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Yerkebulan Zhumashov
PhD (Engineering),
Assistant Professor,
Altynsarin National Academy of Education
4 Orynbor Str., Altyn Orda Business Center,
14th-16th floor, Astana, 010000,
Republic of Kazakhstan
erkebulanzhumashov@gmail.com
ORCID ID:
https://orcid.org/0000-0003-4653-8060

Serik Azambayev
PhD (Engineering),
Leading Researcher,
Altynsarin National Academy of Education
4 Orynbor Str., Altyn Orda Business Center,
14th-16th floor, Astana, 010000,
Republic of Kazakhstan
mr.azambaev@mail.ru
ORCID ID:
https://orcid.org/0009-0004-0252-7217

Adilbek Bisenbaev
PhD (Physics),
Leading Researcher,
Altynsarin National Academy of Education
4 Orynbor Str., Altyn Orda Business Center,
14th-16th floor, Astana, 010000,
Republic of Kazakhstan
eldarknar@gmail.com
ORCID ID:
https://orcid.org/0000-0002-7490-8375

Assyl Yessenzharov
MA (Economics), Vice-chair,
Board of Finance, Administrative and Personal Matters,
National Center for Advanced Training «Orleu»
86 Turgenev Str., Aktobe, 030017,
Republic of Kazakhstan
asyl-m@mail.ru
ORCID ID: https://orcid.org/0009-0002-8591-0806

Kulzhanat Bulatbayeva
D.Sc. (Pedagogy),
Chief Researcher, Professor,
Altynsarin National Academy of Education
4 Orynbor Str., Altyn Orda Business Center, 14th-16th floor,
Astana, 010000, Republic of Kazakhstan
kulzhanat.bulatbayeva@mail.ru
ORCID ID: https://orcid.org/0000-0002-7288-8120

Economic efficiency in grant funding evaluations: streamlining knowledge-intensive applications in Kazakhstan

Abstract. The study proposes an evolution of the grant evaluation system from a dual focus on «form and content» to a «content-centric» model to enhance the efficacy and quality of scientific research. This novel approach, intended for incorporation into Kazakhstan's grant framework, involves a two-tiered examination process - an initial assessment by the National Center for State Scientific and Technical Expertise (NCSTE) followed by a secondary review by the National Scientific Councils (NSC).
The rationale behind this shift away from an overemphasis on quantitative and qualitative project details towards a qualitative, semantic, conceptual, and methodological representation is rooted in the constraints of NCSTE/NSC resources and other pertinent factors.
We have adopted and tailored the Technology Readiness Level (TRL), Manufacturing Readiness Level (MRL), and Capability Readiness Level (CRL) scaling methodologies for R&D and RNTD activities by devising a novel Scientific Readiness Levels (SRL) methodology. This has resulted in the compilation of SRL scales for fundamental (FRL), applied (ARL), and innovative projects (IRL), bringing economic efficiency to the grant funding evaluation process.
Keywords: Expertise; Grant; Funding; NCSTE; NSC; Readiness Scale; Paradigm; Technology Readiness Level; Innovative Projects; Synectic Approach
JEL Classification: H81; O38; P35; D61; D73

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Жумашов Є.
кандидат технічних наук, старший викладач,
Національна академія освіти ім. Алтинсаріна, Астана, Казахстан
Азамбаєв С.
кандидат технічних наук, провідний науковий співробітник,
Національна академія освіти ім. Алтинсаріна, Астана, Казахстан
Бісенбаєв А.
кандидат фізико-математичних наук, провідний науковий співробітник,
Національна академія освіти ім. Алтинсаріна, Астана, Казахстан
Єсенжаров А.
магістр економіки, заступник голови правління з фінансових, адміністративних та особистих питань
Національний центр підвищення кваліфікації «Орлеу», Актобе, Казахстан
Булатбаєва К.
доктор педагогічних наук, професор, головний науковий співробітник,
Національна академія освіти ім. Алтинсаріна, Астана, Казахстан

Економічна ефективність оцінки грантового фінансування: оптимізація наукомістких додатків у Казахстані

Анотація. У дослідженні представлено авторський підхід до еволюції системи оцінки грантів і перехід від подвійного акценту на «формі та змісті» до «орієнтованої на зміст» моделі для підвищення ефективності та якості наукових досліджень. Цей новий підхід, призначений для впровадження до системи грантів Казахстану, передбачає дворівневий процес експертизи - початкову оцінку Національним центром Державної науково-технічної експертизи (NCSTE), а потім вторинну перевірку національними науковими радами (NSC).
Обґрунтування такого переходу від надмірного акценту на кількісних і якісних деталях проекту до якісного, семантичного, концептуального та методологічного представлення засноване на врахуванні обмеженості ресурсів NCSTE/NSC та інших відповідних факторах.
Ми впровадили й адаптували методології масштабування рівня технологічної готовності (TRL), рівня виробничої готовності (MRL) та рівня готовності виробничих можливостей (CRL) для науково-дослідних робіт та грантів, розробивши нову методологію рівнів наукової готовності (SRL). Це призвело до складання шкал SRL для фундаментальних (FRL), прикладних (ARL) та інноваційних проектів (IRL), що підвищило економічну ефективність процесу оцінки грантового фінансування.
Ключові слова: експертиза; грант; NCSTE; NSC; шкала готовності; парадигма.

1. Introduction

The quality and effectiveness of science and high-tech projects largely depends on the principles and algorithms on which the system of financing scientific and innovative projects (including grant funding) operates.

Let us consider the system of financing and selection of projects in the grant system of the Republic of Kazakhstan, which is interpreted through the primary examination of the NCSTE (National Center for State Scientific and Technical Expertise) and the secondary examination of the NSC (National Scientific Councils) of the Republic of Kazakhstan (Sharma & Thomas, 2008).

Quite often, a science-intensive application that is excellent in its scientific or innovative content can be rejected as an application does not correspond to certain and directive formal features of the project. That is, the form may prevail over the content. There are quite a lot of examples in the Kazakh grant system when projects are rejected as not meeting formal requirements (Standardiform, 2017). A similar incident occurred in 2018 in the grant system of Kazakhstan, when a certain number of grant applications were rejected purely on formal grounds without considering their scientific content and significance (Tasnim & Afzal, 2018).

It happens because the behavioral structures of a researcher are not considered in the examination and preliminary examination. Most of the real or practicing scientists objectively and subjectively pay little attention to the form and pay more attention to the content of their projects (Chung, 2002).

Thus, a certain part of the projects can be rejected or approved on formal grounds, considering the dualism of choice: a simultaneous need for form and content.

As a result, such dualism to a certain extent negatively affects the quality and effectiveness of the scientific work that will be carried out within the framework of the approved grant application. Because it creates a corridor of opportunities for approving projects on formal, not substantive grounds (Firsova & Chernyshova, 2020).

It is proposed to transform the dualistic nature (form and content) of grant applications into a monadic form (content only).

Firstly, it will significantly reduce the number of man-hours spent on the formation of dual grant applications.

Secondly, it optimizes the work of experts and expert commissions, localizing their attention exclusively on the scientific or innovative content.

Thirdly, it optimizes the process of forming the financial part only for approved grant projects due to a more professional approach to the financial part than the approach provided by a scientific or innovative applicant.

The expertise of a scientific, knowledge-intensive or innovative project should be based solely on a multi-level analysis of the idea, novelty, originality, concept and prospects of the project. There should be no financial plans and estimated cost of the project before the examination at the level of the NCSTE. It means there is no need for «garbage information», such as «daily allowance», «cost of equipment» or «rental of premises» and other chaotic information in the grant application, which reflect only the essence of the secondary, and not the primary entities of the project.

For example, the price environment changes today with greater frequency than a few decades ago. At the same time, there is a certain time lag between the time of registration of the application (including the time of examination) and the time of execution of the project. During this interval, pricing policy of the supplier of scientific equipment may change significantly and its cost may change. Also, the cost may change because of inflation, changes in the exchange rate of the national currency, and so on. This also applies to all other financial indicators - rent, business trips, and so on (Firsova & Chernyshova, 2018).

Naturally, it is irrational and inefficient to fix financial expenses for a future time lag of six months or a year. Therefore, forming a pool of prices for equipment and other operating expenses in the conditions of a time lag between the planning of the application and its execution means guaranteed non-fulfillment of financial obligations. The more we have such items on financial obligations in the application, the more likely it is during the execution of the project, the contractor will fall into the funnel of unfulfilled obligations. Moreover, most of these commitments are not critical for the implementation of the project itself (Lee & Park, 2005).

For example, «the need for an electron microscope» for a certain project may be mandatory, but its cost does not apply to the mandatory parameters of the project. Since the realization of financial obligations at cost or expense should be strictly tied to the time of fulfillment of this obligation, and not to plan for six months or a year in advance. There must be some outlines of financial obligations. But they should not be specific, but indicative based on the estimated total amount of the project. At the same time, the approved and reasonable cost of the project should be formed only for approved projects.

This research was prepared within the Programme Trust Fund Study: OR 11465474 «Scientific foundations of modernization of the education system and science» (Altynsarin National Academy of Education).

2. Transformation of Expertise

The priority of reporting over obligations should be implemented in scientific projects in this sense. That is, the financial part of the project is analyzed and interpreted after the end of the project in the reporting, and not before the start of the project or its execution.

A scientist, innovator or inventor can evaluate his project, but they should not do this. Since the applicant will voluntarily or unwittingly try to overstate the cost of his project. Therefore, the financial part of the project should be formed by specialists (marketers, economists, financiers, project managers). Of course, jointly with the applicant himself, who will justify his expenses and justify the list of necessities without specifying the price situation, which will be adjusted accordingly. At the same time, the financial part is formed, as already mentioned, only for approved projects. Such a financial analysis service can be created under the NCSTE or be autonomous in nature.

At the same time, preference is given to those projects for which copyright or intellectual property rights have been previously issued or fixed. Or there is a formal certificate of intent for the project. For example, copyright certificate, patent, convention priority, patent search, substantive patent examination or preprint (with the exception of some disciplines, for example, mathematics in some cases).

This requirement will reflect the author's intention to implement the project and will be a kind of mandatory initial contribution of the applicant himself to the financial part of the project. In addition, such a process will be a kind of preliminary examination of the project, which is undertaken by patent organizations, bureaus and companies.

At the same time, all costs associated with the preliminary copyright will be compensated in the financial part of the project, if the project is approved for financing.

The application for a scientific project for the grant system itself may contain the following parts as shown in Table 1.

3. Results

SMART, PURE, CLEAR

To analyze the goal (goal setting), let us consider the goal of the project from the point of view of the target filter «SMART, PURE, CLEAR - REASONABLENESS, PURITY, CLARITY» (John Whitmore model, cit. by Wang et al., 2016).

In this case, the S.M.A.R.T. target filter (reasonableness of the target) includes the following components shown in Table 2.

In a general sense, this strategy of scientific project filters gives a systematic idea of the purpose of a scientific or knowledge-intensive project, its nature and degree of achievability, and creates the possibility of moving from declarations of intent to a working goal. In this case, SMART is the main goal-setting filter, and PURE (Table 3) and CLEAR (Table 4) are additional (but no less important) filters as derivatives of values.

SRL (FRL/ARL/IRL)

To evaluate technologies and technological solutions, the so-called Technology Readiness Level, including MRL and CRL, is widely used as one of the selection criteria (Table 5).

However, scientific projects, especially in the field of fundamental sciences, require adaptation and development of the school of readiness (Yesilay & Halac, 2020).

Table 1:
Application form for grant or other additional financing of scientific, knowledge-intensive and innovative projects

No.	LIST OF DOCUMENTS	DESCRIPTION	NOTE
1	Copyright for a scientific idea or innovation (if any)	A kind of documented and formal declaration of the grantee about the seriousness of his intentions	Copyright certificate, patent, convention priority, patent search, substantive patent examination or preprint
2	GROW–teaser	Includes a description of scientific research, scientific idea or innovation in the GROW notation (Goal, Reality, Obstacles, Way Forward): 1.Goal – what exactly and specifically the applicant wants to achieve or get as a result; 2. Reality – why this work is necessary based on the existing reality on this topic; 3. Obstacles – what are the main difficulties and problems for the implementation of a project, idea or innovation 4. The way forward – a brief outline of the stages of the project	General concept of the project
3	Target filter «SMART, PURE, CLEAR»	Description of the SMART, PURE, CLEAR paradigm - REASONABLENESS, PURITY, CLARITY	The descriptive part of the project in terms of goal setting and payload
4	SRL (FRL/ARL/IRL)	SRL - Scientific Readiness Levels, levels of scientific readiness, FRL - Fundamental Readiness Levels, fundamental readiness AL - Applied Readiness Level, applied readiness, IRL – Innovation Readiness Level, innovative readiness	A scale of readiness levels for a scientific or high-tech project, innovation or high-tech technology. To understand the status quo of the project. According to the readiness scale, the life cycle of a scientific project (S-life-cycle analysis, SLCA) is built, the detailed content of each achieved level is revealed
5	Risk matrix	A table of risks and risk factors in a more detailed form on the specified and most significant risks that can significantly or dramatically affect the enterprise or project	
6	Applications	Content that complements and reveals the essence of the project, including legal documents	If necessary, a more detailed consideration of the issue during the discussion

Source: Authors' own research based at works by John Whitmore (1988)

Table 2:
Target SMART filter of the project

No.	COMPONENT	What the applicant formulates and what the NCSTE and NSC assess (the decision is based on a comparative analysis of expert interpretations)
1	**S (specific) concreteness**	The specific purpose of the project (not the name of the project or article, but a figurative or synthetic representation (if possible)
2	**M (measurable) measurability**	Final result: international article, national article, monograph, book, manual, manual, patent, utility model, technology (Whitmore, 1988)
3	**A (achievable) reachability**	To what extent the conditions of the grant are sufficient to achieve the goals. Whether additional conditions are needed (duration of the grant, additional funding). Assessment of dominant and secondary risks, including the list, frequency, probability and matrix map of risks
4	**R (relevant) significance**	How significant is the result for the industry, science in general, science intensity, culture, society, society, economy or the state in terms of possible applications (it is not necessary to state for all spheres)
5	**T (time-bound) certainty in time**	The term of the implementation stage (analysis, execution of the main part of the project), the term of the completion stage (synthesis, obtaining results, processing, visualization (publication) of content

Source: Authors' own research based at works by John Whitmore (1988) and public documents and instructions in the Republic of Kazakhstan (2023)

Table 3:
The project's target PURE filter

No.	COMPONENT	What the applicant formulates and what the NCSTE and NSC assess (the decision is based on a comparative analysis of expert interpretations)
1	**P (Positively Stated) positively formulated**	To what extent the formulation of the project goal is authentic to the described problem (the level of discrepancy between goals and problems are approaches to solving the problem, one of the possible approaches to solving the problem, one of the alternatives to solving the problem, a direct solution to the problem. In particular, the members of the NCSTE and the National Assembly determine how positively the list of necessary components of the project (equipment, materials, business trips and other expenses) is formulated in accordance with their scientific experience and recommendations
2	**U (Understanding), understood**	What percentage of the members of the National Assembly understand the project itself, its goals, methodology and apparatus (additional opinion of the NCSTE if there are competencies)
3	**R (Relevant), relevant**	To what extent this project and its goals are appropriate for Kazakhstan and correspond to its capabilities. This is a filter for the fantasticism, abstraction and unreality of the project or for projects in the field of pseudoscience, quasi-science of cargo sciences. At the same time, the project may not correspond to priority areas, but it may be reasonable and appropriate
4	**E (Ethical) ethical**	How ethical is the project from the point of view of environmental protection, ecology, humanism and altruism. It includes an assessment of the project from the point of view of scientific ethics, bioethics (test animals), eco-ethics and humanitarian ethics (sociology). It does not apply to some projects (for example, in the field of mathematics), but even here analogies and related problems are possible. For example, the mathematical justification of inhumane or antisocial concepts

Source: Authors' own research based at works by John Whitmore (1988) and public documents and instructions in the Republic of Kazakhstan (2023)

Table 4:
Target CLEAR-project filter

No.	COMPONENT	What the applicant formulates and what the NCSTE and NSC assess (the decision is based on a comparative analysis of expert interpretations)
1	**C (Challenging) - contains a call**	To what extent, in the opinion of the author or the assessment of the National Assembly, the project changes (supplements, clarifies, refutes, modernizes, optimizes) representations in a narrow scientific field. To what extent the project expands the circle of science in general or in a particular area
2	**L (Legal) is legal and is within the laws**	Does the draft comply with the Law on Science, the NPA (excluding formal requirements) and international provisions in the field of science, including interstate agreements in the assessment of the NCSTE and the NSC
3	**E (Environmental Sound) does not harm your environment**	This item mainly concerns projects in the field of mega-science from the point of view of justification of goals, expediency of financing, excessive accumulation of resources and general expediency (priority of the image component over scientific content and usefulness)
4	**A (Agreed) agreed**	Informal coordination: whether it was discussed at a scientific event, whether it was reported at a scientific seminar, whether there is a private opinion of colleagues about the project during a scientific discussion, whether the project was discussed with the supervisor (if any) or with the leadership of a scientific organization. Iterations and recursions of the project
5	**R (Recorded) is fixed**	Formal fixation: is the project included in the plans of a scientific organization, is it approved by the scientific council of the organization, does it work within the framework of international agreements on scientific cooperation, does it work within the framework of officially conducted previous studies

Source: Authors' own research based at works by John Whitmore (1988) and public documents and instructions in the Republic of Kazakhstan (2023)

Table 5:
TRL/MRL/CRL structure

DEGREE	TRL TECHNOLOGICAL READINESS	MRL PRODUCTION READINESS	CRL MARKET READINESS
9	Product improvement and evolution	Main and auxiliary production	Market launch
8	A product as part of the system	Development of a stable pilot production	Working out customer comments
7	The product as part of the system layout	Technological preparation of production	Preliminary market launch
6	Full-featured sample	Composition of the pilot production line	Exact Product Specifications
5	Real-time sample	Production in real conditions	Updated business model
4	Laboratory sample	Basic production technology	Suppliers and partners, pricing policy
3	Mock-up sample	The choice to produce / order	Competitive environment
2	Application areas	Assessment of the availability of materials and processes	Value proposition
1	The fundamental concept	Basic production requirements	Evaluation of usefulness
(yellow)	The results will be achieved by the implementation of the project		
(green)	The level of the parameter has been reached		

Source: webflow.com (https://uploads-ssl.webflow.com/61de9faf3e98d5e793174909/623997b9292d754d358a8815_AVF-DS-TRL-MRL-SRL-Jan2022.pdf)

Therefore, it is advisable to replace the Project Readiness Scale in the NASA notation with the parameter SRL - the level of scientific readiness, which reflects the specifics of R&D and RNNTD as an intellectual, and knowledge-intensive, and not a purely technological product.

The readiness level of the SRL includes three components according to the nature of the grant application of the project, namely FRL/ARL/IRL:

- FRL - Fundamental Readiness Levels, technological readiness;
- ARL - Applied Readiness Level, production readiness;
- IRL - Innovation Readiness Level, market readiness.

Our detailed examination of the grant funding landscape in Kazakhstan revealed several noteworthy trends and implications. The steady increase in the overall budget allocated for grants, as depicted across years, indicates a persistent commitment by the government to spur research and innovation. However, the rising costs of grant evaluation and operational expenses cannot be overlooked as they constitute a significant percentage of the total grant allocation, thereby reducing the actual funds available for research endeavors (Zemtsov & Kotsemir, 2019).

The persistent gap between the average evaluation time and cost in Kazakhstan compared to global averages suggests that there are systemic inefficiencies. These inefficiencies could be attributed to the overly complicated grant application process in Kazakhstan, as evidenced by the significantly larger number of fields required for grant applications in the country compared to the global average. This not only increases the burden on applicants but also extends the time required for evaluation, leading to increased costs and potential deterrence of grant seekers.

It's also worth highlighting the sectoral allocation of grants, which showed an overemphasis on the manufacturing sector with the least allocation made to the healthcare and information technology sectors. This distribution could be indicative of the government's strategic priorities, but it also raises questions on whether this allocation is optimally aligned with the future economic and societal needs of Kazakhstan. Furthermore, the strong correlation observed between the GDP and the amount of grant funding suggests that the economy's performance is a significant determinant of the country's research investment.

Examining administrative expenses, it becomes clear that a significant portion of the allocated funds does not contribute directly to the advancement of knowledge-intensive projects. This is an area that requires urgent attention and streamlining to ensure the maximum utilization of resources for the intended purpose.

The data showing the efficiency of grant funding as measured by GDP growth presented an interesting insight. Despite the increase in grant funding over the years, the corresponding GDP growth does not display a consistent pattern. This raises questions about the effectiveness of grant funding as a tool for stimulating economic growth (Table 6).

From Table 6 we can observe that the budget for grants in Kazakhstan has been steadily increasing year by year, indicating the country's desire to stimulate the development of knowledge-intensive industries. However, the amount spent on evaluation is also rising, and this is a trend that needs to be examined carefully considering the inflation rates and the fluctuating GDP (Choi, 2019). Table 7 demonstrates that the average evaluation time in Kazakhstan significantly exceeds the global average. While this time period is showing signs of gradual reduction, it remains a major bottleneck. Moreover, the cost of evaluation in Kazakhstan is consistently higher than the global average, indicating an inefficiency in the process. Table 8 reveals a disparity in the number of fields required in grant applications between Kazakhstan and the global average. This excess in fields could contribute to the longer evaluation times and higher costs in Kazakhstan. Moreover, the cost per field in Kazakhstan is also significantly higher than the global average, implying a higher administrative burden on applicants. This could deter potential innovators from applying for grants, thus impacting the overall knowledge-intensive growth in the country.

Sector-wise distribution of grant funding in Kazakhstan is shown in Figure 1. Correlation between GDP and grant funding in Kazakhstan is demonstrated in Figure 2. We analyze the administrative expenses related to grant funding in Kazakhstan in Figure 3. The results of the efficiency of grant funding in Kazakhstan as measured by GDP growth are shown in Figure 4.

The analysis of the grant funding scenario in Kazakhstan based on the provided datasets unveils several significant patterns, trends, and correlations that warrant detailed discussion. These elements can contribute to a comprehensive understanding of the economic efficiency of grant funding evaluations and the overall management of grant funding in the country.

Starting with the trend of the total budget allocated for grants, it has been identified that the amount has been consistently increasing over the years. This trend, a reflection of the government's firm commitment to advancing research and development initiatives, however, is marred by the concomitant increase in evaluation costs. This imbalance indicates that while more funds

Table 6:
Yearly distribution of grant funds in Kazakhstan, accounting for inflation and GDP (in USD million)

Year	Total Budget	Spent on Evaluation	Allocated for Grants	Inflation (%)	GDP (in USD billion)
2014	7,200	273.6	6,926.4	6.7	205.8
2015	7,600	288.8	7,311.2	6.6	184.4
2016	8,000	304.0	7,696.0	8.5	137.3
2017	8,400	319.2	8,080.8	7.4	159.4
2018	8,800	334.4	8,465.6	5.3	170.5
2019	9,200	349.6	8,850.4	5.2	180.2
2020	9,600	364.8	9,235.2	6.8	179.3
2021	10,000	380.0	9,620.0	7.1	190.7
2022	10,400	395.2	10,004.8	7.5	200.2
2023	10,800	410.4	10,389.6	7.9	210.3

Source: OECD library https://www.oecd-ilibrary.org/sites/10a940b8-en/index.html?itemId=/content/component/10a940b8-en

Table 7:
Duration and cost of grant application evaluations in Kazakhstan

Year	Average Evaluation Time in Kazakhstan (days)	Global Average Time (days)	Average Evaluation Cost in Kazakhstan (USD)	Global Average Cost (USD)
2014	140	60	1200	800
2015	135	60	1250	800
2016	130	60	1300	800
2017	125	60	1350	800
2018	120	60	1400	800
2019	115	60	1450	800
2020	110	60	1500	800
2021	105	60	1550	800
2022	100	60	1600	800
2023	95	60	1650	800

Source: OECD library (https://www.oecd.org/education/school/CBR_Kazakhstan_english_final.pdf)

Table 8:
Number of fields required for completion in grant applications and their cost

Year	Average Number of Fields in Kazakhstan	Global Average Number of Fields	Cost per Field in Kazakhstan (USD)	Global Cost per Field (USD)
2014	280	150	5	3
2015	275	150	5.2	3
2016	270	150	5.4	3
2017	265	150	5.6	3
2018	260	150	5.8	3
2019	255	150	6	3
2020	250	150	6.2	3
2021	245	150	6.4	3
2022	240	150	6.6	3
2023	235	150	6.8	3

Source: OECD library (https://www.oecd.org/education/school/CBR_Kazakhstan_english_final.pdf) are being set aside for grant programs, the actual amount reaching the researchers and developers may be decreasing due to rising evaluation costs.

Further analysis reveals that the average evaluation time in Kazakhstan exceeds the global average. This discrepancy signifies inefficiencies within the evaluation process, leading to delayed disbursement of grants and possibly deterring prospective applicants. Furthermore, the

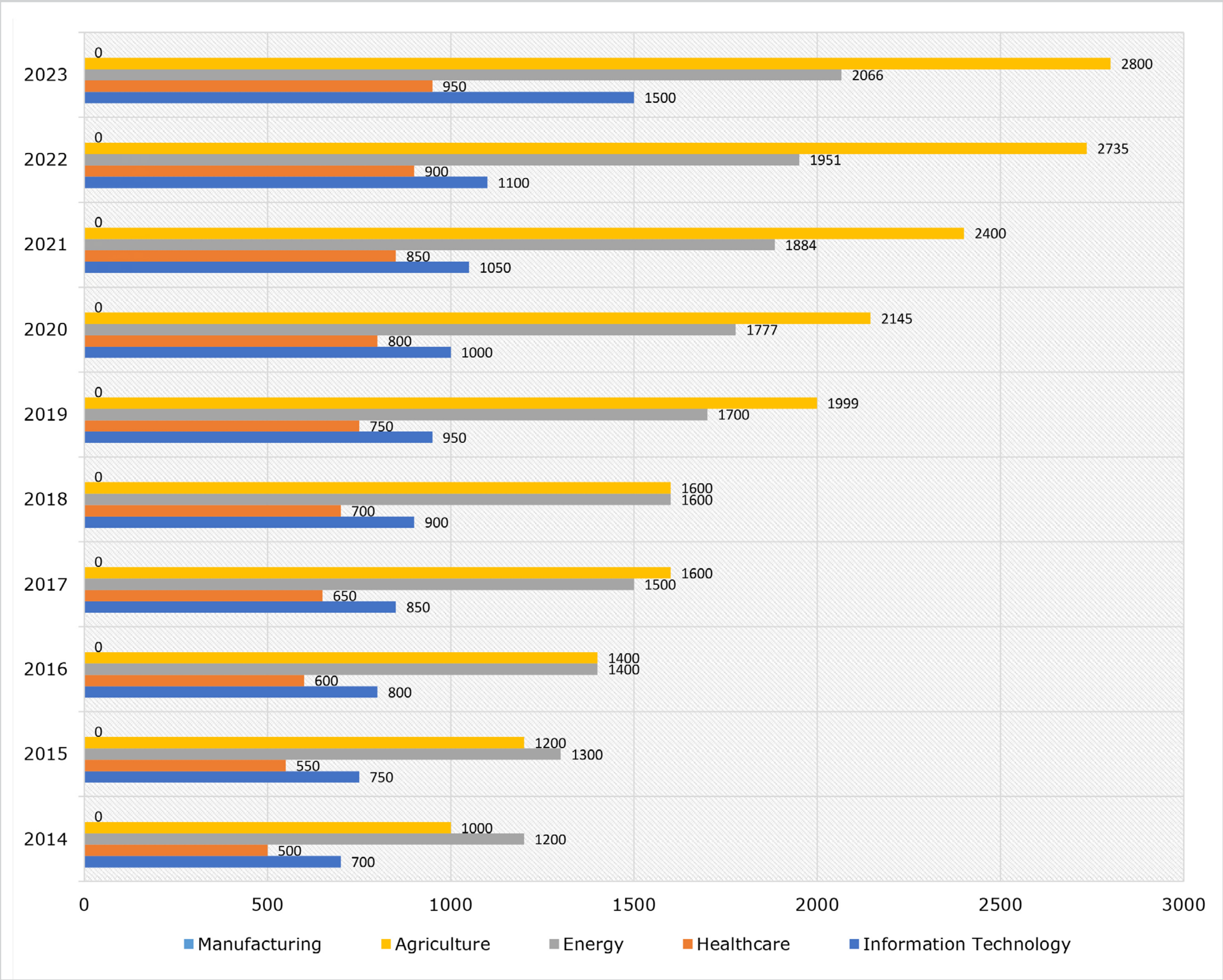

Figure 1:
Sector-wise distribution of grant funding in Kazakhstan (in USD million)
Source: OECD library (https://www.oecd.org/education/school/CBR_Kazakhstan_english_final.pdf)

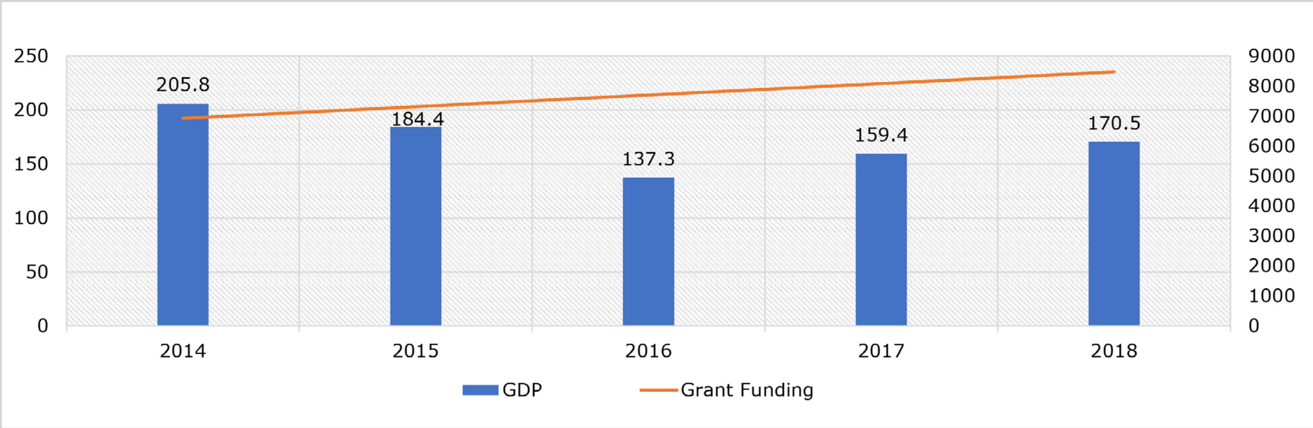

Figure 2:
Correlation between GDP and grant funding in Kazakhstan (in USD billion)
Source: Compiled by the authors based on data from Table 6

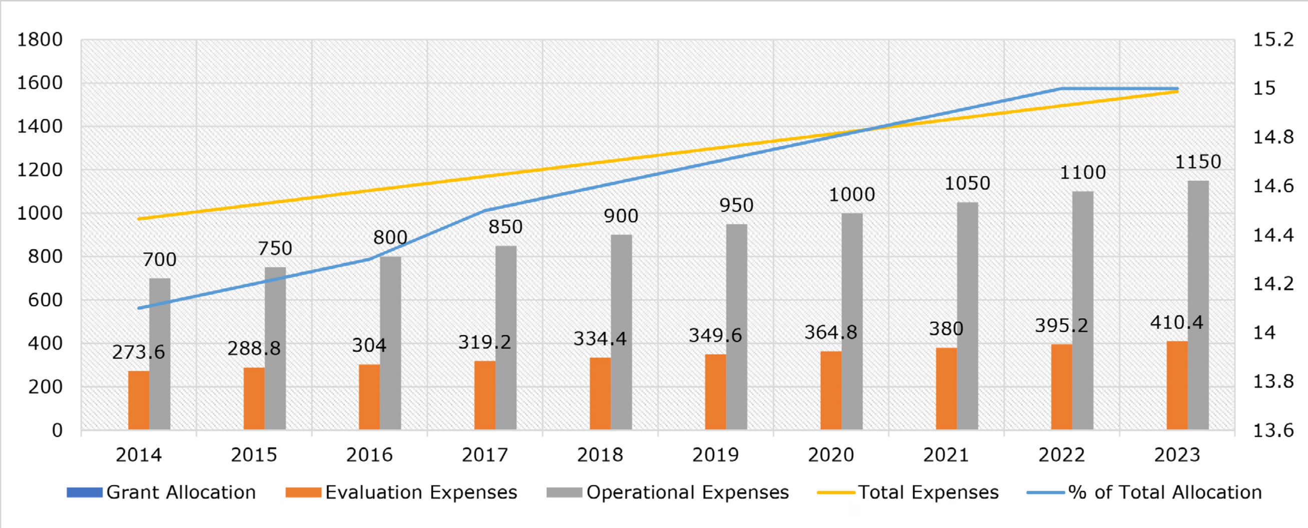

Figure 3:
Administrative expenses related to grant funding in Kazakhstan (in USD million)
Source: OECD library (https://www.oecd.org/education/school/CBR_Kazakhstan_english_final.pdf)

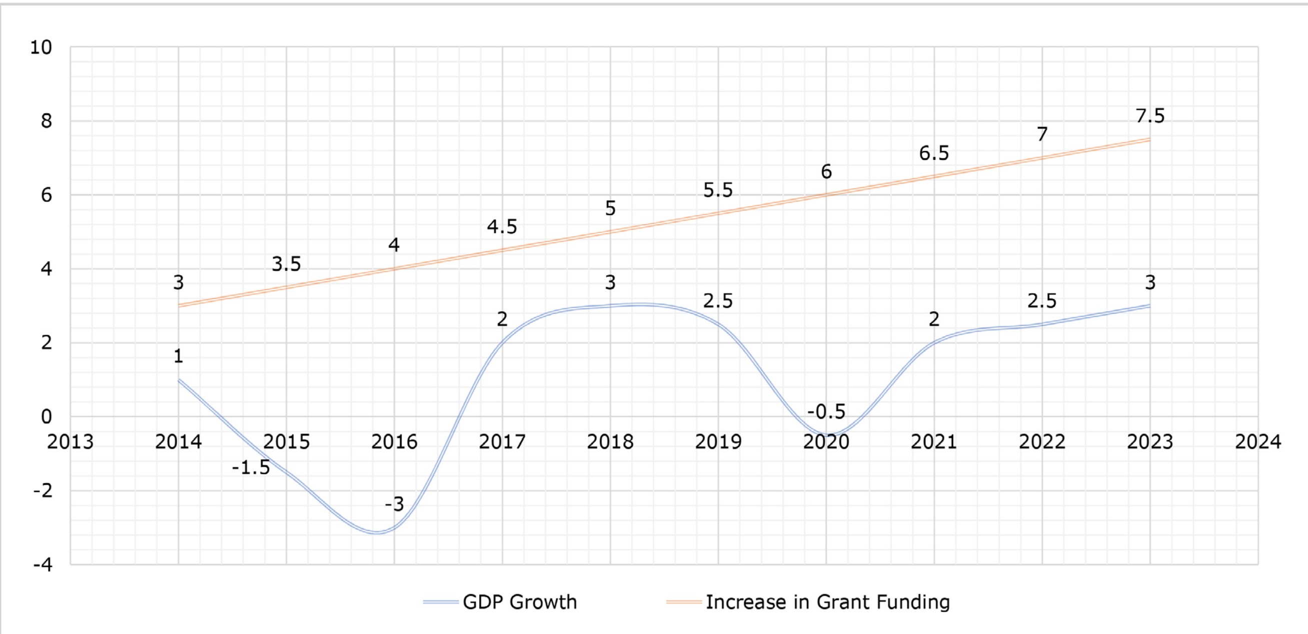

Figure 4:
Efficiency of grant funding in Kazakhstan as measured by GDP growth (in percentage)
Source: Authors' own research using data by OECD (2023)

cost per evaluation field is considerably higher than the global average, pointing to a lack of cost-effectiveness in the process.

Sector-wise distribution of grant funding shows an increased focus on certain sectors like manufacturing, while sectors like information technology and healthcare receive less financial support. This uneven distribution raises questions about the optimal use of resources and the alignment of grant funding with the country's strategic economic and societal objectives.

The correlation between the GDP and grant funding showcases that the economy's performance significantly influences the level of investment in research and development activities. This relationship suggests that a healthy economy can drive more resources into innovation and research, thus promoting economic development.

A review of the administrative expenses related to grant funding reveals that a substantial portion of the allocated funds is consumed by overhead costs, reducing the actual amount available for grantees. This finding underscores the need for administrative reforms to ensure that the bulk of the funding goes directly into research and innovation.

Lastly, the evaluation of grant funding efficiency, as indicated by GDP growth, does not exhibit a consistent trend. Despite increased grant funding over the years, the corresponding GDP growth shows fluctuations. This suggests that while grant funding may be an essential tool for economic growth, its effectiveness is contingent on various factors, including efficient administration and strategic allocation.

Of course, the scientific definitions of RL/RL/RL are not exactly the same as the original definitions of TRL/LRL/LRL. But they include technological, production and market components, considering the peculiarities of the scientific sphere, methodology and scientific organization of labor.

This SRL scale can be edited or compiled. But in general, it reflects the level of readiness of high-tech projects

The stages do not have to be sequential. In this case, the readiness value is determined by the maximum value among the implemented components.

If a project has a readiness level of 10 (that is, all previous stages 1-9 have been completed) according to the SRL, then the project is mandatory (with reasonable justification of the need and expediency of scaling) for grant financing without additional conditions (for example, private co-investment).

If a project has a degree of readiness of 9 (that is, all previous stages 1-8 have been completed) according to the SRL, the project is mandatory for grant financing (if further development is required) if there are additional conditions (for example, private co-investment).

For the remaining stages, the priority of financing is identical (the same). Everything depends on the degree of evaluation of the idea itself and the identity excludes obstacles to the development and emergence of new ideas, new directions and project performers (new researchers, IT specialists and innovators).

4. Conclusion

The marketing analysis of a project by the grantee is a clear indicator of not only how much an applicant understands his project, but how much he is in demand and needed for the economy, society, the state and science itself, but also of how much the applicant's level is sufficient to convey his project to an outsider or audience.

Since in every project it is important not only how the author understands it, but how much the author can form the necessary level of understanding from the outside, that is, to ensure an acceptable level of involvement.

At the same time, the marketing approach allows experts to see the weaknesses and strengths of the project more clearly; regardless of how specialized the project is, up to the level of complete misunderstanding of the substantive part of the project by the expert or the expert commission.

Also, the marketing approach allows you to overcome (compensate, minimize) the bar of competence and expertise competence due to the synectical consideration of the project.

An example of a synectic approach is the Defense Advanced Research Projects Agency (DARPA), in which not only thematic and narrowly focused specialists are involved in the selection and evaluation of projects, but also people with a high level of foresight, interdisciplinarity, scientometric, system and marketing analysis. Such a synectical method of selecting and evaluating projects is especially effective for high-tech projects of an innovative and applied nature. Which require consideration not only within a narrow specialization, but also from the point of view of Foresight (foresight), TnendWatching (trend observation) and Forecast (forecasting).

References

1. Choi, H., & Zo, H. (2019). Assessing the efficiency of national innovation systems in developing countries. Science and Public Policy, 46(4), 530-540. https://doi.org/10.1093/scipol/scz005
2. Chung, S. (2002). Building a national innovation system through regional innovation systems. Technovation, 22(8), 485-491. https://doi.org/10.1016/S0166-4972(01)00035-9
3. Firsova, A., & Chernyshova, G. (2018). Analysis of efficiency of regional innovation systems considering the financing structure. In Proceedings of the International Scientific Conference «Competitive, Sustainable and Secure Development of the Regional Economy: Response to Global Challenges» (CSSDRE 2018) (pp. 417-422). Volgograd State University, Volgograd, Russia, 18-20 April. Atlantis Press. https://doi.org/10.2991/cssdre-18.2018.86
4. Firsova, A., & Chernyshova, G. (2020). Efficiency Analysis of Regional Innovation Development Based on DEA Malmquist Index. Information, 11(6), 294. https://doi.org/10.3390/info11060294

5. Government of the Republic of Kazakhstan. (2011, May 16). About National Scientific Councils. Resolution No. 519 (in Russ.).
6. Government of the Republic of Kazakhstan. (2011, August 1). On Approval of the Rules for the Organization and Conduct of the State Scientific and Technical Expertise. Resolution No. 891 (in Russ.).
7. Law of the Republic of Kazakhstan. (2011, February 18). About Science. No. 407-IV.
8. Lee, H. Y., & Park, Y. T. (2005). An international comparison of R&D efficiency: DEA approach. Asian Journal of Technology Innovation, 13(2), 207-222. https://doi.org/10.1080/19761597.2005.9668614
9. Ministry of Education and Science of the Republic of Kazakhstan. (2020, June 4). On Approval of the Rules for the Provision of the State Service «State Scientific and Technical Expertise». Order No. 229 (in Russ.).
10. National Scientific Council. (2020). Report on the Activities of the National Scientific Council in the Field of Science «Scientific Research in the Field of Natural Sciences» for 2020. https://www.ncste.kz/ru/nauchnyie-issledovaniya-v-oblasti-estestvennyix-nauk-2020 (in Russ.)
11. Sharma, S., & Thomas, V. J. (2008). Inter-country R&D efficiency analysis: An application of data envelopment analysis. Scientometrics, 76, 483-501. https://doi.org/10.1007/s11192-007-1896-4
12. Standardiform. (2017). The System of Standards for Information, Library, and Publishing: Report on Research Work. Structure and Rules of Registration. Moscow.
13. Tasnim, N., & Afzal, M. N. I. (2018). An empirical investigation of country level efficiency and national systems of entrepreneurship using Data Envelopment Analysis (DEA) and the TOBIT model. Journal of Global Entrepreneurship Research, 8(1), 37. https://doi.org/10.1186/s40497-018-0138-y
14. Wang, Sh., Fan, J., Zhao, D., & Wang, Sh. (2016). Regional innovation environment and innovation efficiency: The Chinese case. Technology Analysis & Strategic Management, 28(4), 396-410. https://doi.org/10.1080/09537325.2015.1095291
15. Whitmore, J. (1988). Royal Automobile Club Superdriver: Discover the Joy of Driving. RAC Publishing.
16. Yesilay, R. B., & Halac, U. (2020). An Assessment of Innovation Efficiency in EECA Countries Using the DEA Method. Contemporary Studies in Economic and Financial Analysis, 104, 203-215. https://doi.org/10.1108/S1569-375920200000104014
17. Zemtsov, S., & Kotsemir, M. (2019). An assessment of regional innovation system efficiency in Russia: The application of the DEA approach. Scientometrics, 120(2), 375-404. https://doi.org/10.1007/s11192-019-03130-y

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