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## STATISTICS OF SCIENCE: STATUS, PROBLEMS AND PROSPECTS

**Rakhimova S.A.,**
Candidate of Economic Sciences, Professor,
S.Toraighyrov Pavlodar State University,
Pavlodar, The Republic of Kazakhstan
**Belyaeva G.N.,**
Leading Researcher,
JSC "National Center for Scientific and Technical Information",
Almaty, The Republic of Kazakhstan

### ABSTRACT

*Purpose* – on the basis of research and analysis of the state of science statistics, to identify problems and suggest the ways to eliminate them and the prospects for their development.

*Methodology* – the theoretical method of research, in particular the analysis of the legislative base of the Republic of Kazakhstan, the system of indicators, the use of methodologies, as well as the method of information synthesis, the comparative approach, deduction, the dialectical-logical approach, the study and analysis of international experience, synthesis, and others were used in writing the article.

*Originality* / Value – the assessment of the formation of the system of indicators of science statistics of the Republic of Kazakhstan was carried out, the quality was analyzed in comparison with the similar system of indicators of the Countries of Independent States (CIS) countries, as well as the reasons why the existing statistical information does not provide the needs of the interested society in complete, reliable, official statistics about the processes related to scientific activity in the Republic of Kazakhstan.

*Findings* – Unfortunately, until statistical observation on science does not provide objective initial data for assessing the scientific potential of the republic; its content, functioning and development. The survey program is limited in functionality and unrepresentative in content. The system of indicators of dynamic series is chaotic and does not reflect either the properties or trends of processes occurring in domestic science. Eurostat's experience in engaging users in the development of statistical monitoring programs is one of the main ways to improve the quality of statistics in the domestic science. This is especially relevant, because science becomes the main engine and strategic factor of economic growth.

*Keywords* – research and development (R&D), methodology, legislation, specialists, users, indicators, series of dynamics.

## INTRODUCTION

Developed countries have achieved positive results, have entered the technological core, thanks to a timely choice of innovative direction of economic development.

The European Economic Union (EEU) conducts an active policy in determining the ways and key priorities for further development.

In the Republic of Kazakhstan, the formation of an innovative economy is considered today as one of the priority areas of development. President of the Republic of Kazakhstan, N.A. Nazarbayev, in his message to the people of Kazakhstan "Kazakhstan-2030" – "Prosperity, security and improving the welfare of all Kazakhstanis", outlined his vision for the future of Kazakhstan's society and the mission of the republic. One of the key priorities of the "Kazakhstan-2030" Strategy is economic growth based on the balanced development of the economy, the gradual replacement of the raw material component in the Gross National Product (GNP) with high-tech products, including export products and effective use of the country's scientific and technical potential.

In the Strategic Plan of the Republic of Kazakhstan until 2020, one of the priority areas of development is to ensure sustainable economic growth by accelerating diversification through industrialization. The main goal in this case is to change the economic model and the transition from an extensive type to an intensive, industrial-innovative development of the economy. In this case, an economic environment is created, where much attention should be paid to building a national innovation system, including improving the system of scientific research and development.

The Concept of Long-Term Social and Economic Development of the Russian Federation for the period until 2020 adopted by the Government of the Russian Federation in 2008 determined that the transition of the country and its regions to an innovative development path is impossible without widespread introduction of advanced achievements in science, technology and high technologies in all spheres of human activity.

Focusing on the innovative type of economic development, it is important to highlight the development of science and technology as a key factor.

This circumstance objectively assumes the presence of a powerful and dynamically developing scientific and technical potential.

**MAIN PART OF THE STUDY**

The starting point for a detailed study and further design of possible directions for its development and effective use is the evaluation, that is, the process of determining the real state of the object with respect to the desired state or other object.

The analysis of the state of the object is carried out using statistical data, in our case on the basis of statistics of science. In this regard, it is important that statistics, both as an independent object and as a science reflecting priority development trends, meet all the requirements that objectively reflect the entire real picture in the process, since all subsequent decisions are built on the basis of the statistical research method, an algorithm and a development scenario are built.

The Law of the Republic of Kazakhstan "On State Statistics" states that the tasks in the field of state statistics are:

1) the formation of statistical methodology;

2) implementation of statistical activities in compliance with the principles of state statistics;

3) meeting the needs of society, the state and the international community in official statistical information [1].

The principle of significance, objectivity and accessibility is one of the fundamental principles of official statistics adopted by the European Economic Commission and recognized by Kazakhstani statisticians.

According to the source [2] "Official statistics are an indispensable element of the information system of a democratic society, providing the government, economic circles and the public with data on the economic, demographic, social and environmental situation. To this end, official statistical data of practical value are prepared and disseminated on an objective basis by state statistical agencies to ensure respect for the citizens' right to public information."

The word "statistics" comes from the Latin word status - the state of things. Originally it was used in the sense of "political state". Hence the Italian word stato ~ state and statista - the connoisseur of the state. In the scientific use of the word "statistics" came in the XVIII century. and was originally used in the meaning of "government" [3].

Statistics, how government should represent such a set of information that would allow to see the processes occurring in the state, trace their development, direction and speed.

However, the Law on State Statistics, approved by the President of the Republic of Kazakhstan on March 19, 2010, No. 257-IV, specifies Article 1. P.16, that the object of statistical observation is a socio-economic object and (or) a phenomenon or their totality, which should be quantitative and (or) qualitative characteristics are collected, and statistical observation itself is a scientifically organized collection of primary statistical data on the object of statistical observation [1].

An analysis of the laws on the statistics of the post-Soviet republics shows that in most countries statistics are aimed at collecting information about an object or phenomenon and does not involve monitoring the

development of the process. In general, this gives only general information, making it impossible to monitor the processes that are taking place. In most countries, new statistics are formed under the influence of consultants from international organizations, for which the minimum sufficient level of information is formed at the level of the state as a whole.

However, in view of the large inertia in most of the republics, the formation of statistical data on the principles that were laid down in the Soviet times continues.

At the same time, in a number of countries, such as Armenia, the Russian Federation and Uzbekistan, it is clearly defined that the main purpose of statistical observation is the collection and presentation of information on processes.

For example, in the Federal Law of the Russian Federation in Art. 1 it is written that the purpose of the law on statistics is the creation of legal bases for the implementation of a unified state policy in the field of official statistical recording aimed at providing information needs of the state and society in full, reliable, scientifically sound and timely provided official statistical information on social, economic , on demographic, environmental and other social processes in the Russian Federation. Further, in article 2, paragraph 3, it is determined that the official statistical information is the consolidated documented information on the quantitative side of mass social, economic, demographic, environmental and other social processes in the Russian Federation [4].

One of such socio-economic processes that require statistical observation is scientific and technical activities in the state.

In the Russian Federation, this activity is described in such areas as the availability and development of fixed assets, the costs of science from all sources of financing, the amount of work by type of work and services, internal costs for individual, state programs or promising areas of science, as well as for research and the development of new and improving existing products, technological processes, as well as the number of part-time workers, which allows you to determine the involvement in science of teachers of higher educational establishments and other workers. Such a survey provides the most complete information about the object of the survey and the process of development of the phenomenon from one source of information.

The Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan also conducts annual statistical supervision of organizations engaged in the implementation of scientific and technical work. The indicators on which this observation is conducted are summarized in the form of statistical observation with the index 1-science, whose system of indicators, unlike similar statistical surveys of the Countries of Independent States (CIS) countries, characterizes only the implementation of R & D, and not the scientific and technical activities of both the organization and the science of Kazakhstan in whole.

During the formation of the State Program for Industrial and Innovative Development of the Republic of Kazakhstan for 2015-2019, an increase in the share of domestic expenditure on research and development from gross domestic product to 2% is planned in the section "Goals, objectives and target indicators in innovation sectors" [5].

The Program also says that innovative sectors of the economy represent all the sectors of the so-called "new economy", the development of which is largely determined by the results of research and development. The development of new innovative sectors and the creation of science-intensive industries cannot be solved without the development of domestic science. Therefore, it is so important to have complete information about the scientific potential, which represents the totality of its intellectual, institutional and material resources in all branches of science and types of scientific research.

In accordance with the International Frascati Manual for Statistics on Research and Development, two main input indicators are measured: the costs of R & D and personnel involved in their implementation. However, it is important to know and consider that these are recommendations. Considering the fact that the statistics is not only cognitive, but also applied, the narrowness of the indicators is fraught with the fact that in the case of referring to other statistical surveys, the range of surveyed organizations engaged in scientific research and development may not coincide with the circle of technical surveys of the latter. As a result, the basic principle is violated and incomplete or distorted information appears, unable to reflect the desired in full and in the process.

In order to characterize such a phenomenon as scientific and technical activity, two main input indicators are offered by statistics, but to describe the process, this information is not enough. It is impossible to determine the conditions under which the process of science formation and R & D performance takes place. There is no description of the availability, condition and development of the fixed assets of the organization engaged in R & D. It is impossible to plan scientific research without knowing the material base of the objects involved in the works.

It is not possible to obtain information on the costs of scientific work in the priority areas of science, technology and technology development or socio-economic goals, government programs, which are usually financed from the state budget. There is no possibility to control the process of using budget funds by statistical methods, which generates such phenomena as corruption, theft or misuse of funds.

From the statistical observation, such sections of scientific and technical activities as scientific and technical services fell out, as a result, entire scientific organizations with a volume of work for hundreds of millions were not considered, or their activities were classified incorrectly, which led to a distortion of the results of the information provided.

To determine the domestic policy and to identify its effectiveness, it is important to improve the system of indicators of state statistics by internal forces, which must be of an integral, holistic, systemic nature, reflecting the entire process.

Kazakhstan, like most CIS countries, improves the system of indicators of state statistics with the involvement of international consultants whose main purpose is to provide objective and reliable information at the state level to international organizations such as the World Bank, Eurostat or UNESCO, respectively, the question of how the internal statistics go into the background, or even does not matter. As a result, the statistics of Kazakhstan, existing at the expense of the state budget, is aimed at satisfying only the needs of these international organizations.

The methodology developed by the Organization for Economic Co-operation and Development (OECD) for the formation of key indicators on science statistics (Frascati management) is recommended as a standard practice for assessing R & D by the international community.

In Kazakhstan, this technique has been used since the organization of this statistical observation, embodied in the form 1-science.

The Committee on Statistics was ashamed of the consultants from the statistical office of Finland to audit the existing form. As a result of joint efforts, the "Methodology for Forming Indicators of R & D and Innovation Statistics" dated 20.12.2013 for No. 36 [6] was approved.

In fact, this is a truncated version of Frascati's leadership, which not only does not take into account the national legislation, but some provisions of this Methodology contradict the normative and legal acts of the Republic of Kazakhstan.

So, for example, in accordance with the Methodology, as well as instructions for completing the statistical survey form 1-science, the number of employees performing scientific research and development (ie, researchers) - refers to the number of workers directly involved in R & D, with account managers, managers and administrators.

The list of specialties of research and development organizations that belong to the category of specialists of researchers is legislatively enshrined in such documents as the classifier of occupations of the Civil Code of the Republic of Kazakhstan 01-2005 (1237), having the status of the State Standard, the Qualification Reference Book for positions of managers, specialists and other employees, developed on the basis of this standard, in which the whole section is devoted to the list and qualification characteristics of the posts of employees employed in the research scientist engineering, technological, design and survey organizations. For administrative officers, a list of the names of the positions of employees belonging to administrative personnel has been developed and approved, in which all administrative posts relating to research specialists are listed. In none of these documents do managers and administrators treat scientists.

In each organization, a staffing table is being prepared with job descriptions and qualification requirements for the employee in accordance with the listed documents. Therefore, there is no need to find out who, how

much and what did, as required in the approved Methodology. This approach to determining the category of personnel is also recommended in the Frascati manual (paragraph 325).

To characterize the workforce both in the manual and in the Methodology, the following age categories are proposed:

– up to 25 years;
– 25 - 34 years;
– 35 - 44 years;
– 45 - 54 years;
– 55 - 64 years;
– 65 years and over

Such an age breakdown does not carry any practical information.

The following age categories are defined in the relevant legislative acts of the Republic of Kazakhstan:

– up to 29 years - youth; a young specialist - social relations in this age group are regulated by a special law on state youth policy [7];
– up to 35 years old - young scientist - is regulated by the Law on science [8];
– up to 58 years - women - age of retirement (before 01.01.2018);
– up to 63 years - men - retirement age [9].

For evaluation and planning, these age characteristics must necessarily be present when characterizing scientific personnel.

In order to characterize the financial costs, the Frascati management [10, paragraph 237] recommends that only current expenses be allocated to R & D types, financial means invested in the reporting year for the purchase of machinery and equipment, or other capital investments can not constitute an overhead charge for only one year. However, in statistical reporting, the total volume of all internal costs is distributed, including the costs of fixed assets (machinery, equipment, buildings, etc.) that are capital costs. Based on this, the indicator of internal costs by types of R & D is not representative, that is, it does not give an objective idea of how costs were allocated by types of R & D or by branches of science.

In statistical form there is no indicator for the number of part-time workers and persons who performed work on R & D under civil law contracts. Instead, data are given on the amount of hours worked by them for R & D work. These data, without taking into account the number of employees, do not carry any analytical component.

Data on the number of part-time workers and persons working under civil-law contracts are necessary to determine the involvement of workers in the research process, especially scientific and pedagogical workers. in accordance with the law "On Science" the main type of activity carried out by a higher educational institution, along with the educational one is scientific, scientific and technical and innovative.

In the statistical bulletin there is no data on higher education institutions that submitted a report on the implementation of scientific and technical work (not the sector of higher professional education), although according to the law, statistics are obliged to collect and aggregate information on both scientific and pedagogical workers and in terms of volume, carried out by universities work.

One of the important tasks facing statistics is to study the changes in the analyzed indicators over time. To solve this problem, chronological series (series of dynamics or time series) are constructed.

The correct construction of the series of dynamics obeys a number of requirements, one of which is that the indicators of a number of dynamics should be comparable in content, i.e. are calculated according to the same methodology in the same way. When the methodology is changed, a number of previous periods are recalculated using the new calculation method.

However, the dynamic series on the statistics of science are simply interrupted and there is no question of any recount of speech.

The current state statistical reporting on science from the form of the state survey has become a form for obtaining an array of internationally comparable data.

At the same time, as international statistics work, in particular, Eurostat statistics are clearly visible from the report of the European Statistical System for 2014.

Here are just two examples of how the statistical system in Eurostat is formed.

### How does the ESS function?

Eurostat, together with the representatives of the relevant national statistical offices, develops proposals for new or updated data collections and prepares new statistical methodologies. Years of intensive discussion and refinement may be required to ensure that the views of all member States are taken into account and to find the best solution for the entire European statistical system.

Once agreed, the proposals are submitted to the European Committee on the statistical system (ESCC), which is the highest body of the ESS. It consists of the heads of NSIS of the member States and is headed by the Director General of Eurostat. Liechtenstein, Iceland and Norway, within the framework of the agreement on the European economic area (EEA) and Switzerland, within the framework of the agreement between the EU and the Swiss Confederation on cooperation in statistics, participate fully in the EESC without the right to vote. Other participants are observers. The ESCC meets four times a year and its task is to provide professional guidance for the development, production and dissemination of European articles and to discuss strategic issues for the development of the ESS.

### What is the involvement of data users?

Statisticians strive to produce statistics that meet the needs of their users. Regular dialogues with data users in the production of statistics at the national and European level. The European Statistical Advisory Committee (ESAC) was established in 2008 and represents users and other stakeholders of European statistics, such as the scientific community, social partners and civil society, as well as institutional users such as the EU-rope Confederation of business, the Committee of regions and the European Parliament. The role of the Committee is to ensure that user needs are taken into account in the development of statistical programs within the ESS.

## CONCLUSION

The development of new technologies, innovative activity is becoming a determining factor in the development of the real sector of the economy, which has an impact on science-intensive industries. In this regard, the main task is to stimulate scientific activity, and as a result to obtain new knowledge and new technologies that are the foundation of innovation activity.

The scientific potential, in all sources of information, is understood to mean the totality of its intellectual, institutional and material resources that facilitate the creation and dissemination of new knowledge. Qualitative assessment of scientific potential is a guarantee of effective development of innovations in the social, economic and industrial spheres [12].

Unfortunately, until statistical observation on science does not provide objective initial data for assessing the scientific potential of the republic; it is content, functioning and development. The survey program is limited in functionality and unrepresentative in content. The system of indicators of dynamic series is chaotic and does not reflect either the properties or trends of processes occurring in domestic science.

Eurostat's experience in engaging users in the development of statistical monitoring programs is one of the main ways to improve the quality of statistics in the domestic science. This is especially relevant, because science becomes the main engine and strategic factor of economic growth.

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## РЕЗЮМЕ

Поставленные в статье вопросы весьма актуальны для удовлетворения потребностей всех слоев общества в получении репрезентативной статистической информации. Статья посвящена оценке формирования системы показателей статистики науки Республики Казахстан, их качество в сравнении с аналогичной системой показателей стран СНГ; использование международных рекомендаций при сборе и публикации данных НИОКР, гармонизация с законодательной базой Республики Казахстан, изучение причин, по которым имеющаяся статистическая информация не обеспечивает потребности заинтересованного общества в полной, достоверной, официальной статистике по процессам, связанным с научной деятельностью в Республике Казахстан. При написании статьи использован теоретический метод исследования, в частности анализ законодательной базы Республики Казахстан, системы

показателей, использование методик, а также метод обобщения информации, сравнительный подход, дедукция, диалектическо-логический подход, изучение и анализ международного опыта, синтез и др. При существующем подходе к формированию статистической информации в области науки государственная статистика не в состоянии удовлетворить потребности пользователей. Без тесного сотрудничества с пользователями данных в деле подготовки официальной статистики она останется информацией для общего развития без практического применения внутри страны.

## ТҮЙІН

Мақаладағы көтеріліп жатқан сұрақтар өкілетті статистикалық ақпаратты алуға қоғамның барлық топтарын қанағаттандыру үшін өзекті болып табылады. Мақала Қазақстан Республикасының ғылым статистикасы көрсеткіштерінің жүйесін қалыптастыру, олардың сапасы ТМД елдерінің ұқсас жүйесімен салыстырғанда сапасын бағалауға арналған;  ғылыми-зерттеу және тәжірибелік-конструкторлық жұмыстар туралы мәліметтерді жинау және жариялау бойынша халықаралық ұсыныстарды пайдалану, Қазақстан Республикасының заңнамалық базасымен үйлестіру, қолданыстағы статистикалық ақпараттың мүдделі қоғамның Қазақстан Республикасында ғылыми қызметке қатысты процестер туралы толық, сенімді және ресми статистикаға қажеттілігін қамтамасыз етпейтін себептерін зерттеуге арналған. Мақала жазған кезде теориялық зерттеу әдісі, оның ішінде Қазақстан Республикасының заңнамалық базасын талдау, индикаторлар жүйесі, әдіснамаларды пайдалану, сондай-ақ ақпарат жинау әдісі, салыстырмалы тәсіл, шегерім, диалектикалық-логикалық тәсіл, халықаралық тәжірибені зерделеу және талдау, синтездеу және т.б. пайдаланған. Ғылым саласындағы статистикалық ақпаратты қалыптастыруға қатысты қолданыстағы көзқараспен, мемлекеттік статистика пайдаланушылардың сұраныстарын қанағаттандыра алмайды. Ресми статистиканы қалыптастыру үшін деректерді пайдаланушылармен тығыз ынтымақтастықта болмаса, ол ел ішінде іс жүзінде қолданусыз жалпы даму үшін ақпарат болып қала береді.