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INDICATORS FOR ASSESSING THE STATE OF SCIENTIFIC AND TECHNOLOGICAL SECURITY

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Abstract

This research article examines various approaches to defining scientific and technological security indicators. It contains an analysis of the scientific literature to identify scientific and technological security indicators and their applicability. The authors' approaches to identifying relevant indicators are presented. These approaches depend on the scope of their application and conditions of use for assessing the state of scientific and technological security. Criteria for applying these indicators to assess scientific and technological security are established. International rankings and official statistical information available for assessment are also used as information sources. Special attention is paid to educational potential indicators. Indicators related to scientific research and the technological development of the national economy are examined. Considerable attention is given to indicators used to evaluate various government programs related to scientific and technological potential.

Relevance: The importance of the research subject for the development of the national economy of the Republic of Belarus is highlighted. Today, ensuring scientific and technological security is becoming increasingly important given the importance of technological development for the national economy and society as a whole.

The aim of the research: To identify indicators that can be used to analyze scientific and technological security through its components: scientific, technological and educational potentials.

Materials and methods: While preparing this article, we used scientific literature, international rankings, official statistical information, and regulatory legal acts defining the content of state programs in the field of innovation and science.

Results and conclusions: The principles for defining scientific and technological security indicators have been determined, and key indicators reflecting the state of scientific, technological, and educational potential have been identified. The indicators of state programs are examined as a means of reflecting these potentials.

The purpose of this study is to identify and classify indicators that can be used to assess scientific and technological security.

Keywords: scientific and technological security, scientific and technological potential, educational potential, R&D, innovative development, state programs, rating.

ПОКАЗАТЕЛИ ОЦЕНКИ СОСТОЯНИЯ НАУЧНО-ТЕХНОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ

А. С. Новиков

Реферат

В данной научной статье исследованию подверглись различные подходы, направленные на определение показателей научно-технологической безопасности. Проводится анализ научной литературы на предмет определения показателей научно-технологической безопасности и возможности их использования. Установлены критерии применения показателей для оценки научно-технологической безопасности. В качестве предмета исследования используются также международные рейтинги и официальная статистическая информация, доступная для проведения оценки. Отдельно внимание уделено показателям образовательного потенциала. По общему направлению изучаются показатели, связанные с научными исследованиями и технологическим развитием национальной экономики. Значительное внимание уделено показателям, используемым для оценки различных государственных программ, связанных с научно-технологическим потенциалом.

Актуальность: представлена важностью предмета исследования для развития национальной экономики Республики Беларусь. Сегодня обеспечение научно-технологической безопасности выходит на первый план в контексте важности технологического развития для экономической системы государства и общества в целом.

Цель исследования: определить показатели, которые могут быть использованы для анализа научно-технологической безопасности посредством ее составляющих: научно-технологического и образовательного потенциалов.

Материалы и методы: в процессе подготовки статьи использовалась научная литература, данные международных рейтингов, официальная статистическая информация, нормативные правовые акты, определяющие содержание государственных программ в области инноваций и науки.

Результаты и выводы: выделены принципы определения показателей научно-технологической безопасности, установлены основные показатели, отражающие состояние научно-технологического и образовательного потенциалов. Исследованы показатели государственных программ как способа отражения указанных потенциалов.

Назначение исследования состоит в определении и классификации показателей, которые могут быть использованы для оценки научно-технологической безопасности.

Ключевые слова: научно-технологическая безопасность, научно-технологический потенциал, образовательный потенциал, НИОК(Т)Р, инновационное развитие, государственные программы, рейтинг.

Introduction

The legislatively established formulation of scientific and technological security (abbreviated as STS) as the state of protection of scientific, technological, and educational potentials from threats that hinder the development of scientific activities, the creation and implementation of innovations, and advanced technologies in the real economy sector and other areas [1] is the starting point that is used by officials and state authorities, responsible for its provision. Generally, the above mentioned policymakers are involved in the formation of scientific, technological, and educational potentials.

The official definition of the STS allows to differentiate the state of the designated potentials in order to identify their presence and possible subsequent assessment.

The assessment of the state of STS is important in the context of scientific research and significantly more for achieving the goals of the state's economic policy, industrial production, the development of the scientific sphere, and others. Establishing the evaluation indicators of scientific and technological security, that is of prior importance for its assessment, is necessary to reveal its subject thoroughly, establish connections between its components, and thus gain the ability to influence the scientific and technological sphere of the country by affecting the actors involved in creating scientific, technological, and educational potentials.

Principles and indicators for assessing the state of scientific and technological security

It should be noted that significant attention is paid by researchers to the issues of ensuring scientific and technological security and scientific and technological development. The most significant contribution is made by Russian scientists, who have historically been the first to explore various aspects of STS, considering local specifics. Among the most well-known theorists of scientific and technological security A. E. Varshavsky can be mentioned. His works pay significant attention to the issues of STS and technological development in Russia as a whole. The works of A. I. Ladynin, who highlighted the basic indicators of STS, are of great importance for identifying such indicators. The researcher proposed a model of the system of indicators and drew attention to the possibilities of using neural networks, as well as stock indices for the purpose of monitoring STS. Considering the close connection between STS and technological security, L. D. Kapranova studied the impact of the sanctions regime on the ability to ensure technological security in the Russian Federation.

It is worth to note the approach of some researchers who define STS as part of economic security, using relevant indicators. Belarusian researchers, in particular, V. F. Bainev and T. Yu. Goraeva, in their works allocate an important role to STS in ensuring economic security, considering the problem of technological development as one of the most significant in the development of the national economy. E. V. Presnyakova separately highlights high-tech industries as the basis for forming the added value of the manufacturing industry abroad, which is also promising for the Republic of Belarus.

In general, as a result of analyzing the works presented in the scientific literature, it can be noted that the subject area of STS is reflected in them fragmentarily, and the indicators and mechanisms for its assessment do not cover a significant number of processes and/or participants in creating scientific, technological, and educational potentials, which necessitates further research.

Since STS affects processes occurring not only in recognized sectors of the national economy but also in the education sector, scientific activities, innovative development, and others, the assessment of the state of STS can be described as a complex, multifaceted process that involves multiple objects of assessment. As one of the ways to assess scientific, technological, and educational potentials, the most well-known international rankings related to them can be considered. The advantage of using such rankings and assessments is their wide recognition worldwide, the general acceptance of the methodology used, and the lack of necessity to spend resources on conducting assessments independently. Disadvantages include subjectivity concerning some countries, which significantly distorts the results; the narrow focus of applying such rankings, neglecting local specifics that significantly affects national economies. Nevertheless, an external look on Belarusian science allows to present its state from a different perspective, reflecting its specifics and thereby determining areas for effort application to enhance the effectiveness of activities taken to support it.

Table 1 presents some of the most well-known international ratings and their indicators reflecting certain components of scientific, technological and educational potentials of the Republic of Belarus.

Table 1 – International ratings and their indicators reflecting certain components of scientific, technological and educational potentials

Index	Index Position of the Republic of Belarus, 2024 (total number of countries)
Sustainable Development Goals Index (SDG INDEX)	30 (166)
Graduates in Natural Sciences and Engineering	13 (133)
Patent applications for utility models of the Global Innovation Index	12 (133)
Indicator «Science and technology» of the Good country index	34 (185)
Indicator «Global Contribution to Science and Technology» of the Good country index	55 (174)
Indicator «Human capital and research» of the Global Innovation Index	43 (133)
Indicator «Knowledge and Technology Outcomes» of the Global Innovation Index	46 (133)

Note – Source: [15–17].

The content of Table 1 indicates that the state of Belarusian science is assessed abroad at a fairly high level.

Indicators that can be used to assess STS are indicative. They belong to the components of STS, forming its subject area, and can be used, among other things, to assess the scientific and technological development as well as the state of the scientific and technological sphere of the country as a whole.

It is appropriate to start identifying indicators of scientific and technological security with the basic area by which they are defined – the Concept of National Security of the Republic of Belarus, approved by the decision No. 5 of the All-Belarusian People's Assembly on April 25, 2024. The main indicators of national security are determined by paragraph 70 of the Concept. By examining these indicators, the following related to scientific, technological and educational potentials can be chosen:

- the share of innovatively active organizations in the total number of manufacturing organizations;
- internal research and development costs.

Scientific, technological and educational potentials in the context of their connection with STS should be considered in a comprehensive manner, together with the elements that form them. Assessment of the indicated potentials is possible by conducting a single-level assessment – through the analysis of quantitative indicators and a two-level assessment – by analyzing the results obtained at the first level in order to identify trends.

Scientific, technological and educational potentials cannot be considered as an independent subject of assessment without separation from the participants involved in the process of their creation, since they do not exist separately from them. Accordingly, assessment indicators should reflect the state and (or) activities of such participants. Among them business entities, scientific organizations, government agencies, etc. can be distinguished [18, p. 7].

Educational potential created with the participation of educational institutions is necessary in the process of providing STS due to the need for a competent personnel capable of conducting scientific research, creating new technologies, and introducing them into the production process.

One of the components of the educational potential is the training of highly qualified scientific personnel. On the basis of practice it is appropriate to state that experienced researchers who have devoted considerable time to scientific research and have achieved significant results in the particular scientific area by defending a candidate and (or) doctoral dissertation are more successful in research activities.

Assessment of the country's educational potential can be carried out according to the indicators in Table 2.

The analysis of the actual (quantitative) values of the indicators for assessing educational potential specified in Table 2 for a certain period, including using such additional criteria as gender and age structure, territorial distribution, etc., makes it possible to establish a change in potential and identify trends.

Indicators used to assess scientific, technological and educational potentials should meet such criteria (conditions) as:

1) Belonging to scientific, technological and educational potentials. It is mandatory to have a direct, – in some cases indirect – connection of the indicator with a certain potential.

2) Accessibility. The actual value of the indicator, other information about it, should be available to the participant in the assessment process.

3) Applicability. Quantitative, qualitative and/or other characteristics of the indicators should provide an opportunity for assessment.

4) Objectivity. The indicator should objectively reflect the state of scientific, technological and (or) educational potentials, without any distortions.

5) Sufficiency. The assessment methodology used, including the set of indicators, should fully reflect the status of the indicated potentials.

6) "Local" character. The indicator used for the assessment should be presented by local actual data, which is associated with the peculiarities of the national economy and the possibilities of assessment. Such indicators can be represented, for example, by official statistics of a government agency.

One of the directions for assessing scientific, technological and educational potentials is the publicly available indicators and their actual values provided by the National Statistical Committee of the Republic of Belarus (abbreviated as Statistics Committee). These indicators have open access - you only need to have access to the Internet - and a fairly wide coverage of the subject area of STS.

Above mentioned indicators, presented in such areas as: "science," "innovation," "technological development of sectors of the economy of the Republic of Belarus," correspond to the suggested criteria. They cover the national economy as a whole depending on a certain direction of assessment.

The indicators presented by the Statistical Committee in the direction of "science" can be divided into two areas: the personnel, engaged in scientific activities and the indicators of organizations performing research and development.

Table 2 – Educational potential indicators

Indicator	Value	Dynamics for 1 year, five years
Number of institutions that implement programs of*	x	x
secondary special education	x	x
higher education, advanced higher education, specialty	x	x
Number of students of secondary specialized education institutions *	x	x
Number of graduates from secondary specialized education institutions *	x	x
Number of students of higher education institutions, specialty *, **	x	x
Number of graduates from higher education institutions, specialty *, **	x	x
Number of students enrolled in advanced higher education programs *	x	x
Number of graduates enrolled in advanced higher education programs *	x	x
Number of institutions that provide postgraduate studies		
Number of institutions that provide doctoral studies	x	x
Number of postgraduate students	x	x
Number of doctoral students	x	x
Number of graduates qualified as «Researcher» in the reporting year	x	x
Number of certified PhD candidates	x	x
Number of certified doctors	x	x

Note: * specialties that are used for the assessment relate to scientific and technological potential (technical, engineering, biological, medical, physical and mathematical, etc.).

The specialties used for the assessment are chosen in accordance with the national classifier of the Republic of Belarus OKRB 011-2022 «Specialties and Qualifications», approved by the Decree of the Ministry of Education of the Republic of Belarus dated March 24, 2022 No. 54.

For example, specialties with codes: 6-05-0113-04 (05), 0311, 0411, 0511, 0531, 0533, 06, 07, 081, 09 can be used for specialties, qualifications and the degree of general higher education, providing the degree "Bachelor."

* * retraining specialties may also be included in the group.

Source: author's own result of studies based on [19], [20].

The scientific workforce can also be identified and, accordingly, analyzed separately as part of the overall research capacity and as one of the characteristics of the research and development (abbreviated as R&D) process in conjunction with the assessment of the performance of organizations involved in the R&D process. The pointed indicators classified in accordance with the "cost-result" principle are given in Table 3.

According to the current methodology, "employees" refers to only full-time employees of the organization. External part-timers and persons working under civil contracts are not taken into account [20].

Statistical accounting also does not reflect external costs for R&Ds performed under contracts by external contractors.

Analysis of the content of Table 3 allows to identify quantitative indicators of investments (costs) ("input"), result ("output"), personnel potential ("researchers"). Accordingly, the effectiveness of activities in the field of research and development can be conventionally defined as the ratio of invested resources and the result obtained.

One of the directions for assessing the state of scientific and technological potential is the assessment of the technological development of sectors of the economy, which is a significant factor affecting the provision of scientific and technological safety. This direction of assessment is determined by the importance of technological development for the national economy and the material welfare of society as a whole, since high-tech goods have the greatest added value. The assessment methodology used in the Republic of Belarus is based on the statistical classification of economic activity NACE Rev. 2.0, that is widely known and used around the world. Indicators for assessing the technological development of the national economy, involving their classification on determining and status indicators, are given in Table 4.

Table 3 – Indicator of the Research and development organizations

Indicator Value by year	Value by year (previous period)	Value by year (current value)
Status indicator		
Number of:		
R&D organizations (total), of which (those, that represent):	x	x
public sector	x	x
commercial sector (business sector)	x	x
higher education sector	x	x
non-commercial sector	x	x
employees *:	x	x
of them researchers, of them:	x	x
candidates of science	x	x
doctors of science	x	x
Cost indicator		
Internal R&D costs	x	x
of which current costs	x	x
Performance indicator		
Amount of R&D performed, R&D services rendered	x	x

Note – Source: compiled by the author on the basis of [20].

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Table 4 – Indicators of assessment of technological development of the national economy

Indicator	Value by year (previous period)	Value by year (current value)
Defining indicator		
Labor productivity index by the type of economic activity	x	x
Index of change of stock-making capacity by the types of economic activity	x	x
Index of change in fund output by the type of economic activity	x	x
Commissioning of fixed assets for 1 thousand rubles of investments by the types of economic activity	x	x
The share of investments in machinery and equipment in the total volume of investments in fixed assets aimed at reconstruction and modernization, by the type of economic activity	x	x
Share of employees in high-tech and knowledge-intensive economic activities *	x	x
Production index for high-tech and medium-tech (high level) manufacturing facilities	x	x
Structure of industrial production volume by manufacturability level *	x	x
Manufacturing value added structure by manufacturability Level *	x	x
Status indicator		
Coefficient of renewal of fixed assets by the types of economic activity	x	x
Depreciation of fixed assets by the type of economic activity	x	x
Share of investments aimed at reconstruction and modernization, by the type of economic activity	x	x
The share of investments in machinery and equipment in the total volume of investments in fixed assets aimed at reconstruction and modernization, by the type of economic activity	x	x
Index of physical volume of investments in fixed assets aimed at reconstruction and modernization, by the types of economic activity	x	x
Index of the physical volume of investments in machinery and equipment carried out during reconstruction and modernization, by the types of economic activity	x	x

Note: * indicators that refer both to defining and status groups. Source: compiled by the author on the basis of [21].

The division of the indicators of Table 4 into defining and status indicators is associated with their applicability for assessing scientific and technological potential. In case it is necessary to carry out an assessment at any time in order to simplify it, it is advisable to use the actual values of the defining indicators, since status indicators have a delayed impact on scientific and technological potential.

One of the directions for assessing the scientific and technological potential is the assessment of public policy instruments aimed at increasing it. Unlike the group of indicators presented in Tables 1–4, which largely cover the national economy, the assessment of public policy instruments in the field of scientific, technological and innovative development and the corresponding indicators are more specific in nature due to the targeting of such instruments, certain restrictions related to their specifics. An important role in the implementation of these tools is played by the State Committee on Science and Technology of the Republic of Belarus (abbreviated as SCST). The competence of the SCST as a republican government body is related to the regulation of scientific, technical and innovative activities of the country [22].

Since the instruments of public policy aim to increase scientific and technological potentials, it is advisable to assess the impact of such instruments by analyzing their content, implementation progress and results.

One of the main instruments of state policy aimed at the innovative development of the national economy within the framework of the program-target method is the State Program for Innovative Development of the Republic of Belarus (abbreviated as SPID) [23]. The program is aimed at stimulating innovation by providing irrevocable and refundable financing, various benefits in the process of implementing innovative projects. SPID is primarily designed for enterprises in the real sector of the economy. The importance of the program for the development of the national economy can be determined regarding the amount of funding for its activities and projects, which amounts to 6750876,8 thousand rubles during the period of 2021–2025 years [23].

To participate in the SPID, it is necessary to comply with a number of conditions, in particular, those indicated in paragraph 4 of the Regulation on the procedure for the formation and use of innovative funds, approved by the Decree of the President of the Republic of Belarus No. 357, dated August 7, 2012.

Assessment of SPID as one of the tools for the implementation of innovation policy, a way to increase scientific and technological potential and, accordingly, ensure STS, can be carried out in two directions:

1) using indicators and evaluation mechanisms laid down in the program;
2) based on the actual content of the program through various third-party indicators.

Evaluation indicators defined in the program include target and forecast indicators. These are shown in Tables 5 and 6.

Table 5 – Target indicators of SPID

Indicator (target)	Value by year	
Share of innovatively active organizations in the total number of manufacturing organizations, %	x	x
Share of organizations implementing process innovations in the total number of innovatively active organizations in the manufacturing industry, %	x	x
Share of shipped innovative products in the total volume of shipped products of manufacturing organizations, %	x	x
Share of shipped innovative products new or significantly improved for the domestic or global market in the total volume of shipped innovative products of manufacturing organizations, %	x	x
Share of science-intensive and high-tech products in the total volume of Belarusian exports, %	x	x
Number of jobs created (modernized), units	x	x

Note – Source: [23].

Table 6 – Forecast indicators of SPID

Indicator (forecast)	Indicator value by years	
Number of innovation infrastructure entities, units	x	x
Number of jobs created (modernized) by subjects of innovation infrastructure and residents of scientific and technological parks, units	x	x
Production output by residents of scientific and technological parks, mln. rubles	x	x

Note – Source: [23].

It is important to note that target and forecast indicators of the SPID are used not only to assess innovative projects and program activities. They are also deployed to evaluate innovation progress of industries.

Evaluation of the actual content of the programs, namely innovative projects and activities, can be carried out by the means of indicators that trace certain quantitative parameters of the process and the status of participants, mainly performers. Such indicators grouped on the basis of the "cost-result" principle are specified in Tables 7, 8.

Table 7 – Indicators for assessing the implementation of SPID and its individual innovative projects

Indicator	Quantity (number)	Growth/decrease compared to the previous year
Status indicator		
Number of innovative projects	x	x
Distribution of innovative projects by sectors of the economy (contractors):	x	x
Regional distribution of innovative projects	x	x
including transient	x	x
of which are based on technologies of higher technological structures (V and VI)	x	x
Cost indicator		
Amount of financing, including:	x	x
republican budget funds	x	x
local budget funds	x	x
Funds of the Belarusian Innovation Fund	x	x
Own funds of executing organizations	x	x
Credit resources	x	x
Foreign investment	x	x
Other sources	x	x
Performance indicator		
New production facilities put into service	x	x
That have reached the design capacity	x	x
Production volume of products (works, services), mln. rubles	x	x
Shipped for export of products (works, services), mln. rubles	x	x
Jobs created (upgraded)	x	x

Note – Source: compiled by the author on the basis of [23].

Apart from innovative projects, the State Program for Innovative Development also provides for activities in the field of innovative infrastructure. Innovative infrastructure plays an important role in the country's innovative development by assisting innovative entrepreneurship in various forms. At the same time, the indicators of Table 8 can be used both to assess the process of implementation of the SPID, and in general to assess the state and effectiveness of the innovation infrastructure in the country.

The mechanism for assessing SPID, indicated in the program, involves a comparison of planned (target) and actual indicators for a certain period.

In order to do this we should use the formula [23]:

$$E = \frac{1}{n} \times \sum_{i=1}^{n} \frac{P_{\phi i}}{P_{\pi i}} \times \frac{F_{\pi}}{F_{\phi}},$$

where *E* – the performance indicator of the program;

n – number of targets;

$P_{\phi i}$ – the value of the n-d target indicator actually achieved during the implementation of the program;

F_{ϕ} – the planned value of the i-th target indicator of the program;

F_{π} – the planned value of budget expenditures on scientific, scientific and technical and innovative activities as a percentage of the gross domestic product (taken equal to 1 percent);

F_{ϕ} – the actual value of budget expenditures on scientific, scientific and technical and innovative activities as a percentage of gross domestic product.

The effectiveness of the program is evaluated based on the result of applying the above formula, which is compared with the indicator:

0.9 and higher – effective;

0.8–0.9 – moderately effective;

0.7–0.8 – ineffective;

less than 0.7 – ineffective [23].

Table 8 – Indicators of innovation infrastructure development

Indicator	Quantity (number)	Impact of indicator change (Growth/decrease compared to previous year
Status indicator		
The number of activities to develop innovative infrastructure, of which referring to:	x	x
Scientific and technological parks	x	x
Technology Transfer Centers	x	x
Belarusian Innovation Fund	x	x
National Technology Transfer Center	x	x
Cost indicator		
Amount of financing, including:	x	x
republican budget funds	x	x
own funds of executing organizations	x	x
credit resources	x	x
foreign investment	x	x
other sources	x	x
Performance indicator		
Number of residents	x	x
Production volume, planned / actual:	x	x
in comparison to 1 ruble of invested budget funds	x	x
Specific gravity of shipped innovative products, planned/actual	x	x
Share of exports of knowledge-intensive and high-tech products planned / actual	x	x
Number of jobs created (upgraded), planned / actual	x	x

Note – Source: compiled by the author on the basis of [23].

Another important instrument of state policy implemented within the framework of the program-target method, which can be considered as a means of ensuring STS by increasing scientific and technological potential, are various programs in the field of scientific activities. Such programs approved by resolutions of the Council of Ministers of the Republic of Belarus include state programs (abbreviated as SP), state programs of scientific research (abbreviated as SPSR), state scientific and technical programs (abbreviated as SSTP) [24], [25], [26].

A significant difference between these programs and the SPID is their focus mainly on the development of science and the development of new knowledge, including that for the creation of new and improvement of existing production technologies. The executors of these programs are mainly scientific organizations.

As a rule, SPs include a set of subprogrammes devoted to a wide range of humanitarian and other research. They are characterized by a wider profile with a significant number of contractors and performers, for example, SPs «High-tech technologies and technology» for 2021–2025, «Scientific and innovative activities of the National Academy of Sciences of Belarus» for 2021–2025.

SPSRs and SSTPs have a narrower focus, their main goal is the development of the main areas of scientific, scientific, technical and innovative activities through the acquisition of new knowledge, the study of methods for the practical application of previously discovered phenomena, and the solution of certain practical problems [27]. At the same time, unlike SPSRs, a mandatory stage in the implementation of SSTPs is the creation of final products based on the results of R&Ds and its subsequent production.

SPSRs are focused mainly on basic research, as well as partially applied, related to solving specific fundamental and applied problems promoting country's socio-economic development.

Currently, 12 SPSRs are implemented. Within their framework a significant amount of research is carried out in a wide range of areas, including: new materials, experimental medicine, biotechnology, photonics, energy security, soil fertility, etc. [28].

SSTPs can be assessed according to the indicators presented in the official documents of state bodies, in particular, the order of the SCST No. 212, dated July 19, 2019. These indicators, applicable to SPs and SPSRs depending on their specifics, are presented in Table 9, taking into account the classification used by the author.

The second area of assessing research programs involves an assessment of the implementation of the program and its participants. Thus, you can evaluate the effectiveness of the program. The corresponding indicators in relation to SPs and SPSRs, classified into three groups, are presented in Table 10.

Indicators applicable for assessing the efficiency of SSTPs, and in some cases – SPs and SPSRs are presented in Table 11.

It should be noted that production-related indicators are partially applicable to SPSRs since some of these state programs, for example «Society and Humanitarian Security of the Belarusian State» do not involve the production of goods.

Table 9 – SPSRs assessment directions

Indicator	Actual value of the indicator	Planned value of the indicator	Indicator dynamics (in comparison with the actual value in the previous year)
Status indicator			
Number of programs	x	x	x
Number of program tasks, of which:	x	x	x
aimed at performing R&D activities, including (those)	x	x	x
based on technologies of higher technological structures (V and VI)	x	x	x
Newly mastered (new) products, including (those):	x	x	x
based on technologies of higher technological structures (V and VI)	x	x	x
Number of organizations participating in the program	x	x	x
Number of tasks of the program for performance of R&D activities, including:	x	x	x
performed in the reporting year	x	x	x
not performed in the reporting year	x	x	x
transient	x	x	x
new	x	x	x
excluded	x	x	x
Cost indicator			
Actual amount of expenses for performing R&D, including:	x	x	x
budget funds	x	x	x
local budgets	x	x	x
extrabudgetary funds, including:	x	x	x
own funds of performers	x	x	x
credit resources	x	x	x
Other sources	x	x	x
Performance indicator			
Number of innovations created as a result of the program, put in production	x	x	x
Number of protection documents that protect the result of scientific and technical activities	x	x	x
Number of submitted applications for protection documents for scientific and technical activities results	x	x	x
Number of new production facilities created using technologies developed under the program	x	x	x
Number of modernized production facilities as a result of technologies developed under the program	x	x	x
Number of completed production (implementation) tasks in the reporting year	x	x	x
Volume of new goods produced, bel. rubles	x	x	x
Volume of new goods sold, bel rubles, including:	x	x	x
sold in the Republic of Belarus	x	x	x
exported	x	x	x
Program effectiveness for the reporting year *	x	x	x

Note: * is assessed as a degree of achieving program's planned (target) indicators for the reporting year. Source: based on [29].

Table 10 – SPs and SPSRs assessment indicators

Indicator	Indicator actual value	Indicator dynamics (in comparison with the actual value in the previous year
Status indicator		
Number of programs, of which:	x	x
divided by areas (industries, contractors):	x	x
number of subprograms, of which:	x	x
divided by areas (industries, contractors):	x	x
number of subprograms’ tasks, including (those):	x	x
divided by areas (industries, contractors)	x	x
Number of R&D activities, including (those):	x	x
divided by areas (industries, contractors)	x	x
performed under separate subprograms	x	x
Cost indicator		
Program funding, including (that):	x	x
divided by areas (industries, contractors):	x	x
involving budget funds	x	x
involving extrabudgetary funds	x	x
Performance indicator		
The volume of goods produced under the programs, including (those):	x	x
divided by areas (industries, contractors)	x	x
produced under separate subprograms	x	x
Total sales, including (those):	x	x
divided by areas (industries, contractors)	x	x
sold under separate subprograms	x	x
sold in the Republic of Belarus, including (those):	x	x
divided by areas (industries, contractors)	x	x
sold under separate subprograms	x	x
exported, including (those):	x	x
divided by areas (industries, contractors)	x	x
exported under separate subprograms	x	x

Note – Source: compiled by the author on the basis of [30].

Table 11 – Indicators for assessing the efficiency of SSTPs, as well as SPs and SPSRs, depending on their content

Indicator	Actual value of the indicator	Planned value of the Indicator	Indicator dynamics (in comparison with the actual value in the previous year)
Number of innovations	x	x	x
Number of new production facilities	x	x	x
Number of modernized production facilities	x	x	x
Volume of manufactured products, bel. rubles	x	x	x
Volume of products sold, bel. rubles	x	x	x
Volume of exported products, bel. rubles	x	x	x
Number of R&D activities	x	x	x
Amount of R&D funding	x	x	x
Number of protection documents that protect the result of scientific and technical activities	x	x	x

Note – Source: compiled by the author on the basis of [30].

Conclusion

Based on the study's results, it should be noted that the scientific and technological security can be assessed by assessing the state of its components – scientific, technological, and educational potentials. Various indicators are used for this purpose.

Such indicators can be established by regulation or chosen by the researches on the basis of the specifics of the subject that is to be assessed. Regardless of the exact choice all indicators must meet specific criteria involving belonging to scientific, technological and educational potentials, accessibility, applicability, objectivity, sufficiency.

The above mentioned indicators may relate to the technological development of the national economy, innovation, scientific research, and various government programs in the field of science and innovation development. Some of them cover all branches of the national economy, the others are specific, indicating specific areas of research that also contribute to the creation of the scientific and technological potential, such as various state programs in the field of innovation and scientific activities.

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