



A. Abdikadirova  
L. Sembiyeva  
Zh. Temirkhanov

L.N. Gumilyov Eurasian National University, Astana, Kazakhstan  
(E-mail: ankon\_a@mail.ru)

## Review on measuring the efficiency of research funds: challenges and implications for Kazakhstan

**Abstract.** *This article seeks to discuss the main challenges in evaluating the efficiency of research spendings. Undoubtedly, one of the attributes of the increased attention to science and research activities is the proliferation of competitively allocated grants through various programs. There are also other aspects of this notion such as internationally diversified collaboration and the creation of multiple excellence centers. For these and other reasons, the implementation of traditional research funding methods are being transformed. This article provides a descriptive and analytical review of the research-funding instruments and presents their implications for developing countries by reviewing the literature on research funding. The analysis of key changes in governance and variety funding schemes that have already been implemented in developed countries may contribute to the emerging economies. In addition, the paper suggests recommendations for further research taking into account the indicators of current policy documents regarding the science development.*

**Keywords:** *research funding, funding models, research policy, science.*

DOI: <https://doi.org/10.32523/2789-4320-2022-4-231-242>

**Acknowledgements:** This research article has been supported by the Ministry of Education and Science of the Republic of Kazakhstan within the project «Development of a model for evaluating the effectiveness of research activities of universities in Kazakhstan based on non-parametric and semi-parametric data analysis» (IRN AP13268842).

### Introduction

Policy makers are well aware of the importance of investments in science and have long accented the role of scientific research in economic prosperity of the countries. However, the interpretation of research outputs, in other words the measurement system of the science results is still a disputable topic [1].

In this regard, this article aims to reveal the historical roots of the current measurement systems of research productivity which is mainly dictated by the reforms in public administration. In addition, the article pays attention to the following issues of the research productivity: funding instruments, institutions in charge, measuring the level of science funding, efficiency of funding.

To understand the current practices implemented through policy documents regarding the research funds allocation and efficiency evaluation we need to refer to the changes in public administration practice in Anglo-Saxon countries. In the late 70s and early 80s the New Public Management (NPM) notion has emerged and become disseminated around the globe [2]. NPM was cited as the relevant response for management challenges in various organizational context and policy setting, for instance, in adopting new education and science reforms. The new approach has been perceived as the “gold standard” for political managers in the last decade of the 20th century [3]. The underlying ideas and canons of NPM have been illustrated by Christopher Hood. According to the author, the proponents of NPM have accentuated different aspects of doctrine. But the main seven overlapping rules aggregated in Table 1 below appear in most considered in research of NPM. A

traditional public sector block in the UK, Australia, New Zealand and other member countries of the Organization for Economic Co-operation and Development (OECD) would be likely to have had some elements to most of these rules. It does not mean that all of the characteristics are equally present in all situations.

The table shows that Performance-Based instruments have become the core elements of public administration. These changes affected the development of the science in many countries as performance-based research funding systems have been introduced for distribution of research funds. Kazakhstan is not an exception. As an example, the Concept for the development of science of the Republic of Kazakhstan for 2022 - 2026 states that one of the important performance indicators of a scientist is scientific publications and international databases is the main source of obtaining scientometric indicators [4]. In addition, the chapters of the concept such as

**Table 1**

Core components of new public management

<b>Doctrinal characteristics</b>	<b>Explanation</b>	<b>Reasoning</b>
Practicality of private sector in governmental units	Dynamic, transparent, discretionary power of the top management	Responsibility requires explicit administration of authority
Precise criteria of productivity	Description of objectives, indicators, and their quantitative character	Responsibility requires explicit explanations for civil servants
More accent on results	Distribution of resources and remunerations connected to clear results; decomposition of previous pure central bureaucratism	Ultimate results more important than processes
Breaking up into smaller units the public sector apparatus	Creation of controllable units like in corporations, single unit or small number of units will be responsible for a few results	Separation of interests via balancing the responsibilities
Competitive environment among civil servants	Transparent tendering processes	It is considered as cost optimization and quality enhancement
Copying manners from private businesses	Changes in ethical requirements	Private business practices perceived as more efficient
Efficient use of resources	extreme unwillingness to spend excess resources	Operate and make more with in a restricted environment
Note: sources [2].		

“Vision for the development of the field of science” or “Basic principles and approaches to the development of science” clearly emphasizes the use of numerical indicators in the evaluation process of research spendings. On the one hand, the widespread increase in assessment exercises has been featured in the emergence of an audit practices, institutional rankings, and a cultivation of the financial responsibility of educational institutions. On the other hand, various studies have highlighted that the higher education and science field can be reincarnated by overusing measures [5]. This is clearly consistent with the NPM notion.

This paper analyzes main sources and mechanisms of research fund allocation in OECD countries, the advantages and disadvantages of various instruments. Further, the main problematic aspects related to the financing of scientific activities will be identified: the work of public research councils and other organizations responsible for the distribution of financial resources, the development of a methodology for measuring the effectiveness of research, determining the level of funding based on gross domestic expenditures. In addition, the implementation of Data Envelopment Analysis (DEA) methodology in assessing the scientific performance of organizations will be considered. This methodology is developed to evaluate the performance of complex economic and social structures.

## Methodology

We have used Web of Science, Scopus and google scholar databases for literature review purposes. After the initial collection via titles, abstracts and keywords we did a selection of the articles manually as our research topic has an interdisciplinary nature. In addition, we also referred to technical articles from OECD library and policy documents available on the official websites. Also, we extracted research related papers from review articles regarding the DEA as it has interdisciplinary approach. We adapted a review approach from Pare et al., [5] where the comprehensive goal is to provide a critical

evaluation and interpretive analysis of published articles on a particular theme of concern. It is used primarily to recognize intensity, drawbacks, conflicts, disputes and/or other important challenges in relation to chosen area. Also, this way of dealing with literature not necessarily require an exhaustive search of publications. Furthermore, the article considers the applicability of the DEA for research evaluation purposes in Kazakhstan based on the previous attempts to adopt the given method in different contexts.

## Literature review

*Research funding instruments.* Research organizations in many countries are experiencing an increasingly competitive environment for ideas, human capital and financial reserves. Decision makers have exercised more competitive formats of support to facilitate value for money and progressive research outputs. According to Lepori et al. because of this notion there is a proliferation of project-based funding [6]. However, as research activities require a certain degree of sustainable funding, national systems are forced to practice both forms of financing competitive and non-competitive.

In this regard, Salmi claims that the emergence of the research excellence centers is one of the attempts to deal with sustainability and quality issues in research [7]. Globalization compelled research organizations to have rival for many resources at the international horizon, so excellence centers is a component of measures to make public funding more productive [8]. The centers usually possess many of the following characteristics [9]:

- selection of particular organizations, so it is not for complete list of institutions;
- constant funding (at least more than three years);
- demand for expert evaluations;
- exclusively institutions or research bodies in a contest;
- minimum amount of funding is relatively high.

Other traditional instruments except the abovementioned can be implemented with



Figure 1. The role of government institutions in research activities

Source: [13]

some flexible modalities. The instruments are usually named as follows: projects, thematic programs, stipends, vouchers, research related tax reliefs, prizes, or loans etc. [10]. Most of these instruments are easily understood by default, but some of them need clarification for the analysis purpose as their effectiveness as an instrument could be assessed separately.

**Project funding.** This way of distributing financial resources aims at several persons receiving a support for specific purposes for a particular period of time [11]. The major requirements are published in advance and the support can be both from government and from business owners. This implies a set of projects aligned with the focus on a particular theme and performed jointly by many contributors. A word grant in this regard differentiates from a project by the following: disengagement of the government and responsibility instruments. Traditional examples of the use of such kind of tools are the charity institution. Stipends seem to be analogous but with a lesser degree of communication with respect to results.

Another important aspect of research is the consolidated modalities such as:

- a single call; commonly for any matter in a broad area e.g., call for social sciences or history;

- a single call with a particular matter;
- two-step calls without any specific matter and with a thematic focus; commonly first announcement requires short explanatory note, the second one a full application or proposal;
- restricted calls: applications must include concrete associates (firms, public sector bodies, international organizations etc.);
- co-financing: participants cover to some extent of the preliminary agreed amount.

In addition, the above-mentioned instruments may be applied differently depending on the funding objectives and collaborators (individual researchers, universities, small businesses etc.).

A particular issue in developing a well-functioning feasible way is the need for selection or expert reviews. This is a premise for any of the competition types [12]. Finding experts sometimes may require more than implied benefits. Emerging economies like Kazakhstan usually aims to get expert databases in order to enhance the quality of the proposals.

*Institutions in charge.* Borowiecki, M., & Paunov, C. studied and compared the roles of government institutions throughout the stages of the research activities [13].

Various government bodies supervise research institutions across the survey participants, for

Total intramural costs <sup>1</sup>
Current costs
Labour costs for internal R&D personnel
Other current costs
External R&D personnel
Purchase of services, excluding external R&D personnel (optional breakdown)
Purchase of materials (optional breakdown)
Other, not elsewhere classified (e.g., general administration costs)
Capital costs
Land and buildings
Land (optional breakdown)
Buildings (optional breakdown)
Machinery and equipment
Information and communications equipment (optional breakdown)
Transportation equipment (optional breakdown)
Other machinery and equipment (optional breakdown)
Capitalised computer software
Other intellectual property products
1. Depreciation should not be included in intramural expenditure totals, but should be reported separately.

**Figure 2.** Aggregation of attributable spending items

Source: [14]

instance national Ministries of Science, special agencies or specifically created councils. Figure 1 shows that in one third of surveyed countries practice the traditional approach by monitoring through science ministries. However, six respondents showed that they have several ministries involved in the process. The federal governments as expected do not have strict supervision from one governmental unit.

Regarding the financial support distribution ministries tend to exercise block grants in majority of the OECD countries (more than 90%). Another essential role for the governmental bodies in public science management is the development of the assessment measures and monitoring means. Despite the fact that in two thirds of the countries the corresponding ministries create performance measures, the operational part is the responsibility of other organizations.

The survey results indicate many new governance related facts among the survey respondents and there are plenty of space for

future analysis. For example, researching the decisive elements of control systems and their effectiveness by employing cross-jurisdictional regression patterns, would be more informative and applicable for developing countries.

*Measuring the level of science funding.* The sort of instructions regarding the research information are introduced in the Frascati Manual issued by OECD [14]. The reference book allows some presumptions with respect to collecting and analyzing numerical data. For example, in the instruction there are proposed criteria for recognizing the research:

- should be designed to get fresh ideas;
- should develop originative materials;
- should not have predetermined results;
- should be replicative;

the whole process should have a flow diagram.

There are also additional instructions on recognition (e.g. trials, constantly storing or registration cannot be classified as research), but

it is extremely hard to certify that the statistical data from every jurisdiction identically applied the assumptions. Hence, the possible difference in identifying research may lead to inconsistent statistical data.

One of the most in great request measurements for research significance is Gross domestic expenditure on research (GERD). Commonly it is provided as proportion of expenditure (GERD) to total produced products (GDP). GERD is total pure attributable spendings on research performed in the territory of the country or jurisdiction during a corresponding timeframe. Figure 2 shows the structure of those kinds of expenditures according to the manual.

Despite the fact that the instruction attempts explicitly define every variable and term regarding the statistical data collection, it is extremely challenging to apply those requirements in every jurisdiction.

*Efficiency of funding.* When it comes to efficiency of spendings, there are typical measures of adopted policies such as number of publication numbers, citations, patents, number of awards etc. However, the overreliance on these measures may lead to some negative effects. First, could be classified as mainstream opinion trap, where already recognized ideas constantly prevail [15]. Second is more operational effect, for instance intentionally customizing the numbers or measures which may often overestimate the significance of research. This kind of practices led to the oppositional unions among research community such as San Francisco Declaration and the Leiden Manifesto [16].

Nevertheless, there are many successful applications of quantitative techniques that use comprehensive the same information regarding research. However, the proposed advantage of these techniques is that they can also capture quality of the outcomes. One of these models is called Data envelopment analysis (DEA). DEA has primarily been implemented in other fields, but there are many papers that implant methods to measure research impact. At the starting point of the method utilizes only one index and one output measure. But in more developed models these indexes grow in number [17]. A standard

utilization illustrated in the following formulas (1) and (2).

$$\text{Input} = I = \sum_{i=1}^I u_i x_i \quad (1)$$

Where  $x_i$  is a given input,  $u_i$  is the specific weight assigned to said input, and weights are values between 0 and 1. Virtual outputs are computed using the following formula:

$$\text{Output} = J = \sum_{j=1}^J v_j y_j \quad (2)$$

Where  $y_j$  is a given output,  $v_j$  is the weight assigned to said output, and weights are values between 0 and 1. Efficiency is now calculated as a function represented by (3) of the virtual inputs and virtual outputs, with the constraint that efficiencies must lie between 0 and 1.

$$\text{Efficiency} = \frac{J}{I} = \frac{\sum_{j=1}^J v_j y_j}{\sum_{i=1}^I u_i x_i} \quad (3)$$

At this point, values for inputs and outputs for each decision-making unit (in our case it might be recipients of research funding) are known, but the weights assigned to each are not. Rather than assigning one set weight for each input and output specifically, DEA allows each unit to have its own unique set of weights for all inputs and outputs. Allowing to have its own set of weights serves two major purposes. First, it allows for recognition that specific organization may value specific outputs more than others, and will give more weight to said highly valued outputs compared to others. The second reason for allowing each unit weights to vary is that it allows DEA to take each unit's unique situation into account and assign weights that will maximize efficiency score with the constraint that each efficiency score must lies between 0 and 1. Taking this into account, the formula for efficiency for a unit is now as follows (4):

$$\text{Efficiency} = \max \frac{J}{I} = \max \frac{\sum_{j=1}^J v_j y_j}{\sum_{i=1}^I u_i x_i} \quad (4)$$

Another aspect of the method is usage of various returns to scale. For example, constant return denotes one unit change of index variable drives to exactly the same change in output

variable. However, in practice the direction can be in three ways with the different level: same, increase or decrease.

DEA has started serve as a reliable model from the publication of Charnes et al. in 1970s which matches with the popularity of NPM policies [18]. Notwithstanding the advantages the model also has some inserted judgments depending of the model type [19]. At the starting point it may utilize the following judgements:

- any decision maker block has no common indexes;
- any variable of the main block is also a variable for the smaller blocks;
- there is no overlapping indexes.

Table 2 shows the overview of the reviewed DEA papers. One common feature of any DEA based papers is the new proposed ways of minimizing model limitations. A desire to improve models by strengthening their advantages has been a major trend in literature. Cross-efficiency is based on the original applications. Further

each block can evaluate the rest of the blocks with its own weights. The men of these provides the cross-efficiency score. This way of evolution removes the overlapping blocks.

### Findings and discussion

The review of practices regarding the research policy in OECD countries clearly shows its impact on the developing countries. So called New Public Management reform elements are also attributable to the policy documents in Kazakhstan. For instance, the types of research allocation instruments share almost the same definitions. In addition, we can match the use of the instruments with the objectives. Table 3 illustrates an overview of objectives set together with the instruments most used to achieve a certain purpose and targeted audience. Further, it could be illustrated via indicators used in Concept for the development of science of the Republic of Kazakhstan.

**Table 2**

#### Examples of DEA applications

Authors	Country of the analysis	Summary points
Johnes, J.	UK	exposed the method to a data set of more than hundred higher education organizations to estimate technical and scale efficiency.
Aoki et.al	Japan	Proposes a framework for multi-sided estimations
without regard to the number of indices and decision blocks.		
Wolszczak-Derlacz and Parteka	Europe	Examines more than two hundred public institutions from several European countries across the four-year time period. Two-stage DEA analysis.
Nazarko	Poland	Describes a comparative efficiency study of Polish universities. Constant return to scale, output-oriented DEA model was used for analysis of institutional efficiency.
Gralka et.al	Germany	The panel dataset for the ten-year time frame more than seventy institutions. Estimates the efficiency of two most common measures: number of publications vs sum of research grants.
Ma et. al	China	Tests scientific research efficiency of selected faculty members and proposes an extension of the DEA meta-frontier framework.
Source: [20], [21], [22], [23], [24], [25]		

Further we focus on a few key strategic issues regarding the emerging economies like Kazakhstan. Most of the developing countries utilize block grants (i.e. direct institutional allocations), as they are not expensive form of distribution and provide some advantages: institutional monitoring, autonomy of scholars etc. In addition, it would be more relevant for purposes such as increasing the research potential of the country and basic research [26].

However, most of the countries appear to promote publication output as a main goal, despite the prevalence of ideas about social impact [27]. Furthermore, there are number of challenges in gathering attributable costs to research such as exclusion of acquired research, distinguishing between attributable and non-attributable expenses related to work, incomplete and inaccurate coverage of attributable research, measuring capital expenditures as a service. Hence, the research expenses of Kazakhstan

may not be fully consistent with other countries. Another aspect is the domination of bibliometric measures in policy documents of Kazakhstan. Therefore, we propose to use nonparametric methods like data envelopment analysis in measuring institutional efficiency.

There are a few gaps in our knowledge around research measurement that follow from our findings, and would benefit from further research:

- 1) In-depth exploration of DEA application in Kazakhstan. There are a number of limitations of the model, but there are also ways to increase the robustness.
- 2) More methodological work is needed on how to properly capture the amount of research attributable expenses. Currently, international statistics apply GDP based measures to evaluate the level of funding.
- 3) Usage of a combination of funding instruments based on objectives of the government policy.

**Table 3**

Matching the research objectives and instruments

Possible objective	Possible instruments and target organizations in OECD countries	Indicators used in Concept for the development of science of the Republic of Kazakhstan 2022-2026
Increasing the research potential of the country	Block grant, project, programme (with different focus) for research institutions	Over the past 30 years, there has been a halving in the number of scientists. In 2020, the average salary of scientists amounted to 152 thousand tenge, which is 72% of the average for the economy.
Attract more the international partners	Stipend, project, programme for individual scholars, institutions	On the basis of intergovernmental agreements on scientific and technological activities, implementing scientific projects and programs within the framework of international collaboration
Commercialize the outputs	Award, expert support, venture capital for research groups	three competitions were held via JSC “Science Fund” and 156 projects were supported, of which more than 120 projects reached the sales stage with a total income of more than 16.4 billion tenge
Integration of the theory and practice	Voucher, tax relief, project for small business owners, private-public partnerships	65 projects were supported aimed at the the implementation of joint scientific projects with industrial partners
Training of research staff	Project, programme for young research staff	today more than 1,500 young scientists and researchers are implementing their scientific ideas in 315 projects. Each project funded by the Ministry of Education and Science requires the at least 40% young researchers.
Source: developed by the authors based on references		



Research funding is becoming more globalized and with this has come an increasing degree of isomorphism at the level of practices and institutions. Numerical indicators have become a preferred instrument to measure the science impact at the present time. While the numerical indicators are not always able to capture the quality, as research funding is an area where skill and knowledge can overcome many of the limitations of scarce resources. However, it may be both cheaper and faster to build the quantitative models for policy making purposes.

### References

1. Abbott M., Doucouliagos C. The Efficiency of Australian Universities: A data envelopment analysis // *Economics of Education Review*. - 2003. - №22(1). - pp. 89-97.
2. Hood C. A public management for all seasons? // *Public administration*. - 1991. - №69(1). - pp. 3-19.
3. Farazmand A., Pinkowski J. Handbook of globalization, governance, and public administration. - 1 ed. - New York: Routledge, 2006. - 1208 p.
4. Decree of the Government of the Republic of Kazakhstan «On approval of the Concept for the development of science of the Republic of Kazakhstan for 2022 – 2026» from 25.05.2022 № 336 URL: <https://adilet.zan.kz/rus/docs/P2200000336> (accessed: 25.10.2022)
5. Pare G., Trudel M.-C., Jaana M., Kitsiou S. Synthesizing information systems knowledge: A typology of literature reviews // *Information & Management*. - 2015. - №52(2). - pp. 183-199.
6. Lepori B., P. Van den Besselaar, M. Dinges, B van der Meulen, B. Poti, E. Reale, S. Slipersaeter, J. Theves Comparing the evolution of national research policies, What patterns of change? // *Science and Public Policy*. - 2007. - №34(6). - pp. 372-378.
7. The Challenge of Establishing World Class Universities // The World Bank eLibrary.- URL: <https://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-7865-6> (accessed: 20.10.2022).
8. Deem R., K.H. Mok and L. Lucas Transforming Higher Education in Whose Image? Exploring the Concept of the 'World Class' University in Europe and Asia // *Higher Education Policy*. - 2007. - №21. - pp. 83-98.
9. Promoting Research Excellence: New Approaches to Funding // The OECD Library. URL: [https://www.oecd-ilibrary.org/science-and-technology/promoting-research-excellence\\_9789264207462-en](https://www.oecd-ilibrary.org/science-and-technology/promoting-research-excellence_9789264207462-en) (accessed: 20.10.2022).
10. Research funding instruments and modalities: Implication for developing countries. IHERD—the OECD's Programme on Innovation, Higher Education and Research for Development // The OECD Library URL: <https://www.oecd.org/sti/Funding%20instruments%20Sweden.pdf> (accessed: 18.10.2022).
11. Performance-based Funding for Public Research in Tertiary Education Institutions // The OECD Library URL: [https://www.oecd-ilibrary.org/education/performance-based-funding-for-public-research-in-tertiary-education-institutions/performance-based-funding-for-public-research-in-tertiary-education-institutions-country-experiences\\_9789264094611-6-en](https://www.oecd-ilibrary.org/education/performance-based-funding-for-public-research-in-tertiary-education-institutions/performance-based-funding-for-public-research-in-tertiary-education-institutions-country-experiences_9789264094611-6-en) (access date: 18.10.2022).
12. Hicks D., Wouters, P., Waltman L., De Rijcke, S., & Rafols I. Bibliometrics: the Leiden Manifesto for research metrics // *Nature*. - 2015. - №520(7548). - pp. 429-431.
13. How is research policy across the OECD organised?: Insights from a new policy database // The OECD Library.- URL: <http://dx.doi.org/10.1787/235c9806-en> (accessed: 15.10.2022).
14. Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, // The OECD Library URL: <http://dx.doi.org/10.1787/9789264239012-en> (accessed: 16.10.2022).
15. Fang, H. Peer review and over-competitive research funding fostering mainstream opinion to monopoly // *Scientometrics*. - 2011. - №87(2). - pp. 293-301.
16. Hicks D. Performance-based university research funding systems // *Research Policy*. - 2012. - №41. - pp. 251-261.
17. Jeffrey A. Shero, Stephanie Al Otaiba, Chris Schatschneider & Sara A. Hart Data envelopment analysis (DEA) in the educational sciences // *The Journal of Experimental Education*. - 2022. - №90. - pp. 1021-1040.

18. Charnes A., Cooper W., Rhodes E. Measuring the efficiency of decision making units // *European Journal of Operational Research*. - 1978. - №2(6). - pp. 429-444.
19. Castelli L., Pesenti R., Ukovich W. A classification of DEA models when the internal structure of the decision making units is considered // *Annals of Operations Research*. - 2010. - №173(1). - pp. 207-235.
20. Johnes J. Data envelopment analysis and its application to the measurement of efficiency in higher education // *Economics of Education Review*. - 2006. - №25(3). - pp. 273-288.
21. Aoki S., Inoue K., & Gejima R. Data envelopment analysis for evaluating Japanese universities // *Artificial life and robotics*. - 2010. - №15(2). - pp. 165-170.
22. Wolszczak-Derlacz J., & Parteka A. Efficiency of European public higher education institutions: A two-stage multicountry approach // *Scientometrics*. - 2011. - №89(3). - pp. 887-917.
23. Nazarko J., Šaparauskas J. Application of DEA method in efficiency evaluation of public higher education institutions // *Technological and Economic Development of Economy*. - 2014. - №1. - pp. 25-44.
24. Sabine Gralka, Klaus Wohlrabe & Lutz Bornmann How to measure research efficiency in higher education? Research grants vs. publication output // *Journal of Higher Education Policy and Management*. - 2019. - №41. - pp. 322-341.
25. Ma Z., See K. F., Yu M. M., & Zhao, C. Research efficiency analysis of China's university faculty members: A modified meta-frontier DEA approach // *Socio-Economic Planning Sciences*. - 2021. - №76. - pp. 900-944.
26. Hellström T. and Jacob, M. Revisiting Weinberg's Choice: Classic Tensions in the concept of scientific merit // *Minerva*. - 2012. - №50(3). - pp. 381-396.
27. Bozeman B., D. Sarewitz Public value mapping and science policy evaluation // *Minerva*. - 2011. - №49. - pp. 1-23.

**А.А. Абдикадилова, Л.М. Сембиева, Ж.Т. Темірханов**

*Л.Н. Гумилев атындағы Еуразия Ұлттық Университеті, Астана, Қазақстан*

**Ғылыми-зерттеу шығындарын тиімділігін бағалау:  
Қазақстанға қатысты қиындықтар мен ұсыныстар**

**Аңдатпа.** Бұл мақала ғылыми-зерттеу шығындарының тиімділігін бағалаудағы негізгі қиындықтарды талқылауға бағытталған. Ғылымға және ғылыми-зерттеу қызметіне назардың арту атрибуттарының бірі түрлі бағдарламалар арқылы конкурстық негізде бөлінетін гранттардың көбейгендігі екені сөзсіз. Бұл ұғымның басқа да аспектілері бар, мысалы, халықаралық әртараптандырылған ынтимақтастық және көптеген біліктілік орталықтарының құрылуы. Осы және басқа себептерге байланысты ғылыми зерттеулерді қаржыландырудың қолданыстағы дәстүрлі әдістері трансформациялануда. Бұл мақала зерттеуді қаржыландыру құралдарына сипаттамалық және аналитикалық шолу жасайды және зерттеуді қаржыландыру туралы әдебиеттерді шолу арқылы дамушы елдер үшін ұсыныстар жасайды. Дамыған елдерде қазірдің өзінде енгізілген басқарудағы және әртүрлі қаржыландыру схемаларындағы негізгі өзгерістерді талдау дамушы экономикаларға ықпал етуі мүмкін. Сонымен қатар, мақалада ғылымды дамытуға қатысты ағымдағы бағдарламалық құжаттардың көрсеткіштерін ескере отырып, одан әрі зерттеу бойынша ұсыныстар жасалады.

**Түйін сөздер:** Зерттеуді қаржыландыру, қаржыландыру модельдері, зерттеу саясаты, ғылым

**А.А. Абдикадилова, Л.М. Сембиева, Ж.Т. Темірханов**

*Евразийский национальный университет имени Л.Н. Гумилева, Астана, Казахстан*

**Обзор по измерению эффективности исследовательских фондов:  
проблемы и последствия для Казахстана**

**Аннотация.** В данной статье рассматриваются основные проблемы, связанные с оценкой эффективности расходов на исследования. Несомненно, одним из атрибутов повышенного внимания к науке и исследовательской деятельности является распространение грантов, выделяемых на конкурсной основе

в рамках различных программ. Есть и другие аспекты этой концепции, такие как международное диверсифицированное сотрудничество и создание нескольких центров передового опыта. По этим и другим причинам реализация традиционных методов финансирования исследований трансформируется. В работе представлен описательный и аналитический обзор инструментов финансирования исследований и представлены рекомендации для развивающихся стран на основе обзора литературы по финансированию исследований. Анализ ключевых изменений в схемах управления и разнообразного финансирования, которые уже были реализованы в развитых странах, может внести свой вклад в развивающиеся экономики. Кроме того, в статье предложены рекомендации для дальнейших исследований с учетом показателей действующих программных документов в области развития науки.

**Ключевые слова:** финансирование исследований, модели финансирования, исследовательская политика, наука.

### References

1. Abbott M., Doucouliagos C. The Efficiency of Australian Universities: A data envelopment analysis // *Economics of Education Review*, 22(1), 89-97 (2003).
2. Hood C. A public management for all seasons? *Public administration*, 69(1), 3-19 (1991).
3. Farazmand A., Pinkowski J. *Handbook of globalization, governance, and public administration*. - 1 ed. - New York: Routledge, 1208 (2006).
4. Decree of the Government of the Republic of Kazakhstan «On approval of the Concept for the development of science of the Republic of Kazakhstan for 2022 – 2026» from 25.05.2022 № 336. Available at: <https://adilet.zan.kz/rus/docs/P2200000336> (accessed: 25.10.2022)
5. Pare G., Trudel M.-C., Jaana M., Kitsiou S. Synthesizing information systems knowledge: A typology of literature reviews, *Information & Management*, 52(2), 183-199 (2015).
6. Lepori B., P. Van den Besselaar, M. Dinges, B van der Meulen, B. Poti, E. Reale, S. Slipersaeter, J. Theves Comparing the evolution of national research policies, What patterns of change? *Science and Public Policy*, 34(6), 372-378 (2007).
7. The Challenge of Establishing World Class Universities. The World Bank eLibrary. Available at: <https://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-7865-6> (accessed: 20.10.2022).
8. Deem R., K.H. Mok and L. Lucas Transforming Higher Education in Whose Image? Exploring the Concept of the 'World Class' University in Europe and Asia, *Higher Education Policy*, 21, 83-98 (2007).
9. Promoting Research Excellence: New Approaches to Funding // The OECD Library. Available at: [https://www.oecd-ilibrary.org/science-and-technology/promoting-research-excellence\\_9789264207462-en](https://www.oecd-ilibrary.org/science-and-technology/promoting-research-excellence_9789264207462-en) (accessed: 20.10.2022).
10. Research funding instruments and modalities: Implication for developing countries. IHERD—the OECD's Programme on Innovation, Higher Education and Research for Development, The OECD Library. Available at: <https://www.oecd.org/sti/Funding%20instruments%20Sweden.pdf> (accessed: 18.10.2022).
11. Performance-based Funding for Public Research in Tertiary Education Institutions // The OECD Library. Available at: [https://www.oecd-ilibrary.org/education/performance-based-funding-for-public-research-in-tertiary-education-institutions/performance-based-funding-for-public-research-in-tertiary-education-institutions-country-experiences\\_9789264094611-6-en](https://www.oecd-ilibrary.org/education/performance-based-funding-for-public-research-in-tertiary-education-institutions/performance-based-funding-for-public-research-in-tertiary-education-institutions-country-experiences_9789264094611-6-en) (accessed: 18.10.2022).
12. Hicks D., Wouters P., Waltman L., De Rijcke, S., Rafols I. Bibliometrics: the Leiden Manifesto for research metrics // *Nature*. 520(7548), 429-431 (2015).
13. How is research policy across the OECD organised? Insights from a new policy database // The OECD Library. Available at: <http://dx.doi.org/10.1787/235c9806-en> (accessed: 15.10.2022).
14. Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, The OECD Library. Available at: <http://dx.doi.org/10.1787/9789264239012-en> (accessed: 16.10.2022).
15. Fang H. Peer review and over-competitive research funding fostering mainstream opinion to monopoly, *Scientometrics*, 87(2), 293-301 (2011).
16. Hicks D. Performance-based university research funding systems, *Research Policy*, 41, 251-261 (2012).
17. Jeffrey A. Shero, Stephanie Al Otaiba, Chris Schatschneider & Sara A. Hart Data envelopment analysis (DEA) in the educational sciences, *The Journal of Experimental Education*, 90, 1021-1040 (2022).

18. Charnes A., Cooper W., Rhodes, E. Measuring the efficiency of decision making units, *European Journal of Operational Research*, 2(6), 429-444 (1978).
19. Castelli L., Pesenti R., Ukovich W. A classification of DEA models when the internal structure of the decision making units is considered // *Annals of Operations Research*, 173(1), 207-235 (2010).
20. Johnes J. Data envelopment analysis and its application to the measurement of efficiency in higher education, *Economics of Education Review*, 25(3), 273-288 (2006).
21. Aoki S., Inoue K., Gejima R. Data envelopment analysis for evaluating Japanese universities // *Artificial life and robotics*, 15(2), 165-170 (2010).
22. Wolszczak-Derlacz J., & Parteka A. Efficiency of European public higher education institutions: A two-stage multicountry approach, *Scientometrics*, 89(3), 887-917 (2011).
23. Nazarko J., & Šaparauskas J. Application of DEA method in efficiency evaluation of public higher education institutions, *Technological and Economic Development of Economy*, 1, 25-44 (2014).
24. Sabine Gralka, Klaus Wohlrabe & Lutz Bornmann How to measure research efficiency in higher education? Research grants vs. publication output, *Journal of Higher Education Policy and Management*, 41, 322-341 (2019).
25. Ma Z., See K. F., Yu M. M., Zhao C. Research efficiency analysis of China's university faculty members: A modified meta-frontier DEA approach, *Socio-Economic Planning Sciences*, 76, 900-944 (2021).
26. Hellström, T. and Jacob, M. Revisiting Weinberg's Choice: Classic Tensions in the concept of scientific merit, *Minerva*, 50(3), 381-396 (2012).
27. Bozeman B., D. Sarewitz Public value mapping and science policy evaluation, *Minerva*, 49, 1-23 (2011).

**Авторлар туралы мәлімет:**

*Абдикадирова А.А.* – PhD, Л.Н. Гумилев Еуразия Ұлттық Университеті «Мемлекеттік аудит» кафедрасының аға оқытушысы, Астана, Қазақстан.

*Сембиева Л.М.* – экономика ғылымдарының докторы, Л.Н. Гумилев Еуразия Ұлттық Университеті «Мемлекеттік аудит» кафедрасының профессоры, Астана, Қазақстан.

*Темірханов Ж.Т.* – Л.Н. Гумилев Еуразия Ұлттық Университеті «Мемлекеттік аудит» кафедрасының докторанты, Астана, Қазақстан.

*Абдикадирова А.А.* – PhD, ст. преподаватель кафедры «Государственный аудит» ЕНУ имени Л.Н.Гумилева, Астана, Казахстан.

*Сембиева Л.М.* – доктор экономических наук, профессор, кафедры «Государственный аудит» ЕНУ имени Л.Н.Гумилева, Астана, Казахстан.

*Темірханов Ж.Т.* – докторант кафедры «Государственный аудит» ЕНУ имени Л.Н.Гумилева, Астана, Казахстан.