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Improving the System of Criteria for Evaluating the Effectiveness of Russia's Industrial Policy Under Sanctions Pressure

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ABSTRACT

The relevance of this study is due to the unprecedented level of sanctions pressure on the Russian Federation. This has led to a need for a fundamental re-evaluation of approaches to assessing the effectiveness of industrial policies aimed at ensuring the country's technological security. Currently, existing assessment methods suffer from a lack of coherence and insufficient consideration for the specific nature of sanctions restrictions. This significantly reduces the efficacy of monitoring efforts in terms of technological safety. The **object** of the study is the system of industrial policy of Russia in the field of ensuring technological safety in the context of sanctions pressure. The **subject** of the study is the criteria for assessing the effectiveness of industrial policy measures to ensure technological safety and methodological approaches to their formation. The **purpose** of the study is to develop a comprehensive system of criteria for assessing the effectiveness of industrial policy in Russia under sanctions pressure based on improving methodological approaches to determining threshold values and a multi-level structure of technological safety indicators. **The methodological basis** for this study is the integrated use of a zonal-threshold approach, which includes single-threshold, two-threshold, and multi-threshold assessment options. This approach is based on strategic documents of the Russian Federation and statistical data from Rosstat. The conducted analysis revealed the possibility of using criteria at the macro-, meso- and micro-levels of the economic system. A comprehensive system of new criteria in five strategic areas with the introduction of a specialized "sanction functional criterion" was developed. Scientific novelty lies in the integration of the zonal-threshold approach with a multi-level structure of criteria and the development of fundamentally new tools for monitoring technological security. Practical significance is determined by the possibility of direct implementation of the proposed system in public administration mechanisms.

Keywords: industrial policy; technological security; sanctions pressure; zonal threshold approach; technological sovereignty; performance evaluation criteria; scientific and technological development; import substitution; cybersecurity; innovation; national innovation system; performance monitoring

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INTRODUCTION

In light of the unprecedented sanctions imposed on the Russian Federation, the issue of ensuring the country's technological security and assessing the effectiveness of industrial policy measures in this area has become particularly urgent. Sanctions have affected critical sectors of the economy, posing risks to sustainable technological development and necessitating a reevaluation of current approaches to measuring the success of implemented measures [1].

Modern external challenges necessitate the improvement of a system of criteria to allow an objective assessment of the effectiveness of industrial policy measures aimed at ensuring technological safety. This system must take into account the multicomponent nature of the concept, which includes scientific, technological, and innovative components [2]. The Concept of Technological Development of the Russian Federation until 2030, adopted in 2023, identifies key areas for ensuring the country's technological sovereignty.[1]

An analysis of existing approaches to assessing the effectiveness of industrial policy in the field of technological safety reveals a significant variety of methodological concepts and criteria systems. One approach that deserves special attention is the integrated approach, which emphasizes three key components of technological security: resource indicators, performance indicators, and critical values. Studies that propose a zone-threshold method for determining these critical values have made a significant contribution to the development of assessment methodologies [3].

In today's context, the research on the impact of sanctions on Russia's technological sovereignty has become increasingly relevant. A crucial aspect of this research is the consideration of both traditional and cooperative components of technological security, as well as the infrastructural aspects [4].

Existing methods for assessing technological security are based on various approaches. However, in the context of sanctions pressure, it is necessary to adapt these methods to take into account new threats and risks. The monitoring of indicators of technological independence, the development of import substitution, and the protection of critical infrastructure are of particular importance [5].

The main task is to systematize and develop methodological approaches to assessing the effectiveness of industrial policy measures in the field of technological safety. This should be done based on the analysis of the spatial and sectoral boundaries for applying the criteria, as well as the study of their composition and options for setting thresholds [6].

As part of this project, we plan to analyze existing approaches to forming criteria for assessing technological safety at different levels of the economic system. We will study the composition of these criteria, taking into account their multidimensional nature, and analyze options for setting thresholds based on a zone-threshold approach. We aim to develop proposals for improving the criterion system under sanctions pressure.

Improving the system of criteria for evaluating industrial policy effectiveness in the field of technological security is an important scientific and practical challenge. The solution of this challenge will contribute to enhancing the effectiveness of measures to ensure Russia's technological independence under external constraints.

MATERIALS AND METHODS

The methodological basis for assessing the effectiveness of industrial policy measures in the field of technological safety is based on the integrated application of various approaches to determining criteria and their thresholds. A significant contribution to the development of the methodology was made by

[1] Decree of the Government of the Russian Federation dated May 20, 2023 No. 1315-p. URL: http://government.ru/docs/48570 / (accessed on 15.05.2025).

the works of A.E. Varshavsky, A.I. Gretchenko, A.I. Ladynin, which substantiates the need to take into account the multicomponent nature of technological safety.

The zone-threshold approach, developed in the research of S.N. Mityakov and co-authors, is of fundamental importance. Within the framework of this approach, three main options are distinguished: a single-threshold approach with the establishment of a single threshold value separating the stability zone and the risk zone; a two-threshold approach (the "traffic light" model), which introduces an intermediate zone between critical and stable conditions; a multi-threshold approach that allows assessing the degree of remoteness of criteria values from threshold levels [7].

Various methods are used to determine the threshold values of criteria: international comparisons, expert assessments, mathematical calculations, and regulatory requirements. The method of reference values is of particular importance, when the best industry indicators are taken as the threshold. An important methodological aspect is the division of criteria into "direct" and "reverse" criteria using a rationing procedure to ensure comparability of indicators [8].

The information basis for the formation of the criteria system is an extensive database of regulatory documents and statistical data. It is of crucial importance to note the updated Strategy for the Scientific and Technological Development of the Russian Federation, which was approved by Presidential Decree No. 145 dated February 28, 2024, where technological sovereignty is defined as the ability of a state to create and apply high-tech technologies.[2] An essential source of criteria indicators is the Concept of Technological Development of the Russian Federation for the period up to 2030, which contains target indicators for key areas of technological security.

Statistical support for the assessment is based on data from the Federal State Statistics Service, including indicators of scientific potential, innovation activity, and technological development. International comparisons are based on data from the Global Innovation Index published by the World Intellectual Property Organization. Analytical materials from relevant ministries and departments, expert assessments, and the results of monitoring the implementation of government programs are used to assess the effectiveness of industrial policy measures under the conditions of sanctions pressure.

The most comprehensive approach is the multi-threshold approach presented in the works of A.I. Gretchenko and V.K. Senchagov, which identifies five zones of technological safety with different levels of risks: from catastrophic to moderate. The starting point is the "basic" threshold separating the stability zone from the non-zero risk zones.

Under the conditions of sanctions pressure, the methodology is complemented by special criteria that take into account the impact of restrictive measures on the technological sovereignty of the country. In particular, it is proposed to introduce a "sanctions functional criterion" that evaluates the effectiveness of government support measures to neutralize the negative effects of sanctions.

RESULTS AND DISCUSSION

The analysis of the spatial and sectoral boundaries of the application of criteria for evaluating the effectiveness of industrial policy measures to ensure technological safety demonstrates their multilevel nature. Criteria are formed and used at three main levels of the economic system: macro-, meso- and micro- levels.

At the macro level, technological security is considered as an important component of the national and economic security of the country. The criteria for this level reflect the level of technological cooperation with foreign partners, investments in research and development, and

[2] Decree of the President of the Russian Federation dated 28.02.2024 No. 145 "On the Strategy of Scientific and Technological Development of the Russian Federation". URL: http://government.ru/docs/all/152305 / (accessed on 15.05.2025).

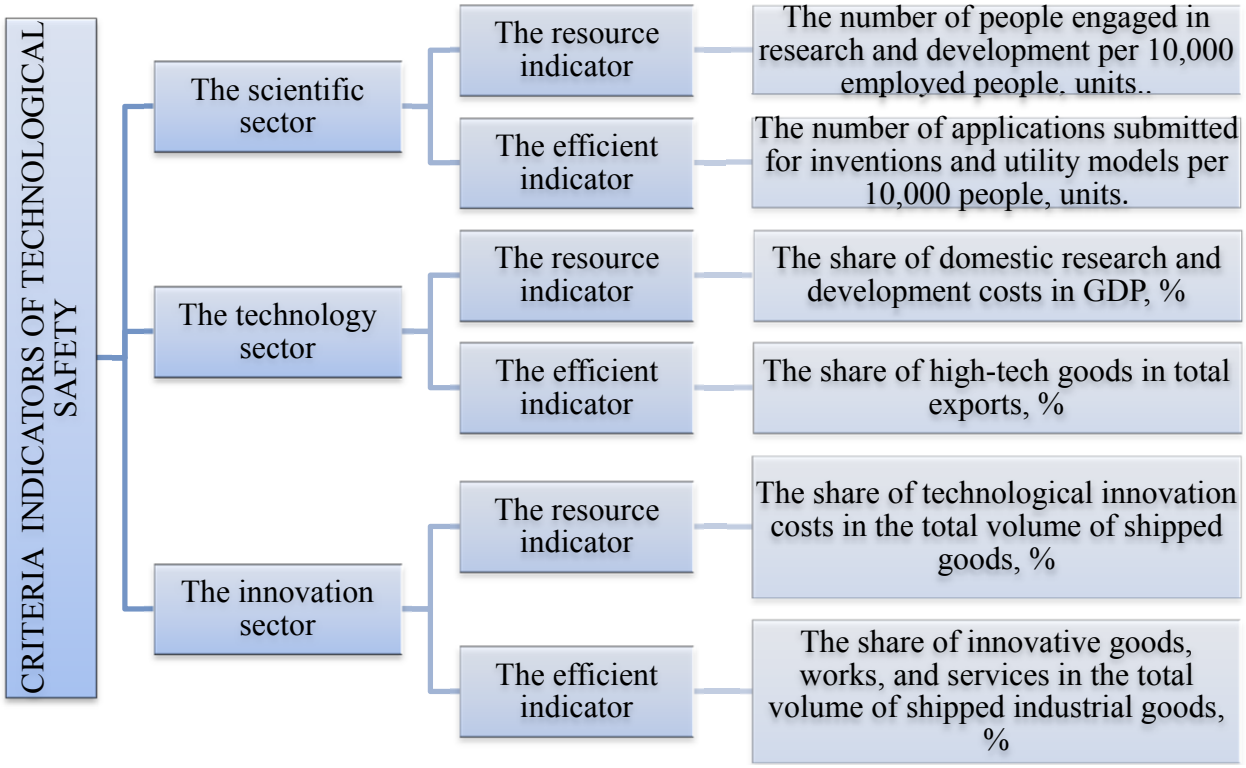

Fig. 1. **An Example of Criteria Indicators for Assessing the Effectiveness of Industrial Policy Measures in Terms of Three Components of Technological Security: Scientific, Technological and Innovative**

Source: Compiled by the authors based on data [12].

the development of the high-tech sector. The meso-level is represented by criteria for assessing the scientific and technological safety of Russian regions and industries through a matrix approach to the formation of criteria for technological safety. At the micro level, the criteria mainly focus on the technical and technological safety of individual organizations within the framework of a functional approach [9].

An important aspect is the relationship between the levels of industrial policy and the spatial and sectoral boundaries of the criteria application. Federal industrial policy corresponds to the macro level, regional and sectoral industrial policy corresponds to the meso-level, and the industrial policy of organizations corresponds to the micro level. At the same time, a specific set of criteria is formed at each level, taking into account the specifics of the appropriate management scale.

In modern conditions, the assessment of the impact of sanctions pressure on technological security is of particular importance, which requires the development of special criteria for analyzing the effectiveness of measures to neutralize the negative effects of sanctions at different levels of the economic system [10].

The multicomponent nature of technological security requires an integrated approach to the formation of a criterion base. Four key components of technological security are distinguished: the level of R&D development, the level of development of key industries of modern technology, innovation potential and national patent activity [11]. At the same time, the first two components form the scientific and production potential, which provides the opportunity to independently solve critical technological tasks even under extreme conditions of sanctions pressure.

The work of A. G. Rubtsov (*Fig. 1*) demonstrates a three-component structure of criteria, including scientific, technological

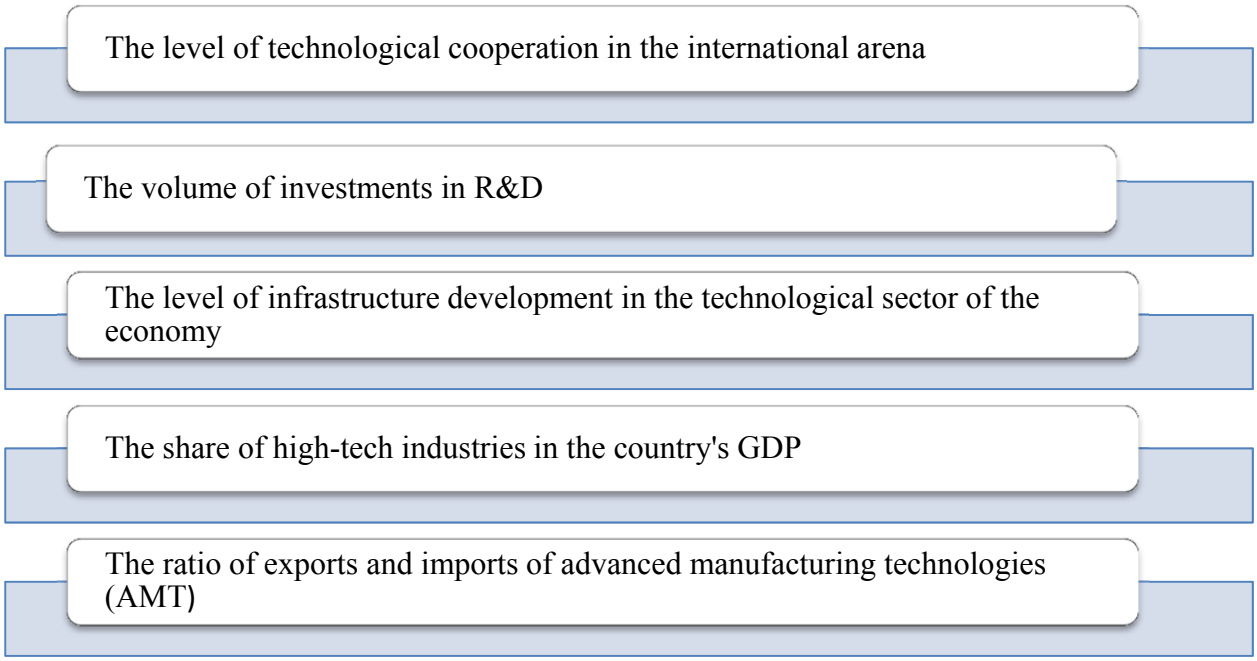

Fig. 2. **An Example of Criteria for Assessing the Effectiveness of Industrial Policy Measures in Terms of Five Components of Technological Security: Cooperation, Scientific, Infrastructure, High-Tech and Export**

Source: Compiled by the authors based on data [13].

and innovative components. Resource and performance indicators are allocated for each of them. The scientific component reflects the role of human capital and technology development, the technological component focuses on high-tech industries and their export potential, and the innovative component characterizes the innovation aspect.

It is possible to expand the system to five criteria, adding cooperative and infrastructural components. This allows us to assess the level of technological cooperation and the development of the high-tech sector (*Fig. 2*).

The criteria of technological sovereignty presented in the strategic documents deserve special attention (*Fig. 3*). They include indicators for the development of critical and end-to-end technologies, and the production of high-tech products based on them.

Under the conditions of sanctions, the need for special criteria has become more urgent. We have justified the feasibility of the "sanctions functionality criterion", taking into account the effectiveness of government support measures and the costs of enhancing technological security under sanctions.

S. V. Shkodinsky and co-authors identify six criteria for the zones of negative impact of sanctions (*Fig. 4*), including an assessment of the investment attractiveness and the state of the high-tech sector as the main "target" of sanctions restrictions.

In developing the analysis of threshold values of criteria for evaluating the effectiveness of industrial policy measures, special attention should be paid to the methodological aspects of their definition. The works of various authors demonstrate the evolution of approaches from simple single-threshold to complex multi-threshold zoning.

The most common is the single-threshold approach, in which a maximum allowable value is set for each criterion indicator, separating the stability zone and the risk zone [15]. For "direct" indicators, the growth of which indicates an increase in the level of security (for example, internal R&D costs, as a percentage of GDP), the threshold value

Fig. 3. **Criteria of Technological Sovereignty, Extracted from Conceptual and Strategic Documents of the Russian Federation**

Source: Compiled by the authors based on legislative documents: Decree of the President of the Russian Federation dated 28.02.2024 No. 145 "On the Strategy of Scientific and Technological Development of the Russian Federation". URL: http://government.ru/docs/all/152305/; Decree of the Government of the Russian Federation dated May 20, 2023 No. 1315-R. URL: http://government.ru/docs/48570/ (accessed on 15.05.2025).

determines the lower acceptable limit. For "reverse" indicators (such as the ratio of foreign and domestic patent applications) — the upper limit is set.

A two-threshold approach is more perfect, implemented in the "traffic light" model with the allocation of three zones [16, 17]:

- "red" (criticality zone);
- "yellow" (transition zone);
- "green" (zone of stability).

The introduction of an intermediate "yellow" zone allows you to track the dynamics of the transition of criteria values between critical and stable states. An example of the application of this approach is the establishment of target and critical thresholds for indicators of technical and technological safety of an enterprise, including return on capital, share of R&D and other indicators.

The most comprehensive is the multi-threshold zone approach presented in the works of A.I. Gretchenko and V.K. Senchagov (*Fig. 5*).

The figure shows a multi-threshold zone approach in relation to the criterion indicator (CI), the growth of which is accompanied by an increase in the level of technological safety. The level of the criterion indicator corresponds to 100% if its value is equal to the a priori established "baseline" threshold separating the stability zone from non-zero risk zones.

There are five zones with different levels of risks for technological security. The Catastrophic

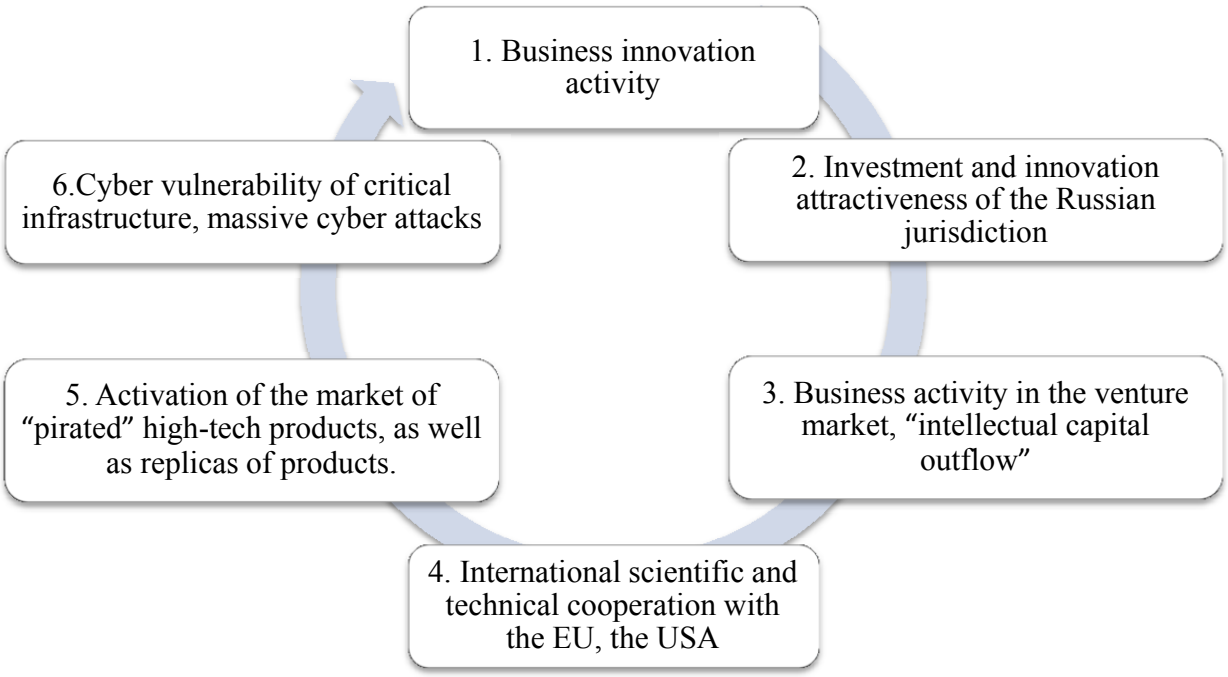

Fig. 4. **Criteria Characterizing the State of Critical Zones of Negative Impact of External Sanctions on the Technological Sovereignty of Russia Against the Background of Neutralizing Measures of Industrial Policy**

Source: Compiled by the authors based on data [14].

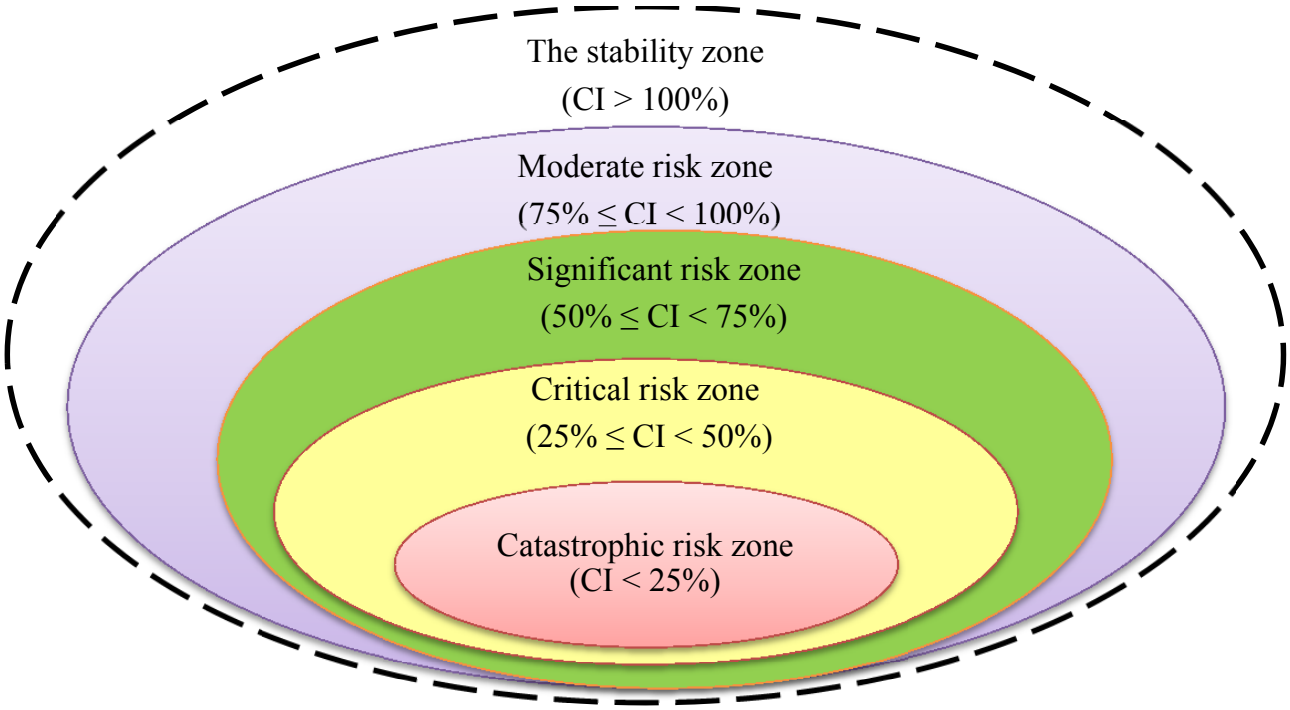

Fig. 5. **Technological Safety Risk Zones for Assessing the Effectiveness of Industrial Policy Measures Based on Criteria Indicators**

Source: Compiled by the authors based on data [18, 19].

risk zone (red) corresponds to the highest threat level, requiring an immediate response from government agencies. The critical risk zone (yellow) indicates possible crisis phenomena in the field of technological security and also requires urgent industrial policy measures. The zone of significant risks (green) is characterized by an undesirable level of threats, especially when moving towards increasing risks. The moderate risk zone (blue) is a transition zone from high-risk to stable zones and is characterized by the lowest level of threats among the risk zones. The stability zone (white) is interpreted as a normal or good condition according to the corresponding component of technological safety.

The starting point is the "base" threshold (100%), which separates the stability zone from the non-zero risk zones. Based on it, the remaining threshold levels are determined. (75%, 50%, 25%). At the same time, the stability zone can also be subdivided into subzones according to the degree of distance from the baseline threshold.

Various methods are used to establish thresholds:

- international comparisons and analogies;
- expert assessments;
- mathematical calculations;
- regulatory requirements;
- selection of industry reference values.

In the context of sanctions pressure, it is particularly important to take into account additional risks when determining thresholds. It is advisable to introduce a special "sanctions functional criterion" that takes into account the averted losses from sanctions and the costs of improving technological security.

As a follow-up to the analysis of the existing system of criteria for evaluating the effectiveness of industrial policy, a number of new criteria are proposed for key areas of technological security in the context of sanctions pressure.

The first direction is to strengthen state support for national developments. To evaluate it, it is advisable to use the following criteria:

The national project financing coefficient (CF), which reflects the share of funds allocated to domestic developments in the total budget of scientific and technical programs. The growth of this indicator indicates increased attention to the development of the national technological base.

The coefficient of investment in national developments (CI), defined as the ratio of total investments in domestic developments to investments in foreign technologies. An increase in this coefficient indicates a reorientation of investment flows in favor of national projects.

The coefficient of financing national projects (*CF*) and the coefficient of investment in national developments (*CI*) allow us to assess the level of state support for domestic technological initiatives [20]. Their importance is due to the fact that in conditions of limited access to foreign technologies, it is critically important to ensure sufficient financing of their own developments.

National Development Support Index (IND), calculated using the formula:

$$I_{nd} = \alpha \times ln(F+1) + \beta \times P + \gamma \times I, \qquad (1)$$

where α, β, γ — are the weighting coefficients reflecting the importance of each of the criteria in the context of national policy and strategic goals; ln(*F*+1) — is the logarithmic transformation of the amount of funding, which makes it possible to smooth out large fluctuations in data; *F* — is financing, which provides the basis for all types of scientific and technical activities; *P* — is the number of projects (shows activity in the field of research and development); *I* — patents, which serve as an indicator of the success and practical significance of research.

This index is necessary for a comprehensive assessment of the technological infrastructure's security against modern threats.

The second direction is the protection of information and technical infrastructure. The following criteria are proposed here:

The Technological Asset Security Coefficient (CSA), which takes into account the ratio of the number of security breaches to the total number of inspections.

The Infrastructure Protection Index (*Ipi*), defined as:

$$(I_{зи}) = \alpha \times S + \beta \times A - \gamma \times R, \quad (2)$$

where α, β, γ — are the weighting coefficients showing the significance of each criterion in the context of infrastructure protection; *S, A, R* — are the normalized values of the level of security system integration, the number of successfully repelled attacks, and the recovery time, respectively.

This index makes it possible to comprehensively assess the security of the technological infrastructure, taking into account:

1. Degree of integration of protective mechanisms (*S*) — characterizes the readiness of the infrastructure to withstand threats. A higher level of integration indicates better preparedness.

2. The effectiveness of countering attacks (*A*) — reflects the actual performance of the security system through the number of successfully prevented incidents.

3. Fault Tolerance (*R*) — evaluates the ability to recover quickly from disruptions, which is critical for the continuity of processes.

The third direction is the creation of conditions for technological independence. Key criteria:

The coefficient of technology implementation efficiency (*Cet*), which characterizes the success of the implementation of new technological solutions.

The Technological Independence Index (*Iti*), which evaluates the ability to meet technology needs at the expense of internal resources. The Technology Implementation Efficiency Coefficient (*Cet*) and the Technological Independence Index (*It*) characterize the industry's ability to import substitution and develop its own technological base. Under the conditions of sanctions, these indicators become particularly important [21].

The fourth direction is the development of scientific and technical potential. The main criteria:

The indicator of the level of scientific equipment (*Ise*), reflecting the state of the material and technical base of research.

The coefficient of commercialization of scientific developments (*Csd*), which characterizes the effectiveness of technology transfer to the real sector of the economy.

The indicator of the level of scientific equipment (*Ise*) and the coefficient of scientific grants utilization (*Csg*) make it possible to assess the state of the material and technical base of research and the effectiveness of the use of allocated resources. This is critically important for the development of domestic technologies.

For a comprehensive assessment of scientific and technical potential, it is advisable to use the efficiency coefficient of scientific research (*Csd*), which is calculated as the ratio of the number of commercialized projects to the total number of developed projects.

The proposed system of criteria makes it possible to comprehensively assess the effectiveness of industrial policy measures to ensure technological safety, taking into account modern challenges and threats.

The validity of the proposed criteria is confirmed by their compliance with the goals outlined in the strategic documents. Thus, in the Strategy of Scientific and Technological Development of the Russian Federation, technological sovereignty is defined as "the ability of the state to create and apply high-tech technologies that are critically important for ensuring independence and competitiveness".[3]

[3] Decree of the President of the Russian Federation dated 28.02.2024 No. 145 "On the Strategy of Scientific and Technological Development of the Russian Federation". URL: http://government.ru/docs/all/152305 / (accessed on 15.05.2025).

The complexity of the proposed criteria system is ensured by covering four key areas:

- support for national developments
- information infrastructure protection
- technological independence
- development of scientific and technical potential.

Specific indicators have been developed for each area, taking into account its features. At the same time, all criteria are methodologically consistent with each other and can be used as a single assessment system.

An important feature of the proposed criteria is the possibility of their quantitative measurement based on available statistical data. This allows for regular monitoring of the effectiveness of industrial policy measures.

The practical applicability of the criteria is confirmed by the possibility of using them to identify problem areas and make corrective management decisions. For example, a decrease in the technological asset security ratio (*TAR*) will signal the need to strengthen cyber security measures.

The proposed criteria system also takes into account international experience in assessing technological safety. In particular, when developing the Innovation Activity Index (*Iai*), the approaches used in compiling the Global Innovation Index were taken into account.

Thus, the validity of the proposed criteria is determined by their complexity, measurability, practical applicability and compliance with the strategic goals of ensuring Russia's technological security in the face of sanctions pressure.

CONCLUSIONS

The analysis of the existing system of criteria for assessing the effectiveness of Russia's industrial policy under the conditions of sanctions pressure made it possible to identify key problems and formulate reasonable proposals for their improvement. It has been established that the current criteria system is characterized by fragmented approaches and insufficient consideration of the specifics of sanctions restrictions, which significantly reduces the effectiveness of monitoring the country's technological security.

The analysis of the spatial and sectoral boundaries of the criteria application has shown the possibility of their use at the macro-, meso- and micro- levels of the economic system with the need for differentiation depending on the level of industrial policy. The zone-threshold approach has demonstrated its effectiveness in diagnosing the state of various components of industrial policy, allowing not only to detect deviations from regulatory values, but also to determine the degree of criticality of the situation.

The presented results make a significant contribution to the development of theory and methodology for assessing the effectiveness of industrial policy under external constraints. For the first time, a comprehensive criteria system has been developed, specially adapted to operate under the conditions of sanctions pressure. A conceptual achievement is the integration of the zonal threshold approach with a multi-level criteria structure covering federal, regional and corporate levels of industrial policy.

A special novelty is the introduction of a specialized "sanctions functional criterion" that takes into account the specifics of the impact of external restrictions on technological security. The index of support for national developments, the index of infrastructure protection and the index of technological independence represent fundamentally new tools for monitoring the state of technological security.

The developed criteria have a high practical value for government agencies. The use of a zone-threshold approach with five risk levels allows management authorities to respond to negative trends in a timely manner and take corrective measures before reaching critical values of indicators.

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S.V. Muzalyov — formation of a system of criteria and coefficients for evaluating the effectiveness of industrial policy under the conditions of sanctions pressure.
N.M. Abdikeev — methodological justification for the zone-threshold approach and analysis of the practical applicability of the developed criteria.
L.V. Obolenskaya — development of the conceptual foundations for research and analysis of existing approaches to assessing technological safety.

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