Strengthening the environmental, energy and food security of the state as part of the development of critical technologies in the agro-industrial complex

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Abstract. To ensure environmental, energy and food security in the face of climate change, it is necessary to optimize the management of agricultural nature management. In this context, a special role belongs to the development of industrial technologies as intersectoral climate-neutral innovations in the agricultural and energy sectors. To achieve the set goal and solve individual problems, general scientific and private methods based on an abstract-logical approach were used: system analysis; content analysis; grouping and systematization; induction; degradation; graphical and tabular presentation. The article discusses the features of the development of critical technologies as intersectoral climate-neutral innovations in the field of agricultural environmental management. The development of critical technologies are considered in the context of determining the criticality of economic sectors and the criticality of individual objects in the regional and national sense. Criteria for the criticality of technologies in the field of agro-industrial complex have been formed. The advantages of the transition to the optimization of agricultural nature management based on the development of intersectoral industrial enterprises of climate-neutral technologies for ensuring environmental, environmental, energy and food security are determined. The structure of the functioning of the agro-industrial hackathon as a way to develop critical technologies in the context of strengthening environmental, energy and food security is proposed.

1 Introduction

The transitivity of organizational and innovative processes in ensuring the sustainable development of the national economy is complemented by the need to move to the circularity of the use of natural resources through the introduction of low-carbon and energy-efficient critical technologies in order to strengthen national security. In this context, ensuring environmental, energy and food environmental security in the field of practical implementation of the environmental, energy and food paradigm: prevention, mitigation and adaptation to climate change is of particular importance.

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The problems of ecology, energy and food are recognized today, as the most adequate civilizational challenges.

At the same time, they pose a serious threat to national security. Therefore, in the context of strengthening national security, the solution of these problems involves the use of critical technologies as an incentive for the sustainable development of the national economy, which contributes to the strengthening of environmental, energy and food security.

The works of the following authors substantiate the need to develop measures to strengthen the development of the renewable energy market in the context of climate change, in particular, bioenergy: S. Z. Zhiznin, V. M. Timokhov [1], N. S. Upyr [2], N. A. Amadziev [3], O. I. Malikova, M. A. Zlatnikova [4] and others. The following authors explore the features of energy security management of enterprises: E. S. Mityakov, A. I. Ladynin [5], V. V. Sulimin, I. S. Kondratenko [6], G. V. Germanovich, T. M. Germanovich [7], A. D. Morozova, A. Yu. Teplov [8] and others. In turn, the authors I. Yu. Zhilina [9], G. H. Ajimet [10], E. E. Tarando [11] and others consider food security as a component of economic security, the factors affecting food security justify the need to ensure national food security in the context of sustainable development.

At the same time, the introduction of key breakthrough technologies solves a number of cross-industry tasks. To ensure the environmental, energy and food security of the state on the basis of climate-neutral development, it is necessary to optimize the management of natural resources in agriculture.

All this contributes to the development of a closed economic cycle in the agricultural and energy sectors, the introduction of a climate management system as a way to strengthen environmental and energy security, contributes to the development of climate policy in the energy market [12], strengthening economic security. With this, the development of critical technologies as intersectoral climate-neutral innovations based on environmental, energy and food management of the national economy is an urgent task.

2 Results and discussion

Sustainable development implies the existence of favorable conditions for the functioning of the ecological, economic and social system. These conditions ensure not only their long-term stable functioning, but also contribute to the restoration of their individual elements, which, in turn, provides development prospects.

In turn, “in the general system of public administration, national security ensures such a state in which there are no or localized real internal and external threats to national values, interests and the national way of life, thus ensuring the important interests of the individual, society and the state” [13, P 21]. As a result, the interdependence between sustainable development and national security is highlighted, such as: on the one hand, sustainable development creates favorable conditions in which all components of national security are formed, and on the other hand, national security is a determining factor for the sustainable development of the economy and society.

It is at the intersection of sustainable development and national security that the country's resource potential is located. Such resource potential is considered as an element of sustainable development, and in conditions of limited natural resources and climate change - as a factor in strengthening environmental, energy and food security. In this context, the transition to the development of critical technologies in energy and agriculture based on intersectoral cooperation and climate neutrality is considered as a way to create conditions for the sustainability of the environmental, energy and food components of national security.

The list of critical information infrastructure sectors in the agro-industrial complex includes, as a separate element, “production and processing of agricultural and/or food products” [14]. In connection with this, for a clear and systematic assessment of the

development of critical technologies in the agro-industrial sector of the national economy on the basis of climate neutrality and food security, it is advisable to graduate technologies in accordance with the critical areas of the agro-industrial complex (AIC), which is based on a generalized normalized assessment of the level of criticality infrastructure facilities (according to the legislative framework of the Russian Federation), the impact of technologies on the level of criticality of facilities and industries, the impact of threats on facilities and industries.

In table 1, criteria for the criticality of technologies in the field of the agro-industrial complex are formed. In particular, crop production, animal husbandry and fishing as a source of direct food supply and as an element that directly affects the country's food security, which is classified as the first category of criticality.

Table 1. Criteria for the criticality of technologies in the field of agro-industrial complex

Scope of activity of the agro-industrial complex	Critical Technologies*		
	1 category	2 category	3 category
I criticality category $0.8 < PK_{OKI} \leq 1$**	Protection from biological, technogenic, climatic impact. Minimization of energy consumption. Reducing dependence on imports	Process safety. Robotization and cost reduction. Modernization of technologies.	Uninterrupted Technology provision and monitoring plots, plantations and farms
II criticality category $0.63 < PK_{OKI} \leq 0.8$**	Protection of processing enterprises from man-made threats. Reducing the level of energy dependence and energy intensity, reducing dependence on imports	Business Security-processes and logistics. Increasing productivity and capital-labor ratio	Systems Improvement monitoring and control recycling processes
III criticality category $0.2 < PK_{OKI} \leq 0.37$***	The uniqueness of the domestic agricultural engineering, energy independence, reducing the level of import dependence in the production of components	Production safety, innovative development in accordance with global trends in the development of the agro-industrial complex, increasing the capital-labor ratio of enterprises	Reconstruction of existing enterprises in order to reduce the wear coefficient, reduce the cost and increase the efficiency of domestic agricultural machines

* Category I - technologies that allow you to completely change the functioning of facilities or industries and minimize their criticality by minimizing the consequences of threats;

** Category II - technologies that allow partially changing the functioning of facilities or industries and reducing their criticality, which significantly limits the impact of threats;

***Category III - technologies that make it possible to modernize facilities and production facilities fragmentally reduce their criticality and partially reduce the impact of threats.

** Note. Criticality criteria are determined in accordance with Decree of the Government of the Russian Federation of February 8, 2018 No. 127 "On approval of the Rules for categorizing objects of critical information infrastructure, as well as a list of indicators of criteria for criticality, significance of objects of critical information infrastructure of the Russian Federation and their cost"

*** Note. The object is not critical if the $PK_{OKI} \leq 0,2$ in accordance with Decree of the Government of the Russian Federation of February 8, 2018 No. 127 "On approval of the Rules for categorizing objects of critical information infrastructure, as well as a list of indicators of criteria for criticality, significance of objects of critical information infrastructure of the Russian Federation and their cost"

In the context of the data in Table 1, it should be noted that the dynamics of the development of the first critical sphere of the agro-industrial complex and the consequences of climate change will have a direct impact on the Category II of the critical sphere of the agro-industrial complex.

This category should include the processing of crop and livestock products, since it is these areas of the agro-industrial complex that form the parameters of food security by distributing products to the corresponding areas of consumer demand.

In addition, in the context of energy decarbonization, the processing of plant bioresources, in particular energy crops, as agrobiomass for the production of "green" energy is seen as a way to circularize natural resources and move towards climate neutrality in agriculture, as well as energy sectors, which, in turn, contributes to strengthening environmental and energy security.

The Category III of critical areas is the areas of support for the main areas of agriculture. The impact of internal threats on these categories can be partially or completely offset by the import component, and their impact on the country's food security is indirect. However, the development of these spheres depends on the state of the spheres of the first and second categories of criticality.

Thus, the assessment of the critical areas of the agro-industrial complex reflects the state in which the search or generation of ideas is fundamental, and the adaptation of the world's best innovative developments that are of great importance for protecting the industry from threats (for example, both external and internal) is carried out to ensure its functioning, as an element of the country's national security system. Among the most significant today in the agro-industrial complex are innovative ideas related to plant growth control systems, as well as automatic selection of animal rations.

To ensure the environmental and energy security of the state on the basis of climate-neutral development, it is necessary to optimize the management of agricultural natural resources. First, an agrobioresource can become a much more efficient consumer of carbon dioxide and a producer of oxygen than a forest, thereby neutralizing the negative impact of other economic factors on the climate. Secondly, the transition to the recycling of agricultural bioresources is both a way to optimize nature management and an alternative source of energy. A separate important characteristic of energy crops is their wastelessness and the possibility of using them in many sectors of the national economy, which contributes to the development of critical technologies in agricultural environmental management as intersectoral climate-neutral innovations aimed at strengthening the energy and food components national security.

Considering the rapid development of modern technologies and the need to systematize, adapt them, as well as expand the possibilities for generating critical (key) innovations in the agro-industrial complex to ensure national security, it is extremely important in Russia to form a special organizational, innovative, financial and economic mechanism for accumulating and implementing innovative ideas. The most effective point of view on the introduction of innovations is the organization and holding of a hackathon. At the same time, according to the authors of the study, a hackathon should be formed in accordance with the tasks that are being solved at a particular moment, or how the key idea generator (prerequisites for computing technologies), or as the adapter for critical technologies (Fig. 1).

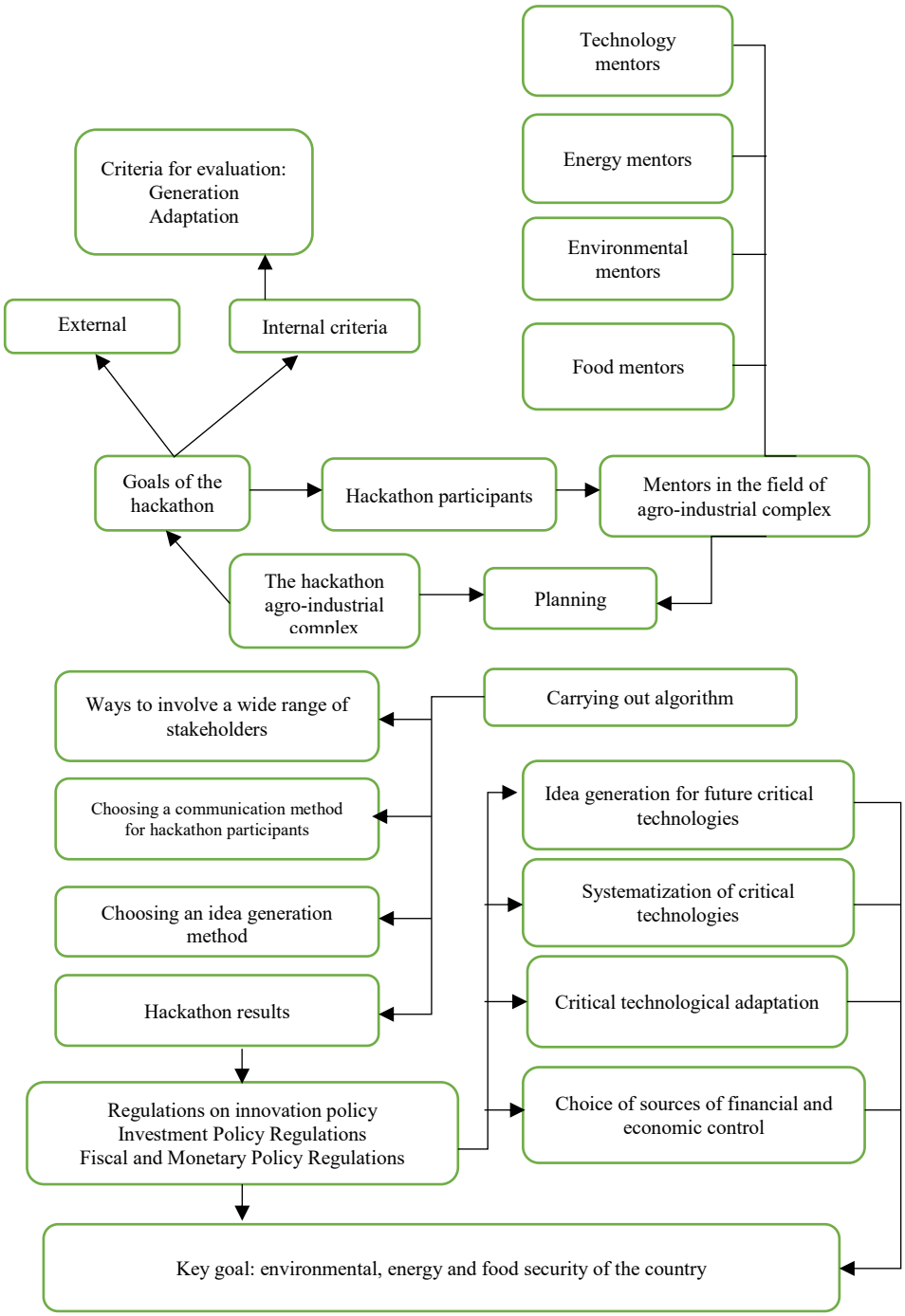

Fig. 1. Functioning of the agro-industrial hackathon as a way to develop critical technologies

In accordance with its functionality, an organized agro-industrial hackathon will allow:

– to form an organizational and innovative mechanism for the introduction of key technologies in the agro-industrial complex;

- to determine the optimal tools for financial and economic support for the implementation of innovative ideas and critical technologies in the field of environmental and energy security;
- take into account the determinants of the development of the industry, the main of which are technological, environmental, energy, climatic and nutritional factors;
- to minimize the level of import dependence through proposals for balancing the innovation, investment, fiscal and monetary policies of the state;
- develop key decisions to ensure the country's food security as an element of national security.

Among the main results of the functioning of the agro-industrial hackathon is the choice of tools for financial and economic support for the implementation of critical technologies and the balancing of innovation, investment, fiscal and monetary policies. Forming an agro-industrial hackathon as a way to develop critical technologies, you can get the following benefits: specification of goals, an appropriate circle of participants, an algorithm for planning and conducting, and, as a result, generated ideas for new technologies and ideas for adapting the world's best innovative solutions.

At the same time, recommendations concerning the key provisions of the state's innovative, investment, fiscal and monetary policy to ensure the environmental, energy, climate and food components of the country's national security become accompanying here.

3 Conclusion

Ensuring the sustainability of the environmental, energy and food components of national security in the face of climate change involves the adoption of innovative solutions through the transition to the development and implementation of critically important climate-neutral technologies. In this context, the development of critical technologies in agricultural environmental management is considered as a way to deepen intersectoral cooperation to strengthen environmental, energy and food security. In the context of the transition to climate neutrality, the impact of critical technologies in the agro-industrial complex on strengthening the country's economy as a whole lies in the fact that food security, as the main goal of the agro-industrial complex, is also one of the elements of ensuring the environmental and energy component of national security through the use of agrobiomass as a renewable source of energy.

On this path, of particular importance is the formation of criteria for the criticality of technologies in the field of the agro-industrial complex, the determination of the advantages of the transition to the optimization of agricultural environmental management on the principles of the development of interstate relations, sectoral climate-neutral technologies to improve environmental, energy and food security. In addition, to ensure innovative development, the development of a structure for the functioning of an agro-industrial hackathon as a way to develop critical technologies in the context of strengthening environmental, energy and food security is of primary importance. In this regard, the prospect of further research is to determine the sustainability of agricultural enterprises to the development of critical information technologies as cross-industry climate-neutral innovations based on the principles of strengthening environmental, energy and food security.

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