the Competitions Module) within the framework of state, sectoral, and scientific-technical programs in the System, as well as to model its functionality, interaction, and integration with other functional modules and external information systems (IS);
- to analyze the qualitative and quantitative characteristics of the data related to the information processes of competitive selections and their outcomes.

3 Presentation of the main material

The System Operating Procedure [12] outlines the responsibilities and duties of the key roles within the Competitions Module, particularly the external roles of the competition organizer — who defines the procedure for conducting competitions, specifies the required document forms — and the System owner, who delegates the appropriate authority to the technical administrator. It also describes the internal role of the technical administrator, who is responsible for maintaining the operation of the System.

The role of the competition organizer is defined in the regulatory and legal acts governing competitive selection procedures. For competitions administered through the System, the organizer is usually the Ministry of Education and Science of Ukraine. External roles are granted user accounts in the System

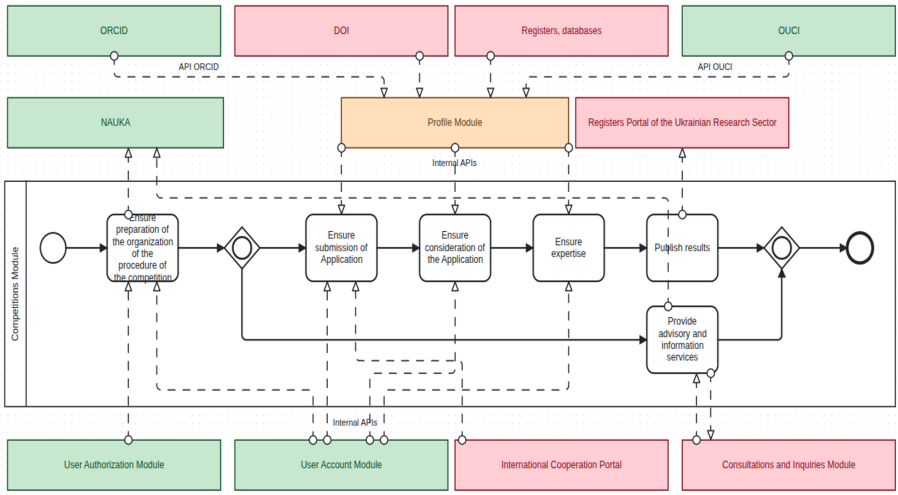

Fig. 1. Modeling of a Universal Competitive Selection Procedure and the Interaction of the System's Functional Modules Using BPMN 2.0 Notation, with Transitional Integration of External Information Systems (IS)

with access rights sufficient at minimum to ensure oversight of the electronic document workflow related to the competition process.

Fig. 1 presents a generally universal procedure typical for competitive selection processes. Conceptually, it includes the stages of competition preparation, submission of application packages, review (formal compliance, registration), expert evaluation, and the decision-making procedure (on results, conflict of interest resolution).

This universal framework was taken as the basis for the development of the Competitions Module, with the aim of adapting it to each specific competition, the specifics of which are determined by legal and regulatory acts governing the procedure and mechanisms—for example, multi-stage submissions, multi-level expert evaluation, specific document package requirements, and corresponding forms.

In order to ensure the procedure of electronic document flow of competitive selection, the System is endowed with a number of functions, including: ensuring compatibility, interaction of functional modules of the System and integration of third-party IS [3]. Fig. 1 shows the functional modules of the System and third-party IS that are used (marked in green), partially used (yellow), or can potentially be used as a proposal of the authors (red) to provide the Competitions Module.

Functional modules of the System represent a set of software tools that automate the processes of subjects and users to the level of operational procedures, provide collection, formation, storage, sharing and verification of stored data [3]. The following functional modules are used to provide the Competitions Module:

– The National Electronic Scientific and Information System Portal for publishing information on competitive calls. This information is presented for each competition on the «Science in Ukraine» (NAUKA) platform [13] under «Useful Information» and «MESU Competitions»;

- The User Authorization Module for assigning user roles and providing access to the Competitions Module;
- The User Account Module for granting authorized users access to the System's functional modules according to their assigned roles;
- The Profile Module for importing information from various profile types (e.g., researchers via identifiers, institutions—potentially via integrated ROR [Research Organization Registry] or GRID [Global Research Identifier Database], publications via DOI [Digital Object Identifier], projects, etc.);
- The Registers Portal of the Ukrainian Research Sector for exporting and publishing information, documents, and records of results;
- The National Portal for International Scientific and Technical Cooperation (International Cooperation Portal) for exporting data on the participation of national research institutions and higher education institutions in international project competitions (e.g., Horizon 2020, Horizon Europe, Euratom, other international grant programs including those with a scientific component such as Erasmus+, and bilateral agreements). This functionality is contingent on further improvements related to integration with external IS or the availability of such information on the portal;
- The Consultations and Inquiries Module for providing consultative and informational services related to competition procedures.

Third-party information systems (IS) refer to systems that contain data which can be utilized to populate the databases of the System's functional modules upon integration. Such integration enables the creation, storage, viewing, and exchange of information, data, and documents between the IS and the System's functional modules [3]. According to the Regulation on the System [3], the list of priority third-party IS includes, for example: ORCID (ORCID entity), DOI register (Crossref), ROR (coordinated by the California Digital Library), the Open Ukrainian Citation Index (OUCI, developed by the State Scientific and Technical Library of Ukraine), and several state registers, among others. Currently, the System supports data export from ORCID (in JSON format) and OUCI (via public API, enabling retrieval of publication information using DOI).

In 2023, two competitive calls for research projects (a general call and a youth call) were conducted in the System using the Competitions Module. In 2024, a total of nine calls were carried out, specifically: three competitive selections for research projects and experimental developments; one call for innovation activities (startups); two scholarship competitions; and three calls under international scientific and technological cooperation programs.

For the first time, the largest-scale competitive selection of projects—covering fundamental research, applied research, and scientific-technical (experimental) developments implemented by HEIs and RIs under the jurisdiction of the Ministry of Education and Science of Ukraine (the General Competition)—was conducted through the System in 2023. Information about the call within the Competitions Module was announced on the NAUKA portal. Details regarding registration, authentication, access, user instructions, forms, and specific procedures were outlined in a corresponding letter from the Directorate for Science Development of the Ministry of Education and Science of Ukraine.

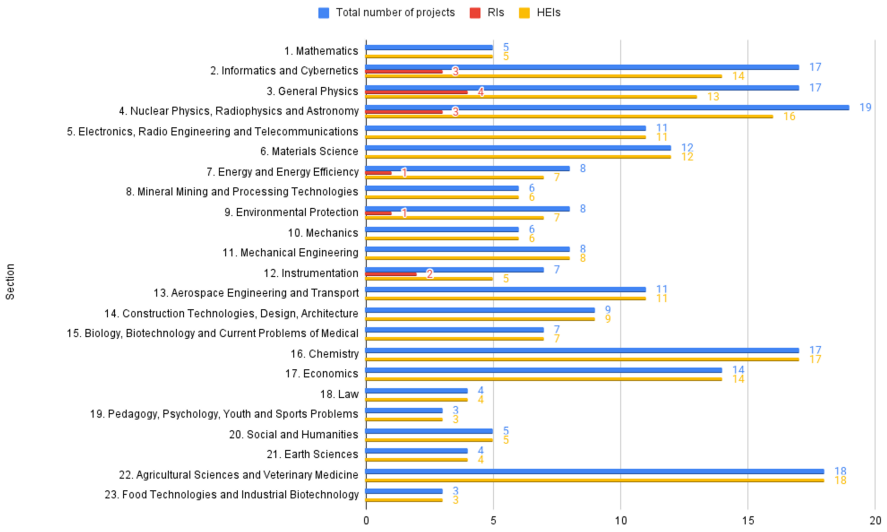

Fig. 2. Comparative horizontal histogram of the number of projects by section (General Competition, 2023)

According to the results of the 2023 General Competition [14], projects carried out by scientific institutions accounted for only 6.4% of the total, while in most sections, projects were implemented exclusively by research teams from HEIs. The highest number of projects was recorded in the field of physical sciences (see Fig. 2).

Since the quantitative indicators are presumably proportional to the actual funding allocated to the section, in the opinion of the authors, such an assessment actually demonstrates only the priority of the section in terms of the amount of financial support. In this case, it would be advisable to monitor the quality of the submitted projects, for example, through the average expert score of the project, the results of the rating vote on projects, and through the adjustment of the passing score. For the analysis, it would also be useful to study the correspondence of the results of the first two indicators, the reasons for the deviation, and the establishment of an acceptable deviation for assessing the quality of the work of experts of different levels.

In 2024, the General Competition was held according to the procedure specified in the Regulation approved by the order of the Ministry of Education and Science of Ukraine dated 04.10.2022 No. 885 [15]. A total of 966 application forms were created in the System, of which 655 were submitted for expert evaluation.

With the accumulation of data over two years, it became possible to conduct a comparative analysis of the results of the General Competition. To analyze the financial component of the results by various indicators, an interactive environment was developed that can be included in the analytical component of the Competitions Module, for data visualization using descriptive statistics, a box-and-whisker diagram. The following Python libraries were used when developing the environment: pandas, NumPy, Plotly, Matplotlib and seaborn. The results data were exported from the Competitions Module, and work was

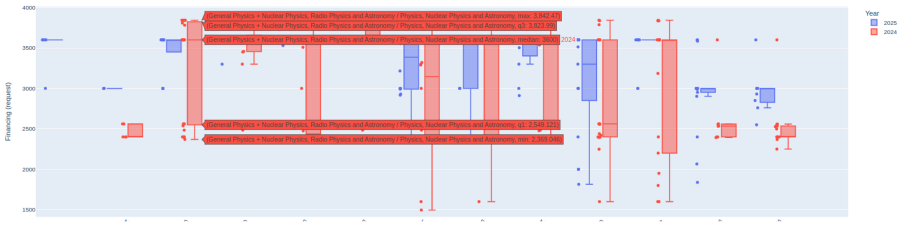

Fig. 3. Interactive environment of funding scope diagrams (request) by sections (General Competition 2023, 2024)

previously carried out to coordinate the list of sections of the Scientific Council of the Ministry of Education and Science of Ukraine, which in 2024 included 14 positions and significantly differed from the list of 2023 in 23 positions, not only quantitatively, but also qualitatively. The basic box plots were modified for categorical distributions, supplemented with scatter plots, and grouping options by indicators were added. Fig. 3 shows an example of an interactive environment of grouped data by concerted sections presented for comparing results from 2 years. Data information includes maximum, minimum, quantiles, including median for a sample of a statistical population, in particular project funding (request).

The specifics of the procedure for conducting competitive selection of projects of fundamental scientific research, applied scientific research, scientific and technical (experimental) developments of young scientists working (studying) in HEIs, RIs, belonging to the sphere of management of the Ministry of Education and Science of Ukraine (Competition Young Scientists), are determined by the Regulations on the conductin the version dated 08.07.2022 [16]. This regulatory legal act does not mention the System, nor does the most recent announcement of the 2024 Competition Young Scientists. However, for several consecutive years, this type of competitive selection has in fact been carried out within the System. In 2024, representatives of HEIs and RIs completed 276 application forms, of which 168 were formally submitted to the Ministry of Education and Science of Ukraine for consideration and expert evaluation, which was conducted in the System by subject-specific expert panels.

Fig. 4 demonstrated the results of the Competition Young Scientists of the last two years [17, 18] using superficial coordination of professional areas of the Council sections that carried out the expertise; appropriate coordination made it possible to compare the results and predict the development of these areas in future periods.

Fig. 4 shows a comprehensive analysis of the results by three characteristics at once: quantitative, score and section. In a two-dimensional interpretation, for example, the largest number of projects (56.1% of the total number of projects) that passed the Competition Young Scientists in 2024 received a score in the interval [80–90), the lowest indicator was recorded for the interval [60–70) (project, section «National Security and Defense»). In total, 82 projects were recorded in 2024, three projects less in 2023. It is worth noting that the projects are actually presented for one type of institution, namely HEIs, only 1 project was identified in the section «Climate Change, Environment, Clean Construction and Sustainable Use of Nature» according to the results of 2023.

Fig. 4. a) Horizontal histogram of the distribution of projects by ranges of points obtained with accumulation by sections (Competition Young Scientists, 2024).
b) Horizontal histogram of the distribution of projects by ranges of points obtained with accumulation by sections (Competition Young Scientists, 2023)

The largest number of projects by young scientists, the funding of which began in 2025, is assigned to the sections «Chemistry, Chemical Technologies and Pharmacy» and «Economic Transformations, Business, Administration and Law» (11 projects each, 13.4%), the smallest is assigned «National Security and Defense», «Mathematics and Statistics», «Human Capital Development, Social Sciences and Journalism» and «Humanities and Arts» (2 projects each, 2.4%). For the 2023 competition, «Information and Communication Technologies, Robotics» was the leader (18 projects, 22.8%), while the security section was similarly minimally represented (1 project, 1.3%).

In 2024 competitive selection of scientific and technical (experimental) developments under a state order (State Order Competition) was automated in the System in accordance with the procedure specified in the order of the Ministry of Education and Science of Ukraine in the current version dated May 15, 2024 [19]. Under the new mechanism, 808 scientific teams from 61 enterprises, institutions or organizations of various forms of ownership took part in the competitive selection, including 29 projects from HEIs, 28 projects from RIs, 2 projects from state enterprises, 2 projects from private sector organizations. 219 applications for scientific and technical work, which included technical tasks, were registered in the System, 109 were submitted for consideration by the Ministry of Education and Science of Ukraine. 65.1% are applications submitted by institutions that are in the sphere of subordination exclusively to the Ministry of Education and Science of Ukraine (Fig. 5 a, b).

The geography of applications is quite wide, the largest number of applications came from institutions, enterprises, organizations of the Kyiv region and Kyiv, significantly fewer from institutions, enterprises, organizations from the Kharkiv region (11), Sumy and Dnipropetrovsk regions (7), less than 4 from other regions (Fig. 5). Visualization of the results using maps allows you to analyze the regional financial support of science, identify areas that require effective management decisions, financial support.

Expert support was carried out at the rate of 3 Ukrainian experts of the unified system of experts of the Ministry of Education and Science of Ukraine for each application, i.e. the System provided for the conduct of 327 expertise.

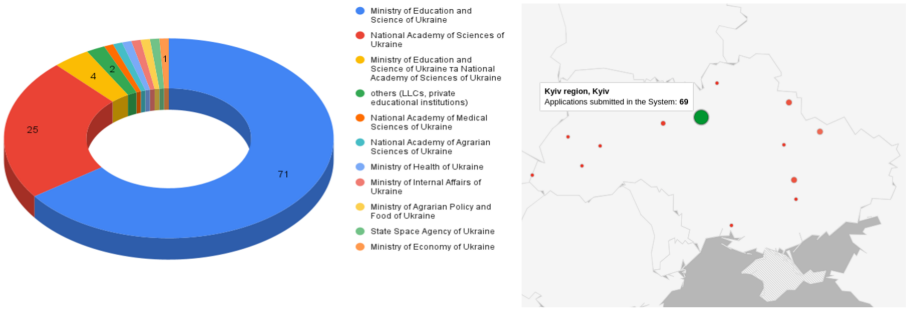

Fig. 5. a) Ring-shaped ordered 3D diagram of the distribution of applications from institutions, enterprises, organizations according to their subordination.
b) Map diagram of applications registered in the System by regions of Ukraine (State Order Competition, 2024)

In 2024, according to the results of the competitive selection, approved by the order of the Ministry of Education and Science of Ukraine dated 12.11.2024 No. 2DSK (for official use), 22 scientific and technical (experimental) developments were recommended for funding. The total amount of funding is UAH 186,794.25 thousand, with a project implementation period of up to two years.

Documents of applicants for submission to the Competition for scholarships of the Cabinet of Ministers of Ukraine for young scientists (Cabinet of Ministers of Ukraine Scholarship Competition) to the Ministry of Education and Science of Ukraine in 2024 were prepared in accordance with the letter of the Ministry of Education and Science of Ukraine dated 20.08.2024 No. 1/15038-24 [20] and submitted through the System. The recommendations of the Board of the Ministry of Education and Science of Ukraine regarding applicants for the award of the Cabinet of Ministers of Ukraine scholarships for young scientists from November 2024 to October 2026, approved by the order of the Ministry of Education and Science of Ukraine dated 28.10.2024 No. 1532 [21], identified 234 scholarships. A visual analysis of the data of scholarship holders by academic degree and years of training of doctoral and postgraduate students is presented in Fig. 6 a), b).

Fig. 7 visualizes the statistics of scholarship holders among scientific, scientific and pedagogical workers.

It is worth noting that since the information about the results is personalized, the corresponding data can be imported into the Scientist Profile of the Profiles module, similarly to previous cases, conducting competitive selections in the System opens up the possibility of internal import from the Competitions Module.

Within the framework of the competition for obtaining state named scholarships for the best young scientists to perpetuate the events of the Revolution of Dignity and honor the feat of the Heroes of Ukraine—the Heroes of the Heavenly Hundred (Competition of Heroes Heavenly Hundred), 5 nominations have been determined. The mechanism for assigning and paying state named scholarships is also determined by the relevant Regulation, approved by the resolution of the Cabinet of Ministers of Ukraine as amended on 02.09.2022 [22].

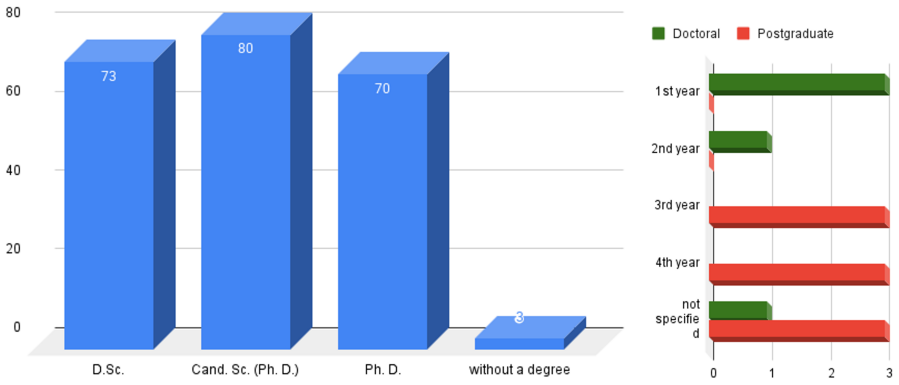

Fig. 6. a) Column 3D diagram of the distribution of scholarship holders by academic degree. b) Horizontal 3D diagram of the distribution of scholarship holders by years of training of doctoral students, postgraduate students (Cabinet of Ministers of Ukraine Scholarship Competition, 2024)

In 2024, 109 forms were created in the System, 77 were submitted for consideration to the Ministry of Education and Science of Ukraine. Fig. 8 proposes a pilot visualization of the quantitative distribution by subordination of institutions in which the scholarship holders work (study), presented with the inclusion of data from the previous period in order to demonstrate the advantages of the proposed visualization method when accumulating data. In general, this method allows you to analyze the potential for changes in the magnitude of influence.

According to the results of [23], out of 25 fellows, 76% are representatives of HEIs, the best represented are institutions where fellows work (study), subordinate to the Ministry of Education and Science of Ukraine (Fig. 8).

According to the procedure of the Competitions Module [12], the procedure of electronic document flow of competitive selections is provided not only for scientific projects of fundamental, applied research, scientific and tech-

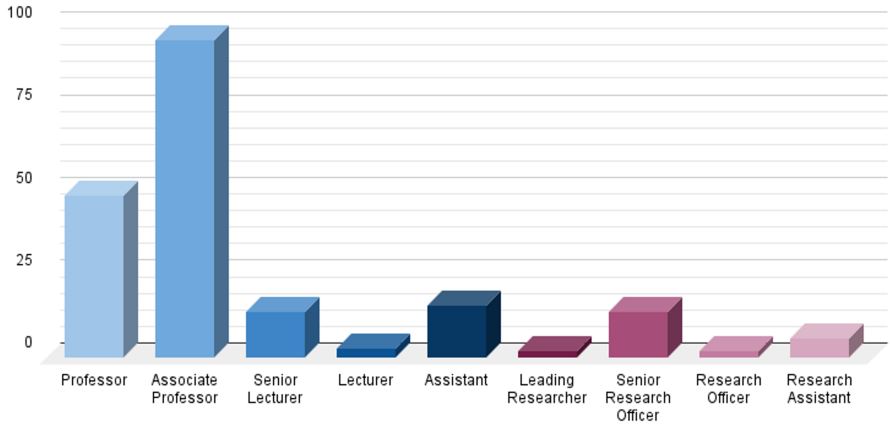

Fig. 7. 3D bar charts of the distribution of scholarship holders of scientific, scientific and pedagogical workers (Cabinet of Ministers of Ukraine Scholarship Competition, 2024)

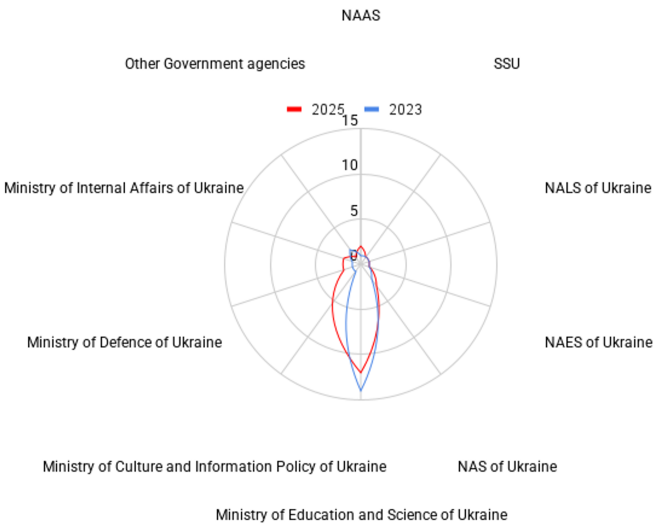

Fig. 8. Petal diagram of quantitative distribution by subordination of institutions where fellows work (study) (Competition of Heroes Heavenly Hundred, 2024, 2023)

nical (experimental) developments, but also for innovative ones. In particular, in 2024, the System conducted a competitive selection of scientific and technical projects aimed at supporting the innovative activities of HEIs and RIs in order to determine the list of HEIs, RIs, on the basis of which a network of startup schools—incubators-accelerators—will be created (Competition startup schools—incubators-accelerators). The financing of the implementation of projects is implemented at the expense of the special fund of the state budget, received as an external instrument of EU assistance to fulfill Ukraine's obligations (previously in Horizon 2020 (2014–2020), currently Horizon Europe). The mechanism for implementing the pilot project to create a network of startup schools—incubators—accelerators based on HEIs and RIs is determined by the relevant Procedure approved by the Resolution of the Cabinet of Ministers of Ukraine dated April 23, 2024 No. 430 [24].

In the System, within the framework of the Competition startup schools—incubators-accelerators, 30 completed application forms out of 98 created were submitted for consideration to the Ministry of Education and Science of Ukraine. Support for the innovative activities of the relevant HEIs and RIs is determined by the deadline for 2024–2026 in 4 stages of financing, in particular, according to the results of such a competition in 2024 [25], 5 HEIs will receive a total of UAH 6997.8 thousand, and a single RI will receive UAH 1457.8 thousand (Fig. 9).

To ensure international scientific and scientific and technical cooperation, namely participation in international scientific programs, in particular in the EU Framework Programmes, a competitive selection of scientific, scientific and technical works and projects financed by the EU external assistance instrument for the implementation of Ukraine's obligations in Horizon 2020 (Reimbursement Competition) was held in the System. The procedure is defined in the relevant Regulation, approved by the Resolution of the Cabinet of Ministers of Ukraine as amended on 28.02.2024 [26].

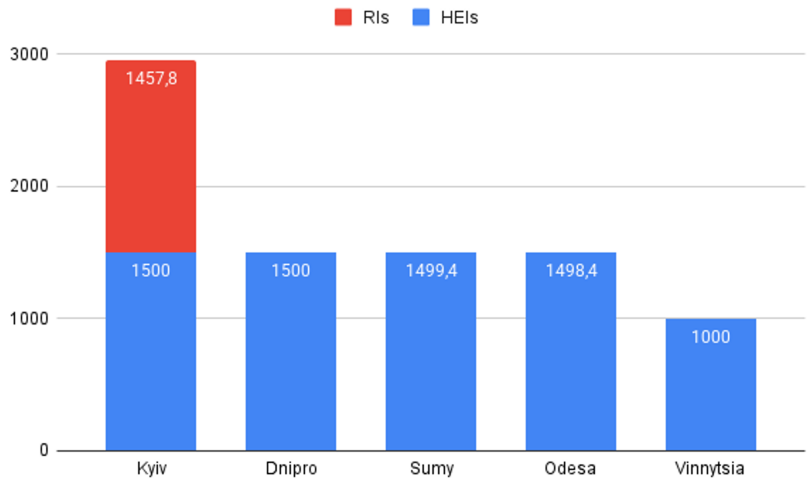

Fig. 9. Bar chart with accumulation of total funding by region by institution type (Competition startup schools—incubators-accelerators, 2024)

In 2024, 213 forms were created in the System, 106 of which were submitted for consideration to the Ministry of Education and Science of Ukraine. According to the data of the final proposals on the list of scientific works, scientific and technical and infrastructure projects recommended for funding [27], the largest share of selected projects, including those additionally selected by the decision of the Council, is assigned to direction 2.1 «Scientific works» almost 59.4%, the smallest is assigned to direction 2.2 «Scientific and technical projects» (3 projects). The distribution is somewhat different by the parameter of the amount of funding, in particular, 44.2% projects of direction 2.1 «Scientific works», 41% 1 «Infrastructure projects», the smallest 2.2 «Scientific and technical projects» 4.5% (Fig. 10).

As part of ensuring bilateral international scientific and technical and scientific and technological cooperation in 2024 in the System was active competitions for joint Ukrainian–Austrian (19 completed forms out of 47 created were submitted for consideration to the Ministry of Education and Science of Ukraine) and Ukrainian-Latvian (64 out of 152) research projects for implementation in 2025–2026.

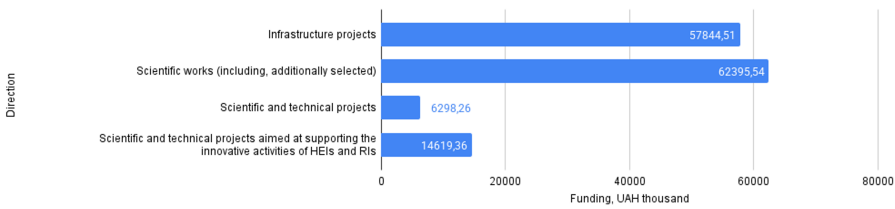

Fig. 10. Horizontal histogram of the distribution of funding volumes by area (Reimbursement Competition, 2024)

4 Conclusions

In the context of the growing role of funding in research, the issue of forming and reforming the policy of balancing basic and competitive funding is becoming more relevant. In Ukraine, the competitive funding procedure necessarily includes a competitive component. The main issues remain the reliability of decision-making processes and the size of economic costs for organizing and conducting competitive selections. When making decisions, significant quality indicators are reliability, as the level of agreement and compromise in the expert environment involved, fairness, as effective evaluation criteria, and predictive validity, as the correspondence between expert assessment in the past and scientific results in the future. As for costs, there is a desire to optimize them in order to increase the net financial profit for the proposed funding schemes. In addition, the transparency of competitive selection and the comfort of its implementation for all its participants are no less important.

To support competitive selection procedures, the Competitions Module of the System has been developed. It is designed to be universal and can be adapted to each specific competition, the features of which are defined by the relevant legal and procedural acts. Depending on these specifics, the Competitions Module is modified to adjust form templates, evaluation criteria, procedures, etc.

This recurring need for adaptation requires developers to intervene in the Competitions Module each time a new selection process — based on its own regulatory documents—is announced. This also necessitates configuring integration with other functional modules of the System and with external information systems.

The data accumulated as a result of the operation of the Competitions Module allows for real-time analysis of information processes of competitive selections and monitoring of the results of such competitions to determine the effectiveness of the activities of scientific and scientific and technical entities in order to substantiate further management decisions in the relevant field and to forecast the trend of scientific, scientific and technical development in the medium and long term for the concentration of resources, in particular financial ones.

References

[1] Pro naukovu i naukovo-tekhnichnu diialnist: Zakon Ukrainy vid 26.11.2015 № 848-VIII. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/848-19(Accessed February 9, 2025).

[2] Pro zatverdzhennia planu zakhodiv z realizatsii Stratehii liudskoho rozvytku na 2021–2023 roky: Rozporiadzhennia Kabinetu Ministriv Ukrainy vid 09.12.2021 № 1617-r. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/1617-2021-%D1%80 (Accessed February 6, 2025).

[3] Pro zatverdzhennia Polozhennia pro Natsionalnu elektronnu naukovo-informatsiinu systemu: Postanova Kabinetu Ministriv Ukrainy vid 27.09.2022 № 1067. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/1067-2022-%D0%BF (Accessed February 7, 2025).

[4] Pro zatverdzhennia natsionalnoho planu shchodo vidkrytoi nauky: Rozporiadzhennia Kabinetu Ministriv Ukrainy vid 08.10.2022 № 892-r. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/892-2022-%D1%80 (Accessed February 6, 2025).

[5] Tian W., Cai R., Fang Z., Xie Q., Hu Z., Wang X. 2024. Research funding in different SCI disciplines: A comparison analysis based on Web of Science. *Quantitative Science Studies* 5, no. 3. P. 757–777. https://doi.org/10.1162/qss_a_00315

[6] Schweiger G., Barnett A., van den Besselaar P., et al. 2024. The costs of competition in distributing scarce research funds. *Proc. Natl. Acad. Sci* 121, no. 50. e2407644121. https://doi.org/10.1073/pnas.2407644121

[7] Zacharewicz T., Pulido Pavón N., Palma Martos L. A., Lepori B. 2023. Do funding modes matter? A multilevel analysis of funding allocation mechanisms on university research performance. *Research Evaluation* 32, Iss. 3. P. 545–556. https://doi.org/10.1093/reseval/rvad023

[8] Dresler M. 2023. FENS-Kavli Network of Excellence: Postponed, non-competitive peer review for research funding. *Eur J Neurosci* 58, Iss. 12. P. 4441–4448. https://doi.org/10.1111/ejn.15818

[9] Langfeldt L., Reymert I., Svartefoss S. M. 2024. Distrust in grant peer review—reasons and remedies. *Science and Public Policy* 51, Iss. 1. P. 28–41. https://doi.org/10.1093/scipol/scad051

[10] Barnett A., Blakely T., Liu M., Garland L., Clarke P. 2024. The impact of winning funding on researcher productivity, results from a randomized trial. *Science and Public Policy* 51, Iss. 6. P. 1042–1050. https://doi.org/10.1093/scipol/scae045

[11] Schweiger G. 2023. Can't We Do Better? A cost-benefit analysis of proposal writing in a competitive funding environment. *PLoS ONE* 18, no. 4. e0282320. https://doi.org/10.1371/journal.pone.0282320

[12] Pro zatverdzhennia Poriadku roboty Natsionalnoi elektronnoi naukovo-informatsiinoi systemy: Nakaz Ministerstva osvity i nauky Ukrainy vid 08.01.2024 № 10. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/z0323-24 (Accessed February 6, 2025).

[13] NAUKA: National Electronic Scientific Information System. https://nauka.gov.ua/ (Last modified February 6, 2025).

[14] Pro zatverdzhennia pereliku proiektiv fundamentalnykh naukovykh doslidzhen, prykladnykh naukovykh doslidzhen, naukovo-tekhnichnykh (eksperymentalnykh) rozrobok, vykonavtsiamy yakykh ye zaklady vyshchoi osvity ta naukovi ustanovy, shcho nalezhat do sfery upravlinnia Ministerstva osvity i nauky Ukrainy, yaki proishly konkursnyi vidbir ta finansuvannia yakykh rozpochnetsia z 2024 roku za rakhunok koshtiv Derzhavnoho biudzhetu Ukrainy: Nakaz Ministerstva osvity i nauky Ukrainy vid 27.12.2023 № 1572. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-zatverdzhennya-pereliku-proyektiv-fundamentalnih-naukovih-doslidzhen-prikladnih-naukovih-doslidzhen-naukovo-tehnichnih-eksperimentalnih-rozrobok-vikonavcyami-yakih-ye-zakladi-vishoyi-osvi (Accessed February 8, 2025).

[15] Pro zatverdzhennia Polozhennia pro provedennia konkursnoho vidboru proiektiv naukovykh doslidzhen i naukovo-tekhnichnykh (eksperymental-

nykh) rozrobok, vykonavtsiamy yakykh ye zaklady vyshchoi osvity ta naukovi ustanovy, shcho nalezhat do sfery upravlinnia Ministerstva osvity i nauky Ukrainy: Nakaz Ministerstva osvity i nauky Ukrainy vid 04.10.2022 № 885. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/z1238-22 (Accessed February 5, 2025).

[16] Pro zatverdzhennia Polozhennia pro provedennia Ministerstvom osvity i nauky Ukrainy Konkursu proiektiv fundamentalnykh naukovykh doslidzhen, prykladnykh naukovykh doslidzhen ta naukovo-tekhnichnykh (eksperymentalnykh) rozrobok molodykh vchenykh, yaki pratsiuiut (navchaiutsia) u zakladakh vyshchoi osvity ta naukovykh ustanovakh, shcho nalezhat do sfery upravlinnia Ministerstva, podalshe vykonannia tsykh doslidzhen i rozrobok za rakhunok koshtiv zahalnoho fondu derzhavnoho biudzhetu ta upravlinnia nymy: Nakaz Ministerstva osvity i nauky Ukrainy vid 14.12.2015 № 1287. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/z0015-16 (Accessed February 7, 2025).

[17] Pro zatverdzhennia pereliku proiektiv fundamentalnykh naukovykh doslidzhen, prykladnykh naukovykh doslidzhen ta naukovo-tekhnichnykh (eksperymentalnykh) rozrobok molodykh vchenykh, yaki pratsiuiut (navchaiutsia) u zakladakh vyshchoi osvity ta naukovykh ustanovakh, shcho nalezhat do sfery upravlinnia Ministerstva osvity i nauky Ukrainy, yaki proishly konkursnyi vidbir ta finansuvannia yakykh rozpochnetsia z 2025 roku za rakhunok koshtiv Derzhavnoho biudzhetu Ukrainy: Nakaz Ministerstva osvity i nauky Ukrainy vid 27.012.2024 № 1801. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-zatverdzhennia-pereliku-proiektiv-fundamentalnykh-naukovykh-doslidzhen-prykladnykh-naukovykh-doslidzhen-ta-naukovo-tekhnichnykh-eksperymentalnykh-rozrobok-molodykh-vchenykh-iaki-pratsiuiu (Accessed February 5, 2025).

[18] Pro zatverdzhennia pereliku proiektiv fundamentalnykh naukovykh doslidzhen, prykladnykh naukovykh doslidzhen ta naukovo-tekhnichnykh (eksperymentalnykh) rozrobok molodykh vchenykh, yaki pratsiuiut (navchaiutsia) u zakladakh vyshchoi osvity ta naukovykh ustanovakh, shcho nalezhat do sfery upravlinnia Ministerstva osvity i nauky Ukrainy, yaki proishly konkursnyi vidbir ta finansuvannia yakykh rozpochnetsia z 2024 roku za rakhunok koshtiv Derzhavnoho biudzhetu Ukrainy: Nakaz Ministerstva osvity i nauky Ukrainy vid 27.12.2023 № 1569. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-zatverdzhennya-pereliku-proyektiv-fundamentalnih-naukovih-doslidzhen-prikladnih-naukovih-doslidzhen-ta-naukovo-tehnichnih-eksperimentalnih-rozrobok-molodih-vchenih-yaki-pracyuyut-navchayu (Accessed February 5, 2025).

[19] Pro zatverdzhennia Polozhennia pro provedennia Ministerstvom osvity i nauky Ukrainy konkursnoho vidboru naukovo-tekhnichnykh (eksperymentalnykh) rozrobok za derzhavnym zamovlenniam: Nakaz Ministerstva osvity i nauky Ukrainy vid 09.02.2017 № 192. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/z0339-17 (Accessed February 8, 2025).

[20] Pro podannia pretendentiv na zdobuttia stypendii Kabinetu Ministriv Ukrainy dlia molodykh vchenykh: Lyst Ministerstva osvity i nauky Ukrainy vid 20.08.2024 № 1/15038-24. Natsionalna elektronna naukovo-informatsiina systema. https://nauka.gov.ua/docs/69/Lyst_MON_Oholoshennia_Konkursu_2024_styp_KMU.pdf (Accessed February 9, 2025).

[21] Pro rekomendatsii shchodo pryznachennia stypendii Kabinetu Ministriv Ukrainy dlia molodykh vchenykh: Nakaz Ministerstva osvity i nauky Ukrainy vid 28.10.2024 № 1532. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-rekomendatsii-shchodo-pryznachennia-stypendii-kabinetu-ministriv-ukrainy-dlia-molodykh-vchenykh (Accessed February 9, 2025).

[22] Pro derzhavni imenni stypendii naikrashchym molodym vchenym dlia uvichnennia podii Revoliutsii Hidnosti ta vshanuvannia podvyhu Heroiv Ukrainy — Heroiv Nebesnoi Sotni: Postanova Kabinetu Ministriv Ukrainy vid 21.11.2018 № 1017. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/1017-2018-%D0%BF (Accessed February 9, 2025).

[23] Pro pryznachennia derzhavnykh imennykh stypendii naikrashchym molodym vchenym dlia uvichnennia podii Revoliutsii Hidnosti ta vshanuvannia podvyhu Heroiv Ukrainy — Heroiv Nebesnoi Sotni na 2025 rik: Nakaz Ministerstva osvity i nauky Ukrainy vid 20.11.2024 № 1639. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-pryznachennia-derzhavnykh-imennykh-stypendii-naikrashchym-molodym-vchenym-dlia-uvichnennia-podii-revoliutsii-hidnosti-ta-vshanuvannia-podvyhu-heroiv-ukrainy-heroiv-nebesnoi-sotni-na-2025 (Accessed February 10, 2025).

[24] Pro realizatsiiu eksperymentalnoho proektu shchodo stvorennia na bazi zakladiv vyshchoi osvity, naukovykh ustanov merezhi startap-shkil—inkubatoriv-akseleratoriv: Postanova Kabinetu Ministriv Ukrainy vid 23.04.2024 № 430. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/430-2024-%D0%BF (Accessed February 9, 2025).

[25] Pro zatverdzhennia pereliku zakladiv vyshchoi osvity, naukovykh ustanov, na bazi yakykh bude stvoreno merezhu startap-shkil—inkubatoriv-akseleratoriv, za rezultatamy konkursnoho vidboru naukovo-tekhnichnykh proiektiv, spriamovanykh na pidtrymku innovatsiinoi diialnosti zakladiv vyshchoi osvity ta naukovykh ustanov, rekomendovanykh do finansuvannia: Nakaz Ministerstva osvity i nauky Ukrainy vid 25.10.2024 № 1512. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-zatverdzhennia-pereliku-zakladiv-vyshchoi-osvity-naukovykh-ustanov-na-bazi-iakykh-bude-stvoreno-merezhu-startap-shkil-inkubatoriv-akseleratoriv-za-rezultatamy-konkursnoho-vidboru-naukovo. (Accessed February 10, 2025).

[26] Pro zatverdzhennia Polozhennia pro konkursnyi vidbir naukovykh, naukovo-tekhnichnykh robit ta proektiv, yaki finansuiutsia za rakhunok zovnishnoho instrumentu dopomohy Yevropeiskoho Soiuzu dlia vykonannia zoboviazan Ukrainy u Ramkovii prohrami Yevropeiskoho Soiuzu z naukovykh doslidzhen ta innovatsii "Horyzont 2020": Postanova Kabinetu Ministriv Ukrainy vid 20.11.2019 № 971. Verkhovna Rada Ukrainy. https://zakon.rada.gov.ua/go/971-2019-%D0%BF (Accessed February 10, 2025).

[27] Pro zatverdzhennia ostatochnykh propozytsii shchodo pereliku naukovykh robit, naukovo-tekhnichnykh ta infrastrukturnykh proiektiv, rekomendovanykh dlia finansuvannia: Nakaz Ministerstva osvity i nauky Ukrainy vid 05.08.2024 № 1103. Ministerstvo osvity i nauky Ukrainy. https://mon.gov.ua/npa/pro-zatverdzhennia-ostatochnykh-propozytsii-shchodo-pereliku-naukovykh-robit-naukovo-tekhnichnykh-ta-infrastrukturnykh-proiektiv-rekomendovanykh-dlia-finansuvannia (Accessed February 10, 2025).